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1. Notes and Comments

Happy New Year 2000!

We are glad to present this first issue of the *IASE Statistical Education Research Newsletter* a new *IASE* publication, which continues the previous *Newsletter of the International Study Group for Research on Learning Probability and Statistics.* The *International Study Group for Research on Learning Probability and Statistics* was first started informally at *ICOTS-1* at the suggestions of Ramesh Kapadia, Anne HAWKINS, Efraim FISCHBEIN, David GREEN, Lennart Råde, Hans Bentz, Ruma Falk, Michael SHAUGHNESSY and Manfred BOROVNICK. Between 1982 to 1999 we have used the name International Study Group for Research on Learning Probability and Statistics. The secretaries have been David GREEN (1982-87), Joan GARFIELD (1988-95) and Carmen BATANERO (1996-99). More information about this group as well as all the Newsletters produced since 1996 to 1996 is available from the web site: http://www.ugr.es/local/batanero/

From January 2000, we have changed our name to the *IASE Statistical Education Research Group, a*

special interest group within the *IASE* (*International Association for Statistical Education*), which is also opened to all who share our common interest in carrying out research into the teaching and learning of statistics and probability. As the main scientific and professional association devoted to promoting and extending statistical education through the world, *IASE* offers its membership the opportunity to contribute to innovations and progress in statistical education. To achieve this aim, the current Executive Committee has recognised, the need to improve channels of communication between statistical educators, who often find themselves relatively isolated in professional terms. Promoting research is also one of IASE's most pressing priorities, as a way of extending our knowledge about the processes of teaching and learning statistics and of advancing the academic recognition of statistical education as a discipline.

We hope that the *IASE Statistical Education Research Newsletter* and the *IASE Statistical Education Reseach Group* can serve this purposes. We intend to continue publishing summaries of research papers, books, and recent dissertations, bibliographies on specific topics; information concerning recent and forthcoming conferences, and Internet resources of interest. We also plan include short papers of general interest, starting with a paper by M. Gabriella OTTAVIANI in this issue, where she describes the point of view of a statistician about statistical education research and which can serve to start our discussion around statistical education research problems, methods and results.

The extent to which a research newsletter is useful depends of the quality and completeness of the information published. We need of your collaboration and we encourage you to send any type of information about your research projects and results that you consider of interest for other colleagues to one of the editors. The team responsible of producing the Newsletter is also increasing. This time we welcome M. Gabriella OTTAVIANI, former IASE president. Joan GARFIELD will be joining us as soon as she recovers from some health problems. We all look forward to work again with Joan who started the first printed version of this newsletter.

Because we are aware that our association can provide you with multiple opportunities to improve your research and share your results with other colleagues, we encourage those of you who are not members of IASE to seriously consider joining this association. The benefits of membership are outlined on http://www.swin.edu.au/maths/iase/benefits.html. A membership form is found from the iase web page http://www.swin.edu.au/maths/iase/ (or you can email the membership officer at the international statistical institute at isi@cbs.nl). However, if you have difficulties in joining IASE and you are still interested in statistical education research you are invited to remain a member of the new group for the year 2000 and to let us know about your future research projects and activities.

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

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2. Research into Statistical Education. The Point of View of a Statistician

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One of the issue emerging from ICOTS-5, in Singapore (PEREIRA-MENDOZA et al., 1998) was the demand for research in statistics education to be recognised as a research discipline in its own right in the academic world. This is the point of arrival of an intensive activity in the field which developed during the second half of this finishing century. Earlier research which influenced statistical education came from psychology (SHAUGHNESSY, 1992). There has been such a strong influence of research into stochastic reasoning within psychology that this new perspective, as well as the interest in the evolutionary development of stochastic ideas from childhood to maturity, has produced numerous psychological investigations into children's and adults' stochastic reasoning.

Through research of psychologists and science educators in statistical education, statistics has proved to be a "modern discipline" useful for developing precisely those skills required by the global world and the information society. Among the abilities needed in today's society are: applying a problem-solving approach, using technology, developing the skills required for collecting, organising and analysing data and working with others in groups. These are precisely the skills that may be developed following a constructivist approach,

utilising problem solving, modelling and simulation as well as strategies and computers in an instrumental way. With regard to "Constructivism" statistics no doubt enjoys a privileged position. Working with data, forming dialogues with it, and interacting with those areas of application to which the data refer, is in fact the statistician's habit of mind.

The development of a world wide information society is now giving a strong impulse to the spreading of the statistical culture in the wider society. This requires statistics and probability to be taught also at school and consequently the necessity to expand two fundamental interrelated activities: teacher training and research in teaching. As already said (OTTAVIANI, 1998; OTTAVIANI, & BATANERO, 1999), research into statistical education has, over time, allowed us to emphasise the modernity of the teaching of statistics and that statistics can satisfy different learning approach and learning methods as it is suitable for those students who are logic based or intuitive or ordered planners or feeling based.

Statistical education covers various research activities, each demanding attention. With respect not only to students, but also to adults and their need to acquire the basics of statistical method, two segments of research and analysis should be considered. In the segment concerning the teaching of young people, studies and qualitative and quantitative research include:

- forms and processes of awareness and learning of statistical concepts by students, with the aim, among others, of preparing and arranging affective presentations of concepts, and didactic materials adapted to different levels of instruction;

- teachers' characteristics, and their inclination to teaching statistics, with the aim of organising training courses and additional courses for in-service teachers;

- analysis of existing textbooks, to reveal gaps and errors with the aim of indicating these to teachers and assembling, at the same time, the major areas of difficulty;

- effectiveness and efficiency in the various didactic strategies which teachers use in teaching, taking into account the technology available, namely amongst others, didactic software of a good level and for the spread of didactics with multimedia tools;

- evaluation of the skills acquired by students in order to verify results obtained in the course of the educational process.

In the segment concerning society, complex studies and qualitative and quantitative research on both the level of quantitative information received by the country and the citizens' attitude towards statistics, may be of relevance.

Research into statistical education, however, demands not only intersection with education sciences but also the development and utilisation of appropriate statistical methods. One must deal with experimental and quasi-experimental designs (due to the difficulty of obtaining completely random designs). It will be necessary to analyse the data not only with the ANOVA approach and with the most common techniques of classical regression for quantitative variables, with logistic regression (for dichotomous variables), with log-linear models (for qualitative variables with more than two modalities), but also making use of more recent multilevel models. These are particularly useful in analysing data of a hierarchical nature, and for analysing students' scores repeated over time. The stochastic processes, the Markovian models and the survival functions form part of the necessary models when one wishes to investigate students' scholastic careers. Multivariate and multiway descriptive analysis can also be particularly useful in examining data from complex questionnaires which investigate complex phenomena such as those regarding didactics.

Statistical education is therefore a peculiar field of research, unlike others. It offers visibility to statistics in terms of teachers, students, and citizens. It allows the subject to examine itself and investigate how it is received by society, availing itself of its own methods and evaluating in this way its own instrumental characteristics. Involving statistics with the science of education may show this discipline the cognitive advantage of applying a quantitative method and of deducing one's own ideas and assertions from the data.

The community involved in research on the problems of teaching and learning statistics and probability includes not only statisticians but also mathematics educators, and psychologists. The contributions and mutual exchange of these three research sources, as well as the collaboration between specialists in these disciplines and others such as pedagogy, history and sociology, are fundamental for having statistical education recognised as an academic speciality.

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

3. *IASE* Members

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All of us know the work by Tim ARNOLD in relation with the *Journal of Statistical Education.* Tim Arnold left the Department of Statistics at the University of North Carolina about two years ago. He is now working at SAS Institute, writing educational material about using the software as well as statistical techniques. He also continues to work in the world of electronic publishing. This past year Tim completed an educational website for Addison-Wesley-Longman as a companion to the statistics text book 'Introductory Statistics' by Neil Weiss. The url for the site is: http://hepg.awl.com/weiss/i_iprojects/index.htm. A subset of this information accompanies a more basic text book, 'Elementary Statistics' with this url http://hepg.awl.com/weiss/e_iprojects/index.htm. The site won an 'Award of Excellence' from the Society for Technical Communication, and the judges had this to say: "[The site]...demonstrates an extremely innovative use of the Web by integrating and synthesising material from widely dispersed sites into a sort of 'open-ended book. 'The combination of supplemental media for the textbook on the home site and well-chosen annotated links to relevant external sites is extremely powerful and invites self-guided exploration. More and more 'online books' like this will undoubtedly appear in the near future", and this: "...a very compelling site that provided a good link between the Internet and the classroom. It shows how a stereotypically dull topic could be quite interesting in practice."

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Shrikant I. BANGDIWALA took a B.S. in Mathematics and Statistics, a M.S. in Biostatistics (1978), and a Ph.D. Biostatistics (1980) at the University of North Carolina, Chapel Hill, NC. In addition to English, he speaks fluent Spanish, as well as some French, Portuguese and Gujarati. He has been working in a number of institutions, including the Pan American Health Organisation, Washington, DC., the Department of Biostatistics, School of Public Health, University of North Carolina, Chapel Hill, NC. He has been a visiting professor at the Faculty of Medicine, Universidad de la Frontera, Temuco, Chile, Centre for Clinical Epidemiology and Biostatistics, The University of Newcastle, NSW, Australia, School of Statistics, University of Costa Rica, San Jose, Costa Rica. Shrikant is an ISI member and has been awarded a number of honours, including a Fulbright Research and Lectureship Award and different National Science Foundation grants. He teaches statistics, statistical inference, biostatistics, nonparametric statistics, designs of experiments, epidemiology and statistical consulting. His research interests include nonparametric methods, observer agreement, international health, methodology for clinical trials, statistical graphics and statistical education. Shrikant has co-operated with short courses, workshops and academic lectures with a number of international institutions in Argentina, Australia,

Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, India, México, The Netherlands, Puerto Rico, the USA and Zimbabwe. Shrikant is presenting a paper at the forthcoming IASE Round Table Conference in Japan this year. We are listing his statistical education papers at the section on complementary short references.

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The Department of Statistics at Brigham Young University has seen an marked increase in student enrolment in the introductory statistics course over the past four years. Rex, Sterling and their colleagues currently teach approximately 3500 undergraduate students each year in the introductory statistics course. Two years ago in the fall of 1997, the faculty in the department agreed to begin a research project in statistical education in an effort to meet the resource demands our introductory course places upon the department, as well as to improve the instruction and learning in this course. Of particular interest to the faculty was studying if, and how, multimedia technologies could be used to improve student learning and teacher instruction. The resulting research project is too large and complex to discuss in any detail here. However, it is worth noting that as statisticians and educators we are interested in collecting data that is statistically defensible; therefore, we have carefully designed an experiment that allows us to compare student outcomes between groups of students who receive instruction via a multimedia-enhanced lecture and groups of students who receive instruction via a lecture using overhead transparencies. In creating these lectures, a committee has carefully reviewed and revised course objectives and created a standard curriculum for all instructors, regardless of instruction method. Student effort and characteristics that could influence student learning have been collected. Also, a follow-up survey will begin in January 2000 to assess long-term learning and attitudes. This survey consists of questions dealing with core content material, as well as attitudes toward the course and discipline. We are looking forward to sharing our results with the larger education research community in the near future. We also plan to study other pertinent questions, such as the impact on student learning and attitudes of reducing student-teacher contact time while increasing student-multimedia contact time.

4. Brief News

Sad News

Lennart Råde, the former chairman of the SEFI MWG, has left us. He was ill for a long time and died a few days ago, on December 9th. Lennart was one of the early leaders in statistic education and one of the people who urged the establishment of this Research group (See Section 1). He organised an International Conference on the Teaching of Probability and Statistics in 1969 at Carbondale, Illinois, USA, whose Proceedings contain material which is still of value today. This was a particularly fruitful time for collaboration between the Americans and the Europeans, and both Lennart and Arthur Engel were able to bring back to Europe rich experiences as a result of their extended stays in the United States. 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 and 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. His colleagues at Chalmers and The University of Gothenburg and at IASE, will all remember him for his deep engagement in mathematics, teaching mathematics and in statistical education. Our condolences go to his wife and family. An article on Lennart will appear soon in an IASE publication

The Royal Statistical Society Centre for Statistical Education *by Neville DAVIES & Peter HOLMES*

On 1 August 1999 the *Royal Statistical Society (RSS) Centre for Statistical Education* moved across the city of Nottingham to *Nottingham Trent University* (NTU). The aim of *the Royal Statistical Society Centre for Statistical Education* is to promote the improvement of statistical education, training and understanding at all ages. Work to support this aim will be carried out in four main areas: (i) school and further education; (ii) higher education for all courses in which statistics is taught; (iii) continuing professional development including all who use statistics as part of their professional life and (iv) society as a whole. Although based in the UK the Centre

has an international role.

The main RSS Centre resource room houses a valuable collection of periodicals, books and IT equipment for research and development. The new Centre at NTU will continue to be the administrative centre for the successful journal, Teaching Statistics. The Centre is funded by sponsorship from three main sources. These are NTU, the RSS and Statistical Products and Service Solutions (SPSS). A five-year commitment of funding from NTU and the RSS, and the final year's commitment from SPSS, together with promised sponsorship from Minitab Ltd, enable the Centre to look forward to a secure future,

Our plans for working with schools throughout the UK include: a) Running a national children's census, joint with the Office for National Statistics, in October 2000; b) Actively promoting good practice in the use of statistics software (MINITAB for data handling in the national curriculum by running a regular series of workshops at schools and/or the Centre for pupils and teachers; c) Working with the DFEE as part of a UNESCO-sponsored World Mathematics Year 2000 to promote statistics; d) Advising on and helping with rewriting the Data- handling part of the national curriculum for Maths for the Qualifications & Curriculum Authority; e) Continuing to market over 25 of the Centre's own publications for use in schools; f) Making resources available to teachers on our Web site (http:science.ntu.ac.uk/rsscse). Currently these include the material from the Schools Council Project on Statistical Education (POSE), chapters from the booklet Teaching and Using Statistics and the contents of The Best of Teaching Statistics; g)Contributing to national (and international) conferences for teachers of statistics; h)Being a source of advice for all matters of statistical education in schools.

Within NTU the Centre will be working closely with the Faculty of Education, and will have regular direct contact with the 300 or so schools in the area that are involved in teacher training contracts. In order to attempt to utilise the collective wisdom of teachers in schools, we plan to create a group of Centre Associates comprising colleagues who are interested in promoting statistical education. We invite you to join a world renowned Society and a distinctive UK university to promote statistical education. If you would like to help and become involved with the Centre in this way, or have ideas and contacts that could help, please phone or email us at The Royal Statistical Society Centre for Statistical Education, Nottingham Trent University, Nottingham NG1 4BU_Phone: 0115 848 4476, Fax 0115 848 2998, Email: rsscse@ntu.ac.uk

The ISI Committee on Women in Statistics *by Mary REGIER*

(CWS) has maintained a mailing list of statisticians who at one time or another have expressed an interest in its activities. Ms Beverley Carlson of the USA, assumed office at the end of the ISI Session in Helsinki in August 1999. Ms Carlson <bcarlson@eclac.cl> is Social Affairs Officer, Division of Production, Productivity and Management at the UN Economic Commission for Latin America and the Caribbean (ECLAC), Casilla 179D, Santiago, Chile. The committee has 3 new members: Ms Heidi Arboleda Philippines) of the UN Economic & Social Commission for Asia and the Pacific; Mr Leonard Cook (New Zealand) of Statistics New Zealand; and Mr Dennis Trewin (Australia) of the Australian Bureau of Statistics, who is also president-elect of the ISI.

"The Role of Women in Statistics in the New Millennium" was the topic of an Invited Paper meeting organised by the CWS at the recently held ISI Session in Helsinki. Six distinguished statisticians took part in the meeting as authors or as discussants, covering a wide range of perspectives and providing useful analyses of current problems and how to overcome them. A stimulating discussion followed the presentations.

Committee member Mrs Lelia Boeri de Cervetto (Argentina) reported on the Characterisations project at an open meeting of the committee during the ISI Session in Helsinki. To receive a copy of her report, "A Characterisation of Statisticians by Gender in Several Countries" by mail, you may e-mail Lelia at: notas@indec.mecon.ar. A monograph, "Women in Statistics: the Profession Speaks" was prepared by Ms Beverley Carlson and published by ECLAC in the spring. It is posted on the ECLAC web site and also on the CWS web site, but hard copies are also available from Beverley upon request. Dr. Martha Aliaga of the University of Michigan is the organiser of an Invited Paper meeting at the next ISI Session, which will be held in Seoul in 2001, on "Womenís Contributions to Leadership in Statistical Education". The meeting is sponsored jointly by the CWS and the International Association for Statistical Education (IASE). If you have any ideas or suggestions for this meeting, please contact Martha at: aliaga@umich.edu. The CWS web site http://sun.cwru.edu/isi, carries more details on the above items as well as on other committee matters

Statistical Reasoning Thinking and Literacy (SRTL) *by Dani BEN-ZVI.*

In July of 1999, 16 statistics educators from six different countries met for five days at Kibbutz Be'eri in Israel to discuss the topics of statistical literacy, reasoning, and thinking. Because this was a first attempt to focus a research forum on the interrelated and often poorly defined topics of statistical literacy, reasoning, and thinking, one difficulty was a lack of a solid theoretical framework for the studies being conducted. There was a wide range of ways in which video material was collected, analysed and used within presentations: "clinical" interviews, more open, exploratory interview, "real" but edited classroom footage. Something, which was missing in many of the presentations, was a focus on learning, rather than on what pupils could or couldn't do. Research methodology issues emerged as merits of qualitative and quantitative methods were contrasted.

Another issue that was discussed was losing track of the technical "soundness" of the statistical content in some learning activities, and the need to collaborate with statisticians who might provide this feedback. Plans are under way to have a SRTL-2 in Australia, and to develop a book or collection of articles, possibly an online book, CD-ROM, or special issue of JSE. To learn more about STRL-1, or learn how to become involved in SRTL-2, please visit the SRTL website (http://www.beeri.org.il/srtl) or contact: Joan GARFIELD (jbg@maroon.tc.umn.edu), or Dani BEN-ZVI (dani.ben-zvi@weizmann.ac.il).

Mathematical Thinking and Learning **Forthcoming Issues on Statistical Education** *by Brian Greer*

The first two issues of the second volume in 2000 of the new journal from Erlbaum, *Mathematical Thinking and Learning* are devoted to the theme: *Statistical Thinking and Learning.* The contents will be: Vol.2(1): Brian Greer: *Statistical thinking and learning: Introduction*; Jane WATSON and Jonathan MORITZ: *The longitudinal development of understanding of average*; Richard Lehrer and Leona Schauble: *Inventing data structures for representational purposes: Elementary grade students' classification models.* Vol. 2(2): Carmen BATANERO: *Controversies around the role of statistical tests in experimental research*; Joan GARFIELD and Beth CHANCE: *Assessment in statistics education: Issues and challenges*; Dani BEN-ZVI: *The role of educational software in enhancing statistical learning in school.*

Special Issue of Mathematics Teacher with Focus on Statistics *by Dani BEN-ZVI*

Volume 92(8) (November, 1999) of *Mathematics Teacher* is focussed on statistics, including the following papers*: A statistical exploration* by Sandra L. Takis, *The role of technology in introductory statistics classes* by George N. Bratton, *Discuss with your colleagues: it's all in the area* by J. Todd Lee, *Sharing teaching ideas: the double stuff dilemma* by Marie A. Revak and Jihan G. Williams, *What is normal, anyway*? by Maria E. Calzada and Stephen M. Scariano, *Test reliability* by Kenneth Clark, German Tanks*: A problem in estimation* by David C. Flaspohler and Ann L. Dinkheller, *Using simulation on the internet to teach statistics* by Vee Ming Ng and Khoon Yoong Wong, *Cooperative teaching opportunities for introductory statistics teachers* by Deborah J. Rumsey, *Data analysis and baseball* by Gary Talsma, *Discovering an optimal property of the median* by Neil C. Schwertman, *Implementing the Assessment Standards for school mathematics secondary students' performance on data and chance in the 1996 NAEP* by J. Michael Shaughnessy and Judith S. Zawojewski, and *Technology tips: investigating distributions of sample means on the graphing calculator,* by Gloria B. Barrett

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5. Summaries of Publications by *IASE* Members

GARFIELD, J. B., & Gal, I. (1999). Assessment and statistics education: current challenges and directions. *International Statistical Review,* 67(1), 1-12.The interaction between new curricular goals for students and alternative methods of assessing student learning is described. Suggestions are offered for teachers of statistics who wish to re-examine their classroom assessment practices in light of these changes. Examples are offered of some innovative assessment approaches that have been used in introductory statistics courses, and current challenges to statistics educators are described.

JONES, G. A., Langrall, C. W., Thornton, C. A., & Mogill, T. A. (1999). Students' probabilistic thinking in instruction. *Journal For Research In Mathematics Education,* 30(5), 487-519. In this study we evaluated the thinking of 3rd-grade students in relation to an instructional program in probability. The instructional program was informed by a research-based framework that included a description of students' probabilistic

thinking. Both an early- and a delayed-instruction group participated in the program. Qualitative evidence from 4 target students revealed that overcoming a misconception in sample space, applying both part-part and part-whole reasoning, and using invented language to describe probabilities were key patterns in producing growth in probabilistic thinking. Moreover, 51% of the students exhibited the latter 2 learning patterns by the end of instruction, and both groups displayed significant growth in probabilistic thinking following the intervention.

BATANERO, C., & SERRANO, L. (1999). The meaning of randomness for secondary school students. *Journal For Research In Mathematics Education,* 30(5), 558-567. In the experimental study reported here we intended to examine possible differences in secondary students' conceptions about randomness before and after instruction in probability, which occurs for the Spanish students between the ages of 14 and 17. To achieve this aim, we gave 277 secondary students a written questionnaire with some items taken from GREEN (1989, 1991). With our results we extend GREEN's previous research to 17-year-old students and complement his results with the analysis of students' arguments to support randomness in bidimensional distributions. Our results also indicate that students' subjective understanding of randomness is close to some interpretations of randomness throughout history.

GIRARD J. C. (1999). Le professeur de mathématiques doit-il enseigner la modélisation ? (Should mathematics teachers teach modelling?), *Repères-IREM*, 36, 7 - 14. The main aim of mathematics is to produce models applicable to various situations. A students' frequent mistake is to confuse model and reality and this is consequence of a teaching where models are not discussed. In this paper, after defining what we understand by model, we show how modelling is implicitly used at primary and secondary school. The we propose ways to make the activity of modelling at these school levels more explicit.

ESTEPA, A., BATANERO, C, & SANCHEZ, F. T. (1999). Students' intuitive strategies in judging association when comparing two samples. *Hiroshima Journal of Mathematics Education*, 7, 17-30. This paper describes an experimental study on students' strategies and association judgements when faced with the comparison of a numerical variable in two different samples (comparison of two samples). The strategies are classified from a mathematical point of view, which allows us to identify theorems in action and two types of misconceptions about association.

MORRIS, E. (1999). *Another look at psychology students' understanding of correlation.* CITE Report nº 246. Milton Keynes: The Open University. Correlation is a statistical topic that is typically covered in introductory statistics courses for psychology students. In recent years. empirical studies have found that students hold misconceptions relating to negative correlation, the strength of correlation and the issue of correlation and causality (ESTEPA, & BATANERO. 1996; MORRIS 1998; MORRIS. 1999). For example. a student might think that a negative correlation is indicative of no relationship between variables and/or that a positive correlation is stronger than a negative correlation when this is not the case. A student might infer causality from a correlation: given a correlation. A student thinks that one variable had a direct causal influence on another variable and they do not suggest, for example, that a third variable could be responsible for the correlation. The study that is described in this report was undertaken as part of research that has investigated psychology students' understanding of correlation (MORRIS. 1998). It was necessary to involve psychology students from a variety of institutions of higher education in this research. A study was therefore carried out involving students taking psychology at a university. The students completed tests on correlation that had been designed to assess students' understanding of correlation and which could also be used to identify their misconceptions.

MORRIS, E. & Scanlon, E. (1999). *Students using ActivStats: A pilot study.* CALRG Technical report nº 185. Milton Keynes: The Open University. In higher education, the statistics curriculum is changing because of advances in computer technology. This means that students from a variety of disciplines, such as psychology and economics will use data-analysis software to obtain statistics and computer-assisted learning applications that include multimedia elements. Indeed, such changes have begun to affect the teaching and learning of statistics and the focus can now be on understanding statistics as opposed to computation (HAWKINS et al, 1992).The study described in this report was carried out as pan of the CASTLE project (Collaboration And Statistics for Teaching and Learning Environments). This project is investigating students learning individually and collaboratively from a variety of computer based learning environments for statistics. The project extends research that concerned the development of a computer-assisted learning system called *Link* that was designed to address students' misconceptions about correlation (MORRIS, 1999), and research that has investigated students solving a probability problem collaboratively by using a computer-based learning environment (Scanlon, 1998). The study was

conducted as a pilot investigation to find out about students' use of learner activities in *ActivStats* and how particular kinds of activities affect the learning process. In contrast to previous work that investigated whether a computer-assisted learning application contributed to students' understanding of correlation by looking at students working individually with the computer, the pilot study described in this research involved pairs of students working with an application.

WATSON, J.M. (1998). The role of statistical literacy in decisions about risk: where to start. *For the Learning of Mathematics,* 18(3), 25-27. For some time now, there has been considerable discussion among sociologists and educational researchers about adolescents' decision making in situations of risk. While many in health education may see educating for risk as a sequence of warnings about negative outcomes of certain behaviours, there is also the important issue of educating students to make intelligent decisions about risk as presented in any context in society. In considering research and teaching programs involving risk, two perspectives are essential. The first involves the social and psychological pressures which affect individuals in making decisions; these may include factors such as self-esteem and locus-of-control. The second perspective relates to the mathematical assessment of the degree of risk involved in a situation based on the information available. In making behavioural choices, there are likely to be interactions between these two aspects of risk analysis. The author presents a model by Sandman who has attempted to bridge the gap between the sociological and numerical aspects by this model for perceived risk, seeing it as a function of hazard (from a statistical point of view) and outrage (from a social or psychological perspective).

6. Recent Dissertations

GORDON, S. (1999). *Understanding students learning statistics: An activity theory approach.* Ph.D. Thesis. University of Sydney. Supervisor: Dr. Kathryn Crawford.

In this project I investigate university students' orientations to learning statistics. The students who participated in my research were studying statistics as a compulsory component of their psychology course. My central thesis is that learning develops in the relationship between the thinking, feeling and acting person and the social, institutional and cultural contexts surrounding him or her. How students orient themselves or position themselves to learn statistics is reflected in their engagement with the learning task — their activities. These activities determine the quality of their learning and emerging knowledge. To understand student learning 1 draw on the powerful theories of Vygotsky (1962, 1978) and Leont'ev (1978, 1981). In particular, 1 extend and apply Leont'ev's construct of activity (Leont'ev, 1981). This suggests that individuals act in accordance with their purposes and needs which are shaped by and reflect histories and resources, both personal and cultural.

My investigation consists of two studies. Study One is a qualitative exploration of the orientations to learning statistics of five older students. These students sought help with statistics at the Mathematics Learning Centre where 1 work. My case studies of these students are inseparable from my efforts to help them learn statistics. Study Two is grounded in Study One. The main source of data for this broader study is a survey which was completed by 279 psychology students studying statistics. In keeping with the theoretical framework, my methodology involves a holistic analysis of students and the milieu in which they act. My findings suggest relationships among students' affective appraisals; their conceptions of statistics; their approaches to learning it; their evaluations and the outcomes of their actions. In Study One the relationships emerged from the students' descriptions. In Study Two 1 quantified the ways in which variables related to each other. Structure for the data was provided by means of correlation, factor analysis and cluster analysis. For this study 1 also interviewed students and teachers of statistics. My data support the systemic view of teaching and learning in context afforded by my theoretical perspective. Learning statistics involves the whole person (Semenov, 1978) and is inseparable from the arena of his or her actions.

The goal of statistics education is surely to enable students to develop useful, meaningful knowledge. My findings suggest that for many of the participants in my project this goal was not being met. Most of these students reported their reluctance to learn statistics and described adopting primarily surface approaches to learning it. A range of conceptions of the subject was expressed, but for many of the students statistical meaning was evidently reduced to performance on assessment tasks. Such orientations to learning statistics may lead to it becoming irrelevant and inert information. For a few students, however, the experience of learning statistics led to self development and enhanced perspectives on the world in which we live. My project indicates the diversity of

students' experiences. It raises issues as to why we teach statistics today and how the teaching and learning of statistics is being supported at university.

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7. Bibliography on Textbook Analysis

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There are five parts to this bibliography: General Educational Theory, Textbooks in General, Mathematics Textbooks in General, Stochastics Teaching, and Stochastics Textbooks. As a supplement to this bibliography, Maria-Gabriella OTTAVIANI has kindly provided a summary of three pieces of work with which she has been involved that are concerned with Italian text-books. If other readers are able to provide further supplements, we should be happy to publish them

General Educational Theory

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Textbooks in General

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Apple, M. (1992). The text and cultural politics. *Educational Researcher*, 21(7), 4-12.
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Mathematics Texbooks in General

BATANERO, C., GODINO, J.D., & Navarro-Pelayo, V.(1993). Epistemology and mathematics instruction: implications for curricular developpement. In L. Bazzini (Ed.), *Proceedings of the V Conference on Systematic Cooperation between Theory and Practice.* (pp. 9-18). Grado, Italy: University of Modena.
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Morgan, C. (1996). The language of mathematics: Towards a critical analysis of mathematics texts. *For the Learning of Mathematics*, 16, 2-10.
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Robert, A, & Robinet, J. (1989). *Enoncés d'exercices de manuels de seconde et representations des auteurs de manuels.* [Wording of exercises in textsbooks at the second level, and perceptions by textbook authors] París: Institute de Récherches en l' Enseignement des Mathématiques).

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ORTIZ, J., BATANERO, C., & SERRANO, L.(1995). La aleatoriedad en los libros de texto de Bachillerato [Randomness in secondary textbooks]. In L. Berenguer, P. Flores, & J.M. Sánchez (Eds.), *Investigación en el Aula de Matemáticas.* (pp.203-210).Granada: Departamento de Didáctica de las Matemáticas. Sociedad Andaluza de Educación Matemática Thales.

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SANCHEZ-COBO, F. T. (1999). *Significado de la correlación y regresión para los estudiantes universitarios* [The meaning of correlation and regression for University students]. Unpublished PhD thesis: University of Granada (Spain).

SANCHEZ-COBO, F. T., & ESTEPA, A. (1996). Análisis de ejercicios de correlación y regresión en libros de texto de bachillerato. [Analysis of correlation and regression tasks in Secondary Education text books]. In M. de la Fuente & M. Torralbo (Eds.), *VII Jornadas de la Sociedad Andaluza de Educación Matem·tica "Thales"* (pp. 303–316). Córdoba (Spain): Sociedad Andaluza de Educación Matemática "Thales".

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SANCHEZ-COBO, F. T., & ESTEPA, A. (1998). La regresión en los libros de texto de Secundaria. [Regression in Secondary Education text books]. In: D. Cárdenas & A. J. López, (Eds.), *VIII Jornadas de la Sociedad Andaluza de Educación Matemática "Thales"* (pp. 333–340). Jaén (Spain): Sociedad Andaluza de Educación Matemática "Thales".

Schacht, S. P. (1990). Statistics textbooks: Pedagogical tools or impediments to learning, *Teaching of Sociology,* 18, 390-396.

SOWEY, E. R. (1998). Statistics teaching and the textbook. An uneasy alliance. In L. PEREIRA- MENDOZA, L. S. Kea, T . W. Kee & W.K. WONG (Eds.), *Proceedings of the Fifth International Conference on Teaching of Statistics,* (vol. 1, pp. 151–158). Voorburg (Netherlands): International Statistical Institute.

YI, L. (1994). Reform of the statistical teaching and statistical textbooks in China, *Proceedings of the IV International Conference onTeaching Statistics* (v. 2, p. 6o5). Marrakesh: INSEA.

Supplement: Three Projects on Italian Textbooks

OTTAVIANI, M. G. (1993). I libri di testo e la statistica: metodi di analisi e confronto di testi [Textbooks and statistics: Analysis methods and texts comparisons] *INDUZIONI. Demografia, probabilità e statistica a scuola,* 6, 93-120 (in Italian). To examine textbooks in statistics a set of indicators was built with reference to the books of Applied Mathematics most utilised in Rome's schools (Italy) in 1990-91. Content indicators introduced were percentage of pages of statistics theory within the number of pages of statistics, and percentage of pages devoted to the different statisticalconcepts within the pages of statistics. Didactic indicators introduced were percentage of frontal exposition pages within the pages of statistics theory, percentage of statistics exercises within the total number of exercises, percentage of exercises with good quality data, percentage of exercises without reference to a real statistical situation, and percentage of tables with quoted references. These indicators allowed me to classify the books into four categories.

As the authors of the mathematics books which also contain statistics in Italy are very often written by non-statisticians, who usually have big difficulties in introducing the subject, I also proposed to utilise a textual analysis, performing SPAD.N, in order to examine the "definition" of statistics given by each author. This analysis helped better to clarify the keyword used to characterise each category of books, and to order the books in an objective way. The conclusion was that to judge a book in Italy it is important not only to look at its exercises (see COBB, 1987) but also after the way it introduces and "define" the discipline.

OTTAVIANI, M. G. (1995). Statistics and probability in educational journals for the primary school in Italy. *Bulletin of the International Statistical Institute, Contributed Papers, ISI 50th Session,* Book 2, pp.934-935. Biejing, China: Organising Committee.With regard to probability and statistics, the present study examines, in quantitative terms, the educational proposals contained in the three most important and widely distributed journals for teachers and then makes a synchronic comparison among the journals as well as a diachronic

comparison of them way in which each journal has modified over time content and teaching aids.

The data obtained concerned teaching aids used and the space they occupied within the article, and educational targets and how they were dealt with. The data base referred to 112 articles for statistics and 110 in probability. Traditional descriptive analysis was used except to study the content, where a multiple correspondence analysis was performed, for statistics and probability articles, respectively.The analysis performed highlighted the different approaches used by the journals in question.

OTTAVIANI, M. G. (1998). INDUZIONI: The Italian journal on teaching statistics. In L. Pereira and others (Eds.), *Statistical Education - Expanding the Network. Proceedings of the Fifth International Conference on Teaching Statistics* (Volume 1, pp.493-499). Singapore: International Statistical Institute.The paper highlights the relationships among the topic, educational level and curriculum area of articles in the journal by applying multivariate correspondence analysis to a set of categorical data observed in each article. The supplementary variable year of publication helps outline how the editorial policy evolved from 1990 to 1997.

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8. Other Publications of Interest

Anderson-Cook, C. M. (1999). An in-class demonstration to help students understand confidence intervals. *Journal of Statistical Education*, 7(3). This article discusses an active learning technique that can be easily incorporated into a variety of introductory statistics classes to demonstrate purely subjective and statistical confidence intervals. The concepts of confidence intervals, confidence levels, and the fixed, but unknown, population parameter are frequently misunderstood by a significant proportion of students. This class activity demonstrates these concepts by stressing the objective nature of statistical confidence intervals. It also emphasises that the precision of the interval depends on the quality of the data used in its construction.

Gibbs, G., & Robinson, D. (1995). Learning abstract concepts with computers. The experience of users learning about correlation. *Psychology Teaching Review* 4 (2), 113-123. Correlation Explorer is a fact-free, almost didactically neutral computer aided learning tool designed to help students learn about correlation, scattergrams and regression. Users can manipulate points and observe the effects on various statistics. The program was formatively evaluated using the analysis of verbal protocols. Analysis showed that some participants who had been asked merely to explore the program, with no prior tasks specified and minimal assistance, did learn about correlation. However, analysis also showed that participants often retained significant misperceptions and it is suggested that such software might be used educationally in a remedial context to detect lack of understanding.

Lakoma, E. (1998). The diachronic view in research on probability learning and its impact on the practice of stochastics teaching Pp. 116-120 in Jaquet, François (ed*.) Les liens entre la practique de la class et la recherche en didactique des mathématiques* [Relationships between classroom practice and research in mathematics education] Proceedings of the CIEAEM 50, Neuchâtel, Switzerland. This work describes an approach to teaching probability which has roots in the historical development of the subject and also in the exploration of probabilistic games and puzzles. It is reporting material from her doctoral thesis in which she has seen the probability concept as having a duality which encompasses an epistemological aspect and a random aspect. She developed an approach to probability teaching which exposed students from a very early age to both of these aspects. The three examples in her brief paper are imaginative, and slightly different from what I am used to seeing in English texts, but I feel I need more information to be able to understand fully the approach which she has taken in her doctoral work.

Lesser, L. M. (1999). Making the black box transparent: Technology motivating mathematics. *Mathematics Teacher*, 92(9), 780-784. Examples are discussed that provide fresh opportunities for viewing technology and mathematical theory as partners rather than competitors. The dominant example is line of best fit (secondary examples are interpolating polynomials, and complete graphs), explaining how the formulas can be derived with algebra rather than calculus.

Lesser, L. M. (1999). The y's and why not's of line of best fit. *Teaching Statistics*, 21(2), 54-55.This article presents a sequence of explorations and responses to student questions (Why not use perpendicular deviations? Why not minimise the sum of the vertical deviations? Why not minimise the sum of the absolute deviations? Why minimise the sum of the squared deviations?) about the rationale for the

commonly used tool of line of best fit. A noncalculus-based motivation is more feasible than may be assumed for each aspect of the least-squares criterion „minimise the sum of the squares of the vertical deviations between the fitted line and the observed data points.

Popper S. J., & Chen, Y. P. (1999), A novel method of proof with an application to regression. *Journal of Statistical Education*, 7 (3) .A useful way of approaching a statistical problem is to consider whether the addition of some missing information would transform the problem into a standard form with a known solution. The EM algorithm, for example, makes use of this approach to simplify computation. Occasionally it turns out that knowledge of the missing values is not necessary to apply the standard approach. In such cases the following simple logical argument shows that any optimality properties of the standard approach in the full-information situation generalise immediately to the approach in the original limited-information situation: If any better estimate were available in the limited-information situation, it would also be available in the full-information situation, which would contradict the optimality of the original estimator. This approach then provides a simple proof of optimality, and often leads directly to a simple derivation of other properties of the solution. The approach can be taught to graduate students and theoretically-inclined undergraduates. Its application to the elementary proof of a result in linear regression, and some extensions, are described in this paper. The resulting derivations provide more insight into some equivalence among models as well as proofs simpler than the standard ones.

de Queiroz e Silva Coutinho, C. (1999). An experience of simulation with Cabri. Paper presented at *CabriWorld 99*, Sao Paulo, Brazil. This research is a part of a doctorate thesis, developed on the theoretical frame of the didactics of mathematics in Grénoble University Joseph Fourier and LEIBNIZ laboratory (EIAH project). This work is a part of a co-operation project CAPES-COFECUB. The main part of this work is about the simulation of random experiments that can be represented by a model, that we will call it pseudo-concrete, of the Bernoulli's Urn. Our didactical hypothesis is: "before introducing the probabilistic models and the calculus of the probabilities for these models, it is necessary that the students make the appropriation of a model building process. If not, they are in risk of making many calculations without signification, because they are not aware of a model giving a sense to these calculations. Consequently, we introduce a device allowing the introduction to the geometric probabilities through an experimental approach: the Urn of Pixels. This urn is a reification of the Bernoulli's Urn designed to represent a given random experiment. The simulation on computers, accessible to teenagers students, is done using the geometric random generators of Cabri-Géométre II.

Wilkinson, L., & the Task Force on Statistical Inference. APA Board of Scientific Affairs. (1999). Statistical methods in Psychology journals. *American Psychologist,* 54, 594-604. In the light of continuing debate over the applications of significance testing in psychology journals and following the publication of Cohen's (1994) article, the Board of Scientific Affairs (BSA) of the American Psychological Association (APA) convened a committee called the Task Force on Statistical Inference (TFSI) whose charge was "to elucidate some of the controversial issues surrounding applications of statistics including significance testing and its alternatives; alternative underlying models and data transformation; and newer methods made possible by powerful computers" (BSA, personal communication, February 28, 1996). Robert Rosenthal, Robert Abelson, and Jacob Cohen (co-chairs) met initially and agreed on the desirability of having several types of specialists on the task force: statisticians, teachers of statistics, journal editors, authors of statistics books, computer experts, and wise elders. Nine individuals were subsequently invited to join and all agreed. These were Leona Aiken, Mark Appelbaum, Gwyneth Boodoo, David A. Kenny, Helena Kraemer, Donald Rubin, Bruce Thompson, Howard Wainer, and Leland Wilkinson. In addition, Lee Cronbach, Paul Meehl, Frederick Mosteller and John Tukey served as Semor Advisors to the Task Force and commented on written materials.

The TFSI met twice in two years and corresponded throughout that period. After the first meeting, the task force circulated a preliminary report indicating its intention to examine issues beyond null hypothesis significance testing. The task force invited comments and used this feedback in the deliberations during its second meeting. After the second meeting, the task force recommended several possibilities for further action, chief of which would be to revise the statistical sections of the *American Psychological Association Publication Manual* (APA, 1994). After extensive discussion, the BSA recommended that "before the TFSI undertook a revision of the *APA Publication Manual,* it might want to consider publishing an article in *American Psychologist,* as a way to initiate discussion in the field about changes in current practices of data analysis and reporting" (BSA, personal communication, November 17. 1997). This report follows that request.

9. Complementary Short References

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BANGDIWALA S. (1990). Systematic bias due to rounding. *Teaching Statistics* 12, 14.

BANGDIWALA S. (1990).Training professionals in clinical research in Latin America: Brazil, Chile, and Costa Rica, *Book of Abstracts, Volume III of the International Conference on the Caribbean and Latin American Crises: A Challenge to International Professionals*, Mexico City, 80-81.

BANGDIWALA S. (1992). The teaching of the concepts of statistical tests of hypotheses to non-statisticians. Presented at the Biometric Society Spring ENAR Meeting, San Antonio.

BANGDIWALA S. (1993). El estadistico, el bioestadistico, y el epidemiologo: Sus roles y los avances en el area de la computacion [The statistician, the biostatistician and the epidemiologist: Their roles and progress in computation]. Invited paper at the First National Congress on Statistics, San Jose, Costa Rica.

BANGDIWALA S. (1993). Teaching biostatistical concepts and methodology to medical professionals: Various alternatives. Presented at the First Meeting of the International Association for Statistical Education, Perugia, Italy.

BANGDIWALA S. (1994). Enseñanza de la estadistica: Presente y futuro [The teaching of statistics: Present and future]. Invited presentation at the Sixth Meeting of the Southern Chapter of the Chilean Statistical Society, Temuco, Chile.

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CARVALHO, C. (1998). Tarefas estatísticas e estratégias de resposta (Statistical tasks and response strategies). Paper presented at the *VI Encontro de Investigaçao e Educaçao Matemática,* Castelo de Vide, Portugal: Sociedade Portuguesa de Ciências da Educaçao.

CARVALHO, C., & CESAR, M. (1999). Reflexões em torno de diâmicas de interacçãao: O caso do trabalho em díade em tarefas não habituais de estatística (Reflections around the interaction dynamic: Working in pairs with unusual statistical tasks). Paper presented at the *VIII Encontro de Investigação Educaçao Matemática.* Mangualde: Portugal: Sociedade Portuguesa de Ciências da Educaçao.

Hancock, C., Kaput, J., & Goldsmith, L. (1992). Authentic inquiry with data: Critical barriers to classroom implementation. *Educational Psychologist,* 27, 337-364.

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Lakoma, E. (1998). On the Interactive nature of probability learning. *Proceedings of CIEAEM-49 (p*p. 144-149). Setubal, July 1998

Mokros, J., & Russell, S. (1995). Children's concepts of average and representativeness. *Journal for Research in Mathematics Education,* 26(1), 20-39.

Sáenz Castro, C. (1999). *Materiales para la enseñanza de la teoría de probabilidades* [Materials for teaching probability theory]. Madrid: ICE de la Universidad Autónoma.

Zavslavsky, O. (1998, April). *Teachers' learning from students' thinking: The case of probability.* Paper presented at the NCTM Research Presession, Washington, DC.

10. Internet Resources of Interest

IASE Web Site. The IASE executive is developing a web site which will provide much information useful to anyone involved with statistical education at http://www.cbs.nl/isi/iase.htm. As ell as providing information about the IASE and ISI, it provides links to relevant conference sites, statistics teaching resources, statistical societies, data archives and discussion lists.

Research on the Role of Technology in Teaching and Learning Statistics. Papers from the 1996 Round Table Conference of IASE, Granada, Spain are available at:
 http://www.dartmouth.edu/chance/teaching_aids/IASE/cover.html

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11. Information on Past Conferences

11.1. Statistical Education Sessions in CLATSE IV, Mendoza, Argentina, July 26-30
Ana Silvia HAEDO, Facultad Ciencias Exactas, y Naturales, Universidad de Buenos Aires, Argentina,
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CLATSE is a meeting organised jointly by the Sociedad Argentina de Estadistica (SAE) and the Sociedad Chilena de Estadística (SOCHE) since 1991. Last Clatse IV was held at Mendoza (Argentina), where sessions on teaching statistics at all levels were organised. These sessions were opened by Maria Gabriella OTTAVIANI (Universitá La Sapienza, Roma Italy) who talked about the *"International Perspectives on Teaching Statistics"* . The conference was followed with attention by an important number of assistants that participate in the final discussions.

Ana Silvia HAEDO organised and chaired a Round Table to discuss statistics education problems. Participants were Maria Gabriella OTTAVIANI, Martha ALIAGA (The University of Michigan, U.S.A.), who explained her experimental method to teach statistics with graphic calculators at University level, and Elsa Servi, head of the School of Statistics at the Universidad Nacional de Rosario, Argentina, who gave a panorama of current problems and projects. Dr. Pilar Iglesias (Universidad Católica de Chile and current SOCHE President) spoke about the methodology that have just being introduced for teaching statistics at Chilean schools. Statisticians collaborating with the Ministry of Education are actively changing programs and methodologies for teaching statistics at the different school and University levels.

The following courses were organised for elementary and secondary school teachers:
- Teaching statistics at elementary school. First and Second level of EGB (6 - 11 year old students). Adriana Mallea de Fuentes, and Ana María Ruiz (Universidad Nacional de San Juan) .
- Teaching statistics at elementary school. Third level of EGB (12 - 14 year old students). Mónica Guitar (Universidad de Mendoza).
- Informatics and education. Simulation and randomness. Ana Silvia HAEDO and Daniel Vazquez Vargas (Universidad de Buenos Aires).
- Teaching statistics at University level (18- 21 year old students). Martha ALIAGA (The University of Michigan)

Posters and oral communications presented interesting results of experiences in different Latin American Countries.

11.2. ISI 52nd Session, Helsinki, Finland, 1999

Statistical educators were present last August in Helsinki where the importance of our discipline was demonstrated at the 52nd ISI meeting. A total of 21 invited speakers and 14 discussants gave some wonderful presentations in the six sessions organised by the IASE plus the joint session with the IAOS. IASE members were also involved in a panel discussion on. statistical literacy. Apart from these there were another five contributed paper sessions in which over 30 papers were presented. The complete papers are available in the Proceedings of the 52nd Session of the ISI, Helsinki, 1999 and from our ISI52 site, ttp://www.swin.edu.au/maths/iase/isi52.html.

Summaries of the Invited Statistics Education Paper Sessions at ISI-52

IPM 58. Statistical Education and Significance Tests Controversy. Organiser /Chair: Carmen BATANERO

DAHL, H. *Teaching Hypothesis Testing. Can it still be useful?* Recently statistics has become a part of the curriculum in secondary schools in Norway including Testing Hypotheses and Interval Estimation. The introduction of these topics has not been without controversy. Because of this the Norwegian Statistical Society in 1996 formed a committee to evaluate the different textbooks. One criticism were the lack of interesting applications of the theory. In his presentation Henrik discussed teaching key concepts, teaching problems and suggested some meaningful examples that can help students to understand basic concepts behind statistical tests.

VALLECILLOS, A. *Some empirical evidence on learning difficulties about testing hypotheses.* In her paper Angustias presented a survey of educational experimental research on this topic, as well as a summary of the results in her own comprehensive assessment of undergraduates' learning difficulties concerning statistical tests. She pointed to some difficulties and errors that underlie the problems described and should be taken into account to improve the teaching and learning of the topics. Students' conceptions about key concepts in statistical tests were also described.

LECOUTRE, B. *Beyond the significance test controversy: Prime time for Bayes?.* To solve the paradoxical situation around statistical tests, Bruno suggested it is time for a positive agreement of procedures that bypass the common misuses of statistical tests. He suggested that the Bayesian philosophy should become an attractive challenge for the scientists, the applied statisticians and the statistical instructors of the 21st century,

In his reaction, Paul K. ITO pointed out that the controversy in fact has three different levels: theoretical statistics (Fisher, Neyman-Pearon and Bayesian inference), applications of statistics (what type of data analysis should we admit in scientific research and published papers) and teaching (when, how and to which extent should we teach statistics). The three levels are in fact interrelated, because our epistemological position affects our applications and our teaching of statistics. Michael CAPOBIANCO provided other significant teaching examples and in his reaction added some other points, such as the difficulty in understanding independence and the philosophical problems around confidence intervals.

IPM 59. Teaching and Training Multivariate Data-Analysis. *Organiser/Chair:* Helena BACELAR Nicolau

Le Calvé, G. *Introduction à la classification en Sciences Humaines.* This paper describes an introductory course on cluster analysis for students in human sciences. Despite their usual weak background in mathematics, these students seem quite prepared to easily go from analysing (data) and learning from real examples what a cluster is, to understanding an abstract notion (distance), since they follow the same kind of reasoning in behaviour sciences. Then they are able to go further, discuss and find solutions to more complex problems of cluster analysis domain.

Bryant, P. G. *Discussion, debate, and disagreement: teaching multiple regression by case discussion.* Peter reported his recent experience in giving courses in statistics in business schools, where he is using the classroom time for debate and discussion rather than lecture, "shifting the emphasis to data and its interpretation rather than focusing on the mathematical techniques involved". The paper particularly focused on teaching multiple regression by emphasising case discussion.

Baeumer, H. P. *Teaching multivariate data analysis in the fields of Biology and Ecology.* Baumer pointed out the relevant role of MDA in these areas. He further pointed out that techniques to teach in a MDA course at the university - spatiotemporal techniques, should already be successfully applied to real world problems and must be implemented in some easy-to-use statistical software systems. An applications-oriented approach how to efficiently collect experimental data as well as how to reliably analyse multivariate data obtained in laboratory and field experiments was described.

Matusita, K. *Some remarks in teaching the correlation coefficient.* Matusita showed some important mistakes that can arise from misinterpreting correlation coefficient values, strongly advising that such kind of studies should be taken into account when teaching and training data analysis, especially MDA methodology. He also referred to graphical representations as adequate tools to help and clarify data analysis problems and to avoid statistical misinterpretation.

The discussion by F. Nicolau included the "need of effective and efficient ways for teaching statistics", "what

about text books and available software", "need of a syllabus and database of basic notions on cluster analysis", "multimedia auxiliary materials and knowledge of new technologies behind new approaches to teaching MDA", "training teachers", "role of classification and data analysis societies" and "preparing one's mind for full citizenship and democracy".

IPM 60. Statistical Education Using Flexible Learning Approaches. Organiser /Chair: Agostino Di CIACCIO

Ramsay, J. B. *Why do students find statistics so difficult?* James outlined that a main problem in learning statistics is that statistics and probability theory are essentially acausal. Starting from this consideration he tried to deduce the implications for the teaching of statistics together with practical suggestions for their implementation.

Nolan, D. & Temple Lang D. *Multimedia Statistical Labs & Toolkit (TILE).* The TILE project consists of two parts: statistics labs that are designed to teach students how to think critically (and statistically) about quantitative problems; and a toolkit, which provides a flexible and extensible environment where instructors can develop portable teaching applications. Deborah showed some instructional labs which use multimedia to create an interactive and applied setting where students learn the important statistical concepts. Exercises, simulations, problem solving and even animated adventures and puzzles are used to involve the students.

SAPORTA, G. *Teaching statistics with Internet: a survey of available resources and the St@tNet Project.*

GALMACCI, G. and PURANEN, J. were the two discussants of the session. Concerning the paper of Ramsay it was argued that there are also other components which make statistics so difficult. There was several positive comments on the innovative project TILE presented by Deborah Nolan, however it was observed that more research should be carried out to evaluate the efficacy of this kind of tools in the teaching of statistics.

IPM 61. Statistical Education for Life. *Organiser/Chair:* Brian PHILLIPS (Australia)

GRAY, M. J*ustice by the numbers: Educating judicial decision makers.* This paper showed how the testimony of statistical experts has become increasingly important in many legal situations elsewhere in the world. However, judges often have great discretion in deciding what evidence can be admitted and ultimately the validity and weight of such evidence. Given that not only is statistics not well understood by the general public, but in fact may produce anxiety, sound judicial decision making is in real jeopardy if the decision makers cannot be made to understand and evaluate statistical evidence properly. Ethical, didactical and statistical related problems were discussed.

Lo Moro, V. *Official statistics and the outside world.* This paper discussed the issue of the increasing demand for official statistics from National Statistical Institutes and the satisfaction of the users in the workplace with the information and service they receive. This paper aimed at suggesting an evolutionary model for statistical education required by the increased consumption of official statistics.

Burls, A. *Childhood leukaemia - communicating with a worried public.* Amanda explained how in circumstances of intense public demand and extensive adverse publicity, health authority's usually respond by setting up, predictably inconclusive, epidemiological studies. However, despite intense public, political, media and management pressure to do just this, her team chose rather to educate the public about disease clusters and the limitations of epidemiological methods. This involved working with the community and media and producing a written report for parents and later working with the BBC to produce programmes on disease clusters. The report is available on the Northamptonshire Health Authority's website http://www.northants- ha.anglox.nhs.uk.

In the discussion John Pidgeon and Helena BACELAR-Nicolau commented how contacts between statistical methodologists and users of statistics must be continually improved and that such a goal can be accomplished by developing co-operation among institutions.

IPM 62. Issues Involved in the Assessment and Evaluation of Student Learning of Statistics. Organiser: Joan GARFIELD (USA) Reported by Joe WISENBAKER (USA)

STARKINGS, S. *How to assess large groups with the minimal amount of resources but preserving quality.* Susan considered the advantages and disadvantages of three different approaches to assessing student learning in the context of large classes: multiple-choice exams, group work and in-class presentations. These were viewed from the perspectives of diagnostic, formative and summative assessment.

Chance, B., GARFIELD, J., & delMas, R. *A model of classroom assessment in action: using assessments to*

improve student learning and statistical reasoning. This paper presented an on-going study of the effectiveness of a computer simulation activity focused on constructing and visualising the concept of sampling distributions. The perspective on assessment that guided their work was directed toward the long term improvement of their computer program and a search for critical features that might serve to enhance students' understanding as assessed through graphics-based test items.

CICCHITELLI, G., Bartolucci, F., & Forcina, A. A*ssessment in statistics using the personal computer.* CICCHITELLI, reported on the development of a computer-based assessment system in introductory statistics courses involving true-false items and latent trait modelling. A central feature of the testing model employed is a large item bank with individual items calibrated with respect to item discrimination and difficulty. Items are blocked and presented by personal computers to students in either a preselected order or by random selection.

In the discussion Dani BEN-ZVI included considerations of alternative assessment practices with a strong emphasis on their purpose. He emphasised the need to combine new methods with the old in the service of improving available information, to view students as active participants in the evaluation process, and to be aware of new developments in assessment. Gilberte SCHUYTEN focused on the paradigmatic and pragmatic differences underlying each paper. In particular, she looked at the why, who, what, when and conditions of assessment considered by the authors.

IPM 63. Visualisation as an Educational Tool. *Organiser/Chair:* Larry WELDON (Canada)

BRADSTREET, T. *Graphical Excellence. The importance of sound principles and practices for effective communication.*" Statistical education needs to take this responsibility more seriously than in the past, since graphics are no longer merely a frill to supplement numerical results but rather a basic form of quantitative communication.

MITTAG, H. J. *Emphasising visualisation and activities in teaching introductory statistics by interactive multimedia.* A multi-media statistical education computer package and the pedagogic principles underlying it were presented. The use of sound, real data sets, and pictures, was also included to stimulate interest. The package was proposed as a way to make statistics more attractive to students. Information about the project and a demo version is at http://www.fernuni-hagen.de/STATISTIK .

PERES, C. *Visualisation for teaching all steps of data-based scientific research.* Clovis proposed that an additional emphasis on the scientific method would help students to bridge the gap between their technical learning and the needs of the scientific world.

Andrej BLEJEC agreed with the idea that a spectrum of objectives exists for graphics, from analytical tools at one extreme to presentation graphics on the other extreme. We need to make students aware of this spectrum as well as give them detailed training in how to choose details from graphing options. He pointed out the need for large budgets and international co-operation in the development of this kind of teaching tool.

IPM 42. Statistical Training of People Working in and With Official Statistics. Co-organised by Carol Joyce BLUMBERG (Representing IASE) and René H. M. Smulders (Representing IAOS, International Association for Official Statistics).

Biggeri, L., & ZULIANI, A. *The dissemination of statistical literacy among citizens and public administration directors.*. The fight against illiteracy has achieved considerable success in the 20th century under the leadership of UNESCO, but statistical literacy, has received little attention. Further, there is a need for a statistical culture among policy makers in both the public and private sectors, as well as among the mass media and teachers at the primary and secondary levels. A strategic plan needs to be developed, with detailed objectives and actions, that includes the implementation of a pervasive educational process both in schools and in society. The paper concluded with the actions carried out thus far by ISI globally, and by SIS (the Italian Statistical Society), Istituto Nazionale di Statistica (ISTAT) and the Ministry of Education in Italy.

BREGAR, L., & OGRAJENSEK, I. *Impact of the internet on Official Statistics: New opportunities and dilemmas for training.* The focus of this presentation was the Course on European Economic Statistics (CEES) which the authors developed in co-operation with TES (Training of European Statisticians) Institute and colleagues at the University of Ljubljana and in Sofia, Bulgaria.

Hewitt, L. *New and emerging demands for statistical training in response to user needs: Meeting the human resource challenge in the Caribbean.* Hewitt began her presentation by explaining how market

globalisation and the increased use of computers and other technologies have made it vital for the Caribbean (and other developing regions) to produce useful economic, demographic, and social statistics. Yet, at the University level statistics is still not regarded as a priority area and not even given a status similar to that of Economics, Engineering, the Natural and Medical Sciences or even the Humanities. The presentation ended with a discussion of the economic obstacles that make the creation of a statistical culture hard in the Caribbean.

The first discussant, Jayanta K. Ghosh discussed Biggieri's definition of statistical literacy and expressed the hope that the World Numeracy Programme will be able to begin to have a visible impact. Paul CHEUNG emphasised that academic statistics programs must do more to help prepare their graduates to fit the needs of the National Statistics Offices (NSOs), while at the same time making sure that statistical education and training does not degenerate into the mere teaching of statistical packages with little theoretical content. Although formal educational institutions and training institutes have an important role to play in basic statistics education, NSOs must be involved in the continuing education of the public and of statistics professionals.

IPM 6. Statistical Literacy: Panel Discussion. Chair: Luigi Biggeri, report by Carol Joyce BLUMBERG.

The panellists were Ajayi, O.O., BLUMBERG, C., OTTAVIANI, M. G. and Podehl, M. Panellists gave 10 minute presentations on what their countries, primarily through their national statistics offices and national statistics and mathematics societies, were doing in terms of statistical literacy. There was then a lively discussion for approximately one hour with many of the members of the audience participating. It is clear that Statistical Literacy is an important issue since this Invited Panel discussion was extremely well attended by those interested in statistics education, in official statistics as well as other areas of statistics.

IASE Contributed Papers

CPM96. Statistical Education I

ENGEL, J. Teaching statistical modelling through smoothing.
HABIBULLAH, S. N. Data analysis talent award: an important step forward.
KORDOS, P. Some aspects of statistical training in transition countries.
Kvuam, P. H The relationships between active learning and long term retention in an introductory statistics course.
Kääeik, E., Vähi, M. Problem oriented tutorial.
Liewendahl, P. Professional development training programme for statisticians.
MCLEAN, Hypothesis testing and Westminster system.

CPM94: Teaching Basic Statistics

AGALABIA, V. The status of statistics education in the Philippine secondary schools.
BATANERO, C., TAUBER, L., & MEYER, R. From data analysis to inference: a research project on students' understanding of the normal distribution.
BERRONDO-AGRELL, M. Trees and generalised Venn diagrams; a rich duality.
CHADJIPELIS, T. Teaching teachers to teach statistics.
LAMPRECHT, T. Assessment in a statistics course under the South African qualification authority.
NASSER, F. Prediction of college students' achievement in an introductory statistics course.
Stene, J., Conradsen, K. Multiple- choice examination papers at a basic university statistics course. Experience through 12 years.
WISENBAKER, J. M., Scott, J., & NASSER, F. A cross cultural comparison of path models relating attitudes about and achievements in introductory statistics course.

CPM 96. Statistical Education II

MOTORYN, R. Teaching international economics statistics. The Ucranian experience.
OGRAJENSEK, I., & BREGAR, L. Economics statistics on-line course developers' challenges and dilemmas.
Takahashi, Y., Takahashi, T., & WISENBAKER, J. M. Using knowledge structure as a diagnostic tool with students taking introductory statistics. Takakazu, S., Shin-Ichi, T. An introduction of statistical testing in secondary education.
WANG, A. L. Understanding exploratory plots in an introductory data analysis course.
Wang, J. Distance education in the statistics training in China.

WELDON, K. L. Experience with an online introductory statistics course.

CPM97. Teaching Statistics for non Statisticians

CHACKO, I. The place of statistics in the school system: case study of a Melanesian island.
Feijo, C. A. The Brazilian statistical office experience in training.
Josimovski, S., & Blagoeva, K. T. Perspective of the global computer networks in the statistical education and practice of the faculty of economics.
Miura, Y. New development of statistical education in the secondary level education in Japan.
PANGE, J. How to teach statistics to a life-long learning group of school teachers.
SEVERINO, L., RUGGIERI, M., & MALVICINI, S. Experience about the result with the application of a new method to teach statistics.
Stander, I. A., Teaching of conceptual vs theoretical statistics to medical students.
TERAN, T. Introducing interactive statistics for teaching statistics to students of the general basic education in Argentina.
Zhiang, X. Tentative plan for the vocational education of non-professional statisticians.

CPM141. Educational Statistics

BAZARGAN, A. Internal evaluation: An approach to use data for action in higher education quality improvement.
Castellano, R. New conceptual and defining spaces derived from example of education in Italy.
Dobson, I. R. Australian higher education student data collections: A blueprint for other countries
KOUADIO, A. O. Impact de l'environment socio-economique et pédagogique sur la réussite des filles en fin de siecle.
Pidgeon, J. The use of labour statistics in education planning.

11.3. Experiences and Perspectives on Teaching Statistics. Challenges for the XXI Century, Florianópolis, Brazil, 20-22 September, 1999

The five-year interuniversity co-operation PRESTA Programme was set up in 1994 by the Laboratoire de Méthodologie du Traitement des Données of the Université Libre of Brussels, Belgium in co-operation with other European Universities, and with the support of the European Union and the Brazilian Statistical Society and IASI (Inter American Statistical Institute). This September PRESTA organised a Conference on the Teaching of Statistics with the help of ASE, the Universidade Federal de Santa Catarina (UFSC). The International Programme Committe was formed by: Eduardo CRIVISQUI, PRESTA, Chair <ecrivisq@ulb.ac.be>; Maria Gabriella OTTAVIANI, IASE <ottavian@pow2.sta.uniromal.it>; Carmen BATANERO, IASE, <batanero@goliat.ugr.es>; Brian PHILLIPS, IASE <bphillips@swin.edu.au>; Lucio Botelho, UFSC, <lucio@reitoria.ufsc.br>, Pedro Ferreiro Filho, UFSC <dpff@power.ufscar.br>. The organising committee was formed by Pedro A. Barbetta, UFSC, <barbetta@inf.ufsc.br>, Paulo J. Ogliari, UFSC, <ogliari@inf.ufsc.br> and Gretel Xerstin Villamonte a, PRESTA <gretel@odon.edu.uy>. About 170 participants from 15 different countries attended. Plenary speakers were Jandyra M. G. Fachel (UFRGS), Maria Gabriella OTTAVIANI, and Eduardo CRIVISQUI. A workshop on exploratory data analysis was organised by Carmen BATANERO and directed to secondary school teachers. The following papers were presented at the conference and are available at http://www.inf.ufsc.br/cee

Round Tables:

1. Teaching statistics in the professional training. Organiser: M. G. OTTAVIANI. Speakers: Pedro A. Barbetta, Renato Dittrich, Ana S. HAEDO, Pedro A . Morettin, and Pedro L. N. Silva.

2. Training statisticians for research and teaching. Organiser: Clóvis A. PERES. Speakers: Lisbeth K. CORDANI, German C. Iglesias, Cesar AGUIRRE, and João Riboldi.

3. Teaching statistics in primary and secondary schools. Organiser: Carmen BATANERO. Speakers: Elena CARRERA , Margarida CESAR, Celi A. E. Lopes), Ernesto A. Sanchez and Dinara W. X. Fernandes .

4. Continuing training in statistics. Organiser: Pedro L. N. Silva. Speakers: Eduardo CRIVISQUI, Omar Barriga, Carlos M. Batista, Mercedes Delgado and José Francisco Soares.

Research Reports

Abraira, V., Cabello, J. B., Gómez-García, J., López-Sánchez, L. & Pozo, F. *Formación estadística de investigadores en ciencias de la salud: El caso EC n=1* (Statistical training of researchers in biomedical sciences. The case EC=1). This paper describes an educational programme on Clinical Research Methodology directed to clinicians and clinical researchers in a hospital. Within 'problem-based learning methodology, clinical trials with individual patients are a good tool for teaching diverse concepts about experimental design and data analysis. Starting with a typical clinical problem, within the clinical practice-research interface, namely making decisions about the best treatment for a patient, it is possible to develop a detailed explanation of the concepts of sample size, randomisation, significance level and test power, and to choose the best test. The most appropriate test for these trials -permutation-based tests-, are particularly intuitive for explaining these statistical concepts.

Batista, C. M., Hocsztain, E., & Aguirre, C. *Experiências metodológicas no ensino da análise exploratória de dados na América Latina* [Methodological experiences to teach exploratory data analysis in Latinoamerica]. This paper deals with innovative experiences in teaching Exploratory Data Analysis in some university centres in Latin America. It focuses on a different approach to teaching and learning statistics based on interaction among data analysis tools, software, instructors and students. The main feature presented is a course in a "one week format" where basic concepts, simple tools or advanced questions are explained in a dynamic way with the effective use of special training material and a specific software. These courses are dedicated to professionals, professors and researchers. These experiences have been well received by the participants.

Borim da Silva, C., Mauricio Cazorla, I. & Ferreira de Brito, M. R.. *Concepções e atitudes em relação à estatística* [Conceptions and attitudes concerning statistics]. The goal of this study was to determine concepts and attitudes toward statistics in students engaged in a student research program in a private university. Subjects were 62 undergraduate Senior students from different areas. Attitudes were measured using a Likert four items scale (m=51,8). These results allowed us to classify the students according to their attitudes toward statistics (44% of students with negative and 56% with positive attitudes). Attitudes were related to the following variables: major area of studies (with or without mathematics), gender, self-perception about performance in statistics and the use of statistics as a tool. Students involved in mathematical courses presented more positive attitudes. Positive attitudes were also observed in male students and those who perceived themselves as good students in statistics. In addition, 54% considered themselves as poor students. Positive correlation was obtained between attitudes and performance. This paper also provides other analysis, including concepts and perceptions about teaching methods.

Delgado Fernandéz, M. *Contribución a la difusión de la cultura estadística en Cuba* [Contribution to statistical literacy in Cuba]. The knowledge of statistics is a world target which becomes in time more necessary. Though, the study of this field is nowadays included in different levels of teaching as well as in several knowledge fields it is still not enough to make an impact in society. So it is necessary in a more direct and effective way to spread statistics mainly to its users. This paper deals with a methodological and organising proposal in order to contribute to more diffusion of statistics, starting from international tendencies and experiences according to the specific characteristic of our country. In fact, it discusses the creation of a Centre for Statistic Reference in Cuba with the support of the PRESTA Program and the collaboration and solidarity of the whole LatinAmerica.

Escartín, E. R. *Papel de la estadística en la formación del profesional de las geociencias. Una experiencia cubana* [The role of statistics in the processional development of geoscientists. A Cuban experience]. Statistical methods have been successfully used in geosciences for more than a century. However, the use of statistics and applied mathematics in geosciences is not always free of difficulty. This paper deals with the special features of applications of mathematics and statistics in the geosciences: the difficulties of modelling, derived from the nature and properties of geologic objects under study, the lack of data and knowledge, the impossibility of establishing proper sampling schemes, and the need for taking into account these features in the educational process of forming qualified professionals of geosciences. Some experiences in training engineers geophysicists in Cuba, including difficulties, subject matters, and dangers in using information tools, are presented.

ESPASANDIN Lopes, C. A. *A probabilidade e a estatística no currículo de matemática no ensino fundamental Brasileiro* [Probability and statistics in Brazilian mathematics curriculum for primary school level]. This paper present a synthesis of the analysis of the teaching of Probability and Statistics focusing on

mathematics curriculum from Brazilian primary school through to the beginning of high school. We analysed the conception of Statistics and Probability underlying these curricula; the choice of statistical and probabilistic concepts in these curricula to be applied to the school program, the approach of teaching them to the students, and the purposes of teaching such concepts, explicated or not by the curricula. From these, we took into consideration some aspects that emerged as the analysis was being developed. Thus, we emphasised the importance of these themes for the students learning, once they offered a possibility of breaking a determinist view of mathematics.

ESPASANDIN Lopes, C. A., & Carvalho Pinto Moran, R. *A Estatística e a probabilidade através das atividades propostas em alguns livros didáticos Brasileiros recomendados para o ensino fundamental* [Statistics and probability through the activities proposed in some books recommended for primary school at Brazil]. In this paper we present a synthesis of the analysis of books indicated for adoption in the Brazilian middle school (7 to 14 years).Our aim is to highlight the perception of the probability and statistics that predominantly permeates, via didactic textbooks, to basic schooling. The focus of the analysis was on the divergence of the conceptions in the national proposal and that of the textbooks. The most frequent misconceptions were pointed out, and also the lack of proper statistical language. Furthermore, the stochastic intended abilities are not in general contemplated since the activities emphasise calculus abilities. Though no specific activities are proposed, some conceptual issues to be treated arose.

GALLESE, E., & Lac Prugent, N. *El Seminario de actualización de econometría aplicada de la Universidad Nacional de Rosario.* [Seminar on practices in applied economics at the National University of Rasario] This paper tells 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. Thinking about future needs and the consequences of the scientific and technological changes ahead, one may ask how the Argentine statisticians and economists are going to accomplish these challenges. In this context, a Update Seminar in Applied Econometrics was implemented, taking special account of the different background of the students of the University of Rosario, Argentina. The event was organised to present and discuss papers describing the current situation of the household surveys, to generate labour and living conditions statistics that show the social realities of the country, in a more adjusted way.

Goldenhersch de Roitter, E. *La enseñanza de la estadistica aplicada en el grado y en el posgrado. Area de ciencias economicas.* [The teaching of applied statistics in under-graduate and post-graduate economics] The main purpose of this paper is to summarise a long experience of teaching statistics (specially applied statistics) in under-graduate and post-graduate courses. It includes specific content, the courses, methodology and the required training and performance by the professors.

Gonzálvez, C. F. F., Strapasson, E., Matsuo, T., Lovato, J. P., Saraiva, T. S., & Benito, R. *Uma metodología de ensino da estatística baseada em pesquisa, aplicada para a 5ª serie de ensino fundamental.* [A teaching methodology based on applied research for Year 5 of primary education]. Another important orientation for the teaching of Statistics in the first and second grades was verified when analysing the documents from MEC (Ministry for the Culture and Education in Brazil) about the National Curriculum Guidelines (PCN). In the documents the didactic orientation of the referred area suggests a teaching procedure by means of practical situations that lead the student to develop field researches. In such cases this work, which is part of a project that has been carried out a UEL, has the purpose of validating a methodology for the teaching of Statistics for the students of the fifth grade of the Elementary School, involving a descriptive analysis of sample data. The proposed methodology was applied in two groups of the grade of the Elementary School at Colegio de Aplicaçao. The students, between the ages of 10 to 12, performed a task with pictures collected from tables and graphics taken from magazines and newspapers and their interpreted them. After understanding the conceptualisation about drawing tables and graphics, the students were gathered in groups and developed a questionnaire with questions of interest, which were applied to friends, family and teachers. After that the students tabulated the gathered data, drew column graphics, interpreted the results and worked out a report. The initial results point out the viability of the proposed methodology, considering that 83% of the students achieved the goal.

Haanwinckel Hurtado, N. , & da Serra Costa, J. F. *A Probabilidade no ensino médio: A importância dos jogos como ferramenta didática.* [Probability in middle school: The relevance of games as didactic tools]. This paper proposes that the teaching of probability for students of high school must start from direct contact with concrete matters, in which the observation of reality remains the principal motivation leading to the study of more complex ideas. It is also believed that the role of science history in the teaching of

probability can contribute to lessen the difficulties normally faced up by students. It is described an example of a game that can be used during probability classes and how the teacher may take advantage of it to introduce concepts of probability trees. The frequentist approach to probability is highlighted.

Herrerías Pleguezuelo, R., Palacios González, F., & Callejón Céspedes, J. *Un método sencillo para enseñar la dependencia o independencia estocástica entre variables aleatorias.* [A method for teaching statistical independence of random variables] The aim of this paper, is to show a new methodology to analyse the stochastic relation between random variables within statistics teaching. The proposed methodology does not require marginal distributions (that are difficult to obtain) and is shorter and easier than the usual way. The stochastic interdependence between the components of a random vector is obtained from a simple analysis of the logarithm derivative of the density function (continuous case) or of the ratio between two values of the probability function (discrete case). Due to the simplicity of such method, this is a helpful tool when teaching students to check the stochastic dependence or independence between random variables.

Hochsztain, E., Ramiréz, R., & Alvaréz, R. *La Computadora en la enseñanza de la estadística* [Computers in the teaching of statistics]. Introducing computers in the teaching of statistics implies unsuspected possibilities, but also many challenges. The author's experience in PRESTA's seminars and in their respective ambits of work, has allowed them to develop some understanding of the influence of computers in the knowledge process, their use, applications and risks, and to reconsider pedagogical strategies. Their proposal is that computers should be present in all the teaching tasks.

Lucchesi de Carvalho, D. ESPASANDIN Lopes, C. A., & Oliveira, P. C.. *O Ensino da estocástica: Uma linha emergente de pesquisa do grupo PRAPEM.* [Teaching stochastics. An emergent research line in the group PRAPEM]. This paper describes the academic path of three researchers in the teaching of stochastics, members of a research group at the Faculty of Education of the Campinas State University, who are investigating the pedagogical practice and the professional development of mathematics teachers. We chose action-research to develop our research in the teaching of stochastics, and we report on the research already completed and that still in progress.

Martino Jannuzi, P. *A formação em estatística do pesquisador social no Brasil*: Notas para discussão [Training social researchers in Brazil. Some notes for discussion]. This paper discusses aspects of the use of statistical methods in Social Research in Brazil. It brings an evaluation of the methods used by demographers since the end of 70s. It discusses some of the reasons which can explain the lack of use of quantitative methods by social researchers in Brazil. Criticism of empirical practices and epistemological questions are some of the aspects that have not allowed an improvement of the use of methods and the social researchers qualification.

Maurício Cazorla, I., Borim da Silva, C., Vendramini, C., & Ferreira de Brito, M. R.. *Adaptação e validação de uma escala de atitudes em relação à estatística.* [Updating and validating an attitude scale towards statistics]. In many countries the influence of attitudes towards Statistics on statistical competence and performance has been studied in different ways and many scales have been developed. However, this kind of research is recent in Brazil. The aim of this study was to adapt and validate an attitudes towards Statistics scale for undergraduate students. This scale was adapted from the Aiken's attitudes towards Mathematics scale, translated and adapted in Brazil by Brito (1998). The 20 item scale is in a 4-point Likert style format, with 10 positive and 10 negative statements. The scale and a questionnaire were administered at the end of the academic year of 1998 to 1154 undergraduate students enrolled in Statistics courses in different major area of studies at two private universities in S‹o Paulo. A Cronbach's coefficient was 0.95 suggesting a high internal consistency of the scale. A principal components factor analysis with varimax rotation was performed and yielded two orthogonal factors having eingenvalues greater than 1.00. These factors accounting for 61á.% of the total variance, being the first of two factors accounting 51.5%, showing that it is the dominant factor. These results indicate that the attitudes scale is essentially unidimensional. An inspection of the coefficients of the first factor showed the clustering of negative and positive items. The results suggest the adequacy of the use of this scale to measure attitudes towards Statistics in undergraduate students.

Rodríguez Hernández, A. G. *Educación estadística para ingenieros informáticos: ¿Para qué?* (Why the statistics education of computer scientists?). [Why the statistics education of computer scientists?]. Statistics professors who design courses and give lessons for Software Engineering students face a very intense challenge due to the enormous changes directly generated in this profession by the continuous developments in information technology, also by the changes induced in other professions, and also by the complex interactions among all those changes. The mission, and in consequence the

contents and the methods for software engineers' statistical education, should be constantly re-analysed and reformulated, and should study the troubles faced in the execution of related jobs, and the feasible roads to solve those problems effectively. Conclusions from these analyses for the author's particular university conditions are defined as principally the creation of convictions and abilities for obtaining greater advantage from the statistical information contained in the systems in whose design or maintenance this engineer participates. Fundamental methods require the ratification of the emphasis in the basic statistical concepts and techniques, jointly with some broad but peculiar statistical culture, the development of abilities for multidisciplinary work specifically in this field, the confrontation of real statistical tasks from the computer engineer's optics, and co-operative learning in groups commanded by professors well informed about their profession.

Tannuri de Oliveira, E, F, & Cabrini Gracio, M. C.. *O Ensino de estatística na graduação: ensaios para sua reformulação* (Teaching statistics to undergraduates: Some attempts to its reelaboration). [Some attempts to restructure the teaching of statistics to undergraduates]. This work aims for a restructuring of statistics classroom practices in courses where it has an instrumental role. Problems like students' lack of interest, difficulties in dealing with content and in establishing links between statistics knowledge and other fields of knowledge have posed emergent questions in the teaching of this discipline. The teaching of statistics is undergoing a process of reformulation reflected in a project based on research and practice, including collecting of data on issues raised by the students themselves.

Xavier Fernandéz, D. X., & Xavier Fernandéz, D. *O prazer de aprender probabilidade através de jogos: descobrindo a distribuição binomial* [The pleasure of learning probability through games to discover binomial distributions]. It is traumatic for the students that enter in the University to discover the existence of set domain between true and false much more a notion linked to our daily life. Not to focus on Probability and Statistics at School is a gap which is reflected in the moment when the students are requested to present a scientific thought, demanding great effort and considerable time. To find appropriate forms of approaching themes of this nature, at School or University, is part of our mission as educators. An interesting proposal consists of organising games that, appropriately worked in small groups in classroom, are conducive to the development of scientific reasoning, and build, intuitively and with pleasure, the main concepts of Probability and Statistics. With this concern, we elaborate the game that is presented in this paper, whose objective is to introduce the Binomial Distribution.

Ungaro, J.F.. Ubeda, C. & Ricci, L. *La constitución de un laboratorio de metodología de tratamiento de datos como medio para propiciar la formación permanente en estadística aplicada en el campo de la salud. La experiencia de Mar del Plata, Argentina* [Setting up a data analysis methodology laboratory as a way to increase the in-service applied statistical training for professionals in biomedical sciences. The experience in Mar del Plata, Argentina]. The purpose of this exposition is to present an experience about the constitution of an inter-institutional Methodology Data Laboratory as an answer to the need of continuous education about the management of statistics applied to health in the Argentine Republic. An overview of the actual requirements of education in that field by the users of different health official levels is shown, and possible strategies to achieve the purpose are mentioned. References of the opinions about the statistical culture among professionals who worked in the health area are given.

Short Oral Reports and Posters

AGUIRRE, C, N., Niño, M. F., & Zoppi, A. M. *Enseñanza de la estadística en las ciencias sociales. Una estrategia centrada en investigación.* [Teaching statistics in social sciences. A research based strategy].

Aranda, C. L., Delgado, M. L., Menendez, C. M., & Lopes Pereyra, S. *Los graficos, la estadística y los medios de comunicación* [Graphs, statistics and the media].

Aravena C. R., del Pino M. G. *Talleres de probabilidad y estadística para la enseñanza media: un proyecto de divulgación científica* [Statistics and probability workshops in secondary school: A project of scientific diffusion].

Blanco Blanco, A. *Una alternativa didáctica a la enseñanza clásica del análisis de varianza* [A didactic alternative to teach analysis of variance].

CARVALHO, C., & CÉSAR, M. *Algumas questões em torno de tarefas estatísticas com alunos portugueses do 7º ano* [Some questions around statistical tasks Year 7 Portuguese students].

Carvalho, L. R., Vieira, R., Zambello, S., & Mischan, M. M. *Ensino de experimentaçao agronómica usando software de autoría.* [Teaching agronomic experiments with author's software].

Cechinel, C., Maciel Dias, K., Menezes Reis, M., Ohira, M., & Nassar, S. M.. *Concepção e implementação de um ambiente de ensino de estatística* [Conception and implementation of an environment for teaching

statistics].

Cavada, G., Schiattino, L., & Villegas, R. *Magister en bioestadística. Escuela de Salud Pública, Facultad de Medicina, U. Nacional de Chile* [A Masters program in Biostatistics].

CÉSAR, M. *Interações entre Pares e Estatística: Um casamento (quase) perfeito!* [Pair Interaction and statistics: A quasi perfect matching!]

Cirillo da Silva, B. R. *Introdução de noções de probabilidade e estatística nas séries de 1º e 2º graus* [Introducing probability and statistics in 1rst and 2nd years].

Cravero, M. B., Martínez, P.L., MEYER, R., & Rodríguez, M. I. *Actividad en educación estadística en Argentina (1990-99)* [Statistical education activities in Argentina, 1990-99].

Dierê W. Xavier Fernandéz, Lisiane P.R. de Selau. *Cadeias de Markov: Um estudo aplicado ao curso de estatística* [Markov chains: A study applied to a statistics course].

Echeveste, M.E., Messa, L.C. *Pesquisa com alunos e professores para planejamento de melhorias no curso de estatística da UFRGS.* [Research with students and teachers to improve the statistics course at UFRGS].

FERRERI, N., GALLESE, E., Panzeri, A. A., Santone, B., & Cabrini Grácio, M. C. *La currícula estadística acorde a los requerimientos espaciales y temporales* [Statistics curriculum as regards spatial and temporal requirements].

Franzini, D., Baigorria, B., Sánchez, R., Pekolj, M., Ranzuglia, G., & Vannucci, O. *Experiências didácticas que contribuyem ao desarrollo del pensamiento estadístico* [Didactical experiences contributing to developing statistical thinking].

Guedes, T. A., & Ludgero, I. *Aspecto da seleçao de variáveis na análise de correspondéncia* [Selecting variables for correspondence analysis].

Isern de Perretti, S. *Cartas de control estadistico en procesos industriales, una forma de presentar información* [Control quality charts: A way to present information].

Koatz, V. M., & Prado, N. *Qué aprender para enseñar* [What to learn for teaching].

Luchessi, D., ESPASANDIN, C., Oliveira, P. C. *O Praprem. Pratica pedagógica en matemática* [The Praprem. Pedagogical approach for mathematics].

Lunkes, R. A., Guedes, T. A., Martins, A. B. T., & Ivanqui, I. L. *Perfil dos alunos ingressantes na Universidade Estadual de Maringé 1997* [Profile of students entering the Universidade Estadual de Maringé 1997].

MALVICINI, S. *La estadística en Argentina: Una realidad, incumbencias* [Statistics in Argentina: Reality and competencies].

Marçal Mazza Sundefeld, M. L., Nues da Silva, M., Frei, F., & Costa Corrêa D. *Estatística aplicada. Fazendo e aprendendo* [Applied statistics: Doing and learning].

Mendes, C. R. *Uma análise sobre a prática em sala de aula em relação aos conteúdos de estatística inseridos na disciplina de matemática* [An analysis of classroom practice in relation to statistical content in the mathematics curriculum].

Muniz, J. A. *Maestrado en estatística e experimentaçao agropecuaria na Universidade federal de Lavras* [A Masters program in statistics and agronomic research].

Nalbart, L., Ramirez, R. *Formación de estadísticos. Licenciatura en Estadística* [Training statisticians].

Ormeño Aguirre, M. I., Vanlesberg, S. & Seluy, S. *Métodos estadísticos multivariantes, Su importancia y aplicación al análisis de los fenómenos hidrológicos* [Multivariate statistics methods. Their relevance and application to hydrology].

Ribeiro Bartinik, M. *A estatística como instrumento para melhor compreensão da realidade* [Statistics as a tool to for a better understanding of reality].

Rodríguez de Escontrela, B. *Estrategia para elevar los niveles de rendimiento de los estudiantes en la asignatura estadística* [Strategy to increase students' achievement in statistics assignments].

Russo, S., Ilgner, N., Irassogue, C., Butsen, M., & Preussler, R. *Utilizaçao de técnicas estatísticas em projetos de iniciaçao científica* [Using statistical techniques in introductory scientific projects].

SALCEDO, S. *Interpreación de enunciados de probabilidad en su acepción frecuencial por estudiantes españoles y venezolanos* [Interpretation of frequentist probability by students in Spain and Venezuela].

SALCEDO, A. *Tendencias recientes en la educación estadística en Venezuela* [Recent tendencies in statistical education in Venezuela).

Tannuri de Oliveira, E. F., Cabrini Grácio, M. C. *Atividades e indicativos realizados no II Encontro de Ensino de Estatística na Graduação* [Activities at the 2nd Meeting of Graduate Statisticians].

TERÁN, T. E. *Estadística interactiva: Una experiencia en la educación general básica* [Interactive statistics: An experience in general primary education].

Velandrino Nicolás, A. P. & Parodi, L. H. La escala de actitudes hacia la estadística (EAE): Desarrollo y propiedades psicométricas [The scale of statistical attitudes: development and psychometric properties].

Viada González, C., Fernández Gárcia, E., & Escobar Añel, M. L. *Importância del diseño estadístico en la investigación clínica* [Relevance of statistical design in clinical research].

Xavier, D. *Licenciatura en estadística: Necesaria o superflua?* [Statistics degree: Is it really needed?]

Xavier Fernandez, D., Xavier Fernandez, D. W. *Uma aplicação da metodologia de índices de preços* [Application of index number methodology].

Zibetti, N. M. *Cursos de estatística no Brasil* [Statistics courses in Brazil].

11.4. North American Chapter of the International Group for the Psychology of Mathematics Education XXI Meeting, Cuernavaca, México, October 23-26, 1999

The following papers were presented and have been published in the Proceedings, edited by Fernando Hitt and Manuel Santos, Centro de Investigación y Estudios Avanzados, México, 1999.

Plenary Papers

Ojeda, A. M. *Concept and representation in the research on probability education* (v.1, pp. 83-96). This work refers to the way in which elements in the constitution of concepts in the individual are being considered in a research project on stochastics in education. Emphasis is given to the link between concepts and representation by means of semiotic registers. Results from research exhibits how the way of using semiotic registers in classroom sessions on probability can hinder further development of the concept at issue and may impose constraints on the students' interest in the study of random phenomena.

Working group: *The complexity of learning to reason probabilistically.* Co-ordinators: Carolyn Maher and Robert Speiser <cmaher@rci.rutgers.edu and robert_speiser@byu.edu> (pp. 101).

Over the last several years, we have given serious attention to how students learn to reason probabilistically; that is, how learners build mathematical models, and how these models interrelate with each other and with data. A special focus has been on how students build and work with information. Some of this work has been reported and discussed at Singapore (ICOTS-5, June 21-26, 1998), at PME-NA 20 (North Carolina State University, Raleigh, North Carolina, October 31– November 3, 1998), and at the third Robert B. Davis (RBD) Working Conference (Snowbird, Utah, May 22-26, 1999). Discussion, investigation and collaboration continues at various sites around the world. At PME–NA 20 (North Carolina State University, Raleigh, North Carolina, October 31–November 3, 1998) our working group began to build a joint agenda for research and discussion in this sprit. Related work from the Rutgers-Kenilworth longitudinal study, now in its eleventh year is extensive. The working group at PME-NA 20 proposed the following more detailed agenda as an initial focus:

1. Reasoning from data (through modelling and making predictions);

2. Attention to how reasoning and thinking are enacted through communities of learners, teachers and researchers;

3. Studying the development of mathematical ideas as students reason with data;

4. Interpreting students' thinking through an analyses of their images, data representations, model building, and generalisations; and

5. Examining the role of the task, of the classroom environment, of the teacher/researcher, as well as student-teacher interactions and the flow of information and ideas among the learners.

The working group, in building this agenda, emphasised the importance of bringing together a community of researchers to engage in collaborative, cross-cultural research on the long-term development of probabilistic reasoning. We would like to extend the agenda, to address the interplay of combinatorial and probabilistic reasoning for constructing images and models in the course of task investigations. With these aims in mind, we invite participants to join us to collaborate and strengthen both our work and our community.

Research Reports

Alatorre, S. <alatorre@solar.sar.net>. *Adult's intuitive answers to probability problems* (v.1, pp. 451-458). Some of Piaget's experiments with two open urns and simple extraction were repeated with University students. A methodology was constructed in order to design different situations (i.e., combinations of favourable and unfavourable cases) using *combinations* and *locations*, and to detect different strategies used by the

subjects, namely *averages* and *relations* of different sorts, which they use in simple or composed forms. Subjects were interviewed using a variation of Piaget's clinical method. Situations were classified according to their difficulty in six levels, and according to their difficulty of verbal expression. Strategies were also analysed, showing that the most frequently used ones are not correct strategies and that some tend to be used more in composed forms than others. Subjects were classified in one of the six levels; only 20% could solve the problems described by Piaget for the stage of formal operations and at most 66% those for the stage of concrete operations. A hierarchical model is proposed to account for the ways in which adults use their formal or intuitive knowledge.

Berenson, S. <sarah_berenson@ncsu.edu>. *Students' representations and trajectories of probabilistic thinking* (v.1, pp. 459-465). The purpose of this classroom research was to study students' representations of probability generally, and sample space specifically as they engaged in a process of making, testing, and defending conjectures over time. First the data were scanned to collect students' representations of why several dice games were fair or unfair, and how to make the games fair. From these instances a coding system was developed and then the data were scanned again to establish a trajectory of individual student's representations over the game-playing process. Of interest when considering the students' representations are the ebb and flow of these ideas. When traced over time, the collection of representations created trajectories or paths which appeared to be different, unique, and sometimes contradictory for each student within the socio-cultural context. One question of interest is how can such different trajectories come together so that students can develop a shared meaning of chance events?

Cortina, J. L., Saldanha, L. & Thompson, P. <jose.luis.cortina@vanderbilt.edu, luis.a.saldanha@vanderbilt.edu, pat.thompson@vanderbilt .edu>. *Multiplicative conceptions of arithmetic mean* (v.1, pp. 466-478).We elaborate a multiplicative conception of the arithmetic mean that is grounded in quantitative reasoning. This elaboration serves as a frame-work for the design and analysis of teaching experiments intended to support students' building this conception of the mean. We discuss in-sights into students' conceptions and their instructional implications.

Koirala, H. P. <koiralah@ecsu.ctstateu.edu>. *Inconsistencies in preservice teachers' thinking about probability* (pp. 479-484). This paper reports some preservice teachers' inconsistent probabilistic reasoning while solving a variety of probability problems in a test-like written setting and an interview setting. The inconsistent reasoning was mainly because of the tension between their formal and informal thinking. The preservice teachers' thinking appeared to be inconsistent especially in the interview setting when the investigator probed them further about their initial responses. Although all the participants were aware of probabilistic concepts of independence and randomness, the tasks and settings of the investigation played an important role on how they viewed these concepts.

McClain, K. <kay.mcclain@vanderbilt.edu>. *The teacher's role in supporting students' development of statistical reasoning* (pp. 485-491).The purpose of this paper is to highlight the teacher's proactive role in supporting students' ability to reason about data while developing statistical understandings related to exploratory data analysis. In doing so, I will present an episode taken from a seventh-grade classroom in which I participated in a twelve-week teaching experiment. One of the goals of the teaching experiment was to investigate ways to proactively support middle school students' development of statistical reasoning. The goal of the instructional sequence then became that of students engaging in instructional activities in which they both developed and critiqued data-based arguments. In this setting, the teacher's role was viewed as critical in supporting shifts in both the students' ability to engage in data analysis and to reason statistically about the data they were analysing.

Metz, K. E. <metz@citrus.ucr.edu>. *Why sampling works or why it can't: Ideas of young children engaged in research of their own design* (pp. 492 This research is part of a multi-year project investigating the potential of children's data-based scientific research, through a combination of classroom-based educational design experiments and associated laboratory studies. The subjects in this analysis consisted of second, fourth and fifth graders in three elementary school classrooms (*n*=75). Shortly after the children had designed and implemented a research project with a small group of fellow students, the author conducted a structured interview that probed their ideas concerning interpretation of the data in their respective study, warranted generalisations and extrapolations, how they could strengthen their study, *etc.*. Surprisingly few children thought they could make inferences about the population on the basis of a small sample, thus not falling prey to the buggy *law of small numbers* identified by the judgement and decision-making literature. This propensity is attributed to their acute awareness of variability, a recurrent theme across most of their rationales of why sampling couldn't work. Adequate sample size and robust

sample trends constituted the most common necessary conditions children articulated for justifying inference from sample to population.

Tarr, J. R. & Aspinwall, L <jetarr@mtsu.edu, leslie@mtsu.edu>. *Middle school students' awareness of the relationship between experimental and theoretical probability: making the connection between data and chance* (pp. 499. For too long, we have seen the consequences of teacher-centred middle school learning environments: formula-driven representations of probability concepts force unsuccessful students to develop strategies for coping without understanding. One means of effecting innovation involves curricular change. Results of this study illustrate that, while typical middle school students are unaware of the relationship between experimental and theoretical probability, appropriate cognitive activity engaging students in probability simulations can enrich such conceptual development.

Short Orals

Limón Segovia, A. <eramon@mail.cinvestat.mx>. *Probabilistic teaching elements for elementary school children from 5 to 8 years old* (pp. 506).

Perrusquía Máximo, E.<eperrusq@sep.gob.mx>. *Probability and arithmetic: an epistemological study in middle school* (pp. 507).

Ávila, R. & Sánchez, E. <esanchez@mail.cinvestav.mx>. *The reading and treatment of bivariate data in contingency tables* (pp. 509).

Posters

Limón Segovia, A. *How 5 to 6 year-old pupils interpret rectangular diagrams* (pp. 511)

Liao Hodge, L. <lynn.l.hodge@vanderbilt.edu>. S*upporting students' statistical development in a technology intensive classroom* (pp. 512).

11.5. Statistical Education One Day Seminar AUS-ICOTS 2, December 10, 1999

Organisers: Brian PHILLIPS < bphillips@swin.edu.au>, and Lorraine McLennan < mathematics@swin.edu.au>. Reported by John TRURAN.

In December 1998 the first Auslcots was held at Swinburne University of Technology, Australia. This gave people the opportunity to hear Australians who presented at ICOTS-5 and to retain links formed in Singapore. This year a second meeting was held to continue to give the opportunity for all interested to learn about the latest in Statistical Education in Australia. Australia is currently fortunate in having the IASE President, Brian PHILLIPS, within the country, and Brian has now worked hard and successfully to organise two one-day seminars in Melbourne to try to maintain the momentum generated by the Singapore ICOTS Conference. The title "AUS-ICOTS" is totally illogical when you think about it, but it conveys the right spirit. Melbourne is in the south-east of mainland Australia, and is the capital of Victoria, our most densely populated state. The nearest very large cities are over 700 km away in other states. So the fact that the 1999 conference on 10 December included six visitors from three other states among its 40 enrolments was very pleasing indeed.

Sixteen talks were presented during the day. Not surprisingly, many addressed the use of computers: using computers for on-line assessment; using Excel to illustrate basic power analysis graphically; using StatPlay to explore statistical concepts; using thoughtfully constructed artificial data bases to illustrate real-life principles; using computers for examining the teaching and learning of the Central Limit Theorem. More discursive papers discussed: the teaching of consulting to final year students; the importance of well-designed questionnaires in expensive medical research (with interesting counter-examples!); using labour statistics in educational planning (or "where universities are going now"); teaching epidemiology to mature age students; seeing the null hypothesis as a cultural product of the Westminster system; students' use of graphs to solve problems; students' understanding of confidence intervals. Two papers addressed more general issues: the teaching and used of statistics in a wide variety of scenarios and the importance of relating theory and practice in statistics research.

Some of the papers represented work in progress, and it was interesting to follow through on people's attempts to improve the teaching and/or learning of specific topics. But for me personally, locked away in the unreality of academia, the most interesting talks were those dealing with real life applications of statistics, and particularly the difficulties in doing really good surveys, even when money is of relatively little importance. Some fears were expressed over coffee that statisticians are a dying breed, yet it seemed to me that part of the problem

was that the world as a whole did not realise really what statisticians had to offer.

Small mini-conferences of this sort are all too rare in Australia, and this one provided a good opportunity for a very relaxed, low-key conference which covered a wide variety of very interesting topics. It also helped to highlight important issues of concern to members which may be of help in planning ICOTS-6. The biggest disadvantages of the day were that the large number of papers reduced the time available for discussion, and the logistics of transport in a large country and a sprawling city for a one-day conference meant that not everyone was able to join in the very pleasant happy hour which was followed by an equally pleasant time at a nearby restaurant.

Members were also informed of future plans for IASE and had an opportunity to make suggestions about the Statistics Education Workshop at the forthcoming Statistical Society of Australia Conference. More information is available at <http:www.swin.edu.au/maths/iase/ausicots2.html>.

Papers

PHILLIPS, B. *IASE matters.* As there are a very large number of people involved in teaching statistics it is more important than ever that it is taught well and enthusiastically. As one of the main aims of the IASE is the improvement of statistical education world-wide, we have an important role to play in helping to achieve this. Modern methods, including advances in technology, can greatly assist us in getting statistical concepts and ways of thinking statistically to an audience with a wide range of professional interests and abilities. By together as part of an international community of statistical educators, we can become better informed and better prepared for the challenges which confront us. This brief talk discusses what is the latest from the IASE.

LIPSON, K. *Teaching statistics on-line: An online workbook.* The development of an online statistics workbook has been an ongoing process for the past three years. The beginning of Semester One 1999 marked the first trial of the Online Workbook, which had been introduced for a number of reasons. The primary goal of the workbook is to make accessible and timely feedback a high priority for our first year statistics students. The secondary goal is to use the workbook as an assessment and administration tool. The Online Workbook has enabled students to journey through the course using a combination of a 'stand-alone' learning guide, lectures (also available on video) and non-compulsory 'drop-in' tutorials. This model, with the recent addition of the Online Workbook, allows students to work at the campus utilising the support of staff in a 'face-to-face' environment, or from home using the World Wide Web. Support is provided to students working off-campus in the form of email and discussion threads. The Online workbook has allowed staff to track an individual student's progress, to monitor group participation and to analyse areas of difficulty. Students obtain immediate feedback in the form of a printable receipt which lists, not only their final mark for a task, but also correct answers for each question. In this way the students are able to direct their study to areas that may be problematic. The online workbook does attract a summative form of assessment to encourage participation. Each student is given their own data set and is encouraged to print out the tasks and to work on them before entering their answers into the computer. There is also a practice set of data from which they may attempt the task without fear of losing marks. The online workbook has solved the huge administrative nightmare of marking 500 paper-based tasks every three weeks, while enabling students to track their own progress and identify areas of weakness for further study.

CARR, R. *The flexibility of Excel in teaching statistics - An example: teaching power analysis.* Excel is an incredibly flexible tool for teaching and learning. In this talk we show just how flexible it can be by putting together a simple demonstration for teaching basic power analysis "on the fly" in the actual talk, starting with a blank workbook. The point is not this particular application - the point is that, with a little training and practice, teachers can create powerful tools for themselves.

MACGILLIVRAY, H. *Similarities and contrasts in teaching introductory statistics across the disciplines.* Like all the mathematical sciences, some of the power of the statistical sciences lies in the capability to move between the particular and the general, and between the formal and the interpretative. These are reflected in statistical teaching by the ongoing fine-tuning of the balance between the immediate and the long-term needs of the "client". It is not a coincidence that an essential ingredient in statistical consulting is discovering and identifying both the immediate and the overall statistical needs of the client. So how do the clients of statistical teaching divide or aggregate – by discipline similarity? by quantitative inclination or background? or perhaps by personality types? To whom is it possible to teach some statistical thinking within the pressures of requested content, time and resources constraints, and

"getting the clients through"? Just as developing statistical similarities across problems helps progress the statistical sciences, so sharing and analysing similarities and contrasts in teaching across the disciplines has significant potential in progressing statistical teaching and learning, including the very important aspect of keeping the teaching of statistics in touch with developments and good practice in statistics. This talk aims to present an overview of similarities and contrasts in the teaching and clients of introductory statistics in a range of scenarios, disciplines and time, and then to gather a range of comments from the audience to form a basis for a continuance of shared knowledge on which the statistical community can build.

BISHOP, G., & Jarrett, R. *Training senior statistics students in consulting and applied statistics.* Much emphasis is given to methods of teaching introductory statistics but here I would like to focus on advanced students. In particular, students in their final year must be prepared for the workforce. They may have to provide statistical advice to non-statisticians; they may have to give training courses; friends and colleagues may ask them to comment on articles from the popular press. At the University of Adelaide we have taught final year Honours Statistics students ways to deal with such situations. I shall discuss the range of topics covered, various aspects of communication skills as required in presentations, team work, statistical consulting and report writing, technical skills that bring together much of the material they have already learnt in a comprehensive manner and, finally, methods of assessment.

McCarty, C. *Teaching epidemiology to mature age students.* I teach epidemiological methods to a number of audiences: postgraduate students, ophthalmology registrars, and students in the Graduate Diploma of Health Statistics program at Swinburne. The common denominator among all of these audiences is that they are mature age students with life experiences and interests that make them very different from undergraduate audiences. I have taught the subject at Swinburne three times and always review my teaching strategy based on feedback from the students. Generally the students are interested in applying the knowledge gained in the course to their current work situations and they tend not to be very quantitative. The following topics are covered during the semester: study design, power/sample size, critical review of the medical literature, grant writing, chronic disease epidemiology, screening/disease surveillance, and outbreak investigation. Students are encouraged to actively participate in discussion and 10% of their mark is allocated to class participation. In addition, because learning is based primarily on discussion, students are required to attend at least 9 of the 12 class sessions to receive a passing mark. To understand the practical applications of the epidemiological theory, I present to them information about the large, population-based study of age-related eye disease that I direct. Through anecdotes about what has worked and what has not worked in the context of a real study, the students learn about the application of epidemiological methods in the real world. The students have several assignments throughout the semester. They are required to review and critique current medical research during the first half of the semester. The primary project is the writing of a grant application. Students are required to prepare a grant application in the format of the National Health and Medical Research Council. The students have found this exercise to be both challenging and useful. A number of the students actually used the projects as projects for their Masters degrees, while several other of the projects have been conducted in the context of their work settings. For the mature age student, it is important to make teaching and assignments current and relevant.

SHAW, P. & Outhred, L. *To draw or not to draw: that is the question?* This paper summarises the findings of a study carried out at two Universities into the extent to which students in introductory statistics courses use diagrams when solving problems. The results of the study showed that many students did not use diagrams but those who used diagrams were more successful. Use of diagrams and university entrance score appeared to be better predictors of success than the level of mathematics studied at secondary school.

DANSIE, B. *Ideas for the statistics education workshop at the SSA conference.* The Statistical Education Workshop - July 1-2, 2000, to be held immediately before the SSA conference, 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. In this talk ideas for this session will be discussed and ideas sought from the participants. Refer http://www.sapmea.asn.au/15ASC.htm

MCLEAN, A. *Hypothesis testing and the Westminster system.* Hypothesis testing, as generally taught, is very

much influenced by notions of fairness, conservatism, and the cultural concerns of the Westminster system, presumably because the techniques were developed by statisticians who had grown up with these. If hypothesis testing is concerned with identifying objective truth, it is reasonable to assume the truth of the null and insist that the alternative 'prove itself'. Recognising that hypothesis testing is a form of model selection, it becomes clear that this approach is merely optional.

FINCH, S., THOMASON, N., & CUMMING, G. *Linking theory and practice: Classroom applications of StatPlay* We discuss the need for students to understand ways of exploring samples of data, frequency-based theoretical concepts, and the application of inferential procedures to samples of data. New developments in the StatPlay software that encourage building links between theoretical concepts and applications will be demonstrated, and classroom experience described.

CUMMING, G., Fidler, F., Brennan, S., Webb, P., FINCH, S., & THOMASON, N. *Understanding with confidence: What we all need to know about confidence intervals.* Advocates of reform of research practice in psychology promote the use of confidence intervals (CIs) as a standard for statistical inference. Some reformers argue that CIs will not suffer the problems of misinterpretation and misunderstanding of Null Hypothesis Significance Tests (NHST). We report several approaches we are taking to study how people learn about, understand and use CIs. We believe that reform requires a much better understanding of all these aspects of CIs. At present there is not good evidence about the best ways to teach CIs, the best ways to present them, or even how researchers understand them. We report evidence suggesting that researchers will need support and/or improved presentation practices if CIs are to make a major contribution to reform. We make proposals about the teaching of CIs in relation to NHST, and also suggest some simple rules ('Rules of eye', ROI) that should assist a reader gain an understanding of the visual presentation of results--and assist students learning about CIs and inference.

Pidgeon, J. *The use of labour statistics in educational planning.* A number of Australian universities are considered to be intersectoral institutions (that is, comprising both a higher education and vocational educational education and training segments) as a consequence of their historical origin. Other universities have progressively acquired an intersectoral profile as a result of mergers and amalgamation. Intersectoral universities typically promote the concepts of 'professional education' and 'career orientated education ' as one part of their mission. Accordingly, labour market analysis and monitoring is regarded as an important component in strategic planning both from the perspective of addressing new market opportunities for educational services and for the revision and maintenance of existing courses and subjects. Some would argue that labour market analysis for educational planning is simply a reflection of the paradigm shift currently impacting on universities as they attempt to address changing customer and market forces against the background of reduced government flinging for their total operations. For institutions which have had a long standing involvement in professional education programs, the challenge in planning terms, is whether perceived adjustments to academic programs amount to a need for the re-engineering (or transformation) of products and services or whether such changes should be regarded as more transitional in nature. This paper identifies the student segments typically represented in an intersectoral university. It then assesses the impact of labour market trends on both the content and delivery of academic programs.

BOYLE, R. *Teaching statistics with large data bases using Excel and PaceXL: the Deakin experience.* There are numerous challenges facing the statistics instructor. Three key ones are (a) for students to appreciate the use of statistics in the workplace, (b) for them to become interested in statistical decision making and (c) for them to learn how to explain statistical results and findings in plain, non-technical language. One means of addressing these is by basing assignments on large, multi-variate data bases, such as a random sample of supermarkets from a large chain, a random sample of shoppers from such a chain, or a random sample of workers from a large firm. Students can be asked to investigate broad issues such as: "significant variation in profit between supermarkets", "why some shoppers would use the Internet for home-shopping but others wouldn't", or "whether males really have higher productivity than females". Examples of such data bases will be given, a model for setting assignments will be presented, and a demonstration given of how Excel and PaceXL are utilised. The proposition is that statistics is made more interesting, challenging and relevant for students by requiring them to analyse large data bases in a detailed way.

TRURAN, J. *The Place of educational theory in evaluating and improving a service statistics course.* This paper follows from the publication Arnold, Anne; TRURAN John M. (1999) "Working With Students to Enhance a Statistics Course". In Fallows, Stephen; Ahmet, Kemel (eds) Inspiring Students—case studies in

motivating the learner London: Kogan Page. In this chapter Anne & I summarised our work in listening to non-science students using four different approaches to find out why they were unhappy with a service statistics course, as a first step towards raising their interest. The approaches were very effective. Journal-keeping inspired the students to think more deeply about the course content, and this led to some changes in the course emphasis. The four approaches taken together produced remarkably consistent results. While a small, often vocal, minority remained negative, most found the course to be at least satisfactory, and failures were usually due to non-academic reasons. Finally, finding that the vocal minority was not representative of the class inspired the lecturer to work for still further improvements. Anne & I have different backgrounds—one in statistics, the other in mathematics education. A blend of these skills was particularly valuable in developing a helpful understanding of students' appreciation of the course. In this paper I shall look at the value of making use of such a blend by analysing in detail how and why it was so effective, and by drawing on other examples from the literature as well. I shall summarise some of the difficulties which have been experienced in linking stochastics education research with practice, and conclude by making some remarks on the implications of using both pedagogical and content skills in defining the nature of professionalism in statistics education.

Roberts, L., & Piece, R. *Some reflections on different ways to teach the Central Limit Theorem.* Students in an introductory statistics class were introduced to the concepts of sampling variability and the Central Limit Theorem using three different modes of instruction: traditional "chalk and talk", hands-on sampling exercises, and computer-based instruction. One aim of the experiment was to see if recently developed interactive computer based learning packages could improve student comprehension of this difficult topic. Differences between pre-test and post-test results showed no significant difference between the groups, and no great improvement in understanding. However comments from tutors and students showed a wide variety of preferred learning styles, and can provide insights into the use of new technologies in the statistics classroom.

TAFFE, J. *Questions researchers' didn't ask but should have.* There is more to being a statistician than just analysing data, and in particular I propose that designing items for questionnaires is doing statistics, because ensuring that the information to be analysed is of good quality is a statistician's responsibility. This is a proposition that may be worth some thought when designing courses in statistics. In rerunning for you a talk given recently to an audience of medicos based on comparing interview responses with diary data, I ask you to suggest the statistical questions they should have asked but didn't.

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12. Forthcoming conferences

Western Statistics Teachers Conference 2000, March 17-18, 2000

The second bi-annual Western Statistics Teachers Conference (WeSTCo2000: Statistics Education for the New Century) will be held March17-18, 2000 at the McKee Hall of Education on the University of Northern Colorado campus, with the Ramada Inn serving as the official hotel for the conference.

Dan Mundfrom and Larry Lesser invite teachers of statistics courses at all levels to plan to attend and submit a presentation proposal, especially involving research and/or significant innovation in one of the following areas: Integrating Data Analysis throughout the Curriculum, Interdisciplinary, Connections, Quantitative Literacy, Teaching the Advanced Placement Statistics Course, Teaching the Mathematical Statistics Course, Teaching the Introductory Statistics Course, Use of Technology in Teaching Statistics, Use of Alternative Assessment in Teaching Statistics, Teaching New Topics (or Old Topics in New Ways).

For more information, contact Dan Mundfrom at   djmundf@unco.edu. or check out our website at www.math.armstrong.edu/faculty/lesser/WeSTCo2000.html

Data Mining by the Method of 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 Dudactique 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. Kodratodd, P. Kuntz, E. Lacasta, J. Lejeune, I.C. Lerman, G. Noel, M.G. OTTAVIANI, M. J. Perrin, and J. Phillipe.

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).

Call for papers. Anyone concerned with classification or data analysis can present research results. Send a title, an abstract no longer than 200 words (in French and English), authors' name(s) and affiliation(s), keywords, and the paper (maximum 4000 words, in French, Word PC, Times 12, with a hard copy) to Régis Gras, 14 Avenue de la Chaise, 35170 BRUZ, France, before March 11, 2000. Proceedings will be published after the conference with the different contributions.

Alhambra 2000, Granada, Spain, July 3-7, 2000

Organised as a satellite activity of the 3rd European Congress of Mathematicians (see below), this joint Mathematical European-Arabic Conference will be held in Granada, Spain, on July 3-7, 2000, and offers an opportunity of a meeting between mathematicians from every European-Arabic culture. Among the themes of the meeting is the History of European and Arabic Mathematics and Mathematicians, which will deal with historical perspectives on contributions of both cultures to the present mathematical knowledge, and also will discuss the state of the more relevant mathematical concepts over the centuries and the way they have evolved. Another tentative theme is Public Mathematics. For information, contact Ceferino Ruiz (Universidad de Granada) at alhambra2000@ugr.es or visit the website http://www.ugr.es/~alhambra2000/

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.si.upc.es/3ecm/

Australian Statistical Conference, July 1-2, 2000, Adelaide, South Australia

The Statistical Society of Australia 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 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 at http://www.sapmea.asn.au/15ASC.htm

EM 2000, Grénoble, 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.

An international program committee has identified ten sub-themes for the conference, dealing among others with issues such as pedagogical methods, assessment, evolution of curricula in the 20th century, integration of young teachers in the school reality, mathematical games and competitions, the relationship between mathematics and informatics, mathematics and others disciplines or mathematics as a lifelong cultural element.

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, July 23-27, 2000 Hiroshima, Japan

Proposal for Discussion Group for PME24: 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 co-ordinators for this proposed Discussion Group will be: DANI BEN-ZVI <dani.ben-zvi@weizmann.ac.il>, BRIAN Greer <b.greer@qub.ac.uk>, Kath TRURAN <kath.truran@unisa.edu.au>, and Jonh TRURAN <jtruran@arts.adelaide.edu.au> . PME web site: http://www.ipc.hiroshima-u.ac.jp/~pme24/

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 Yañez 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?*

Short communications can be presented in the Poster Sessions. 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/

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

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, °ßHistory in Mathematics Education: Challenges for a new millenniu (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

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 <ottavian@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 6th International Conference on Teaching Statistics,
"Developing a Statistically Literate Society", Durban, South Africa, July 7-12, 2002

The sixth International Conference on Teaching Statistics will be held in Durban, South Africa, July 7 to 12, 2002. The IASE will make a special effort to attract African participation, 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 organisers are now in place and the sessions are being planned.

International Programme Committee
- Maria-Gabriella OTTAVIANI Chair, <ottavian@pow2.sta.uniroma1.it>
- Brian PHILLIPS International Organiser, <bphillips@swin.edu.au>
- Dani BEN-ZVI IPC Secretary, <ntdben@wiccmail.weizmann.ac.il>
- Delia North, Chair of the Local Organising Committee, <delian@icon.co.za>

Topics and Conveners:
- *School level:* Lionel PEREIRA-MENDOZA, <lpereira@nie.edu.sg>
- *Post Secondary*: Gilberte SCHUYTEN, <gilberte.schuyten@rug.ac.be>
- *Workplace*: Carol Joyce BLUMBERG <wncarolj@vax2.winona.msus.edu> and René H. M. Smulders, <RSLS@cbs.nl>
- *Wider Society*: Helen MACGILLIVRAY , <h.macgillivray@fsc.qut.edu.au>
- *International Perspective*: Vitalis MUBA, <eastc@ud.co.tz>
- *Research*: Carmen BATANERO, <batanero@goliat.ugr.es> and Joan GARFIELD, <jbg@maroon.tc.umn.edu>
- *Technology*: Lawrence WELDON , <weldon@sfu.ca>
- *Other Determinants*: Philip J. BOLAND, <philip.j.boland@ucd.ie>
- *Local Teachers*: To be determined.