NEWSLETTER OF THE INTERNATIONAL STUDY GROUP FOR RESEARCH ON LEARNING PROBABILITY AND STATISTICS

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1. Notes and Comments

Happy New Year!

1998 was the year of ICOTS V, where many of us could meet, discuss and share our perspectives on statistical education. The Proceedings, which contain about 200 papers and is an invaluable resource for teachers and researchers in our area, has now been published. Another result of the conference was the setting up of new discussion lists about specific topics in statistical education. This can help the impetus and enthusiasm generated by conferences not to get lost in the pressures of daily life.

Our own Study Group was started at ICOTS I and therefore is a result of the activities by IASE (The International Association for Statistical Education). We are including information on the IASE Round Table and the Topic Group 4 in ICME 9 which IASE are organising for the year 2000 in Japan. PME 23 and the International Research Forum are two important meeting points in Israel this year.

In this Newsletter we are including a bibliography on historical aspects of stochastics education compiled by John Truran. Other Study Group members are sending us bibliographies on association and correlation to be included in the April issue. We encourage those of you who have recently finished your dissertations on particular stochastics education topics to share with us your bibliographies.

In this Newsletter we start the first of what we hope will be a regular set of Critical Reviews of important literature in stochastics education. We want to build this up to form an authoritative resource for old and new researchers, and which might in time acquire a status like the Featured Reviews of the American Mathematical Society. We encourgage both contributions and comments on what we are doing.

We hope that our Newsletter is providing a good way of helping people to find out what happened during past conferences and to maintain links with those who could not attend. All of this is especially necessary now that work loads are increasing, and travel budgets are being reduced. Therefore, please do not forget to send us information about your recent works, the conferences which were held in your countries, as well as your suggestions and feedback about the content of the Newsletter.

If there are any corrections or additions to the newsletter, please post them to all members on the list by using the e-mail address alias: stated_list@goliat.ugr.es

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2. Change in method of Distributing this Newsletter

Our newsletter is suffering from its own success and from the growing interest in stochastics education research. The e-mail complete version is becoming quite long, but we do not want to lose readers who do not have access to more sophisticated equipment. So we have decided to test the
following procedure.

A summary of the Newsletter (including the Table of Contents) is being sent by e-mail to all subscribers. The whole text may be found on the Web at http://www.ugr.es/local/batanero/

If you are unable to access the web, please write to Carmen at batanero@goliat.ugr.es and she will be happy to put you on the list of people who want to receive the complete e-mail version.
We hope to introduce further changes in publication later in the year, but the present methods will continue to remain in place.

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3. New Members

Alberto F. Déboli

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Alberto has a major in Psychology and a Bachelor in Mathematical Sciences at the Universidad de Buenos Aires. He is member of a research group at the College of Psychology, where he is working on an educational psychology project (UBACYT), and in particular on the study of cognitive mathematical thinking processes. He is lecturing in calculus to Mathematics and Engineering students, with special emphasis on heuristic processes in teaching. This year he attended the III CIBEM in Caracas, where he contributed to the stochastics working group and met members of the International Study Group for Research on Learning Probability and Statistics. So he decided to join our group to exchange his ideas and work with other colleagues with the same interests.

Helen M. Doerr
Syracuse University Mathematics Department, 215 Carnegie Hall, Syracuse, NY 13244, USA
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Helen was a member of our group when Joan Garfield was organising the newsletter, but she seemed to have been dropped off the list. She has changed her work location, and has sent us her new address.

Patricia González
Universidad de Palermo, Araoz 1547 2°-A P.O. Box 1414, Buenos Aires, Argentina
pgonza@mail.palermo.edu.ar
Patricia teaches probability and statistics to students majoring in history, journalism, communication, education and psychology. She is head of the Mathematics Department at the Universidad de Palermo. She plans to organise a research group on statistics education in collaboration with researchers from education and psychology.

Otavio Roberto Jacobini
Universidade Católica de Campinas, Brazil

otavio@zeus.puccamp.br
Otavio teaches to Social Sciences students at the Universidade Católica de Campinas. His teaching is based on three main points: (a) Using real problems related to social sciences; (b) integrating statistics with psychology, politics and anthropology; (c) using mathematical modelling as a main work methodology. Topics such as "political-ideological profile of social science students" serve to develop the programs in statistics, sociology and politics. He is also using simulation to help students explore the normal curve and related concepts.

Jaime Llopis
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Jaime has interdisciplinary training, with degrees in mathematics, biology, philosophy and philology, and has done consultancy for about 20 years now. He is teaching statistics at the Universidad de Barcelona, where he has worked and reflected on the teaching of mathematics and statistics, trying to find new ideas and materials to increase students' interest in the topic. He has published a book where he develops his didactic ideas on teaching statistics.

José Manuel Maseda García
E.U.E. Empresariales Universidad del País Vasco, Elcano 21, 48008, Bilbao, Spain
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José Manuel is teaching probability and inference in the Faculty of Business and doing research in the Technological Centre of LABEIN, in the Basque Country. He is working within the Technology of Information Unit, and he is helping to develop a distance training system for software developers, which includes a statistical component within a research project funded by the European Union.

Zuly Millán Boadas
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Zuly is a lecturer at the Universidad Central de Venezuela and attended the stochastics working group at the last Ibero-american Conference in Mathematics Education. She is interested in didactical strategies for teaching statistics at University level. She plans to assess her way of training teachers in statistics, and also the teaching-learning conceptions underlying her teaching practice.

Irene Mauricio Cazorla
Universidade Estadual de Campinas, São Paulo, Brasil
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Irene is a doctoral student in Mathematics Education, Universidade Estadual de Campinas, São Paulo, Brazil. Her previous training and Master in Statistics was done in Lima, Peru. She is focussing her research on mathematical abilities: specifically the ability to obtain relevant statistical information from graphs in the media by building basic concepts, recognising the main elements in a graph, identifying the variables involved and recognising the underlying statistical hypotheses.

John S. Oke
Federal Polytechnic, PMB 231, Ede, Osun State, Nigeria
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John's interests are the studies related to the statistics curricula for secondary schools and the applied statistical courses for business-related students at the tertiary educational level, and their applications in industry. He has worked for the past 18 years in industry and taught statistics and operations research to business and accounting students in polytechnics in Nigeria. He is presently Head of Academic Planning, where he has the responsibility for designing and implementing academic programmes.

Guido del Pino Manresa
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Universidad Católica de Chile, Casilla 306, Santiago 22, Chile

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Guido is currently developing a curriculum project in probability and statistics for secondary education in Chile, where recent curriculum changes have incorporated these topics into the secondary curriculum. The Statistics Department is offering Bachelor, Master and Doctoral degrees and is trying to be involved in pre-university education, as the number of qualified statisticians in scarce in Chile.

Rahim Shahlaee
Department of Statistics, Faculty of Mathematical Sciences,
Shaheed-Beheshty University, Evin, Tehran 19834, Iran.
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Rahim has a B.Sc. in mathematics from the American University of Beirut, an M.Sc. in statistics from the University of Newcastle, England, and a Ph.D. in statistics from Southampton University, England. He is a lecturer in statistics with interests in applied statistics, design and analysis of experiments, non-parametric statistics, and the teaching of probability and statistics.

Julio Alberto Alvarez Varilla
Universidad del Sinu, Monteria, Cordoba, Colombia
jalvarez_varilla@hotmail.com.co
Julio Alberto is teaching statistics at the Universidad del Sinu and also teaching mathematics and statistics at secondary school and pre-university levels.

4. Changes in e-mail addresses

Roberto Meyer: rmeyer@fce.unl.edu.ar.

5. Proceedings of the Fifth International Conference on Teaching Statistics

The International Conference on Teaching Statistics was held in Singapore in June, 1998. The ICOTS conferences are organised by IASE and are held every four years. Over 400 participants from some 40 countries attended and more than 200 papers were presented. The Proceedings cover the eight main topics of the Conference:

1. Statistical education at the school level;

2. Statistical education at the post-secondary level;

3. Statistical education for people in the workplace;

4. Statistical education and the wider society;

5. An international perspective of statistical education;

6. Research in teaching statistics;

7. The role of technology in the teaching of statistics;

8. Other determinants and developments in statistical education.

As these topics indicate, the Proceedings cover the spectrum of issues for statistical education at all levels. There are in three volumes containing approximately 200 papers, with authors from 40 countries presenting the latest thinking in statistical education. The Proceedings contain some

papers that discuss general issues and others that contain practical suggestions for implementing ideas at the classroom level. The three volumes are an invaluable source of information for anyone who is concerned with statistical education and can be ordered from CTMA Pte Ltd, 425A Racecourse Road, Singapore 218671, Tel: (65) 299 8992, FAX: (65) 299 8983, ctmapl@singnet.com.sg. For people wanting a list of the papers presented at the conference, a complete list can be found at: www.nie.ac.sg:8000/~wwwmath/THEFINAL.html

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6. Summaries of publications by members

DAHL, H. (1994). Teaching statistics in small group. Presentation in the _RSS Conference_, Guilford.

At Agder College in Norway we have developed small group teaching since 1973. Most of the problems for the groups are taken from textbooks. In addition, small projects that can be completed by a group in less than tow hours can be assigned. The system is used in a majority of the courses given. A summary of our experience is presented.

DELMAS, R., GARFIELD, J., & Chance, B. (1988). Assessing the effects of a computer microworld on statistical reasoning. In L. PEREIRA-MENDOZA, L. Seu, T. Wee, & W. K. Wong (Eds.), _Proceedings of the Fifth International Conference on Teaching Statistics_. Voorburg (The Netherlands): ISI Permanent Office.

The Sampling Distributions program and ancillary instructional materials were developed to guide student exploration and discovery. The program provides graphical, visual feedback, which allows students to construct their own understanding of how sampling distributions behave. Diagnostic, graphics-based test items were developed to capture students' conceptual understanding before and after use of the program. Two different activities were used and students' responses were found to vary with the type of activity. The results suggest that the simulation is most effective when students are required to test their assumptions about sampling distributions. While software can provide the means for a rich classroom experience, software alone does not guarantee conceptual change.

ESTEPA, A., & SANCHEZ COBO, F.T. (1.998). Correlation and regression in secondary school textbooks. In L. PEREIRA-MENDOZA, L. Seu, T. Wee, & W. K. Wong (Eds.), _Proceedings of the Fifth International Conference on Teaching of Statistics_ (vol. 2, pp. 671-676). Voorburg (The Netherlands): ISI Permanent Office.

In this paper we present results from analysing the topic of correlation and regression in 11 Spanish textbooks, for secondary education. We study the organisation and theoretical exposition of the topic, as well as the tasks proposed to the students. Some teaching implications are finally presented.

FRIEL, S., N., & BRIGHT, G. W. (1998). Teach-Stat: A model for professional development in data analysis and statistics for teachers K-6. In S. P. LAJOIE et al, (Ed), _Reflections on statistics: Learning, teaching, and assessment in Grades K-12_ (pp. 89-117). Mahwah, NJ, USA: Lawrence Erlbaum Associates.

Teach-Stat: A Key to Better Mathematics was a project designed to plan and implement a program of professional development for elementary teachers, grades 1-6, to help them learn more about statistics and integrate teaching about and teaching with statistics in their instruction. Thus, when the study of statistics is framed with the context of a process of statistical investigation and involves the use of relevant "hands-on" applications and activities, teachers and students quickly

become engaged. Unlike much of the traditional elementary school mathematics, teaching statistics within this framework provides for a much more open learning environment.

GAL, I. (1998). Assessing statistical knowledge as it relates to students' interpretation of data. In S. LAJOIE et al. (Eds.), _Reflections on statistics: Learning, teaching, and assessment in Grades K-12_ (pp. 275-295). Mahwah, NJ, USA: Lawrence Erlbaum

In thinking about the goals of statistics education, this chapter distinguishes between generative and interpretive skills. We argue that the mathematics and statistics education communities have overemphasised the development of generative skills and that too little attention has been paid to interpretative skills. It explores some conceptual and practical challenges that assessment of interpretative skills poses to teachers and researchers. The focus on assessment issues stems from the observation that the majority of teachers have had little opportunity to develop instructional expectations and understanding regarding students' learning processes in statistics. In the 1st section I reflect on the goals of statistics education, explore in more detail the nature of interpretative skills that students need to possess, and focus on opinions as a target for instructional and assessment efforts. The 2nd section examines issues involved in eliciting and evaluating students' opinions about data, with illustrations related to students' opinions about data in simple 2x2 tables. What follows is a discussion on the implications for general assessment practices in statistics education, and for instruction and future research.

GARFIELD , J., & GAL, I. (In press). Assessment and statistics education: Current challenges and directions. _International Statistical Review_.

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.

GARFIELD, J., & GAL, I. (In press). Teaching and assessing statistical reasoning. In _Mathematical Reasoning: National Council Teachers of Mathematics 1999 Yearbook_.

This chapter begins by distinguishing statistical reasoning from mathematical reasoning, and then outlines goals for students studying statistics. Challenges in assessing statistical reasoning are described and information is provided on a unique paper and pencil instrument, the Statistical Reasoning Assessment. The final section suggests ways teachers may help students develop sound statistical reasoning skills.

GARFIELD, J. (1998). Challenges in assessing statistical eeasoning. Paper presented at AERA, San Diego.

This paper describes the development and validation of the Statistical Reasoning Assessment (SRA), an instrument consisting of 20 multiple-choice items involving probability and statistics concepts. Each item offers several choices of responses, both correct and incorrect, which include statements of reasoning explaining the rationale for a particular choice. Students are instructed to select the response that best matches their own thinking about each problem. The SRA provides 16 scores which indicate the level of students' correct reasoning in eight different areas and the extent of their incorrect reasoning in eight related areas. Results are presented of a cross cultural study using the SRA to compare the reasoning of males and females in two countries.

GARFIELD, J. (1998) The statistical reasoning assessment: Development and

validation of a research tool. In L. PEREIRA-MENDOZA, L. Seu, T. Wee, & W. K. Wong (Eds.), _Proceedings of the Fifth International Conference on Teaching Statistics_. Voorburg (The Netherlands): ISI Permanent Office.

This is an abbreviated version of the AERA paper.

Lidster, S. T., WATSON, J. M., Collis, K. F., & PEREIRA-MENDOZA, L. (1996). The relationshop of the concept of fair to the construction of probabilitic understanding. In P. C. Clarkson (Ed.), _Technology in mathematics education _ (pp. 352-359). Melbourne: MERGA.

This report combines the results of two small studies of probability based on the concept of fair. The outcomes of the first study led to additional opportunities in the second and finally to a hypothesis of conceptual development. In both studies students from grades 3 to 9 were interviewed using a protocol designed to assess their understanding of fair in relation to dice. The theoretical framework used to analyse student responses was the SOLO model with multimodal functioning developed by Biggs and Collis.

MORENO, J., & Schollenberger, J. (1998). The American Statistics Poster competition. Teaching Statistics, 20(2).

The article covers the American Statistics Poster competition, describes the authors' view on what constitutes a statistical poster, and presents a future outlook for the competition.

MORITZ, J., WATSON, J. M., & Collis, K. F. (1996). Odds: Chance measurement in three contexts. In P. C. Clarkson (Ed.), _Technology in mathematics education_ (pp. 390-397). Melbourne: MERGA.

What are students' views of odds? Students were asked to interpret a newspaper headline. Three different perspectives were distinguished: (1) a probability view often using traditional part-whole ratios, (2) a frequency view involving scores and frequency of wins, and (3) a social view, usually involving betting and money exchange in part-part ratios. Each view followed a developmental sequence with interaction between them.

SANCHEZ COBO, F.T., & ESTEPA, A. (1.998). The stochastic curriculum in primary and secondary education in Spain. In L. PEREIRA-MENDOZA, L. Seu, T. Wee, y W. K. Wong (Eds.), _Proceedings of the Fifth International Conference on Teaching of Statistics_ (vol. 2, pp. 599-604). Voorburg (The Netherlands): ISI Permanent Office.

In this paper, we describe the Spanish stochastic curriculum (Probability and Statistics) for compulsory and optional education. We summarise the objectives, learning contents (conceptual, procedural and attitudinal contents), and evaluation criteria. Brief comments are also made.

SANCHEZ COBO, F. T., & ESTEPA, A. (1998). La regresión en los libros de texto de Secundaria. [Regression in secondary education textbooks.] In F. J. Muñoz, D. Cárdenas & A. J. López (Eds.), _Actas de las VIII Jornadas Andaluzas de Educación Matemática Thales_ (pp. 333-340). Jaén: Servicio de Publicaciones de la Universidad.

In this paper, the authors study the presentation of regression in Baccalaureate textbooks and obtain conclusions for planning the teaching of this topic.

SCHEAFFER, R. L. (1998). Making the Grade. AP Statistics, 1997. _STATS: The

Magazine for Students of Statistics_, 22, 8-12.

The author provides a perspective on the Advanced Placement Statistics Exam by describing its history, the content and structure of the exam, grading schemes, results of a comparability study, and implications for student preparation.

SCHEAFFER, R. L., WATKINS, A. E.., & Landwehr, J. M. (1998). What every high-school graduate should know about statistics. In S. P. LAJOIE et al, (Ed), _Reflections on statistics: Learning, teaching, and assessment in Grades K-12_ (pp. 3-31). Mahwah, NJ: Lawrence Erlbaum Associates.

This chapter describes the statistical content that should be part of the K-12 curriculum. The topics are organised and discussed in terms of 5 broad strands: Number sense, planning a study and producing data, data analysis, probability, and statistical or inferential reasoning. Although this order of the topics is in roughly increasing level of sophistication and intellectual difficulty, successful education requires treating each of these topics in several different contexts and over a range of grade levels.

WATSON, J. M., Collis, K. F., & MORITZ, J. B. (1997). The development of chance measurement. _Mathematics Education Research Journal_, 9(1), 60-82.

This paper presents an analysis of three questionnaire items, which explore students' understanding of chance measurement in relation to the development of idea of formal probability. The items were administered to 1014 students in Grades 3, 6 and 9 is Tasmanian schools. The analysis using the NUD. IST text analysis software was based on the multimodal functioning SOLO model. An analysis of the results and a developmental model for understanding chance measurement are presented, along with implications for curriculum teaching practice.

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7. Historical Aspects of Stochastic Education. A Brief Bibliography

John TRURAN, University of Adelaide, South Australia

At recent ICOTS meetings there have been special sessions devoted to the history of statistics education. History is supposed to be dull, boring and irrelevant, but the session at Singapore in 1998 certainly attracted a surprisingly large audience. A refreshingly large number of the participants, undoubtedly encouraged by Linda GATTUSO's entertaining and perceptive opening address, contributed to a very lively and constructive discussion. It was clear that reflecting on the past was seen as a helpful way of understanding the present and working towards the future.

This bibliography is a first attempt to put together some useful references for readers who would like to take this study further. It makes no claim to be comprehensive: Its author is conscious that he is not involved in the various networks concerned with the history of science of mathematics education. What is presented here is a deliberately short list, prepared by an interested amateur, which might help a new researcher to gain some feel for what has been done so far. We may note that neither of the two "state of the art" summaries of mathematics education which have been produced in the 1990s have dealt in any depth with the history of statistics education research. But these are both listed here to provide a starting point.

Bishop, A. J., Clements, M. A., Keitel, C., Kilpatrick, J., & Laborde, C. (Eds) (1996) _International handbook of mathematics education_. Dordrecht, Netherlands: Kluwer.

Kilpatrick, J. (1992). A history of research in mathematics education. In D. Grouws

(Ed.) _Handbook of research on mathematics teaching and learning_ (pp. 3–38). New York: Macmillan

In preparing this bibliography, I have been struck by just how few of the references used by workers with whom I was familiar were actually located by the standard search mechanisms which I used. The moral is clear. Our current academic cataloguing and indexing procedures are not managing to provide a comprehensive data base for new workers seeking to enter this field. This is true even for English language publications, let alone those in other languages. So if readers are able to offer other references, then the editors will be happy to publish a supplement in a future edition of this Newsletter. Unfortunately, not all of the papers presented at ICOTS 4 in Morocco were published in their entirety. So references for this Conference are mainly of abstracts only.

Histories of Stochastic Thought

While our principal concern here is with teaching, this cannot be divorced from statistical thought itself. There are some excellent general histories available.

Benzécri, J.P. (1.982). Historie et préhistorie de l'analyse des données [History and pre-history of data analysis]. París: Bordás.

Droesbeke, J. J., & Tassi, P. (1990). _Histoire de la statistique_ [History of statistics]. París: P.U.F.

Gigerenzer, G., Swijtink, Z., Porter, T., Daston, L., Beatty, J., & Krüger, L. (1989). _The empire of chance. How probability changed science and everyday life_. Cambridge, UK: Cambridge University Press.

Hacking, I. (1975). _The emergence of probability_. London: Cambridge University Press.

Hacking, I. (1990). _The taming of chance_. London: Cambridge University Press.

Kendall, M., & Placket, R. L. (1977). (Eds.), _Studies in the history of statistics and probability. Vol II. Londob: Charles Griffin.

Krüger L, Datson L., & Heidelberger M. (Eds) (1987). _The Probabilistic revolution. Vol. 1: Ideas in history_. Cambridge, MA: Massachusetts Institute of Technology Press.

Krüger L, Gigerenzer G., & Morgan M. S. (eds) (1987). _The probabilistic revolution. Vol. 2: Ideas in the sciences_. Cambridge, MA: Massachusetts Institute of Technology Press.

Owen, D. B. (Ed.), _On the history of statistics and probability_. New York: Marcel Dekker.

Pearson, E. S., & Kendall, M. (1.970) (Eds.), _Studies in the history of statistics and probability. Vol. 1_. London: Charles Griffin.

Porter, T. M. (1986). _The rise of statistical thinking: 1820–1900_. Princeton, NJ: Princeton University Press.

Stigler, S. M. (1986). _The history of statistics. The measurement of uncertainty before 1900_. Cambridge, MA: Harvard University Press.

Todhunter, I. (1865). _A history of the mathematical theory of probability from the time of Pascal to that of Laplace_. Cambridge, UK: Macmillan.

These ideas need to be interpreted within a general history of scientific thought. The first of the following two references is an "academic" history, the second a more "popular" one.

Crombie, A. C. (1994). _Styles of scientific thinking in the european tradition_. London: Duckworth.

Koestler, A. (1959). _The sleepwalkers. A history of man's changing vision of the universe_. Harmondsworth, UK: Penguin.

Histories of Specific Stochastic Ideas

One author has proposed that a study of the history of the development of a mathematical concept may be used as a basis for developing a pedagogy, and for understanding the likely nature of misconceptions to be encountered in a classroom. Using this approach for negative numbers has been described in:

Hefendehl-Hebeker, L. (1991). Negative numbers: Obstacles in their evolution from intuitive to intellectual constructs _For The Learning of Mathematics_, 11(1), 26–32.

This idea has been taken up by some workers in stochastics:

Bennet, D. J. (1994). _The development of the mathematical concept of randomness: Educational implications_. (Doctoral dissertation, New York University, 1993). _Dissertation Abstracts International_, 54, 449A. (University Microfilms No. 93-17, 657).

ESTEPA, A., & SÁNCHEZ COBO, F.T. (1.994). Desarrollo histórico de la idea de asociación estadística [Historical development of the concept of association]. _Epsilon_, 30, 61-74.

Huberty, C. J. (1993). Historical origins of statistical testing practices: The treatment of Fisher versus Neyman-Pearson views in textbooks. _Journal of Experimental Education_, 61(4), 317–333.

Ineichen, R. (1995). Zur geschichte einiger grundlegender begriffe der stochastik [On the history of some fundamental terms in stochastics]. _Didaktik der Mathematik_, 23(1), 1–7.

Lavoie, P. & GATTUSO, L. (1998). An historical exploration of the concept of average. In PEREIRA-MENDOZA, L., Kea, L. S., Kee, T. W., & Wong, W. K. (Eds), _Statistical Education. Expanding the network. Proceedings of the Fifth International Conference on Teaching of Statistics_. (Vol. 3, pp. 1051– 1057). Voorburg, Netherlands: International Statistical Institute.

Pizzamiglio, P. L. (1992). Ruolo didattico della storia della matematica. Parte 4. Termini e concetti matematici considerati dal punto di vista storico. [The role of the history of mathematics in teaching mathematics. Part 4. Mathematical terms and concepts from an historical point of view]. _Insegnamento della Matematica e della Scienze Integrate_, 15(9), 909–923.

TRURAN, J. (1998). The development of the idea of the null hypothesis in research

and teaching. In PEREIRA-MENDOZA, L., Kea, L.S., Kee, T.W., & Wong, W.-K. (Eds), _Statistical Education—Expanding the network. Proceedings of the Fifth International Conference on Teaching of Statistics_. (Vol. 3, pp. 1067–1073). Voorburg, Netherlands: International Statistical Institute.

van Brakel, J. (1976). Some remarks on the prehistory of the concept of statistical probability. _Archive for History of Exact Sciences_, 16(2), 119–136.

van Brakel, J. (1985). The possible influence of the discovery of radio-active decay on the concept of physical probability. _Archive for History of Exact Sciences_, 31(4), 369–385.

General Histories of Stochastics Teaching

Bibby, J. (1986). _Notes towards a history of teaching statistics (H.O.T.S.)_. Edinburgh, UK: Bibby (Books).

Vere-Jones, D. (1995). The coming of age of statistical education. _International Statistical Review_. 63(1), 3–23.

Vere-Jones, D. (1998). Background influences on the development of statistical education. In PEREIRA-MENDOZA, L., Kea, L.S., Kee, T.W., & Wong, W.-K. (Eds), _Statistical Education. Expanding the network. Proceedings of the Fifth International Conference on Teaching of Statistics_. (Vol. 1, pp. 27–42). Voorburg, Netherlands: International Statistical Institute.

Biographies of Statisticians

Armatte, M. (1994). François Divisia. Un economiste qui enseigne la statistique dans trois grandes ecoles (1926–60) [François Divisia. An economist who taught statistics in three famous schools]. In _International Conference on Teaching Statistics. Proceedings of the Fourth International Conference on Teaching Statistics_ (p. 411). Rabat, Morocco: National Institute of Statistics and Applied Economics.

Bibby, J. (1991). Karl Pearson and the history of teaching statistics. _Teaching Statistics_, 13(2), 38–39.

Droesbeke, J. J. (1994). Rôle et importance de l'enseignmeent dans l'oeuvre d'Adolphe Quetelet [The place and importance of teaching in the work of Adolf Quetelet]. In _International Conference on Teaching Statistics. Proceedings of the Fourth International Conference on Teaching Statistics_ (p. 413). Rabat, Morocco: National Institute of Statistics and Applied Economics.

Finney, D.J. (1998). Remember a pioneer: Frank Yates (1902–1994). _Teaching Statistics_, 20(1), 2–5.

Johnson, N. L, & Kotz, S. (1997). (Eds.), Leading personalities in statistical sciences. New York: John Wiley.

Histories of Developments in Individual Countries

Bibby, J. (1994). Teaching statistics in Victorian England. The other side of a Darwinian coin. _Teaching Statistics_ 16(1), 26-28; 16(2), 45-46.

De la Fuente, L., Hernandez, R., & Mendoza, M. (1994). The teaching of statistics in Mexico (a brief historical review). In _International Conference on Teaching Statistics. Proceedings of the Fourth International Conference on Teaching Statistics_ (p. 423). Rabat, Morocco: National Institute of Statistics and Applied Economics.

Desrosières, A. (1994). L'Ecole Nationale de la Statistique et de l'Administration Economique (ENSAE–Paris): Eléments d'histoire [Aspects of the history of the National School for Statistics and Economic Administration]. In _International Conference on Teaching Statistics. Proceedings of the Fourth International Conference on Teaching Statistics_ (p. 412). Rabat, Morocco: National Institute of Statistics and Applied Economics.

GATTUSO, L. (1994). Evolution of the teaching of statistics in colleges in Quebec. In _International Conference on Teaching Statistics. Proceedings of the Fourth International Conference on Teaching Statistics_ (pp. 414–421). Rabat, Morocco: National Institute of Statistics and Applied Economics.

HENRY, M. (1994). _L'Enseignement des probabilités: Perpsectives historiques, épistémologiques et didactiques_ [Historical, epistemological, and pedagogic perspectives on the teaching of probability]. Besançon, France: IREM de Besançon.

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TRURAN, J. (1997). The Introduction of probability into Australian schools interpreted within a broad-spectrum ecological framework. In Biddulph, F., & Carr, K. (Eds) _People in mathematics education. Proceedings of the Twentieth Annual Conference of the Mathematics Education Research Group of Australasia Incorporated held at Rotorua, New Zealand, 7–11 July 1997_ (pp. 522–529). No place of publication: Mathematics Education Research Group of Australasia Incorporated.

Using the History of Stochastics as a Basis for Classroom Practice

One article justifying the historical approach to teaching is:

> Glickman, L. (1989). Why teach the history of probability? _Teaching Statistics_, 11(1), 6-7.

A valuable and compact source of original writings may be found in:

> Newman, J. R. (Ed.) (1956). The world of mathematics. London: George Allen and Unwin Ltd.

Articles which address the use of history in an educational context include:

> Dickey, D. A., & Arnold, J. T. (1995). Teaching statistics with data of historical significance: Galileo's gravity and motion experiments. _Journal of Statistics Education_, 3(1). <http://www.stat.ncsu.edu/infor/jse/v3n1/>.
>
> Dupont, P. (1991–1992). La storia delle scienze al servizio della didattica delle scienze. Probabilita [Using the History of Science to Improve the Teaching of Science]. _Insegnamento della Matematicae della Scienze Integrate_, 14(11/12), 1007–1052; 15(6), 590–619.
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> Glickman, L. (1990). Lessons in counting from the history of probability. _Teaching Statistics_, 12(1), 15–17.
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> Kunoff, S., & Pines, S. (1986). Teaching elementary probability through its history. _College Mathematics Journal_, 17(3), 210–219.
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> Lightner, J. E. (1991). A brief look at the history of probability and statistics _Mathematics Teacher_ , 84, 623–630.

Sources

In addition to standard search mechanisms (namely, ERIC & ZDM) I also made use of

> Sharma, S., & Begg, A. (1995). _Statistics education bibliography [Partially annotated]_. Hamilton, New Zealand: Centre for Science, Mathematics and Technology Education Research, University of Waikato. (PB 3105, Hamilton, New Zealand).

Readers' attention is also drawn to the very comprehensive bibliography prepared by Sahai and his collaborators:

> Sahai, H., Khurshid, A., & Misra, S.C. (1996). A second bibliography on the teaching of probability and statistics. _Journal of Statistics Education_. 4(3). <http://www.stat.ncsu.edu/infor/jse/v4n3/>.

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8. Stochastics Education Research Critical Reviews

Purpose

Over the last eighteen months there have been various discussions, mainly within the PME Stochastics Working Group, about setting up a regular feature of Critical Reviews of what are seen as important writings in stochastics education research. A small number of members has shown interest, but not as many as we had hoped.

We still think, however, that there is a need to develop a more critical evaluation and codification of the work which has been done, in order to make it easier for old and new researchers efficiently to address issues of importance. The pressures on academics to be "efficient" are increasing, and we have to respond to them in some way.

Journals like this one do their best to keep readers up to date with current work and succeed reasonably well. More structured publications like ZDM and ERIC provide valuable electronic data bases, but inevitably material takes a little time to be added to the data base. Older literature is usually not covered, and material in minority languages is likely to slip through the net.

It is effectively impossible for any worker to keep up to date with all relevant publications. Many publications are not available on the web, and declining library budgets are making it harder and more expensive to obtain journals, especially those in languages not widely used within one's own country. Yet it is not unknown for referees to reject a submitted article "because the author has not referred to X (1998)", which can lead the author to long and difficult searchers only to find that X (1998) was really not relevant to the submitted article.

We believe there is a need to examine critically what are seen as important papers, books and chapters in the field, in order to set them into a wider context. We are looking for critiques which cover all forms of scholarly work, including work which has been done a long time ago, and which are deeper than, for example, the "Short Book Reviews" which are circulated by the International Statistical Institute. In time we hope that the Reviews will reach the standard and status of the "Featured Reviews" of the American Mathematical Society.

We do not want to stop readers from going back to original sources. Just the opposite. Rather, we hope to provide readers with perspectives on these sources which will make them easier to interpret. Ideally, for crucial papers, we hope to provide several perspectives on the same paper, in order to encourage an open debate and interaction which is often lacking from conference discussions and academic writing. This will be best achieved by providing thought-provoking reviews of important articles.

Immediate Plans

So, on the grounds that from small acorns mighty oaks may grow, we have decided to include a small "Critical Reviews" Section as a trial in the four 1999 editions of this Newsletter. In this issue we include two reviews which have been circulated as part of our preliminary discussions. We encourage readers to send in alternative comments on the two papers reviewed (long or short), and we will publish these in the next issue. Comments should be sent to John Truran.

We shall be personally asking some readers to offer reviews for the next three issues, but we are more than happy to receive offers, particularly from those who have recently finished major theses or projects. Reviews may be offered in any language, as we shall find a way of making a translation. Contributions may be on any research work of the reviewer's choosing, but should be on papers of wide generality and should be thought-provoking. After twelve months we shall conduct a survey of our readers to see whether they consider that the trial is worth continuing and/or what changes should be made. But helpful comments are welcome at any time.

Critical Reviews 99/1–2

For this edition we include two reviews, one by each of the editors. Both have been circulated as part of the discussions on this project. The examples have been chosen because both papers seem to us to have something important to say, but have tended to be neglected by researchers in the field. We believe they are articles which are worth following up, we hope that some readers will, and that they will send us alternative perspectives to be published in the next edition.

CR 99/1/ADI: Adi, H., Karplus, R., Lawson, A., & Pulos, S. (1978). Intellectual development beyond elementary school VI: Correlational reasoning. _School Science and Mathematics_, 75, 675-683. (Rewier: Carmen Batanero, University of Granada).

In view of the fundamental role played by correlational reasoning in the subjects' formal capacities, the authors investigate the way in which 80 high school science and mathematics students (age 13.7 to 15.8) approached two correlational tasks, using interviews. Half the sample was given a task involving a possible causal relationship between pill-taking and body size of rats and the rest of students were given a task concerning the possible coincidental relationship between tail colour and body size of rats. The students were given a set of 3x5 cards, where each card represented a case and asked to examine the cards and discover if there was a relation. Students initially unable to proceed were given assistance in classifying the cards into a 2x2 contingency table. Positive association, negative association and independence data were provided.

Students' responses were categorised according to the following scheme, which the authors identify with the Piagetian substages of intellectual development as detailed by Inhelder and Piaget's study of correlation:

NR: No relation among cells frequencies is considered (NR1: the subject does not accept the possibility of a relationship in view of the non-confirming cases; NR2: the subjects describe various events qualitatively; NR3: the subjects describe various events qualitatively)

TC: The number of events in two cells is compared.

FC: The number of events in all four cells is used to make two comparisons (FC1: comparing the events in two pairs of cells; FC2: combining two cells having a common attribute and compare one cell with the total, then does the same with the other pair of cells).

CO: Correlation is described by a quantitative comparison using all four cells (C01: identifying and comparing rations; CO2: identifying and comparing percentages; CO3: comparing the number of confirming cases with the number of disconfirming cases).

Although the nine subcategories of responses identified do not form an unidimensional scale of increasingly successful and complex reasoning, they reflect the development of two parallel ways of reasoning: probability and proportionality.

Their findings show that a significant number of students did not use correlational reasoning and suggest better results in the coincidental task, possibly because the students were not distracted by their previous hypotheses from considering all the data. There was also a general advance in reasoning with age.

CR/99/2/FRE: Freudenthal, H. (1974). The crux of course design in probability _Educational Studies in Mathematics_, 5, 261–277. (Reviewer: John Truran, University of Adelaide).

This article by a man who was distinguished and respected both as a mathematician and as a mathematics educator examines the formal mathematics of probability in an endeavour to decide

what is appropriate for probability teaching in schools, and how it might best be taught.

The approach is formal and symbolic and so does not invite careful attention from non-specialists. But Freudenthal raises critical issues about the divergence between the traditional view that probability is a function of events or statements about events and the axiomatic view which sees it as a measure defined on a system of sets. He argues that the traditional view is of far more value, but that it is often constrained by failing to emphasise the generality of its claims. He argues that this may be overcoming by emphasising that probability theory makes statements about "stochastics", rather than about sets. In this way the statements are generalised to wide fields of application rather than to narrow fields such as, for example, a tossing of a single coin.

Unfortunately, his mathematical definition of a stochastic does not match his informal one. Sometimes he seems to mean that it is the outcome of a random trial, but he also refers to is as "a chance experiment" and later as an ordered triple comprising a domain (sample space), a set of subsets of the domain, and a function which ascribes probability values to these subsets.

This paper is of great importance in spite of its inconsistencies because it argues that the traditional approaches found in most textbooks are imprecise, and that the approach advocated is one which can be easily used in the classroom. It has been seriously neglected, and deserves much greater attention.

Future Plans

In due course we hope to provide an archive of reviews on a web-site, where the text of individual articles may be easily accessed, together with all the commentaries which have been submitted. This involves issues of copyright, and will take some time to establish.

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9. Recent dissertations

> Cantero, A. (1998). Razonamientos de alumnos de 12 años en tareas de comparación de probabilidades (12-year-olds students' reasonings when comparing probabilities). Masters thesis. Universidad de Granada, Spain. Supervisor: Carmen BATANERO.

The aim of this research was to deepen our appreciation of 12-year-old students' knowledge and strategies when comparing probabilities. The answers given by 64 students to four comparison tasks are analysed. In each task, students were asked to decide which of two different games provided
them with better opportunities to win and to justify their decision. The results show a variety of reasonings using numerical data in different situations, and also factors unrelated to the problem data. In each task the most common error and the percentage of different answers are analysed. The response patterns and consistency are also described.

There was only a small percentage of correct responses and a lack of consistency in the students' responses. The use of the numeric data was not general, and a variety of subjective arguments was able to be described. More research is therefore needed into the student's real capacities comparing and computing probabilities in order to develop sound didactic guidelines which will help to achieve the curriculum aims for the teaching of probability.

> Cobo-Merino, B. (1998). Order statistics in secondary education. Masters Thesis. Universidad de Granada, Spain. Supervisor: Carmen BATANERO

The central topic of this research is order statistics (such as median, quartiles, percentiles, and

ranges of percentiles), which take into account the relative position of certain elements inside the data set. Order statistics are the basis of non-parametric statistics, which is adequate for non-normal distributions, ordinal data or small samples. They are also intensively used in exploratory data analysis, which is recommended in the new curriculum designs for secondary education in many countries.
The specific difficulties that secondary students find in conceptual understanding of order statistics and in solving related data analysis problems are studied from both theoretical and practical points of view. The theoretical analysis includes the study of the curriculum, mathematical analysis and a summary of previous related research. In the experimental study the answers by thirty 16 year-old-students to a questionnaire on conceptual and procedural understanding of order statistics are analysed. Although this pilot study does not allow for the generalisation of its results, it has been a first step to determining the students' specific difficulties in conceptual understanding of order statistics and their use in problem solving.

> Lahanier-Reuter, D. (1998). Etude des conceptions du hasard: Approche épistémologique, didactique et expérimentale en milieu universitaire. (Study of conceptions about chance: Epistemological, didactical and experimental approaches at University level). Ph.D. Université de Rennes I. Supervisor: Régis GRAS.

In this thesis the author aims to demonstrate that different conceptions of the word "hasard" may arise during the teaching and learning of probability as a model for statistical situations. ("Hasard" includes chance, randomness and risk.) The students' discussions and productions provide the basis for a study of their knowledge and pragmatic conceptions, which may be used as a didactic tool. It is a particularly efficient tool for understanding phenomena where there is a mismatch between the understandings of pupils and teachers, an also for designing didactic situations which may help to eliminate these phenomena.

After discussing the choice of relevant descriptive parameters, the author presents an epistemological analysis of conceptions of "hasard" in the field of Mathematics and some others scientific ones, such as History, Physics and Biology. She then analysis conceptions of "hasard" which are found within teaching practice, using an analysis of official documents and standard exercises as her principal sources.

She deals with conceptions of "hasard" found in everyday life and describes ifferences between scientific and everyday constructions of the concept, which are supported by real projects and problematic. Three investigations were conducted to describe the experiences and understandings of Science of Education students and secondary school pupils from two different levels. These experiences made use of "hasard" as a principal aid for solving both real problems and more formal "mathematical" problems and provided a way for elucidating the semantic associations which the word held for the students.

Particular data analysis methods, such as cluster analysis and implicative analysis were used, which showed the students' conceptual organisation of "hasard", and helped to define didactic variables. Finally, the author used these variables to design some didactic situations which helped to
resolve the students' misunderstandings and conflicts of meaning.

> Ritson, I. L. (1998). _The development of primary school children's understanding of probability. PhD Thesis: The Queen's University of Belfast Supervisor: Brian GREER.

This research was in the form of a longitudinal study with the aim of identifying how children in

primary schools develop an understanding of probability. A total of 46 children, initially in three Northern Ireland primary schools, were involved and these children were in three age groups at two-year intervals, and the progress of each child was monitored over a period of almost three years. The ages of the children in the three groups and the total time span of the study were such that the overall research showed a continuous progression through an age range from 5 years 9 months to 12 years 9 months.

The methodology was to interview each child individually and every child was interviewd on twelve separate occasions over a period of almost three years, in the last year of which the children in the oldest groups were in the first forms of their post-primary schools. These interviews were designed to be independent of the children's differing abilities in reading and writing. As the interviewing programme progressed, individual interviews were modified according to the stage of development which the child had reached. Each interview was recorded on video tape and conducted in a separate room, away from the classroom, with only the child and the interviewer present.

The three main aspects of probability which were addressed related to conceptions about sampling with replacement, spinners, and dice. The report of this research maps the conceptual stages through which the children progresed towards probabilistic understanding , it also identifies the different rates and stages of understanding within these three aspects of probability and includes an analysis of children's strategies in choice situations. Consideration is given to the pedagogical implications based on both previous research and developments identified in this present investigation.

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10. Other publication of interest

Aberson, C. L., Berger, D. E., Emerson, E. P., & Romero, V. L. (1997). WISE: Web interface for statistics education. _Behavior Research Methods, Instruments and Computers_, 29(2), 217-221.

The Web Interface for Statistics Education (WISE) is a project which includes a World-Wide Web site to support the teaching of introductory social-science statistics courses. The site provides easy access to data bases, archived discussion lists, electronic journals, links to other sites focused on relevant statistics topics. The easy linkage between Web pages provides support for a highly interactive tutorial, which uses "failure-based" learning and immediate feedback. 23 graduate students rated the tutorial as easy to use and indicated that it would have improved their initial statistics course.

Bishop, G. (1998). A series of tutorials for teaching statistical concepts in an introductory course. Sampling from an aerial photograph. _Journal of Statistics Education_, 6 (2).

This paper outlines one of a series of tutorials developed as part of an introductory statistics course for agricultural and natural resource sciences students. Here we compare two methods of sampling from an aerial photograph to obtain an estimate of the proportion of a particular type of vegetation. One method, transect sampling, is traditionally used by field ecologists, while the other is simple random sampling in a plane. Preparation details and possible extensions to the tutorial are described.

Couch, J. V. (1997). Using the Internet in instruction: A homepage for statistics. _Psychological Reports_, 81(3), 999-1003.

Educational uses of the Internet are expanding at a rapid rate. This article describes the use of a homepage for a course in psychological statistics from which students could download most of the information germane to the class. 42 of 51 students' evaluations of the homepage were positive.

Dunn, D. S. (1996). Collaborative writing in a statistics and research methods course. _Teaching of Psychology_, 23(1), 38-40.

In this paper it is presented the application of collaborative writing (CW) and peer review (PE) methods to an experimental project in a statistics and research methods course to develop writing (WR) techniques in psychology classes, and discusses student reactions to these methods.

Fox, W. P., & Fowler, C. W. (1996). Aiding understanding of covariance and correlation. _Primus_, VI (3), 235-244.

We describe the use of graphical exercise to explain the concepts of covariance and correlation as they are used in an undergraduate course on probability and statistics. Students seem unable to grasp the concepts and interpreation, although they can perform the necessary calculations. We provide examples that help to illustrate the two key concepts and show the importance of understanding the meaning of correlation.

Gelman, A. (1997). Using exams for teaching concepts in probability and statistics. _Journal of Educational and Behavioral Statistics_, 22(2), 237-243.

In this paper several classroom demonstrations that have sparked student involvement in the author's introductory undergraduate courses in probability and statistics are presented. The demonstrations involve both experimentation using exams and statistical analysis and adjustment of exam scores. Examples include use of scatterplots for mapping guessed and actual exam scores, and varying test question order to demonstrate randomization effects.

Gelman, A. (1998). Some class-participation demonstrations for decision theory and Bayesian statistics. _The American Statistician_, 52(2), 167-174.

We present several classroom demonstrations that have sparked student involvement in our undergraduate course in decision theory and Bayesian statistics. Some of the demonstrations involve student participation, while others are essentially lectures with extra class discussion.

Gelman, A., Nolan, D., Men, A., Warmerdam, S., & Bautista, M. (1998). Student projects on statistical literacy and the media. The American Statistician, 52(2), 160-166.

This article describes some assignments that have been useful in getting students to learn how to gather and process information presented in the newspaper articles and scientific reports they read. We discuss two related assignments. For the first kind of assignment, students work through prepared instructional packets. Each packet contains a newspaper article that reports on a scientific study or statistical analysis, the original report on which the article was based, a worksheet with guidelines for summarizing the reported study, and a series of questions. In the second kind of assignment, each student is required to find a newspaper article themselves, track down the original report, summarize the study using our guidelines, and write a critique of the article. Here, we describe the guidelines we developed to help the student in reading the newspaper article and original source, and the procedures we used for each type of assignment. Examples of handouts and assignments appear as appendixes.

Hassebrock, F., & Snyder, R. (1997). Applications of a computer algebra system for

teaching bivariate relationships in statistics courses. _Behavior Research Methods, Instruments and Computers_, 29(2), 246-249.

Describes Maple, a computer algebra system used in undergraduate psychology courses to promote students' conceptual learning of basic principles associated with bivariate relationships. Maple's symbolic computation, graphic displays, and animation capabilities are used along with other classroom activities to study concepts related to: (1) Correlation coefficients, scatterplots, and regression lines; (2) factors that affect the magnitude of sample correlations; (3) inferential tests; and (4) prediction error. For each of the 15 Maple procedures, students select population correlation values and examine the effects of different values on computer-generated graphical representations of scatterplots, regression lines, and sample correlations. The procedures are described and examples of exercises with 22 undergraduates too support their use are appended.

Horvath, J. K., & Lehrer, R. (1998). A model-based perspective on the development of children's understanding of chance and uncertainty. In S. P. LAJOIE et al, (Ed), _Reflections on statistics: Learning, teaching, and assessment in Grades K-12_ (pp.121-148). Mahwah, NJ, USA: Lawrence Erlbaum Associates.

We consider the development of children's models of chance and uncertainty by considering their performance along 5 distinct, albeit related, components of a classical model of statistics: (a) The distinction between certainty and uncertainty, (b) the nature of experimental trials, (c) the relationship between individual outcomes (events) and patterns of outcomes, (d) the structure of events, and (e) the treatment of residuals. After discussing these 5 dimensions, we summarize and interpret the model-based performance of 3 groups as they solved problems involving classical randomization devices such as spinners and dice. The 3 groups included 2nd graders (age 7-8), 4th/5th graders (age 9-11), and adults. We compare groups by considering their interpretations of each of these 5 components of a classical model of chance. We conclude by discussing some of the benefits of adopting a modeling stance for integrating the teaching and learning of statistics.

Hunt, G. (1998). Knock 'm down. _Teaching Statistics_, 20(2).

The author describes a game that engages students in collecting data and interpreting results. The author discusses extensions of the activity with probability modeling and computer simulations.

Mansfield, E. R., & Adams, B. M. (1996). Teaching the standard deviation of linear combinations of random variables using graphics. _Primus_, VI (3).

This article gives a geometric interpretation that views the standard deviation of a linear combination of random variables in terms of the length of the hypotenuse of a triangle and its calculation as equivalent to the theorem of Pythagoras.

Merles, J. (1998). A probability game. _Teaching Statistics_, 20(2)

The author describes a simplified form of snakes and ladders that can be used to initiate an open ended investigation of probability.

Naude, P., Band, D., Stray, S., & Wegner, T. (1997). An international comparison of management's use of quantitative techniques, and the implications for MBA teaching. _Management Learning_, 28(2), 217-233.

Surveyed 1219 MBA graduates in the United Kingdom, South Africa, and New Zealand in order to assess the extent to which managers use a range of statistical techniques in their work. Although the overall awareness of basic techniques was disappointingly low, this research indicates that

most managers saw a positive role for the use of statistics in their work. Implications for the design and teaching of the quantitative component in MBA courses are suggested.

> Rappaport, K. D., Kettaneh, N., & Wold, S. (1998). Perspectives on implementing statistical modeling and design (smd) in an industrial/chemical environment. _The American Statistician_, 52(2), 152-159.

In the competitive environment of today's chemical industry, an efficient approach of experimentation is necessary in all facets of research and development. This article discusses the tools of statistical modeling and design in this perspective.

Rinaman, W. C. (1998). Revising a basic statistics course. _Journal of Statistics Education_, 6(2).

Members of the faculty of Le Moyne College made sweeping changes in the basic statistics course provided for the social and life sciences by the Department of Mathematics. The result is a course that is significantly different from its predecessor. It places more emphasis on concepts and technology. A laboratory component was added to give students experience with Minitab and messy datasets. The implementation of the course had the expected problems. These are documented along with what was done to improve the course the second time it was offered.

> Schram, C. M. (1996). A meta-analysis of gender differences in applied statistics achievement. _Journal of Educational and Behavioral Statistics_, 21(1), 55-70.

Coded 18 samples from 13 articles that examined gender differences in statistics achievement in postsecondary-level psychology, education, and business courses. The following items were coded in the meta-analysis: Source of article, year of publication, focus of gender differences, educational level. awareness of participation in a study, department offering the course, type of statistics course, level of attrition, and information about the outcome measure. Undergraduate males showed an advantage over undergraduate females. Undergraduate males also significantly outscored females when the outcome was a series of exams. Females significantly surpassed males when the outcome was total course performance. Females outscored males in courses offered by business departments.

> Sedlmeier, P. (1997). Basic Bayes: A tutor system for simple Bayesian inference. _Behavior Research Methods, Instruments and Computers_, 29(3), 328-336.

To date, attempts to teach Bayesian inference to nonexperts have not met with much success. Basic Bayes, the computerized tutor presented here, is an attempt to change this state of affairs. BasicBayes is based on a novel theoretical framework which focuses on the connection between "cognitive algorithms" and "information formats." BasicBayes teaches people how to translate Bayesian text problems into frequency formats, which have been shown to entail computationally simpler cognitive algorithms than those entailed by probability formats. The components and mode of functioning of BasicBayes are described in detail. Empirical evidence demonstrates the effectiveness of BasicBayes in teaching people simple Bayesian inference.

> Sowey, E. R. (1998). Statistical vistas: Perspectives on purpose and structure. _Journal of Statistical Education_, 6(2).

A body of research on enhancing the teaching of statistics has been accumulating now for more than fifty years. Yet undergraduates continue to find courses in statistics unappealing. Perhaps this is because their teachers too commonly fail to open statistical vistas, and thus fail to convey a rich understanding of the purpose and structure of the subject. A vista is inherently a perspective view. This paper shows, with examples, how perspective views can illuminate both purpose and

structure. A well-devised perspective on purpose, offered early, can make each topic in the course immediately meaningful. And perspectives on structure, unveiled strategically, can highlight the coherence of statistics. The author's experience over twenty-five years shows hat teaching with perspectives can help to produce that ideal long-term retention of learning

> Townsend, M. A. R., Moore, D. W., Tuck, B. F., & Wilton, K. M. (1998). Self-concept and anxiety in university students studying social science statistics within a co-operative learning structure. _Educational Psychology_, 18(1), 41-54.

137 female and 16 male college students enrolled in an educational psychology course, which included a laboratory component in social science statistics, were assessed for mathematics self-concept and mathematics anxiety at the beginning and end of the course. The laboratory teaching practices emphasized co-operative learning activities and full-class discussion in an attempt to provide a positive environment. Self-concept improved significantly over time, as did student confidence in dealing with statistical problems, but mathematics anxiety did not show a significant reduction. These attitudinal factors were mediated by prior experience in mathematics. It is concluded that it is important that such attitudinal factors be considered alongside curriculum issues when designing instruction in mathematics-related areas, particularly where strong negative attitudes are known to exist for some groups of students.

> Turner, J. C. (1998). Using Spreadsheets to calculate Prob(X + Y = w). _Teaching Statistics_, 20(2).

The author describes how spreadsheets can be set up to calculate the sum of two or more discrete random variables with arbitrary distributions.

> Varnhagen, C. K., Drake, S. M., & Finley, G. (1997). Teaching statistics with the Internet. _Teaching of Psychology_, 24(4), 275-278.

The Internet is a popular tool for accessing information and enhancing communication. We used components of the Internet to administer the laboratory portion of an intermediate statistics course offered to psychology honors students. Using an online questionnaire, we evaluated 16 students' perceived effectiveness of using the Internet to offer the course. Students found the communication components of the Internet laboratory more useful than the information components, perceived few barriers to their learning, and rated the value of the system positively.

> Villagarcía, T. (1998). The use of consulting work to teach statistics to engineering students. _Journal of Statistics Education_, 6(2).

This article presents the use of an interesting consulting problem as a practical exercise for a basic course in statistics for engineering students. The consulting problem considered is the estimation of the reliability of the Spanish power generating system. We have used this problem to illustrate the distribution of sums of random variables, the central limit theorem and its limitations, and other issues. We have also designed a practical exercise to show the students the use of Monte Carlo simulation to solve part of the statistical problem.

> Young, P. G. (1998). Probability, matrices, and bugs in trees. _The Mathematics Teacher_, 91(5), 402-406, 412-415.

The article describes an interesting problem that can be addressed by probability modeling. The author states the problem as follows: "Suppose that three trees are located around a small lake or pond. One of the trees becomes infested with an insect population that destroys the leaves or fruit of the tree." The article describes activities which use basic probability, simple random walks,

matrices, and Markov chains to model the path of a single insect and to determine the spread of the insect population to the remaining trees. Example activity sheets are provided in appendices.

11. Complementary short references

Cushman, J. (1996). _Hasard our probabilité? [Chance or probability?]_ París: Flammarion.

Deheuvels, P. (1982). _La probabilité, le hasard et la certitude_ [Probability, chance and certainty] . París: P.U.F.

GATTUSO, L. (In press). La moyenne: Un concept inexploité, d'une richesse exceptionnelle. _Repères_.

GATTUSO, L., & Mary, C. (1997). La moyenne, un concept évident? _Bulletin de l'AMQ_, 10–19.

GATTUSO, L., & Mary, C. (1998). Development of the concept of weighted average among high-school children". In _Proceedings of the Fifth International Conference on Teaching Statistics_. Singapore: International Statistical Institute. 685-692.

LECOUTRE B., & POITEVINEAU J. (1998). Aller au delà des tests de signification traditionnels: Vers de nouvelles normes de publication [Beyond traditional significance testing: Towards new publication guidelines] . _L'Année Psychologique_.

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12. Internet resources of interest

12.1. Secondary Mathematics Assessment and Resource Database

SMARD is the Secondary Mathematics Assessment and Resource Database. It is owned and managed by the Queensland Association of Mathematics Teachers and sponsored by Sharp Corporation. SMARD provides an opportunity for secondary maths teachers to share quality assessment and resources. Most of the assessment and resources available from this site have been classroom-tested, and much of it is non-traditional. The SMARD website also contains a list of the websites that we feel are the most valuable for secondary school teachers and students.
http://smard.cqu.edu.au

12.2. SMART web site

Mike Talbot (mike@bioss.sari.ac.uk) reminds us a collaborative project that several groups throughout the world have been involved in developing. SMART - Statistics and Mathematics As Research Tools - is concerned with trying to expand researchers' vision of what statistics can do for them beyond the basics. SMART is web- based and can be accessed at:

http://www.bioss.sari.ac.uk/smart.htm

If you have an opportunity to try it out, feedback would be appreciated. Should you be interested enough to consider developing your own set of modules, there are already some on-line instructions available which make it very easy to produce one's own presentation.

12.3. Seeing Statistics

Gary MacClelland (Gary.McClelland@Colorado.edu) is author of a browser-based textbook titled Seeing Statistics (due for official release from Duxbury Press in early 1999). Seeing Statistics lives up to its name by providing hundreds of java applets allowing students to see and to interact with statistical principles. About a dozen applets from Seeing Statistics are currently publicly available at various places on the web. The final product embeds these applets in a textbook format with lots of popup windows available for such things as examples from a variety of disciplines, computer examples, glossary, etc.

http://www.tellduxbury.com/seeing_stats_home_page.htm

The four topics illustrated there are: 1) scattergram and correlation; 2) minimising sums of squares in regression; 3) normal probabilities and z-scores; 4) contingency tables, mosaic plots, and chi-squared

http://www.duxbury.com/authors/mcclellandg/tiein/johnson.htm provides links to various Seeing Statistics applets linked to material in a textbook by Johnson & Kurby.

http://psych.colorado.edu/~mcclella/java/zcalc.html links to a variety of applets illustrating aspects of using the normal distribution.

12.4. ICOTS V proceedings content on the web

The table of contents for the proceedings has been put up on the web. The WEB site for the contents is: www.nie.ac.sg:8000/~wwwmath/THEFINAL.html

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13. Information on past conferences

13.1. Fourth Iranian Statistics Conference

Information sent by Ali REJALI, Research Group in Statistical Education, School of Mathematical Sciences, Isfahan University of Technology, Iran. E-mail: a_rejali@cc.iut.ac.ir and Rahim SHAHLAEE, Shahid Beheshti University, Tehran. E-mail: a-shahlaee@cc.sbu.ac.ir

The fourth Iranian Statistics Conference was held at Shahid Beheshti University, Tehran, Iran, on 23-25 August 1998. This series of conferences were started in 1990 at Isfahan University of Technology, in connection with the establishment of the Iranian Statistics Society. In addition to statisticians, the 1200 participants included official statisticians, representatives from government, medical and business institutions, mathematicians, actuaries, mathematics educators, and students. About 200 posters and papers were presented, selected from more than 300 applications. Most of the papers were presented in Farsi, with a reduced number of English papers presented by invited speakers, which included experts in different fields from Canada, France, Georgia, the Netherlands, India, Italy, Kenya, Spain, UK, and the USA. There were some days with up to 11 parallel sessions, which included theoretical and applied papers, applications to environmetrics, official statistics, economy, agronomy, engineering, psychology, sociology, management, biostatistics and education.

A section of the conference was devoted to Statistics Education, and chaired by Ali Rejali of Isfahan University of Technology. Katherine Hart, from the Shell Centre of the University of Nottingham, England was invited to present a workshop on Teaching probability and statistics at elementary level of schooling, and Carmen Batanero, from the University of Granada, Spain and IASE vice-president was invited to present a plenary lecture on The current situation and future perspectives for statistical education. The following papers were presented:

"A review of high school statistics text books", by Ali Madani, Tehran University;

"Some important but easy examples for introductory probability courses", by Javad Behboodian, Shiraz University;

"What should be taught in mathematical statistics courses at B.Sc. level", by Ahmed Parsian, Isfahan University of Technology;

"Using Minitab as a tool for teaching statistics in elementary courses", by Mahbanoo Tata, Kerman Shahid Bahonar University;

"A historical survey on mathematical statistics, using an observation from bivariate normal distribution", by Mina Amin Ghafari, Shiraz University;

"A proposal for teaching applied statistics in Universities", by Hamid Reza Navabpour, Tehran Alameh Tabatabaee University;

"The connection between teaching theoretical and applied statistics", by Ali Reza Fotouhi, Meshed Ferdowsi University;

"Teaching probability and statistics to engineers" by Mahmood Taheri, Isfahan University of Technology;

"A look at the M.Sc. program and the need for a change", by Majid Reza Ketabdar, Ghazvin Medical Sciences University;

"The role of probability in the high school curriculum", by Bijan Zohori Zangeneh, Sharif University of Technology,

"Analysis of the pre-university entrance test in Iran" by Masud, Ajami Bakhtiarvand, Isfahan University,

"On the teaching of probability and statistics to students in engineering" by Seyed Mahmoud Taheri, Shiraz University,

"A simple method of conveying statistical concepts to students" by Abdol-karin Borhani, Islamic Azad University, Mahabad,

"Analysis of the opinion poll of the teachers regarding the new system of teaching at high school"s by Hossein Haji Zadeh.

"Use of computers in the teaching of statistics" by Mohammed Reza Eshraghian, College of Public Health and Institute of Public Health Research, University of Medical Sciences and Public Health Services, Tehran.

In addition, two panel discussions were devoted to Ph.D. Programs in statistics and to a new school course in statistics and modelling. Finally there was a series of discussions on Statistics Competitions and the establishment of the Iranian Statistics Olympiad (proposed by Ali Rejali of Isfahan University of Technology and approved by the Iranian Statistical Society). The curricula at different levels, publications, journals, etc., were among the non-official programs of this section.

The aims of this section were to study the following problems in statistics education: a) problems of teaching statistics at elementary, high school and university level; b) the effect of computers on statistics education; c) problems of statistical curricula and methods of teaching at different levels. Some of the goals were achieved, and the community of statisticians is trying to work on these problems by doing research and experimental studies at those levels. For example the Isfahan University of technology research group is working on teaching probability and statistics at school-level. The next Iranian Statistical Conference will be held from August 22nd to 24th, 2000 at Isfahan University of Technology.

13.2. IASS-IAOS joint Conference in Mexico

This Conference was attended mainly by official statisticians and by applied statisticians in the field of economic and social statistics. As the IASE President put in evidence in her presentation the three sister Associations (IASS, IAOS, IASE) share some common interest themes. They are involved with "producers and users of statistics", and in particular the IASE is concerned with citizen as "users" of statistics. They are involved with "globalisation" and the IASE members' research has been fundamental to put in evidence the usefulness of the teaching of statistics to develop some of the skills required by the global world and the information society.

In her invited paper titled: "Developments and perspectives in statistical education", M. G. OTTAVIANI discussed in particular about two key issues emerging from the concerns of the ICOTS 5 Conference: one is the demand for recognition in academic world that research in statistics education is a research discipline in its own right. The other is to address the problem in statistics training of those researchers and professionals who must then apply statistics to diverse substantive disciplines. The paper was distributed to the Conference participants, along with some IASE materials and copies of the Table of contents of ICOTS 5 three volumes of Proceedings.

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14. Forthcoming conferences

IX International Symposium on Applied Stochastic Models and Data Analysis

June 14 - 17, 1999, Lisbon, Portugal

The Symposium 1999 will focus on new trends in theory, applications and software of applied stochastic models and data analysis. Chairs: Jacques Janssen, Belgium, (,janssen@ulb.ac.be) and Helena BACELAR, Lisbon, Portugal (hbacelar@fc.ul.pt).

web page: www.di.fct.unl.pt/asmda99

Creativity and Mathematics Education, July 15-19, 1999, Muenster, Germany

You will find the complete 1st announcement via

http://wwwmath.uni-muenster.de/math/inst/didaktik/u/meissne/WWW/complete1.htm

More information is available from Prof. Dr. Hartwig Meissner. E-mail: meissne@uni-muenster.de

23rd conference of the International Group for the Psychology of Mathematics Education,

The Technion - Israel Institute of Technology, 25-30 July 1999

In addition to attending the PME Stochastic Project Group and discussion group on Data Handling, researchers are invited to submit proposals to present a personal presentation at the conference, according to the following tentative deadlines: Proposals of research report presentations must be in the hands of the Conference Chair by 15 January 1999. Proposals for short oral communications, posters, working groups and discussion group presentations must be in the hands of the Conference Chair by 1 March 1999. More information from http://edu.technion.ac.il/conference/pme23

CIEAEM 51, 21-26 July 1999

The 51st conference of International Commission for the Study and Improvement of Mathematics Education (Commission Internationale pour l'Etude et l'Amélioration de l'Enseignement des Mathématiques), (CIEAEM) will take place in Chichester, Sussex, England, 21-26 July 1999. The general theme of the conference is 'Productive Collaboration in Mathematics (Education) across Cultures. For further information, please contact CIEAEM 51, The Mathematics Centre, Chichester Institute of Higher Education, Upper Bognor Road, Bognor Regis PO21 1HR, England. Email: maths@chihe.ac.uk

ICTMA 9, July-August 1999

The 9th International Conference on the Teaching of Mathematical Modelling and Applications, ICTMA 9, will be held in Lisbon, Portugal, 30 July - 3 August 1999. For further information, please consult the Chair of the Programme Committee, Professor João Filipe Matos, Departamento de Educao, Faculdade de Ciencias, Universidade de Lisboa, Portugal (joao.matos@fc.ul.pt),

International Research Forum on Statistical Reasoning, Thinking, and Literacy (SRTL)

July 18-23, 1999, Kibbutz Be'eri, Israel

The International Study Group for Research on Learning Probability and Statistics is offering the first in a series of International Research Forums, to be held in Israel in July 1999. Sponsored by the University of Minnesota, The Maurice and Gabriela Goldschleger Conference Foundation at the Weizmann Institute of Science, and Kibbutz Be'eri, this forum offers an opportunity for a small number of researchers from around the world to meet for a few days to share their work, discuss

important issues, and initiate collaborative projects. The topic of the first forum will be Statistical Reasoning, Thinking and Literacy. One outcome of the forum will be the publication of monograph summarising the work presented, discussions conducted, and issues emerging from this gathering.

The SRTL Research Forum organisers invite anyone interested in participating in this forum to contact them as soon as possible. Initial expressions of interest are invited as well as brief descriptions of relevant work to be shared at the forum. More information can be get from Dani Ben-Zvi, at ntdben@wiccmail.weizmann.ac.il Joan Garfield, at jbg@tc.umn.edu

ICTMT4, 9 - 13 August 1999, Plymouth, England

The 4th International Conference on Technology in Mathematics is being held in Plymouth, England from 9th to 13th August 1999. The conference is being organised jointly by the Centre for Teaching Mathematics at the University of Plymouth and the University College of St. Mark and St. John, Plymouth. Information can be obtained from Karen Eccles (keccles@plymouth.ac.uk) or at the web address: http://www.tech.plym.ac.uk/maths/CTMHOME /ictmt4.html

International Conference on Mathematics Education Into the 21st Century: Societal Challenges, Issues and Approaches, Cairo, Egypt, November 14-18, 1999

The Mathematics Education Into The 21st Century Project, co-ordinated by Dr. Manmohan S. Arora, Associate Director, Mathematics Resources & Technology Centre, Clark Atlanta University, USA, is planning a series of International Conferences to be held throughout the World leading into the next millennium. The first of these will be in Egypt in co-operation with the Third World Forum. It will be chaired by Prof. Ismail-Sabri Abdalla - Former Director of The Institute of National Planning and former Minister of Planning (Egypt). The Local Organising Committee is Chaired by Prof. Fayez M. Mina, Professor of Curriculum and Instruction, Faculty of Education- Ain Shams University, Cairo. The conference will include contributions already made to the project by leading mathematics educators world-wide. Individual papers are also welcomed from those planning to attend on the themes:

- The impact of new developments in knowledge on mathematics education (e.g. multiple intelligence, limits to problem solving, mathematics of complexity modelling)
- Societal Conditions (e.g. mathematics in and for different cultures, linguistical limitations, examples from life and from the environment)
- Information Technology and Society (e.g. interactive solving of problems, self-learning, modelling and simulating system dynamics)
- Classroom Practice (e.g. curriculum development, psychological aspects, the teacher of the 21-Century, creativity).

For further information and a copy of the First Announcement please email your contact details to arogerso@mgs.vic.edu.au (or write to Dr. A. Rogerson, 22 Violet Grove, Hawthorn, Vic 3122, Australia).

ICME9, Tokyo/Makuhari, July 31 to August 6, 2000

The National Organising Committee for the 9th International Congress on Mathematical Education (ICME9) on behalf of the International Commission on Mathematical Instruction (ICMI), is pleased to announce that ICME9 will be held in Tokyo/Makuhari, Japan, from July 31 to August 6, 2000. Makuhari is located between the centre of Tokyo and Tokyo International

Airport (Narita).
Secretariat of ICME9: Prof. Toshio Sawada, Department of Mathematics, Science University of Tokyo (icme9@ma.kagu.sut.ac.jp). International Program Committee Chair: Prof. Hiroshi Fujita. National Organising Committee President: Prof. Hiroshi Fujita; Chairperson: Prof. Yoshishige Sugiyama; Secretary: Prof. Toshio Sawada.
Major events: Plenary Lecture; International Round Table; Regular Lecture; Working Group for Action (WGA); Topic Study Group (TSG); Poster Presentation; ICMI Study Group; ICMI General Assembly; Social Activities; Exhibitions. Plenary speakers: Hiroshi Fujita (Japan), Morgen Niss (Denmark), Terezinha Nunes (Brazil/United Kingdom), Erich Ch. Wittmann (Germany).
International Round Table Moderator: Lee Peng Yee (Singapore)
Working Grops for Action:

WGA 1: Mathematics Education in Pre- and Primary School
WGA 2: Mathematics Education in Junior Secondary School
WGA 3: Mathematics Education in Senior Secondary School
WGA 4: Mathematics Education in Two-Year Colleges and Other Tertiary Institutions
WGA 5: Mathematics Education in Universities
WGA 6: Adult and Life-long Education in Mathematics
WGA 7: The Professional Pre- and In-service Education of Mathematics Teachers
WGA 8: Research , Practice and Theory of Mathematics Education
WGA 9: Communication and Language in Mathematics Education
WGA 10: Assessment in Mathematics Education
WGA 11: The Use of Technology in Mathematics Education
WGA 12: The Social and Political Dimensions of Mathematics Education
WGA 13: History and Culture in Mathematics Education

Topic study groups:
TSG 1: The Teaching and Learning of Algebra
TSG 2: The Teaching and Learning of Geometry
TSG 3: The Teaching and Learning of Calculus
TSG 4: The Teaching and Learning of Statistics
TSG 5: Teaching and Learning Aids and Materials in Mathematics Education (Hands-on)
TSG 6: Distance Learning in Mathematics Education
TSG 7: The Use of Multimedia in Mathematics Education
TSG 8: Vocational Mathematics Education
TSG 9: Mathematical Modelling and Links between Mathematics and Other Subjects
TSG 10: The Trends in Mathematics and the Mathematical Sciences: Their Reflections on
Mathematics Education
TSG 11: Problem Solving in Mathematics Education
TSG 12: Proof and Proving in Mathematics Education
TSG 13: Mathematical Learning and Cognitive Processes
TSG 14: Constructivism in Mathematics Education
TSG 15: Mathematics Education for Students with Special Needs
TSG 16: Creativity in Mathematics Education and the Education of Gifted Students
TSG 17: Mathematics Education and Equity
TSG 18: Mathematics Competitions and Mathematics Education
TSG 19: Entrance Examinations and Public Examinations in Mathematics Education
TSG 20: Art and Mathematics Education
TSG 21: Ethnomathematics
TSG 22: Topics in Mathematics Education in Asian Countries

TSG 23: TIMSS and Comparative Studies in Mathematics Education

Susan STARKINGS has been officially appointed as Chief Organiser for Topic Group 4 (TSG4): The Teaching and Learning of Statistics. She can provide more information to those interested in participating in this group. Her address is Susan Starkings, Head of Mathematics Support, South Bank University, Caxton House, Borough Road, London SE1 OAA, England, Fax: + 171 815 6464, E-mail: starkisa@vax.sbu.ac.uk

Training of Researchers in the Use of Statistics

IASE Round Table Conference

Meiji University, Tokyo, Japan, 7-11 August 2000.

Since 1968, a number of Round Table Conferences have been organised on statistical educational topics, initially by the Education Committee of the International Statistical Institute and, since 1988, by IASE (the International Association for Statistical Education). It has been usual for these conferences to be held as satellite meetings to each ICME (International Congress on Mathematics Education). Next Round Conference will be held in the year 2000 at Meiji University (Tokyo), after ICME 9 (International Congress on Mathematics Education). An IASE publication on the theme of the conference will follow. Please remember that the first deadline for receiving proposals is June, 30, 1999. The following are possible topics and issues to be discussed at this the Round Table Conference:

- Statistical competencies that researchers in different disciplines should acquire in their postgraduate training;
- Statistical training of researchers in specific fields;
- Assessing/ identifying frequent errors in the use of statistics;
- Consultation as a teaching/ learning process;
- Researchers' attitudes towards statistics and its effect on the role of data analysis in experimental research;
- Informal statistical learning from reading research literature;
- Effects of technology on the statistical training of researchers;
- Design/ evaluation of courses for training researchers in particular statistical topics and learning problems.

More information can be obtained from Carmen BATANERO, batanero@goliat.ugr.es of from the Web site: http://www.ugr.es/~batanero/iasert.htm