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

VOLUME 12, NUMBER 2, APRIL 1999

Secretary and Editor: **Carmen Batanero**

Departamento de Didáctica de las Matemáticas

Facultad de Ciencias de la Educación, Universidad de Granada

e-mail: batanero@goliat.ugr.es, http://www.ugr.es/local/batanero/

Associate Editor: **John Truran**

Mathematics Education

Graduate School of Education,University of Adelaide

e-mail: jtruran@arts.adelaide.edu.au

Table of Contents

1. Notes and Comments

Research into statistical education is reaching academic recognition in different countries, as it is shown in the summaries we include in the section on Recent Dissertations, as well as in the various international conferences we are reporting. We hope to receive the summaries of those who have done other dissertations in this area to let our members know what types of problems are you investigating and what types of methodology have you found useful to carry our this research.

The bibliography on association included in this issue suggests that doing research into statistical education requires a varied background and knowledge, including statistics, education, psychology, pedagogy, philosophy and research methodology. John has written some reflections on the problems of being updated in this varied statistics education bibliography. We hope that this Newsletter may reduce this problem, although we need your cooperation in sending us the summaries of your publications, and information on the conferences held in your countries. Bringing other colleagues to the Study Group is also an effective way to make our work more complete and productive.

We are again approaching the northern hemisphere Summer, and a number of conferences with statistical education components are being organised around the world, including the Study Group Research Forum organised by Dani Ben-Zvi and Joan Garfield. Information on this and other conferences are included in this issue.

Brian Phillips is also offering a note on Andrejs Dunkels, a wonderful person and an enthusiastic statistics and mathematics educator, who died very recently. In Brian's words many members have been privileged to meet, listen to, work with, discuss ideas and have fun with Andrejs. The list of selected references include at the end of the note is a modest homage to his work in mathematics and statistics education.

In this announcement 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.

2. New Members

Víctor Larios

Universidad Autónoma de Querétaro, México.

E-mail: vil@sunserver.uaq.mx

Víctor is a lecturer at theUniversidad Autónoma de Querétaro (México). He is developing a web site on statistical education, which is based on a course for training secondary mathematics teachers . He would be glad of receiving suggestions and comments about the material included at the site: (http://www.uaq.mx/matematicas /estadisticas).

Dione Lucchesi de Carvalho

Universidade Estadual de Campinas,

Rua Carop 519, CEP: 05447-000, Sao Paulo, Brazil.

E-mail: dione@obelix.unicamp.br

The *CEMPEM* (Círculo de Estudos, Mémoria e Pesquiza em Educaçao Matemática) at the Faculty of Education, University of Campinas, Brazil, is responsible for teaching mathematics education to students majoring in Mathematics, Pedagogy, post graduates in Mathematics Education and in-service teachers (kindergarten, primary and secondary school levels). A National Documentation Centre and the mathematics education journal *Zetetiké* are also managed from the group.

Within *CEMPEM* the group *PRAPEM* (Prática Pedagógica em Matemática) was started in 1995 and is devoted to research and teaching, curricular development and teachers' professional development, with a subgroup working in Statistics, Stochastics and Combinatorial Analysis. Permanent members of this group are Anna Regina Lanner de Moura, Dario Fiorentini and Dione Luchessi de Carvallo at the Faculty of Education and Joao Frederico Meyer and Vera L. Figueiredo at the Institute of Statistics and Computer Sciences. There are about 40 additional temporary members, including doctoral and master students, secondary teachers and undergraduates.

The idea of establishing the group arose from teachers and students dissatisfaction with two dominant tendencies in mathematics education research and practice: The technical. instrumental bias towards objective causal scientific explanations, following a model of technical rationality in empiric analytical sciences, and the practical-pragmatical tendency without a theoretical-epistemological and ethical-political reflection where pedagogical practice is superficially described.

Consequently the starting of the group was devoted to the extensive work of organisation and to reading national and international bibliography on topics such as research-practice relationships, relationships among students' and teachers' beliefs, conceptions and social representations, the role of theory in education research, and

new methodological alternatives. Research on the epistemology of pedagogical practice in mathematics, that is about the process of emergence of school and didactic-pedagogical knowledge is also a focus of their interest. Members of the group are currently developing the following research:

- Professor Celi Aparecida E. Lopes has carried out a Master Thesis on *Probability and Statistics in Compulsory Education: A curricular analysis* and is starting her doctoral dissertation on the topic *Theoretical and practical training of teachers to teach probability and statistics at Primary Education*.

- Professor Wilton Sturn is finishing his Master Thesis on *Some alternatives for teaching Combinatorial Analysis*.

- Professor Paulo César Oliveira is starting his Doctoral Dissertation on the topic: *Teachers' representations on the teaching and learning of statistics*.

- Professor Dione Luchesi de Carvallo is starting her doctoral dissertation on the topic: *The use of statistics projects related to their class mates profile as a means to recover the indentity of migrant students*.

Virginica Rusu

Dept. of Economics, North University of Baia Mare, Romania

(chrisalex@excite.com)

Virginica is assistant professor at North University of Baia Mare, Romania, where she teaches statistics at the Department of Economic. She is also developing a PhD on "*An informatic view on some forecasting alghoritms*". She graduated in Economics at the Babes-Bolyai University of Cluj-Napoca, Romania, in Marketing at the University of Baia Mare, Romania, and in Geophisics at University of Bucharest, Romania. She has worked in marketing,, statistics, forecasting, data processing, and computers for different compnies. Her publications include papers in Romanian and international journals and conference proceedings.

César Sáenz Castro

Instituto de Ciencias de la Educación, Universidad Autónoma de Madrid,

Ciudad Universitaria de Cantoblanco, 28049 Madrid, Spain.

(cesar.saenz@uam.es)

César is a lecturer at the Department of Mathematics Education, Universidad Autónoma de Madrid, Instituto de Ciencias de la Educación. He is working in pre-service and in-service secondary teachers training. He has publihsed over 30 papers in Spanish and international journals. He is currently editing a book on the interdisciplinary study of weather and statisticas, which includes an educational software and teaching materials. We are including in this issue the summary of his PhD. on *Intuition and mathematics in probabilistic reasoning and learning*. He is also interested in the psychology of statistical education and in the teaching and learning of

inference with the help of new technologies.

Maria Inés Rodríguez

Facultad de Ciencias Exactas, Fisico-Química y Naturales, Universidad Nacional de Rio Cuarto Ruta 8 - Km.608 (5800) Rio Cuarto, Córdoba, Argentina.

E-mail: mrodriguez@exa.unrc.edu.ar

Inés has got a Master in Biostatistics and is teaching mathematics, statistics and experimental design to students in Mathematical Sciences, Biology, Microbiology, Chemistry, and Agronomy. In her Department there is also a Master Program in Mathematics Education, Applied Mathematics and a Master program in Statistics. This is the first time these masters programs are bein held and the students are starting to carry out their theses. There are 6 lecturers teaching statistics out of a total of 36 leacturers in this department.

Ann Watkins
California State University, Northridge
Northridge, CA 91330-8313
E-mail: ann.watkins@csun.edu

Ann teaches statistics at her university and writes and edits probability and statistics curricular materials. She most enjoys working with secondary teachers who wish to teach statistics. She is chair of the College Board's Advanced Placement (AP) Statistics Development Committee.

---

3. Changes in E-mail Addresses

Eliseo Borrás Veses: eliseo@sylow.algebr.uv.es

Theodore Chadjipadelis: chadji@eled.auth.gr

---

4. It’s Jungle Out There.

Note by John Truran

Some readers will have seen the film "Shine" about David Helfgott, a brilliant, but severely disturbed, pianist. The film shows him waiting backstage before a competition and talking to Roger Woodward, also a brilliant pianist and one who achieved considerable success. Helfgott observes, "It’s a Jungle out there, Roger." The film goes on to show just how much of a jungle it can be for some. "Shine" was mainly filmed here in Adelaide where I work, partly on our university campus. From the outside, academia looks as neat and tidy as does our campus, but if we scratch the surface we can find quite a lot of jungle.

In particular, even after fifteen years in academic research, I still feel that the world of locating and using of previous academic work is a jungle, and does not seem to be

getting better as technology improves and micro-chips become more powerful. With pressures on academics increasing yearly, the maxim "publish or perish" is seen as more and more critical. As a result, more and more papers are being published in more and more places. Electronic publishing means that this can be done more and more cheaply.

We all know how hard it is to keep up with this ever-increasing literature, even with the assistance of abstracting services like ERIC and ZDM and of select lists such as we publish in this Newsletter. Yet it also seems to be the case that referees will reject submitted papers on the grounds that "the author has not read the works of XXX and YYY," even though XXX and YYY have not even written in a language the author can read. The Tower of Babel is itself a jungle. I have even been told that I had not read the works of a person with a name as common as "Jones" and with no further indication of which "Jones" this might happen to be. In the course of following up such claims I have found one case of a cited article which simply did not exist at all in the stipulated publication, and another of an article whose title was quite different from that actually cited. Such problems do not make hacking away at the jungle any easier.

But, putting aside these examples of human frailty, the reality is that in our field it is no longer possible for journal and conference articles to refer to all relevant previous work in any meaningful sense. If we are to prevent undesirable fragmentation of research efforts our academic community needs to find new sets of criteria for assessing papers which retain academic standards, but which face the reality of the size of the publication jungle within which we have to work. I do not have any idea what the best solutions to this problem will be, but I am sure that this is an issue, which we need to address carefully in the next few years. Letters to the editors on this topic will be welcome.

---

5. Brief News

5.1. Australian post ICOTS-5 meeting

Brian PHILLIPS ran an interesting follow-up to ICOTS in which some of the Australian ICOTS-5 speakers presented their papers to a group of locals over a day. It proved most successful and Australian statistical educators hope to continue meeting on statistics education matters on at least an annual basis. Brian has a short report on the web at http://www.swin.edu.au/maths/icots5/ausicrep.html

---

6. Andrejs Dunkels (In Memoriam)

Brian PHILLIPS, Swinburne University of Technology (bphillips@swin.edu.au).

The best part of being involved with an International Organisation such as the IASE is the opportunity of meeting wonderful people from around the world. I am sure that many will agree with me, that Andrejs Dunkels was on the top of the list of people we have been privileged to meet, listen to, work with, discuss ideas and have fun with.

Andrejs was born in Riga, Latvia, in 1939. With his family, he escaped to Sweden in

1944, but was unable to return to Latvia for many years because of the Russian occupation. From 1959 he studied Mathematics and Physics at Uppsala University then worked as a teacher and university lecturer. While working he continued his studies and obtained a MSc(Ed) in 1965. From 1966/1968 he established the Mathematics Department at the Kenya Science Teachers College in Nairobi, a Swedish Government foreign aid project, which trained teachers for lower secondary school. On returning to Sweden in 1969 he took up a position in the Mathematics Department at the Umeä University. Along with his teaching and further studies in mathematics, (obtaining a Licentiate in 1972, equivalent to a US PhD and a Diploma of Education (Honors) in 1973.

From that time on he worked at Luleå University, Sweden. He spent half his time teaching engineering students, the other half-teaching student teachers, specialising in mathematics for grades 1-7. In 1986 he was awarded Teacher of the Year at his University. Over a period of more than 20 years from the mid 1970's, Andrejs delighted conference delegates round the world with many invited conference papers in mathematics and statistics education, wrote many articles and was author and co-author of numerous text books especially for primary school children. He was also the illustrator and translator for a number of texts and was heavily involved with many associations and publications in a number of countries with wide ranging interests including "Mathematics in a Multi-cultural Society" and "Women in Mathematics". Despite his health problems he completed his PhD titled 'Contributions to mathematical knowledge and its acquisition' in 1996, was able to attend ISI in Beijing in 1995 and later do an international study tour. He had planned going to ICOTS-5, but had to pull out near the end.

At the start of this year we were devastated to hear that Andrejs died of a heart attack on the 30 December 1998. Many of his friends have the warmest memories of Andrejs. With his wife Kerstin Vännman he formed a wonderful partnership. They both showed a passion for the teaching of statistics and Kerstin was one of the leading forces in establishing the IASE. He was a most warm and caring person who made anyone in his company feel special. He will be remembered for his enthusiasm for living and particularly his gift for teaching mathematics and statistics. Whoever met him or heard him talk came away more enthusiastic about education. We will all miss Andrejs.

Below we include a selection of Andrejs's works in statistics education and mathematics education. An extended version of this note will appear in the next edition of the ISI newsletter. A more extended paper about Andrejs with comments from many friends has been put on the web under:

http://www.swin.edu.au/maths/icots5/andrejs2.html

Selected references from Andrejs Dunkels' work

Dunkels, A. (1966-1974). *KSTC mathematics*. Nairobi: Kenya Science Teachers College, Five volumes. (Coauthor and founder.)

Dunkels, A (1969). *School mathematics of East Africa, books 1 and 3*. Cambridge University Press/East African Publishing House, (Coauthor.)

Dunkels, A. (1977). Reader reflections: Another slant on slope. *Mathematics Teacher,* 70(8), 644-645.

Dunkels, A. (1978). Impressions of ICOTS II. *Teaching Statistics*, 9(1), 7.

Dunkels, A. (1979). Clock problem a second time. *Mathematics Teacher*, 72(5), 322.

Dunkels, A. (1982). Exponents: excesses and deficits. *Mathematics Teacher*, 75(3), 190.

Dunkels, A. (1982). More popsicle-stick multiplication. *Arithmetic Teacher*, 29, 20-21.

Dunkels, A. (1983). Complete induction unintentionally. *International Journal of Mathematical Education in Science and Technology*, 14(2), 251-258.

Dunkels, A. (1986). EDA in the primary classroom. Graphing and concept formation combined. In R. Davidson, & J. Swift (Eds.*), Proceedings of the Second International Conference on Teaching Statistics*, (pp. 61 -66). Victoria, B. C.: University of Victoria.

Dunkels, A. (1987). A mathematical lunch in the air. *Mathematics Teaching*, 121, 45.

Dunkels, A. (1987). An example from the inservice mathematics classroom. *Zentralblatt für Didaktik der Mathematik*, 4, 159-161.

Dunkels, A. (1988). Angle sum without telling. *Mathematics Teaching*, 123, 39.

Dunkels, A. (1988). Points of order. *Mathematics Teaching*, 124, 18.

Dunkels, A. (1988). Apples of knowledge *Mathematics Teaching*, 124, 29-30.

Dunkels, A. (1988). EDA em classes primarias. Formaçao de conceito e grafico combinados [EDA in the primary school. Graphing and concept formation combined]. (Portuguese). *Bolema*, 3(5), 35-46.

Dunkels, A. (1988). Visualization of whole numbers with applications to divisiblity rules.Invited paper to *ICME 6*, 11 pp.

Dunkels, A. (1989). Exploratory data analysis in the primary classroom. Graphing and concept formation combined. In R. Morris (Ed.), *Studies in Mathematics Education. Volume 7, the teaching of statistics* (pp. 7-19). Paris: UNESCO.

Dunkels, A. (1989). Learning the unteachable. *Journal of Mathematical Behaviour*, 8(1), 21-24.

Dunkels, A. (1989).What's the next number after G. *Journal of Mathematical Behaviour*, 8(1), 15-20.

Dunkels, A. (1990). Some classroom experiences of peer group teaching of mathematics. *International Journal of Mathematics Education in Science and Technology*, 21(4), 672-677.

Dunkels, A. (1990). Examples from the in-service classroon (age group 7-12). In A. Hawkins (Ed.), *Training teachers to teach statistics. Proceedings of the ISI Round Table Conference* (pp. 103-109). Voorburg: ISI.

Dunkels, A. (1990). Making and exploring tangrams. *Arithmetic Teacher*, 37(6), 38-42.

Dunkels, A. (1990). Stengel-Blatt-Diagramme in der Grundschule [Stem-and-leaf-plots in the primary grades]. (German). *Stochastik in der Schüle,* 9(1), 4-12.

Dunkels, A. (1991). Interplay of the number concept and statistics using attitudes and techniques of EDA. In D. Vere-Jones, S. Carlyle, & B. P. Dawkins (Eds.), *Proceedings of the Third International Conference on Teaching Statistics* (vol.1, pp. 129-139). Voorburg: ISI.

Dunkels, A. (1991). Much more than multiplying by 5. *Mathematics in the School*, 20(3), 9-11.

Dunkels, A. (1991). Colouring the multiplication table and other arrays of numbers. *Mathematics Teaching*, 136, 42-45.

Dunkels, A. (1991). Geometri och statistik. [Geometry and statistics. Book for in-service education]. *Statistik i skolan.,* 167-182.

Dunkels, A. (1993). Impact of EDA on primary education. In L. Pereira-Mendoza (Ed.). *Introducing data analysis in the schools: Who should teach it and how?* (pp. 138-158). Voorburg: ISI.

Dunkels, A. (1993). Looking at Euclid's proposition 20 of book III with closed and open eyes. *The Journal of Mathematical Behavior* 12(1), 9-15.

Dunkels, A. (1994). Interweaving numbers, shapes, statistics, and the real world in primary school and primary teacher education. In D. Robitaille, D, Wheeler and K. Kieran (Eds.), *Selected lectures from the 7th International Congress on Mathematical Education* (pp. 123-135). Sait- Foy (Quebec): Les Presses.

Dunkels, A. (1995). Il valore posizionale delle cifre con i diagrammi ramo-foglia e con i tappi a corona, nella scuola elementare. (Positional value in steam and leaf plots at elementary school). *Induzione*.

Dunkels, A. (1995). Mathematics as a didactical adventure. *International*

Journal of Mathematical Education in Science and Technology, 26(3), 417-429.

Dunkels, A. (1996). *Contributions to mathematical knolwledge and its acquisition*. PhD. Department of Mathematics, Luleä University.

Pereira-Mendoza, L., & Dunkels, A. (1989). Stem-and-leaf plots in the primary grades, *Teaching Statistics*_ 11(2), 34-37.

Pereira-Mendoza, L., & Dunkels, A. (1994). Stem-and-leaf plots in the primary grades. In D. R. Green (Ed.), *Teaching Statistics at its best* (pp. 2-6). Loughborough: The Teaching Statistics Trust.

Dunkels, A. (To appear). Numbers, shapes, and statistics-triad towards graphicacy in the education of primary school teachers. In S. Arora (Ed.), *Mathematics Education into the 21st Century, Volume II: Futuristic Trends*.

Vännman, K., & Dunkels, A. (1984). *Boken om kreativ statistik med EDA*. (The book on creative statistics with EDA). Göteborg: Gothia.

---

7. Summaires of Publications by Members

GIRARD J. C. (1998). A bas la moyenne! ou á propos des paramètres de tendance centrale et de dispersion d'une série statistique (Down with the mean! Or a proposal for other measures of central tendency and dispersion). *Repères-IREM*, 33.

This article draws attention to the fact that the mean is only one measure of central tendency among others, and that it should always be linked with a measure of dispersion such as the standard deviation. After summarising the definitions, properties and disadvantages of these two parameters, an example is used to present other measures of central tendency and dispersion.

GIRARD J. C., & PARZYSZ, B.(1998). Les maths, c'est pas la réalité ou de la modélisation en mathématiques (Maths, neither reality nor mathematical modelling). *Bulletin de l'Association des Professeurs de Mathématiques de l'Enseignement Public (APMEP)*, 418.

This article aims to emphasise that between a real problem and its mathematical solution lies the process of modelling. This essential step is often implicit at school, which can lead to students' choosing a model by chance or as part of a "didactic contract". Two examples are used to illustrate the argument: proportionality problems at both primary and tertiary levels, and probability problems at secondary level.

Perry, B., JONES, G., THORNTON, C. A., Langrall, C. W., Putt, I. J., & Kraft, C. (1999). Exploring visual displays involving beannie baby data. *Teaching Statistics,* 21(1), 11-13.

This article describes the learning experiences of young children meeting stem-and-leaf plots for the first time.

ROSSMAN, A. J., Short, T. H., & Parks, M. T. (1998). Bayes estimators for the continuous uniform distribution. *Journal of Statistical Education,* 6(3).

Classical estimators for the parameter of a uniform distribution on the interval are often discussed in mathematical statistics courses, but students are frequently left wondering how to distinguish which among the variety of classical estimators are better than the others. We show how classical estimators can be derived as Bayes estimators from a family of improper prior distributions. We believe that linking the estimation criteria in a Bayesian framework is of value to students in a mathematical statistics course, and we believe that the students benefit from the exposure to Bayesian methods. In addition, we compare classical and Bayesian interval estimators for the parameter and illustrate the Bayesian analysis with an example.

SÁENZ, C., & León, Orfelio, G. (1998). El sistema de ideas probabilísticas de los adolescentes (Probabilistic ideas of adolescents). *Infancia y aprendizaje*, 59, 25-44.

In this paper we analyse the thinking of high school students (14-18 years old) about probability and randomness, following Fischbein's framework about intuitions. A questionnaire with 28 items was built, which covers all the probabilistic concepts taught at high school. In addition to answering the question, we asked the students to provide an estimate of their confidence in their response. We describe the students' ideas that were classified according to the level of intuitive acceptance.

WATSON, J. M. (1998). Professional development for teachers of probability and

statistics: Into an era of technology. *International Statistical Review,* 271-290.

The focus of this paper is the professional development of teachers of probability at school level. Within a world where the statistics curriculum is changing at school level, the professional development needs of teachers of statistics are changing and the technology to meet these needs is changing as well. This paper reviews the work in the filed, describes the development of a multimedia package for professional development of statistics teachers and looks to the future.

WATSON, J. (1997). Chance and data for LUDDITES**.** *The Australian Mathematics Teacher,* 53(3), 24-29.

Workers destroying machinery in Northern England at the time of the Industrial Revolution were called luddites: hence the term is used to describe those who oppose technological innovation. This title was used to attract attention for a teacher development project conveying the opposite to the original meaning: "Learning the Unlikely at Distance Delivered as an Information Technology Enterprise". Throughout the three phases of the project there were two central concerns: the provision of essential content for teacher of chance and data, and the evaluation of various technologies for delivering the content to teachers across Australia.

WATSON, J., Collis, K. F., & MORITZ, J. (1997). The development of chance measurement**.** *Mathematics Education Research Journal,* v. 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 ideas of formal probability. The items were administered to 1014 students in Grades 3, 6 and 9 in Tasmanian schools. The analysis, using the NUDIST 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 and teaching practice.

---

8. Recent Dissertations

GORDON, S. (1999). *Understanding students learning statistics: An activity theory approach*. PhD. Faculty of Education. University of Sidney. Supervisor: Dr K. 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 I draw on the powerful theories of Vygotsky (1962, 1978) and Leont'ev (1978, 1981). In particular, I 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 I 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 addition, I interviewed selected students and teachers of statistics. 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 emerge from the students' descriptions. In Study Two I quantify the ways in which variables relate to each other. Structure for the data is provided by means of correlations, factor analysis and cluster analysis. The results 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 investigation 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.

References

Leont'ev, A. N. (1978). *Activity, consciousness, and personality*. (M. J. Hall, Trans.). Englewood Cliffs, New Jersey: Prentice-Hall.

Leont'ev, A. N. (1981). The problem of activity in psychology. In J. V. Wertsch (Ed.), *The concept of activity in Soviet psychology*, (pp. 37-71). New York: M. E. Sharpe.

Semenov, N. (1978). An empirical psychological study of thought processes in creative problem solving from the perspective of the theory of activity. *Soviet Psychology*, 16(1), 3-46.

Vygotsky, L. S. (1962). *Thought and language*. Cambridge, Massachusetts: The M.I.T. Press.

Vygotsky, L. S. (1978). *Mind in society*. Cambridge, MA: Harvard University Press.

ORTIZ DE HARO, J.J. (1999). *Significado de los conceptos proabilísticos elementales en los libros de texto de Bachillerato* (The meaning of elementary probabilistic concepts in secondary school text books). PhD. University of Granada. Supervisors: Carmen BATANERO, & Luis SERRANO.

In this thesis we study the elementary probabilistic concepts from the theoretical and experimental points of view. The theoretical study is aimed to show the systemic nature of the meaning of mathematical concepts and their different type of elements, as well as the institutional and personal dimensions of knowledge. Our analysis of the elements of meaning for each probabilistic concept, the comparison of its presence or absence in the text books, and the diversity of ways in which they are presented point to the various meanings given by the text books to the same concept at the same teaching level.

The experimental study consisted of a detailed analysis of the presentation of probability in a representative sample of secondary school textbooks published in the period 1975-1991. This study has been carried out at two different levels. A first qualitative analysis of the intensional and extensional elements of meanings identified in the theoretical study has been carried out in the whole sample of books. This is complemented by a quantitative study of the task variables in the exercises and examples and by a qualitative analysis of representational elements of meaning in two textbooks.

A first result is the theoretical analysis and the list of elements of meaning identified for each probabilistic concept, which can serve in the analysis of other textbooks, in building assessment instruments and in designing didactic materials for teaching probability. Our study also serves to characterise the result of didactic transposition of probabilistic concepts in secondary education, emphasising its strong points, as well as its biases and limitations. Other results are the characterisation of task variables in elementary probabilistic problems, the empirical study of its distribution in two books, the analysis of the curricular framework in this period and the survey of research concerning mathematics textbooks.

SÁENZ-CASTRO, C. (1995*). Intuición y matemáticas en el razonamiento y aprendizaje probabilístico. (*Intuition and maths in probabilistic reasoning and learning). PhD. Universidad Autónoma de Madrid. Supervisor: Ofelio León García.

The two main goals in this research were: 1) to analyse and categorise secondary school students' ideas about chance and probability; 2) to design and test efficient teaching methods that take into account students' alternative ideas. Our aim was to improve the research framework regarding students' alternative conceptions, which is usually intended to determine the students' wrong ideas about a particular scientific field. This is a useful but limited goal. Even when teachers are provided with these lists, they do not usually have a specific teaching proposal to deal with these alternative ideas.

Two empirical studies related to the first objective were carried out. A first pilot, exploratory study was carried out with University students. A second empirical study, based on Fischbein's theory of intuitions, was focused on secondary school students (13- 18 year- olds). This was done because there is a scarcity of studies related to

adolescents' probability understanding, even when researchers such as Green, Piaget and Inhelder, and Shaughnessy, have suggested that adolescence is a crucial period in the stochastic conceptual development. This research allowed us to establish: a) A "conceptual ecology" system of adolescents' personal ideas about chance nature, language and measurement, and about assigning probabilities, in the sense of Posner, Strike, Hewson and Gertzog's (1982); b) The contingent and constructive nature of students' probabilistic reasoning, which depends on task and subject factors. Instruction in probability was the most influential factor among the different subject variables.

Our second aim was to design and test a didactic teaching method regarding probability. We found three different approaches in previous studies of probabilistic reasoning and learning: mathematical-historical, psychological and didactical. The lack of relationship between these three approaches strongly attracted our attention and, therefore we tried to relate and integrate the different perspectives of the problem. Our didactic proposal has a double theoretical inspiration: 1) Hakata's epistemology regarding the quasi-empirical nature of mathematical theories; 2) Poser et al.'s conceptual Change Approach to the teaching -learning process. It was also articulated around seven elements derived from the three aforementioned approaches.

To answer the question "*Is our didactic proposal more efficient than a traditional methodology?*" *w*e designed three achievement indicators: knowledge of probability calculus, quality of probabilistic reasoning and change produced in attitude. Experimental students performed better with knowledge of probability calculus and quality of probabilistic reasoning, with a smaller presence of wrong ideas about probability and chance. There was not significant progress in students' attitudes towards mathematics as compared with the control students.

Some methodological questions arose in view of Borovcnick and Bentz (1991) critiques to empirical research on probabilistics understanding. Assuming that the problem structure and wording might affect students' answers, we applied the range of tasks to unambiguous random situations and to unexplored research fields (chance language, chance measurement, etc). Moreover, the task structure was based on probabilistic judgement rather than on choice. Students had to decide whether a probabilistic reasoning was correct or not, assigning a confidence degree to their judgement. This degree, taken from the Calibration Paradigm, within the conductive decision theory, provides information about the intuitive strength of the subject's ideas, whether it is correct or not. This task structure serves to categorise three levels of probabilistic concepts: intuitive, counterintuitive and internally contradictories, which were used to compare the conceptual change level in experimental and control students. One main problem in our research was the teachers' scientific and didactic training. A seminar of 100 hours was organised with two objectives: a) to reflect on the teacher's probabilistic conceptions; b) to reflect on the correct way of teaching probability. Finally, the following unsolved questions, which require a more extended and urgent study were enumerated: 1) the role of metacognitive strategies and affective factors in learning probability; the role of computers in learning probability; and 3) adolescents' probabilistic thinking outside school.

LOPES, C. E. *Probability and statistics in compulsory education: A curricular analysis*. (Probability and Statistics in Compulsory Teaching: A curricular analysis). Masters Thesis. Universidade de Campinas.

The aim of this study was to investigate and analyse probability and statistics teaching within the mathematics curriculum in compulsory education. The question in this research was the following: Which are the objectives of probability and statistics in the proposed mathematics curriculum in the states of Minas Gerais, Sao Paulo, Santa Catarina and the National Curriculum Parameters, taking some international curricula as referents?

To carry out this analysis the following criteria were followed: The statistics and probability conceptions underlying these proposals; the selection of probability and statistics notions to be "transposed" to the school level; the way in which these proposals suggest the treatment of these notions with the students and the explicit or implicit aims of teaching these notions to the students. From these criteria we considered some aspects emerging from the analysis and we pointed out to the importance of these topics in the students' training to produce a break with the deterministic vision of mathematics.

The teaching of probability and statistics can be a wide space of interdisciplinary work and provide an exploration of the idea of chance, using experiments. By carrying out observations, recording and representing data, students would be able to read and interpret differentiated information. Statistical concepts are important tools to solve problems and to help students to take decisions. We therefore underline the necessity to provide learning situations that enable to develop statistical thinking and from here to form critical citizens.

---

9. New Book on Statistical Methodology

Rouanet H., Bernard J. M., Bert M. C., LECOUTRE B., LECOUTRE M. P., Le Roux B. (1998). N*ew ways in statistical methodology. From significance tests to Bayesian inference*. Bern: Peter Lang.

This book, with a Foreword by the outstanding philosopher of science and mathematical psychologist Patrick Suppes of Stanford University, is the outgrowth of the work developed within the "Groupe Mathématiques et Psychologie", a research unit of the University René Descartes and CNRS (the French National Center for Scientific Research). New ways in statistical methodology are presented, which complement the familiar significance tests by new methods better suited to the researchers' objectives, in the first place, Bayesian methods. In mathematical statistics, Bayesian methods have made a breakthrough in the last few years, but those developments are still ignored by the current statistical methodology and practice. The present book is really the first one to fill this gap.

This book is written for a large audience of researchers, statisticians and users of statistics in behavioural and social sciences, and contains an analysis of the attitude of researchers toward statistical inference, and concrete proposals for improving statistical practice. The statistical consulting experience of the authors is centred around psychology and covers a broad range of subjects from social sciences to biostatistics. All methods developed by the authors are implemented in software.

Table of contents:

1. Foreword by Patrick Suppes
2. Rouanet, H. - Statistics for researchers, 1-27.
3. Rouanet, H. - Statistical Practice revisited, 29-64.
4. Lecoutre, M.-P. - And...What about the researcher's point of view, 65-95.
5. Rouanet, H., & Bert, M.-C. - Introduction to combinatorial inference, 97-122.
6. Lecoutre, B. - From significance tests to fiducial Bayesian inference, 123-157.
7. Bernard, J.-M. - Bayesian inference for categorized data, 159-226.
8. Rouanet, H., Le Roux, B., Bernard, J.-M., & Lecoutre, B. - Geometric data: From euclidean clouds to Bayesian MANOVA, 227-254.

---

10. Bibliography on Association

Antonio ESTEPA & Francisco-Tomás Sánchez-Cobo, University of Jaén, Spain

Editorial Note: This quarter's extremely thorough bibliography has been prepared by two colleagues, each of whom has prepared two dissertations in the field. Between them their interests cover, pedagogy, understanding, technology and textbooks. We are all aware of weaknesses in students' understanding, but these researchers have gone further, and have examined how we can use computers and textbooks actually to improve this understanding. So this bibliography may be seen as the result of studies which have been deeply based. While they are confined to Spain, it is likely that they have wide application, and we hope that this bibliography will inspire others to undertake similar studies.

Some of the references are of particular interest because they address issues outside the main stream of research studies. Several come from the *Journal of Abnormal Psychology* and look at responses outside those to be expect from "average" people. One of these looks at "illusory correlation", which is probably not a pathological response, and in fact gets several references in other journals as well. Some papers look at scatter plots, and others at contingency tables. From this bibliography it does seem that more work needs to be done on how people make links between the two. Finally, we may note that this bibliography contains no references from Teutonic languages. Many stochastics research workers seem to be able to cross the boundaries set up by the various romance languages, but we do not seem to be as good at reaching across the Teutonic boundary. We would be most grateful if one of our German, Dutch or Scandinavian members could supplement this list with some relevant work in their language.

Abramson, L., & Alloy, L. B. (1980). Judgment of contingency: Errors and their implications. In A. Baum & J. Singer (Eds.), *Advances in Environmental Psychology* (vol. 2, pp. 11–139). Hillsdale NJ (USA): Lawrence Erlbaum Associates.

Achen, C. H. (1982). *Interpreting and using regression*. Beverly Hills CA (USA): Sage University Paper.

Adi, H., Karplus, R., & Lawson, A. (1978). Intellectual development beyond elementary school VI: correlational reasoning. *School Science and Mathematics*, 75, 675–683.

Allan, L. G., & Jenkins, H. M. (1983). The effect of representations of binary variables on judgment of influence. *Learning and Motivation*, 14, 381–405.

Alloy, L. B., & Tabachnik, N. (1984). Assessment of covariation by humans and animals: The joint influence of prior expectations and current situational information. *Psychological Review*, 91, 112–149.

Alloy, L. B., Abramson, L. Y., & Kossman D. A. (1986). The judgment of predictability in depressed and nondepressed college students. In J. B. Overmier & F. R. Brush (Eds.), *Effect, conditioning and cognition: Essays on the determinants of behavior*, (pp. 229–246). Hillsdale NJ (USA): Lawrence Erlbaum Associates.

Anderson, J. E., & Dayton, J. D. (1995). Instructional Regression Modules Using XLISP-STAT. *Journal of Statistics Education*, 3(1), <http://www.stat.ncsu.edu/info/jse/v3n1/anderson.html>.

Anderson, J. R., & Fincham, J. M. (1996). Categorization and sensitivity to correlation. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 22(2), 259–277.

Arcuri, L., & Forzi, M. (1988). Prior expectations and manner of data presentation as factors influencing covariation estimates for incomplete contingency tables. *Acta Psychologica*, 67, 121-133.

Arkes, H. R., & Harkness, A. R. (1983). Estimates of contingency between two dichotomous variables. *Journal of Experimental Psychology: General*, 112(1), 117–135.

Arkes, H. R., & Rothbart, M. (1985). Memory, retrieval and contingency judgments. *Journal of Personality and Social Psychology*, 49(3), 598–606.

Baker, A. G., Berbrier, M. W., & Vallée-Tourangeu, F. (1989). Judgements of a 2 x 2 contingency table: Sequential processing and the learning curve. *Quarterly Journal of Experimental Psychology*, 41B(1), 65–97.

BATANERO, C., & GODINO, J. D. (1998). Understanding graphical and numerical representations of statistical association in a computer environment. In: L. PEREIRA-MENDOZA, L. S. Kea, T . W. Kee & W. K. Wong (Eds.*), Proceedings of the Fifth International Conference on Teaching Statistics* (vol. 2, pp. 1017–1024). Voorburg (Netherlands): International Statistical Institute.

BATANERO, C., ESTEPA, A., & GODINO, J. D. (1991). Estrategias y argumentos en el estudio descriptivo de la asociación usando microordenadores. [Strategies and arguments in the descriptive study of association using microcomputers]. *Enseñanza de las Ciencias*, 9(2), 145–150.

BATANERO, C., ESTEPA, A., & GODINO, J. D. (1995). Correspondence analysis as a tool to analyse the relational structure of students' intuitive strategies in judging statistical association. In: R. Gras (Ed.), *Méthodes d'Analyses Statistiques Multidimensionnelles en Didactique des Mathématiques*, (pp. 155–166). Rennes (France): Association pour la Recherche en Didactique des Mathématiques.

BATANERO, C., ESTEPA, A., & GODINO, J. D. (1997). Evolution of students' understanding of statistical association in a computer based teaching environment. In J. GARFIELD & G. BURRILL (Eds.), *Research on the Role of Technology in Teaching and Learning Statistics* (pp. 191–205). Voorburg (Netherlands): International Statistical Institute.

BATANERO, C., ESTEPA, A., & GODINO, J. D. (1998). La construcción del significado de la asociación mediante actividades de analisis de datos: Reflexiones sobre el papel del ordenador en la enseñanza de la estadística. [Building the meaning of association through data analysis: Reflections on the role of computers in teaching statistics]. *II Seminario de la Sociedad Española en Educación Matemática*. Pamplona (Spain): Sociedad Española de Educación Matemática,

BATANERO, C., GODINO, J. D., & ESTEPA, A. (1998). Building the meaning of association through data analysis activities. In: A. Olivier & K. Newstead (Eds.), *Proceedings of the 22nd Conference of the International Group for the Psychology of Mathematics Education* (vol. 1, pp. 221–236). Stellenbosch (South Africa): University of Stellenbosch.

BATANERO, C., ESTEPA, A., GODINO, J. D., & GREEN, D. R. (1996). Intuitive strategies and preconceptions about association in contingency tables. *Journal for Research in Mathematics Education*, 27(2), 151–169.

BATANERO, C., GODINO, J. D., VALLECILLOS, A., GREEN, D. R., & HOLMES, P. (1994). Errors and difficulties in understanding elementary statistical concepts. *International Journal of Mathematics Education in Science and Technology*, 25(4), 527–547.

Beach, L. R., & Scopp, T. (1966). Inferences about correlations. *Psychonomic Science*_ 6, 253–254.

Berry, W. D., & Feldman, S. (1985). *Multiple regression in practice*. Beverly Hills CA (USA): Sage University Paper.

Besse, Ph., & Falguerolles, A. (1985). Exploration interactive d'un nuage de points dans le plan [Interactive exploration of scatter plots in the plan].

Bulletin de l' APMEP, 347, 21–29.

Beyth-Marom, R. (1982). Perceptions of correlation re-examined. *Memory and Cognition*, 10(6), 511–519.

BIEHLER, R. (1997). Software for learning and for doing statistics. *International Statistical Review*, 65(2), 167–190.

Birnbaum, M. H. (1972). The devil rides again: Correlation as an index of fit. *Psychological Bulletin*, 79(4), 239–242.

Bolger, F., & Harvey, N. (1993). Context-sensitive heuristics in statistical reasoning. *Quarterly Journal of Experimental Psychology*, 46A(4), 779–811.

Bollen, K. A. (1989). *Structural equations with latent variables*. New York: John Wiley & Sons.

Chapman, L. J. (1967). Illusory correlation in observational report. *Journal of Verbal Learning and Verbal Behavior*, 6, 151–155.

Chapman, L. J., & Chapman, J. P. (1967). Illusory correlation as an obstacle to the use of valid psychodiagnostic signs. *Journal of Abnormal Psychology*, 74, 271–280.

Chapman, L. J., & Chapman, J. P. (1969). Genesis of popular but erroneous psychodiagnostic observations. *Journal of Abnormal Psychology_* 72, 193–204.

Chapman, G. B., & Robbins, S. J. (1990). Cue interaction in human contingency judgment. *Memory and Cognition_* 18(5), 537–545.

Chatlosh, D. L., Neunaber, D. J., & Wasserman, E. A. (1985). Response-outcome contingency: Behavioral and judgment effects of appetite and aversive outcomes with college students. *Learning and Motivation*, 16, 1–34.

Cleveland, W. S.; Diaconis, R., & Mcgill, R. (1982). Variables on scatterplots look more highly correlated when the scales are increased. *Science*, 256(4), 1138–1141.

Cook, R. D., & Weisberg, S. (1994). *An introduction to regression graphics*. New York: John Wiley & Sons.

Crocker, J. (1981). Judgment of covariation by social perceivers. *Psychological Bulletin*, 90(2), 272–292.

Crocker, J. (1982). Biased questions in judgment of covariation studies. *Personality and Social Psychology Bulletin*, 8, 214–220.

Crocker, J. (1981) Judgment of covariation by social perceivers.

Psychological Bulletin, 90(2), 272-292.

Curran, T., & Hintzman, D. L. (1997). Consequences and causes of correlations in process dissociation. _Journal of Experimental Psychology: Learning, Memory, and Cognition_, 23(2), 496–504.

Dickinson, A., & Shanks, D. (1985). Animal conditioning and human causality judgment. In L. G. Nilsson, & T. Archer (Eds.), *Perspectives on learning and memory* (pp. 167-191). Hillsdale NJ (USA): Lawrence Erlbaum Associates.

Dickinson, A., Shanks, D., & Evenden, J. (1984). Judgment of act-outcome contingency: the role of selective attribution. *Quarterly Journal of Experimental Psychology*, 36A, 29–50.

Einhorn, H. J., & Hogart, R. N. (1981). Behavioral decision theory: Processes of judgment and choice. *Ann. Rev. Psychol*, 32, 53–88.

Erlick, D. E., & Mills, R. G. (1967). Perceptual quantification of conditional dependency. *Journal of Experimental Psychology*, 73(1), 9–14.

ESTEPA, A. (1995a). Las tablas de contingencia y su enseñanza, ¿qué podemos aprender de las investigaciones? [Contingency tables and their teaching, what can we learn from research?]. *Uno*, 3, 89–100.

ESTEPA, A. (1995b). Algunas consideraciones sobre la enseñanza de la asociación estadística. [Some reflections on the teaching of statistical association]. *Uno*, 5, 69–79.

ESTEPA, A. (1990). *Enseñanza de la estadística basada en el uso de ordenadores: Un estudio exploratorio*. [Teaching statistics with the help of computers: An exploratory study]. Unpublished Masters thesis: University of Granada (Spain).

ESTEPA, A. (1994). *Concepciones iniciales sobre la asociación estadística y su evolución como consecuencia de una enseñanza basada en el uso de ordenadores*. [Preconceptions on statistical association and its evolution after a computer-based teaching experiment]. Unpublished PhD Thesis: University of Granada (Spain).

ESTEPA, A., & BATANERO, C. (1994). Judgments of association in scatterplots. In: *Proceedings of the Fourth International Conference Psychology on Teaching Statistics*, (p. 587). Morocco: The National Institute of Statistics and Applied Economics. (Complete version in J. GARFIELD (Ed.), *Research Papers from the Fourth International Conference on Teaching Statistics* (pp. 117–124). Minneapolis MN (USA): International Study Group for Research on Learning Probability and Statistics.

ESTEPA, A., & BATANERO, C. (1995). Concepciones iniciales sobre la asociación estadística [Preconceptions about statistical association].

Enseñanza de las Ciencias, 13(2), 155–170.

ESTEPA, A., & BATANERO, C. (1996). Judgments of correlation in scatter plots: student's intuitive strategies and preconceptions. *Hiroshima Journal of Mathematics Education*, 4, 25–41.

ESTEPA, A., & Sánchez-Cobo, F. T. (1994). Desarrollo histórico de la idea de asociación estadística [Historical development of the idea of statistical association]. *Epsilon*, 30, 61–74.

ESTEPA, A., & Sánchez-Cobo, F. T. (1996b). Association judgements in the comparison of two samples. In: L. Puig & A. Gutiérrez (Eds.), *Proceedings of the 20th Conference of the International Group for the Psychology of Mathematics Education*, (v. 2, pp. 337–344). Valencia (Spain): University of Valencia.

ESTEPA, A., & Sánchez-Cobo, F. T. (1998). Correlation and regression in secondary school text books. 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. 2, pp. 671–676). Voorburg (Netherlands): International Statistical Institute.

ESTEPA, A., BATANERO, C., & Sánchez-Cobo, F. T. (in press). Students' intuitive strategies in judging association when comparing two samples. *Hiroshima Journal of Mathematics Education*.

ESTEPA, A., GREEN, D. R., BATANERO, C., & GODINO, J. D. (1994). Judgments of association in contingency tables. An empirical study of students' strategies and preconception. In: J. P. Ponte & J. F. Matos (Eds.), *Proceedings of the XVIII International Conference on the Psychology of Mathematics Education*, (vol. 2, pp. 312–319). Lisbon: University of Lisbon.

FALK, R., & WELL, A. D. (1997). Many faces of the correlation coefficient. *Journal of Statistics Education*, 5(3). <http://www.stat.ncsu.edu /info/jse/v5n3/falk.html>.

Franklin, L. A. (1988). Clarifying regression concepts using 3 point data sets. *Teaching Statistics*, 10(1), 8–12

GAL, I (1997). Assessing students' interpretations of data: Conceptual and pragmatic issues. In B. PHILLIPS (Ed.), *Papers on Statistical Education presented at ICME-8*, (pp. 49–58). Hawthorn (Victoria, Australia): Swinburne University of Technology.

GODINO, J. D., BATANERO, C., &, ESTEPA, A. (1991). Task variables in statistical problem solving using computers. In J. P. Ponte, J. F. Matos, J. M. Matos, & D. Fernandes (Eds.), *Mathematical problem solving and new information technologies. Research in contexts of practice* (pp. 193–203). Berlin: Springer-Verlag.

GODINO, J. D., & BATANERO, C. (1996). Clarifying the meaning of mathematical objects as a priority area of research in mathematics education. In A. Sierpinska & J. Kilpatrick (Eds.), *Mathematics education as a research domain: The search of an identity*. Dordrecht (Netherlands): Kluwer.

GODINO, J. D., BATANERO, C., & ESTEPA, A. (1990). Estrategias y argumentos en el estudio descriptivo de la asociación usando microordenadores. [Strategies and arguments in the descriptive study of the association using microcomputers]. In G. Booker, P. Cobb & T. N. Mendicuti (Eds.), *Proceedings of the XIV International Conference of Psychology of Mathematics Education*, (pp. 157–164). México: Psychology of Mathematics Education Program Committee.

Gokhale, D. V., & Kullback, S. (1978). *The information in contingency tables*. New York: Marcel Dekker, Inc.

Goode, S. M., & Gold, E. J. (1987). Linear regression and correlation: an enlightening approach. *Teaching Statistics*, 9(2), 60–62.

Hamilton, D. L., & Rose, T. R. (1980). Illusory correlation and the maintenance of stereotypic beliefs. *Journal of Personality and Social Psychology*, 39, 832–845.

Haylock, D. W. (1983). Scattergrams and an elementary index of correlation. *Mathematics in School*, 37–39.

Inhelder, B., & Piaget, J. (1955). *De la logique de l'enfant à la logique de l'adolescent*. [From the child's logic to the adolescent's logic]. Paris: Presses Universitaires de France.

Jenkins, H. M., & Ward, W. C. (1965). Judgment of contingency between responses and outcomes. *Psychological Monographs*, 79, 1–17.

Jennings, D. L., Amabile, T. M., & Ross, L. (1982). Informal covariation assessment: Data-based versus theory-based judgments. In: D. Kahneman, P. Slovic & A. Tversky (Eds.), *Judgment under uncertainty: Heuristics and biases*, (pp. 211–230). New York: Cambridge University Press.

Jones, S. K., Jones, K. T., & Frisch, D. (1995). Biases of probability assessment: A comparison of frequency and single-case judgments. *Organizational Behavior and Human Decision Processes*, 61(2), 109–122.

Jong, P. J. de, Merckelbach, H. & Arntz, A. (1995). Covariation bias in phobic women: The relationship between *a priori* expectancy, on-line expectancy, autonomic responding and *a posteriori* contingency judgment. *Journal of Abnormal Psychology*, 104(1), 55–62.

Kareev, Y. (1995). Positive bias in the perception of covariation. *Psychological Review*, 102(3), 490–502.

Kelley, H. (1973). The process of causal attribution. *American Psychologist*, 28, 107–128.

Klinger, M. R., & Greenwald, A. G. (1995). Unconscious priming of association judgments. *Journal of Experimental Psychology*, 21(3), 569–581.

KONOLD, C. (1995). Issues in assessing conceptual understanding in probability and statistics. *Journal of Statistics Education*, 3(1), <http://www.stat.ncsu.edu/info/jse/v3n1/konold.html>.

Lane, D. M., Anderson, C. A., & Kellam, K. L. (1985). Judging the relatedness of variables: The psychophysics of covariation detection. *Journal of Experimental Psychology. Perception and Performance*, 11(5), 640–649.

Laviolette, M. (1994). Linear regression: the computer as a teaching tool. *Journal of Statistics Education*, 2(2). <http: www2.ncsu.edu/ncsu/pams/stat /info/jse>.

Li, K. I., & Shen, S. M. (1992). Students' weaknesses in statistical projects. *Teaching Statistics*, 14(1), 2–8.

Liebetrau, A. M. (1985). *Measures of association*. London: Sage Publications.

Little T. D. & Lopez, D. F. (1997). Regularities in the development of children's causality beliefs about school performance across six sociocultural contexts. *Developmental Psychology*, 33(1), 165–175.

Lynch, R. M. (1994). Common elements in correlation. *Teaching Statistics*, 16(1), 17–19.

Maldonado, A., Martos, R., & Ramírez, E. (1991). Human judgements of control: The interaction of the current contingency and previous controllability. *Quarterly Journal of Experimental Psychology*, 43B(2), 347–360.

MEVARECH, Z. R. (1983). A deep structure model of students' statistical misconceptions. *Educational Studies in Mathematics*, 14, 415–429.

MORRIS, E. J. (1997). *An investigation of students' conceptions and procedural styles in the statistical topic correlation*, Report No 230. London: Open University, Centre for Information Technology in Education.

MORRIS, E. J. (1998). Link: The principled design of a computer assisted learning program for correlation. In: L. PEREIRA-MENDOZA, L. S. Kea, T . W. Kee, & W.-K. Wong (Eds.), *Proceedings of the Fifth International Conference on Teaching Statistics*, (vol. 2, pp. 1033–1040). Voorburg (Netherlands): International Statistical Institute.

Murphy, G. L., & Medin, D. L. (1985). The role of theories in conceptual coherence. *Psychological Review*, 92(3), 289-316.

Naylor, J. C., & Domine, R. K. (1981). Inferences based on uncertain data: Some experiments on the role of slope magnitude, instructions, and stimulus distribution shape on the learning of contingency relationship. *Organizational Behavior and Human Performance*, 27, 1–3.

Neunaber, D. J., & Wasserman, E. A. (1986). The effects of unidirectional versus bidirectional rating procedures on college students' judgments of response-outcome contingency. *Learning and Motivation*, 17, 162–179.

Newbold, P., & Bos, T. (1985). *Stochastic Parameter Regression Models*. Beverly Hills CA (USA): Sage University Paper.

Nisbett, R., & Ross, L. (1980). *Human inference: Strategies and shortcomings of social judgment*. Englewood Cliffs NJ (USA): Prentice Hall, Inc.

Nurhonen, M. & Puntanen, S. (1991). Adding a data point to a scatterplot. *Teaching Statistics*, 13(1), 18–19.

Nurhonen, M., & Puntanen, S. (1992). Illustrating regression concepts. *Teaching Statistics*, 14(1), 20–23.

Oliveira Salazar, A. & Zúñiga Barrera, S. (1987). *Regresión y correlación*. [Regression and correlation]. México: Limusa.

Ortega Martínez, A. R. (1991). *Contingencia y juicios de covariación en humanos*. [Contingency and covariation judgements in humans]. Unpublished PhD thesis: University of Granada (Spain). Departamento de Psicología Experimental y Fisiología del Comportamiento.

Pearson, K. (1920). Notes on the history of correlation. *Biometrika*, 13, 25–45. In: E. S. Pearson & M. Kendall (1970) (Eds.), *Studies in the history of statistics and probability*, (v.1, pp. 185–205). London: Charles Griffin.

Pérez Echeverría, M. P. (1990). *Psicología del razonamiento probabilístico* [Psychology of probabilistic reasoning]. Madrid: Ediciones de la Universidad Autónoma de Madrid.

Peterson, C. R. (1980). Recognition of noncontingency. *Journal of Personality and Social Psychology*, 38(5), 727–734.

Piaget, J., & García, R. (1971). *Les explications causales* [Causal explanations]. Paris: Presses Universitaires de France.

Piaget, J. & Inhelder, B. (1951). *La genése de l'idée de hasard chez l'enfant*. Translated by L. Leake, jr, P. D. Burrell & H. D. Fischbein (1975), *The origin of the idea of chance in children*. London: Routledge & Kegan Paul.

Pitz, G. F. & Sachs, N. J.(1984). Judgment and decision: Theory and application. *Annual Review of Psychology*, 35, 139–163.

Porkess, R. (1996). Bivariate data: lessons from students' coursework. *Teaching Statistics*, 18(3), 76–80.

Pozo, J. I. (1987). *Aprendizaje de la ciencia y pensamiento causal* [Learning of science and causal thought]. Madrid: Visor.

Price, P. C., & Yates, J. F. (1995). Associative and rule-based accounts of cue interaction in contingency judgment. *Journal of Experimental Psychology: Learning, Memory and Cognition,* 21(6), 1639–1655.

Reynolds, H. T. (1977). *Analysis of nominal data*. London: Sage Publications.

Rosnow, R. L., & Rosenthal, R. (1989). Statistical procedures and the justification of knowledge in psychological science. *American Psychologist*, 44(10), 1276–1284.

Ross, J. A. & Smyth, E. (1995). Thinking skills for gifted students: The case for correlational reasoning. *Roeper Review*, 17(4), 239–243.

Rubin, A. (1989). Reasoning under uncertainty: Developing statistical reasoning. _Journal of Mathematical Behavior_, 8, 205–219.

Samaniego, F. J., & Watnik, M. R. (1997). The separation principle in linear regression. *Journal of Statistics Education*. 5(3), <http://www.stat.ncsu.edu /info/jse/v5n3/samaniego.html>.

Sánchez-Cobo, F. T. (1996). *Análisis de la exposición teórica y de los ejercicios de correlación y regresión en los textos de bachillerato*. [Analysis of theoretical exposition and of correlation and regression exercises in Secondary Education textbooks]. Unpublished masters thesis. University of Granada (Spain).

Sánchez-Cobo, F. T. (1999). *Significado de la correlación y regresión para los estudiantes universitarios*. Unpublished PhD thesis: University of Granada (Spain).

Sánchez-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 Matemática "Thales"* (pp. 303–316). Córdoba (Spain): Sociedad Andaluza de Educación Matemática "Thales".

Sánchez-Cobo, F. T., & ESTEPA, A. (1997a). Estudio de la presentación de la correlación en los libros de texto. [Study of the presentation of correlation in textbooks] (pp. 287–297). In L. García Aretio (Ed.), *El material impreso*

en la enseñanza a distancia. Madrid: UNED.

Sánchez-Cobo, F. T., & ESTEPA, A. (1997b). Demostraciones y definiciones en enseñanza secundaria. [Proofs and definitions in secondary education.]. In: Sociedad Castellano-Leonesa de Profesorado de Matemáticas (Ed.), VIII Jornadas para el aprendizaje y la enseñanza de las Matemáticas, (pp. 507–511). Salamanca (Spain): HERGAR S.L.

Sánchez-Cobo, F. T., & ESTEPA, A. (1998). La regresión en los libros de texto de Secundaria. [Regression in Secondary Education text books]. In: D. Córdenas & 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".

Scholz, R.S. (1987). *Cognitive strategies in stochastics thinking*. Dordrecht (Netherlands): D. Reidel Publishing Company.

Schroeder, L. D., Sjoquist, D. L., & Stephan, P. E. (1986). *Understanding regression analysis. An introduction guide*. London: Sage Publications.

Shaklee, H. (1983). Human covariation judgment: Accuracy and strategy. *Learning and Motivation*, 14, 433–448.

Shaklee, H., & Mins, M. (1982). Sources of error in judging event covariations: Effects of memory demands. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 8(3), 208-224.

Shaklee, H., & Tucker, D. (1980). A rule analysis of judgments of covariation between events. *Memory and Cognition*, 8(5), 459-467.

Shanks, D. R. (1987). Acquisition functions in contingency judgment. *Learning and Motivation*, 18, 147-166.

Shanks, D. R. (1989). Selectional processes in causality judgment. *Memory and Cognition*, 17(1), 27-34.

Shanks, D. R., & Dickinson, A. (1988). Associative accounts of causality judgment. *The Psychology of Learning and Motivation*, 21, 229–261.

Shanks, D. R., Pearson, S. M., & Dickinson, A. (1989). Temporal contiguity and judgment of causality by human subjects. *Quarterly Journal of Experimental Psychology*, 41B(2), 139–159.

SHAUGHNESSY, M. (1993). Probability and Statistics. *Mathematics Teacher*, 86(3), 244–248.

SHAUGHNESSY, M. (1992). Research in probability and statistics: Reflections and directions. In D. A. Grouws (Ed.). *Handbook of Research on Mathematics Teaching and Learning*. (pp. 465–494). New York: Macmillan Publishing Company.

SHAUGHNESSY, M.; (1997). Emerging research issues in the teaching and learning of probability and statistics. In B. PHILLIPS (Ed.), *Papers on statistical education presented at ICME 8*, (pp. 39–48). Hawthorn (Victoria, Australia): Swinburne University of Technology.

SHAUGHNESSY, M., GARFIELD, J., & GREER, B. (1996). Data handling. In A. Bishop, K. Clements, C. Keitel, J. Kilpatrick, & C. Laborde (Eds.). *International handbook of mathematics education*. (pp. 205–235). Dordrecht (Netherlands): Kluwer.

Smedlund, J. (1963). The concept of correlation in adults. *Scandinavian Journal of Psychology*, 4, 165–174.

Székeley, G. J. (1986). *Paradoxes in probability theory and mathematical statistics*. Dordrecht (Netherlands): Kluwer Academic Publishers Group.

Tamura, H. (1994). Model comparison in regression. *Teaching Statistics*, 16(2), 47–49.

Tassoni, C. J. (1995). The least mean squares network with information coding: A model of cue learning. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 21(1), 193–204.

Thompson, B. (1984). *Canonical correlation analysis*. Beverly Hills CA (USA): Sage University Paper.

Tomarken, A. J., Sutton, S. K., & Mineka, S. (1995). Fear-relevant illusory correlations: What types of associations promote judgmental bias? *Journal of Abnormal Psychology*, 104(2), 312–226.

Trolier, T. K., & Hamilton, D. L. (1986). Variables influencing judgments of correlational relations. *Journal of Personality and Social Psychology*, 50(5), 879–888.

TRURAN, J. M. (1995). Some undergraduates' understanding of the meaning of a correlation coefficient. In: B. Atweh & S. Flavel (Eds.) *MERGA 18: Galtha*, (pp. 524–529). Proceedings of the Eighteenth Annual Conference of the Mathematics Education Research Group of Australasia (MERGA). Darwin (Australia): Northern Territory University.

TRURAN, J. M. (1997). Understanding of association and regression by first year economics students from two different countries as revealed in responses to the same examination questions. In: J. GARFIELD & J. M. TRURAN (Eds.), *Research Papers on Stochastic Education from 1997*. (pp. 205–212). Minneapolis, MN (USA): University of Minnesota. Department of Educational Psychology.

Tversky, A., & Kahneman, D. (1982a). Causal schemas in judgments under uncertainty. In: D. Kahneman, P. Slovic & A. Tversky (Eds.), *Judgment under uncertainty: Heuristics and biases*. (pp. 117–128). New York:

Cambridge University Press.

Tversky, A., & Kahneman, D. (1982b). Judgment under uncertainty: heuristics and biases. In: Kahneman, D., Slovic, P. & Tversky A. (Eds.), *Judgment under uncertainty: Heuristics and biases*. (pp. 3–20). New York: Cambridge University Press.

Tversky, A., Sattath, S., & Slovic, P. (1988). Contingent weighting in judgment and choice, *Psychological Review*, 95(3), 371–384.

Vallée-Tourangeau, F., Baker, A. G., & Mercier, P. (1994). Discounting in causality and covariation judgements. *The Quarterly Journal of Experimental Psychology*, 47B(2), 151–171.

Vázquez, C. (1987). Judgment of contingency: cognitive biases in depressed and non depressed subjects. *Journal of Personality and Social Psychology*, 52(2), 419–431.

Wallace, E. (1993). Exploring regression with a graphing calculator. *Mathematics Teacher*, 86(9), 741–743.

Ward, W. C., & Jenkins, H. M. (1965). The display of information and the judgment of contingency. *Canadian Journal of Psychology*, 19, 231–241.

Wasserman, E. A., & Shaklee, H. (1984). Judging response-outcome relations: The role of response-outcome contingency, outcome probability and method of information presentation. *Memory & Cognition*, 12(3), 270–283.

Wasserman, E. A. Chatlosh, & D. L. Neunaber, D. J. (1983). Perception of causal relation in humans: factors affecting judgment of response-outcome contingencies under free-operant procedures. *Learning and Motivation*, 14, 406–432.

Well, A. D., Boyce, S. J., Morris, R. K., Shinjo, M., & Chumbley, J. I. (1988). Prediction and judgment as indicators of sensitivity to covariation of continuous variables. *Memory and Cognition*, 16(3), 271–280.

Wild, C., & Pfannkuch, M. (1998). What is statistical thinking ? In: L. PEREIRA-MENDOZA, L. S. Kea, T . W. Kee, & W.-K. Wong (Eds.), *Proceedings of the Fifth Conference on Teaching Statistics*, (vol. 1, pp. 333–339). Voorburg (Netherlands): International Statistical Institute.

Wilkie, D. (1980). Pictorial representation of Kendall's rank correlation coefficient. *Teaching Statistics*, 2(3), 76–78.

Wright, J. C., & Murphy, G. L. (1984). The utility of theories in intuitive statistics: the robustness of theory-based judgments. *Journal of Experimental Psychology: General*, 113(2), 301–322.

Yates, J. F., & Curley, S. P. (1986). Contingency judgment: Primacy effects

and attention decrement. *Acta Psychologica*, 62, 293–302.

11. Other publication of interest

Briggs, N. E., Sheu, C. F. (1998). Using Java in introductory statistics. *Behavior Research Methods, Instruments, & Computers*, 30(2), 246-24.

Information is provided on how to gather the necessary pieces to write, compile, and execute a Java program. Monte Carlo estimation and simple linear regression are used as tutorial examples of the versatility of Java.

Clarke, G. M. (1999). What is the Royal Statistical Society? *Teaching Statistics*, 21(1), 2-3.

This is the first of a short series of articles briefly describing the organisations that sponsor Teaching Statistics.

Conners, F. A., Mccown, S. M., & Roskos, E. B. (1998). Unique challenges in teaching undergraduate statistics. *Teaching of Psychology*, 25(1), 40-42.

The statistics instructor faces four major challenges unique to this course: motivating students to study material they think is uninteresting, handling math anxiety, dealing with performance extremes, and making the learning memorable. We discuss each challenge along with solutions offered in the literature.

Gatti, G. G., & Harwell. M. (1998). Advantages of computer programs over power charts for the estimation of power. *Journal of Statistics Education*, 6 (3).

Statistics and research design textbooks routinely highlight the importance of a priori estimation of power in empirical studies. Unfortunately, many of these textbooks continue to rely on difficult-to-read charts to estimate power. That these charts can lead students to estimate power incorrectly will not surprise those who have used them, but what is surprising is that textbooks continue to employ these charts when computer software for this purpose is widely available and relatively easy to use. The use of power charts is explored, and computer software that can be used to teach students to estimate power is illustrated using the SPSS and SAS data analysis programs.

Gibson, B. (1999). Industrial visits work. *Teaching Statistics*, 21(1), 4-7.

This paper describes how visiting industry help students to see how statistical methods are used in practice.

Lan, W. Y. (1998). Teaching self-monitoring skills in statistics. In D. H. Schunk, B. Zimmerman, et al. (Eds.), *Self-regulated learning: From teaching to self-reflective practice* (pp. 86-105). New York: Guilford Publications.

This chapter presents findings of studies the author conducted with 69 students in a

college statistics course and shows how self-monitoring (SM) affected various aspects of college students' learning. Analyzing the reasons for students' SM deficits in the class, the author decided that the deficits were primarily caused by cognitive factors and that it was the challenging learning tasks and students' state-oriented thinking that used up their information-processing capacity and prevented them from SM their own learning. An external cue triggering a SM process was needed to help students to engage in SM when studying statistics. The cues used were protocols designed to direct students' attention to their own learning activities or the instructor's teaching activities. Students were randomly assigned into SM, instructor-monitoring, or control conditions. As predicted, students in the SM condition outperformed their counterparts in the instructor-monitoring and control conditions on the course examinations and increased the frequency with which they use other self-regulated learning strategies.

Magel, R. C. (1998). Using cooperative learning in a large introductory statistics class. *Journal of Statistics Education,* 6(3).

This article discusses one active learning technique, cooperative learning, that can be used in large classes. This technique requires that students be divided into learning teams. A method for quickly dividing a large class of students into learning teams is presented. Two examples of cooperative learning exercises used in an introductory statistics class are given. These serve as illustrations of the type of cooperative learning exercises that can be assigned in a large class. In particular, these exercises were used in a class of 195 students. Preliminary findings by the instructor of the advantages of using cooperative learning exercises are discussed.

Sgoutas-Emch, S. A., & Johnson, C. J. (1998). Is journal writing an effective method of reducing anxiety towards statistics? *Journal of Instructional Psychology*, 25(1), 49-57.

This paper examines the efficacy of journal writing in reducing perceived anxiety and physiological reactivity towards a statistics course required for a major in psychology. Subjects were 44 undergraduates. Their performance, attitudes, and anxiety towards the course were compared with a control group who did not keep a journal. Results show that the journal group showed improvement in their grades, lower anxiety before exams, and lower physiological reactions. Research suggests that journal writing may be an effective tool in curtailing feelings and responses to exams in statistics and possibly other related courses.

Smith, G. (1998). Learning statistics by doing statistics. *Journal of Statistics Education,* 6(3).

To help students develop statistical reasoning, a traditional introductory statistics course was modified to incorporate a semester-long sequence of projects, with written and oral reports of the results. Student test scores improved dramatically, and students were overwhelmingly positive in their assessment of this new approach.

West, R. W., & Ogden, R. T. (1998). Interactive demosntrations for statistics education on the World Wide Web. *Journal of Statistics Education,* 6(3).

The World Wide Web (WWW) is a tool that can be used in many ways for basic statistics education. Using the latest WWW technology, educators can now include

interactive demonstrations in the form of Java applets within their WWW materials. Six example applets developed by the authors are introduced and discussed. Suggestions for class use are made, and instructions for incorporating the applets within a WWW document are given.

---

12. Complementary short references

Arnholt, A. (1999). Simulating sampling distributions. *Teaching Statistics,* 21(1), 14-16.

Cai, J. (1998). Exploring students' conceptual understanding of the averaging algorithm, *School Science and Mathematics,* 98, 93-98.

Chow, L. S. (1996). *Statistical significance. Rationale, validity and utility.* London: Sage Publications.

FALK, R., & Tadmor-Troyanski, M. (1999). Think: A game of choice and chance. *Teaching Statistics,* 21(1), 24-27.

FRIEL, S. N. (1998). Teaching statistics: What's average? In L. J. Morrow (Ed.), *The teaching and learning of algorithms in school mathematics* (pp. 208-217). Reston, Va: National Council of Teachers of Mathematics.

Gal, I. (1997). Numeracy: reflections on imperatives of a forgotten goal. In L. A. Steen (Ed.), *Quantitative literacy* (pp. 36-44). Washington, DC: College Board.

HANCOCK, C., Kaput, J. J., & Goldsmith, L. T. (1992). Authentic inquiry with data: Critical barriers to classroom implementation. *Educational Psychologist*, *27(3)*, 337-364.

Lehrer, R., & Romberg, T. (1996). Exploring children's data modeling. *Cognition and instruction,* 14, 69-108.

Reading, C., and Pegg, J. 1995. Teaching Statistics: Background and implications. In Grimison, L. and Pegg, J. (Eds), *Teaching secondary school mathematics: theory and practice* (pp. 140-163). Marrickville, Australia: Harcourt Brace and Company.

Scott, T., & Jackman, S. (1999). Examples of the use of technology in teaching statistics. *Teaching Statistics,* 21(1), 20-23.

Perry, B., JONES, G., THORNTON, C., & Langrall, C. (1997). Using technology in data exploration. *Australian Primary Mathematics Classroom*, 2(4), 27-31.

---

13. Internet Resources of Interest

13. 1. Statistics Education Site in Spanish Language

Víctor LARIOS (vil@sunserver.uaq.mx) is developing a web site in Spanish language directed to mathematics secondary teachers at http://www.uaq.mx/matematicas /estadisticas. He is interested in receiving suggestions on his work.

13. 2. MATHDI database is now available via the www

MATHDI (MATHematical DIdactics) is the most comprehensive and up-to-date computerized information service in the fields of mathematics education and computer science education, elementary mathematics and its applications as well as psychological and pedagogical issues for mathematics and science education. MATHDI is the online-version of the well-known international abstracting service in mathematical education: ZDM. Important features of this new service are:

- worldwide unique access to literature on research and practice in mathematics education from 1976 to present: more than 76.000 entries.
- on screen TEX or Postscript view of full review text
- easy menu search
- hypertext links to authors, and classification, ...
- links to the EMIS (European Mathematical Information System) server with access to the database MATH and free e-journal access, conference calendar, and other services offered by FIZ Karlsruhe.
- Free access to the snupper version (Sneak preview with only three items for any question)

All a user needs to do is to open the URL: http://www.emis.de/MATH/DI.html. More information is available from ZDM Gerhard Koenig, managing editor (gk@fiz-karlsruhe.de). For a list of more events and other information in the area "technology in mathematics teaching" visit the webpage at http://www.kutzler.com

---

14. IASE and Other Educational Invited Paper Meetings at the ISI's 52nd Biennial Session

Helsinki (Finland), August 10-18, 1999

There are seven IASE invited paper meetings planned for ISI-52. One is co-organised with IAOS.

- *Statistical Education and the Significance Tests Controversy*, organised by C. BATANERO. The following papers will be presented: *Beyond the significance test controversy,* by Bruno LECOUTRE, *Students' difficulties and errors in the learning of statistical tests*, by Angustias VALLECILLOS, and *Teaching hypothesis testis. Can it still be useful?* by Henrik DAHL. Reactors will be Paul

K. ITO, and Michael CAPOBIANCO.

- *Issues Involved in the Assessments and Evaluation of Student Learning of Statistics*, organised by J. GARFIELD. The following papers will be presented: *How to assess large groups with the minimal amount of resources but serving quality,* by Susan STARKINS, *A morel of classroom assessment in action: using assessment to improve student's learning and statistical reasoning,* by Beth Chance, and *Assessment in statistics using the personal computer,* by Giuseppe Cichitelli. Reactors will be Dani BEN-ZVI, and Gilberte SCHUYTEN.

- *Teaching and Training Multivariate Data Analysis*, organised by H. BACELAR-NICOLAU. The following papers will be presented: *Teaching data analysis to statistics students,* by A. Rizzi, *Introduction á la classification en sciences humaines,* by George Le Calvé, *Discussion, debate and disagreement teaching multiple regression to business students,* by Peter G. Bryant, and *Teaching multivariate data analysis in the fields of biology and ecology,* by Hans-Peter Baeumer. Reactors will be Gilbert Saporta, and F. Costa Nicolau.

- *Visualisation as an Educational Tool*, organised by L. Weldon. The following papers will be presented: *Graphical excellence: the importance of sound principles and practices multimedia,* by Thomas E. Bradstreet, *Emphasising activities and visualisation in teaching introductory statistics by interactive multimedia,* by Hans-Joachim Mittag. Clovis Pérez is presenting another paper. The reactor will be Andrejs BLEJEC.

- *Statistical Education Using Flexible Learning Approaches*, organised by A. Di Ciaccio. The following papers will be presented: *A toolkit for an interactive learning environment,* by Deborah Nolan and Duncan Temple Lang, *Teaching statistics with internet: a survey of available resources and the Statnet project,* by Gilbert Saporta, and *Why do students find statistics so difficult* by James B. Ramsey. Reactors will be Gainfranco GALMACCI, and Juha Puranen,

- *Statistical Training for People Working in and with Official Statistics*, organised by C. BLUMBERG (IASE) and R. Smulders (IAOS). The following papers will be presented: *The dissemination of statistical literacy among citizens and public administration directors* by Luigi Biggeri, *Training official statisticians in communicating with users: a review of current practice and possible improvement* by Rudols Teekens, and *New and emerging demands for statistical training in response to user needs in the 21st century* by Linda Hewitt. Reactors will be Jayanta K. Ghosh, Mario Palma Rojo and Paul Cheung.

- *Statistical Education for Life*, organised by Brian PHILLIPS and Anne HAWKINS. The following papers will be presented: *Justice by the numbers: educating judicial decision makers,* by Mary Gray, *Official statistics and the outside world,* by Vincenzo Lo Moro, and *Helping the public to understand risk* by Amanda Burls. Reactors will be Helena BARCELAR-NICOLAU, and Geoff Laslett.

Other sessions of interest for statistical education are: Session 3, *History of ideas in statistics and probability in Scandinavian countries,* Session 6, *Panel discussion on*

Statistical literacy, Session 11, *Critical issues for statistics in the next two decades,* Session 13, *Statistics in art,* Session 14, *Information revolution and statistics in developing countries,* Session 15, *Opportunities for statisticians in business, industry and public service,* Session 19, *Panel discussion on Statistics, science and the media,* Session 50, *Official statistics in the 20th century, historical perspective,* and Session 74, *The role of women in statistics in the new millennium,* The indicative list of topics for contributed papers drawn up by the Local Programme Committee contains the following topics: *Teaching basic statistics; Educating statistical majors; Statistical education; Teaching statistics for non-statisticians; Statistical Literacy* and *Statistical consulting*. More instructions and information can be found at http://www.stat.fi/isi99

---

15. 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 (meissne@uni-muenster.de).

CIEAEM 51, 21-26 July 1999, Chichester, England

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

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

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

The annual Conference of 1999 is scheduled in Haifa, Israel, from July 25 to July 30.Information may be obtained from the Conference Secretariat (pme@netvision.net.il) or the home page of the conference: http://edu.technion.ac.il

/conference/pme23. Information about the PME Project Group activities may be get from John Truran (jtruran@arts.adelaide.edu.au).

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. More information can be get from Dani BEN-ZVI (ntdben@wiccmail.weizmann.ac.il) and Joan GARFIELD (jbg@tc.umn.edu), and from the web page(www.beeri.org.il/SRTL).

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

CLATSE 4, July 26 - 30, 1999, Mendoza, Argentina

In 1999, in Argentina the CLATSE 4. Congreso Latinoamericano de Sociedades de Estadistica, will be held in Mendoza, from July 26 to July 30 organised jointly by the Sociedad Argentina de Estadistica (SAE) and the Sociedad Chilena de Estadistica (SOCHE). Sessions on teaching statistics at all levels will be organised by Ana Silvia Haedo, Vice-President of the SAE in collaboration with the IASE. More information may be obtained from Ana Silvia Haedo (haedo@qp.fcen.uba.ar) and from the Web site: http://fce.uncu.edu.ar/clatse4.htm

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

PRESTA with IASE co-operation

The five-year interuniversity co-operation PRESTA Programme was set up in 1994 by the Laboratoire de Méthodologie du Traitement des Données of theUniversité Libre of Brussels, Belgium in co-operation with other European Universities, and with the support of the European Union. PRESTA is now
organising a Conference on the Teaching of Statistics with the help ofASE, which will be held at the Universidade Federal de Santa Catarina (UFSC), Florianópolis, Brazil in September, 1999. The International Programme Committe is formed by:

Dr. Eduardo Crivisqui, PRESTA, Bruxelas, Belgium, Chair (ecrivisq@ulb.ac.be);

Prof. Maria Gabriella Ottaviani, IASE President, Rome, Italy (ottavian@pow2.sta.uniromal.it);

Prof. Carmen Batanero, IASE, Granada, Spain (batanero@goliat.ugr.es);

Prof. Brian Phillips, IASE President-Elect, Swinburne, Australia (bphillips@swin.edu.au);

Prof. Lúcio Botelho, UFSC, Florianópolis, Brazil (lucio@reitoria.ufsc.br)

Prof. Pedro Ferreiro Filho, UFSCar, São Carlos, Brazil (dpff@power.ufscar.br)

Prof. Pedro A. Barbetta, UFSC, Florianópolis, Brazil; Chair Local organising Committee, (barbetta@inf.ufsc.br)

Prof. Paulo J. Ogliari, UFSC, Florianópolis, Brazil (ogliari@inf.ufsc.br)

Prof. Gretel Xerstin Villamonte Techera, PRESTA representative in Uruguay (gretel@odon.edu.uy)

More information can be obtained from the Chair of the Local Organising Committee, Pedro Alberto Barbetta, Departamento de Informática e de Estadística /CTC, Universidade Federal de Santa Catarina, 88-040, Florianópolis, SC, Brazil, Tel: 55-048-3319739; Fax: 55-048-3319770, E-mail: barbetta@inf.ufsc.br,
or from the Chair of the Programme Committee Dr. Eduardo Crivisqui, Avenue Jeanne, 44B-1050, Bruxelles, Belgium, Tel: 32-2-650.3270; Fax: 32-2-6503266, E-ail: ecrivisq@ulb.ac.be. More information on the PRESTA Programme is available from the website: http:/www.ulb.ac.be/assoc/presta

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).

ICME 9 Topic Group: The Teaching and Learning of Statistics

The forthcoming ICME-9 Conference will be held in Tokyo/Makuhari (Japan), since July 31 to August 6, in the year 2000. Prof. Hiroshi Fujita, Chair of ICME-9 IPC, has invited Dr Susan Starkings, the ICME-9 contact facilitator, to be the chief organiser of the Topic Study Group No. 4 on: The Teaching and Learning of Statistics. The Topic Theme is: Statistics and Statistical Education for the year 2000 plus. Papers are particularly invited on statistical education from for children aged 11-18, students in higher education, and also for adults, and which fall into one of the following categories:

i) Research that has been carried out on students learning statistics and how this can help the statistical educators of tomorrow.

(ii) New innovations used and proposed to be used in the statistics teaching environment.

(iii) Practical examples of statistical work carried out in developing countries and the way forward for these countries.

(iv) Work related statistical education and its relationship to the classroom.

(v) How future statistical education can be enhanced.

(vi) Global statistical education for the future.

If you want to submit an abstract for a paper, then please contact to organiser:Susan Starkings, Head of Mathematics Support, Caxton House, South Bank University 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

IASE Sessions in the ISI 53rd Biennial Meeting

Seoul (Korea) 2001

Lionel PEREIRA MENDOZA is the representative of the IASE within the Programme Co-ordinating Committee for the 2001 ISI Congress in Seoul (Korea). The Committee will meet during the 52nd ISI Session. Suggestions are being actively sought regarding session topics and organisers. There will be six or seven themes directly related to Statistical Education. Suggestions concerning any aspects of teaching statistics are welcome but preference will generally be given to topics of wide interest. Sessions that

are organised in collaboration with IASE's sister Associations within the ISI family are strongly encouraged. Suitable names and contact information for organisers, speakers and discussants will also be appreciated.

Suggestions should be sent to Lionel PEREIRA MENDOZA.

ICOTS-6 Durban (South Africa), 2002

Plans to held ICOTS-6 in the Summer of 2002 are already under way. The venue is Durban, in South Africa, during mid July. The IASE will make a concerted effort to attract participation from African developing nations, in part offering funds to delegates as was the case at ICOTS-5. The International Programme Committee (IPC) is formed at present by:

- Maria-GABRIELLA Ottaviani, Italy, Chair
- Brian PHILLIPS (Australia), International Organiser
- Dani BEN-ZVI (Israel), IPC Secretary
- Delia North, (South Africa), Chair of the Local Organising Committee

IASE encourages members to submit suggestions for session topics, for organisational arrangements, or other areas. ICOTS is IASE major conference; we want it to respond to members' wishes. Any suggestions or other communication from interested members relevant to the activity of the IPC will be welcomed by M.Gabriella OTTAVIANI (ottavian@pow2.sta.uniroma1.it) and Brian PHILLIPS (bphillips@swin.edu.au).