NEWSLETTER OF THE INTERNATIONAL STUDY GROUP FOR RESEARCH

ON LEARNING PROBABILITY AND STATISTICS

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1. NOTES AND COMMENTS

In a few days many of us are going to meet at the ICOTS V Conference in Singapore. We hope that you can attend the group meeting on Tuesday 23.

Joan Garfield will be in the chair, and the first purpose of the meeting is to enable members to put names to faces. Electronic communication is wonderful, but it is better to know people face to face. The second is to discuss future plans for the group. There are three major items planned, but members are encouraged to raise other issues.

Carmen Batanero will talk about plans for the future of the Newsletter. Kath Truran will talk about plans for a Handbook of Stochastics Education which is being planned by the PME Stochastics Working Group, but which will need to draw on the expertise of non-PME members. John Truran will present plans for establishing a data base of stochastics research, and also developing a procedure for critical reviews of the stochastics education literature as part of the Newsletter.

We very much hope that some of our members will want to be part of these activities, and we hope to hold preliminary discussions about implementing these plans during our time in Singapore. For those who are not able to attend the Singapore Conference, there will be a report of our meetings in the October Newsletter. Information about this and other conferences with stochastics education content is included in this Newsletter.

Please, remember that the newsletters are available from our web page at the University of Granada (http://www.ugr.es/local/batanero/).

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

2. NEW MEMBERS

Yilmaz Akdi

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Yilmaz is an Assistant Professor at Ankara University since 1995. He is teaching statistics at the Faculty of Science, mainly as introductory courses for undergraduates. Recently he has started to be interested in statistical education. He attended the 51st Session of the International Statistical Institute in Istanbul, last summer.

Ana Apilluelo

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Ana is teaching statistics at the Faculty of Economics and Biostatistics at the School of Medicine,

Universidad Pública de Navarra. She has been teaching for 15 years now and is becoming more interested in statistical education. She has got a degree in Economics at the University of Barcelona.

Rubén Hernández

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Rubén got his Ph. D. in Applied Mathematics at the University of Grenoble and most of his work has been in applications to sociology, demography and voting pools. The Instituto Federal Electoral, Gobierno de la Ciudad de México, and the Asociación Mexicana de Estadística have published most of his research papers and technical reports. He is preparing a textbook on categorical data analysis. Along all this work he has been realising the relevance of statistical education and he attended ICOTS-4 in Marrakech, where he contacted some French researchers on the topic. He is now interested in the history of statistics; in particular he is trying to find out about the influence that Quetelet and others had on Mexican statisticians. He is currently in Sabbatical at the Facultad Latinoamericana de Ciencias Sociales, México.

Andrés Nortes Checa

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Andrés is a lecturer in mathematics and mathematics education at the Faculty of Education, University of Murcia, Spain since about 20 years now. He has written numerous books and papers on mathematics education, including statistics, and statistics education, a field in which he is particularly concerned.

Peter S. Mortensen

The Aarhus School of Business

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Since 1992 Peter has been involved more in research in statistical education. He is still interested and active in the subject and is organising/chairing a session at the next ICOTS-conference in June this year in Singapore. He has published the following papers in Danish: Business statistics: Survey sampling, Systime, 1989; Business statistics: Probability theory, Systime, 1986, 1989. Business statistics: Tutorials, Systime, 1988; Business statistics: Quality control, Systime, 1992; Advanced survey sampling, The Aarhus School of Business, 1992. Information about other papers in statistical education by Peter is given in the section on short references.

Clovis de Araujo Peres

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Clovis is currently teaching statistics to post graduate students in Medicine. She tries to implement her own pedagogical ideas on the topic. She is attending this year the stochastics working group at the III Iberoamerican Conference on Mathematics Education.

Dave Pratt

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Dave is working at the Mathematics Education Research Centre, University of Warwick. He has been attending a number of Conferences on the Psychology of Mathematics Education (PME), where he has presented some papers on stochastics. He is a member of the PME Stochastics working group and this year is presenting a Research Forum paper at PME 22. We are including the summary of Dave' thesis in this issue.

Ernesto A. Sánchez

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Ernesto Sánchez is a mathematician, and got his degree at the National University of Mexico (UNAM), M.S. (1990) and Ph. D. (1996) in Mathematics Education by the Departamento de Matemática Educativa at the Centro de Investigaciones y Estudios Avanzados del Instituto Politécnico Nacional (CINVESTAV) in México City. He is titular professor at this Department. He has been interested in learning and teaching problems on probability and statistics concepts in introductory courses. His Ph. D. thesis explores secondary school teachers' difficulties in stochastic independence. He is currently working on learning of conditional probability concepts with secondary students. Also he has been exploring the possibilities of using "superculators" for mathematical learning. This year Ernesto is a visiting scholar at the University Louis Pasteur in Strasbourg, where he is working with François Pluvinage and Claire Dupuis. He is also doing a

two months visit to colleagues at the Statistical Education Research Group, University of Granada, Spain.

Dr. Lola Ugarte

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Lola is teaching statistics at the Universidad Pública de Navarra and her main interest are theoretical and applied statistics. She has recently known of our group and she is joining because she is also interested in statistical education.

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

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3. SUMMARIES OF PUBLICATION BY MEMBERS

CAI, J. (1998). Exploring students' conceptual understanding of the averaging algorithm. _School Science and Mathematics_, 98(2), 93-98.

Conceptual understanding of arithmetic average includes both an understanding of the computational algorithm and the statistical aspects of the concept. This study focused on the examination of 250 sixth-grade students' understanding of the arithmetic average by assessing their understanding of the computational algorithm. The results of the study showed that the majority of the students knew the "add-them-all-up-and-divide" averaging algorithm, but only about half of the students were able to correctly apply the algorithm to solve a contextualized average problem. Students were able to use various solution strategies and representations to solve the average problem. Those who used algebraic and arithmetic representations were better problem solvers than those who used pictorial and verbal representations. This study not only suggests that the average concept is more complex than the simplicity suggested by the computational algorithm, but also indicates the need for teaching the concept of average, both as a statistical idea for describing and making sense of data sets and as a computational algorithm for solving problems.

CLARK-CARTER, D. (1997). _Doing quantitative psychological research: From design to report_. ISBN 0-86377-789-9. Psychology Press.

This book has four aspects which together make it unique. Firstly, it takes the reader through all the stages of research from design, through conduct, analysis and interpretation to reporting the research, including advice on presenting a paper or a poster at a conference. Secondly, it describes a wide range of methods and although it concentrates on quantitative approaches, it also briefly describes a number of qualitative methods. Thirdly, the coverage of statistical techniques is thorough, but the way in which they are described is designed for the reader who will do the

analysis by computer. Accordingly, the techniques are presented in as non-mathematical a way as possible, with the emphasis on choosing the appropriate test and interpreting and reporting the results. Nonetheless, formulae, worked examples and more complex material are contained in extensive appendixes. Fourthly, the importance of statistical power and effect size is stressed, with guidelines on how to choose an appropriate sample size for most of the statistical tests covered in the book. These include a wide range of both parametric and non-parametric tests. The book concentrates on univariate statistics - such as t-tests, ANOVA and multiple regression - and bi-variate statistics - such as correlation - but also includes a chapter which describes multivariate techniques to give the reader an idea of when they can be used.

Contents: Introduction. The methods used in psychological research. Choice of topic, measures and research. Design. The preliminary stages of research. Variables and the validity of research designs. Designs and their internal validity. Methods. Asking questions: Interviews and surveys. Measuring attitudes and meaning. Observation and content analysis. Data analysis. Scales of measurement. Summarising and describing data. Going beyond description. Samples and populations. Analysis of differences between a single sample and a population. Effect size and power. Parametric and non-parametric tests. Differences between two levels of an independent variable with more than two levels. Analysis of designs with more than one independent variable. Subsequent analysis after ANOVA or x2. Correlation. Regression. Multivariate analysis. Meta-analysis. Sharing the results. Reporting research.

HENRY, M. (1998). _Les premiers apprentissages en probabilités: Un processus de modélisation_ (First learning on probability: A modelling process). National Seminar of ARDM (Association pour la Recherches en Didactique des Mathématiques). Paris.

HENRY, M. (1997). _Les premiers apprentissages en géométrie et en probabilités: Des processus de modélisation comparables_ (First learning of geometry and probability. Two comparable modelling processes). Grénoble: Séminaire Didatech, Laboratoire Leibniz - IMAG.

Over the last 30 years, probability has been introduced at the end of secondary education. When changing from a combinatorial calculus to a description of mathematical structure, the solving of real problems was not taken into account. This didactic decision to circumvent real problems has hidden the process of the learning of modelling, which is similar in many ways to the first steps in learning geometry at primary and secondary education. The current epistemological position underlying the teaching of probability poses new didactic questions in this field. Some new mathematics education material is being developed on the epistemological nature of probability. In these seminars, we propose to examine further the learning of probabilistic modelling, by analysing the deep analogy with what pupils have found in geometry. From a didactic point of view the goal in the teaching of probability is for pupils to practice the actual doing of modelling.

PEREIRA-MENDOZA, L., & Schulz, H. (1997). Implicit assumptions and communication in statistics. _School Science and Mathematics_, 97(8), 429-432.

Statistics is becoming an increasingly important component of the school curriculum. The subject provides students with opportunities to explore situations that they read about or face in their everyday lives. This article describes a statistics project that focuses on communicating conclusions and on understanding implicit assumptions that may affect conclusions based on the information. The ability to make a table and draw graphs and charts is an important component of statistical education. However, the ability to communicate ideas to others and understand implicit assumptions associated with data are key objectives of educating students for a world that increasingly relies on statistical information as a means of mass communication.

Romero R., Ferrer, A., CAPILLA, C., Zunica, L., Balasch, S., Serra, V. (1995). Teaching statistics to engineers (An innovative pedagogical experience). _Journal of Statistical Education_, .2 (3).

Within the framework of the Educational Innovation Project (PIE) of the Polytechnic University of Valencia, a group of lecturers in the Department of Statistics introduced an innovation project beginning in 1989. In this paper we explain different aspects of the project, emphasising the important role of computer resources and the satisfactory results obtained.

Romero, R., Alcover, R., Zunica, L., Ferrer, A., CAPILLA, C., Balasch, S., & Serra, V. (1995). Reforma de las asignatura de estadística en la Escuela Técnica Superior de Ingenieros Agrónomos, Facultad de Informática y Escuela Universitaria de Informática. Presented at the _Symposium of University Innovation_. University of Barcelona.

In this paper we evaluate the results of an educational innovation project, which started at the Agronomy Engineering School in 1990. During the academic year 91/92, this project was also introduced in Computer Science studies. The first results of the extension of this project are discussed, as well as future changes in the teaching project.

RUSSELL, S. J., & Mokros, J. (1996). Research into practice: What do children understand about average. _Teaching Children Mathematics_, 2(6), 360-64.

Interviews with fourth, fifth, and sixth graders found that they thought about the concept of average as mode, median, and/or a procedure. The paper presents approaches to develop the concept of average.

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4. RECENT DISSERTATIONS

CARDEÑOSO, J. M. (1998). _ Las creencias y conocimientos de los profesores de primaria andaluces sobre la matemática escolar. Modelización de concepciones sobre la aleatoriedad y probabilidad_ (Andalusian primary teacher's beliefs and knowledge on school mathematics. Modelling conceptions about randomness and probability). Ph.D. University of Cádiz. Supervisor: Dr. Pilar AZCARATE.

This research has studied the future primary teachers' conceptions on some basic stochastic notions, such as the characterisation they make of randomness and their strategies to assign probability to simple events. The study consists of two different phases. In the first phase we have analysed the teachers' conceptions and have observed an incomplete understanding of uncertainty, since very few subjects show a clear idea of randomness. Most of then use causal reasoning to explain chance. They are also strongly influenced by contextual factors and personal experience on the images and beliefs about these phenomena. The levels of understanding and use of normative models to assign probabilities is low and, usually restricted to the context of games. An absence of elementary instruments is detected and quantification of their expectations in the occurrence of an event is made from personal approaches without a global analysis of the phenomenon.

In the second phase we are classifying subjects with respect to tendencies found among teachers: Determinism, causation, uncertainty, contingency and personal beliefs. A questionnaire on probabilistic conceptions has been developed (CCP), which has been used to develop a classification algorithm for future respondents. The analysis of results has shown the inadequate preparation of primary teachers to teach probability, since they lack an organised representation of stochastic concepts. These results are clearly relevant for curricular design in stochastic knowledge with respect to the professional development

of teachers.

Hui-ju Carol Liu (1998). A Cross-cultural study of sex differences in statistical reasoning for college students in Taiwan and the United States. Ph.D. University of Minnesota. Supervisors: Dr. Ernest C. Davenport and Dr. Joan GARFIELD.

Considerable research has been done in the area of sex differences in mathematics ability and in the area of reasoning about probability and statistics. However, sex differences in statistical reasoning has rarely been the subject of a major research effort. The present study focuses on the question of whether there are sex differences in statistical reasoning. Subjects include 245 college students from Cheng-Chi University and Feng-Chia University in Taiwan, and 267 college students from the University of Iowa. The Statistical Reasoning Assessment (SRA), a 20 multiple-choice test, was the instrument used in the study. While the original version of the test was administered to students at the University of Iowa, a Chinese version of the instrument was administered to the examinees in Taiwan.

Various statistical methods were used to ascertain: (1) Whether there are mean differences between males and females, (2) whether there is equality between the correlation matrices for males and females, and (3) whether there is qualitative similarity between the factor structures for males and females. All the analyses are based on both the correct reasoning scores and the misconception scores obtained from the SRA instrument. Results support the general research findings that when sex differences appear, they are in the direction favouring males, particularly in higher level cognitive tasks such as mathematical reasoning and problem solving. Results also show that sex differences may be greater for students who have higher intellectually ability. Analysis of the factor structures suggest that males have a greater number of factors than females. While there is insufficient evidence to conclude the equality between the factor structures for males and females, analysis of the correlation matrices suggest that there are no sex differences. It should be noted that low intercorrelations of the test items may contribute to both the small discrepancies between the correlation matrices to be compared, and the difficulties to factor analyse the data.

Damasceno, J. A. (1996). _Conceptions manifestés par les élèves durant la modèlisation-simulation d'une situation aléatorie a l'aide de l'ordinateur_ (Students' conceptions during modelling- simulation of a random situation with the help of computers). Ph.D. Université Laval, Quebec. Supervisor: Dr. Claude GAULIN.

This research is an exploratory study of Brazilian students' conceptions of a simple random situation which is examined with the help of computers. We study the conceptions of the stochastic notions and the components of a simulation process using computers.

In Chapter 1 we present the research problem. We start by summarising the specialised bibliography, and by conceptualising and describing the modelling-simulation process of a random situation (with or without computer) as well as its different components. We then discuss the relevance of didactic uses of modelling-simulation (with or without computer) at school. We show the scarcity of research work concerning our specific field of study and we examine some works slightly related to it.

In Chapter 2 we describe the research methodology. A total of 215 students were given a questionnaire consisting of 18 items taken from Green's test, which served to establish a 4-level Guttman scale. Using this test the 315 students have been classified in 4 levels of probabilistic thinking (Green's levels) and we have interviewed 4 students from Green's Level 0 and 5 students from each of his Levels 1 to 3. During a clinical interview these students were asked to solve a simple random problem with simulation with the help of a logicial. At the same time, different

questions concerning stochastic notions, such as randomness, a priori and a posteriori probability and the components of the simulation process (modelling, simulation, validation and prediction) were proposed to the students.

The analysis of responses is presented in Chapter 3 and 4 and serve to identify some subjects' conceptions: 3 conceptions concerning stochastic notions, 7 conceptions concerning the process of modelling-simulation. It appears clearly that the conceptions are more complete when the Green's level is higher: Naive conceptions appear at levels 0 and 1, while more complete conceptions are found in levels 2 and 3.

POTEVINEAU, J. (1998). _Méthodologie de l'analyse des données expérimentales: Étude de la practique des tests statistiques chez les chercheurs en psychologie, approches normatives, prescriptive et descriptive_ (Methodology of the analysis of experimental data: The use of significance tests by psychologists, from normative, prescriptive, and descriptive approaches). Ph.D. Université de Rouen. Supervisor: Dr. Bruno LECOUTRE.

The thesis presented is that the current use of significance tests by psychologists is unsuited for experimental research. This question is examined through three approaches, normative, prescriptive and descriptive, which constitute the three parts of the dissertation.

The first part is devoted to the study of the theories of statistical test developed by Fisher and by Neyman and Pearson, which now constitute the statistical norm, from a methodological viewpoint. The main features of these theories are first described, then the numerous criticisms which are still directed towards statistical tests are examined. Misuses of tests are also examined, as well as possible reasons for the continued use of these tests.

The second part deals with the pertinence of the prescriptions. Among the main alternatives to the tests reviewed, only confidence interval methods and Bayesian methods seem to be potential challengers to the traditional tests. From the analysis of six popular textbooks of statistical inference designed for psychologists, it appears that the theories of statistical tests are rarely accurately reported and that those textbooks contain some misuses, particularly among the examples used.

The third part is devoted to the attitudes of psychologists toward significance tests. Some statistical re-analyses of published results are presented, as long as a re-analysis we performed using standard Bayesian tools. Some experiments involving researchers as subjects are also reported, including the two we realised for this thesis. We conclude that the use of significance tests by psychologists is a socially adapted but methodologically unsuited, because the use of an inadequate tool is promoted through misleading guide-lines of standard textbooks. We also mention a probable change in psychologists' attitude toward significance tests, as a consequence of recommendations from the American Psychological Association that are likely to appear in the near future, and the possibility that Bayesian analysis will become more and more used.

PRATT, D. (1998). The construction of meanings in and for a stochastic domain of abstraction. Ph.D. Institute of Education University of London. Supervisor: Richard Noss. This thesis can be recovered from the web site: http://fcis1.wie.warwick.ac.uk/~Dave_Pratt/

This study takes as its focus young children’s intuitive knowledge of randomness. Previous work in this field has studied the misconceptions that people, especially adults, hold in making judgements of chance (see, for example, the work of Kahneman & Tversky and Konold). In contrast, I study how primitive meanings for randomness form a basis for new meanings, a process which the misconceptions approach fails to illuminate. The guiding principle for this study is that the observation of students' evolving thought in a carefully designed computer-based domain will

provide a better understanding of how the specific features of the domain shape and are shaped by activities within it.

There are, then, two deeply connected strands to this thesis: the study of children's evolving meanings for randomness as expressed *in* a computer-based microworld, and the articulation of design principles which encapsulate pedagogic meanings *for* that microworld. More specifically, the thesis aims to shed light upon the answers to four crucial questions: Meanings for the domain: What do formalisms of stochastic behaviour look like in a domain of abstraction? What structures in the domain for stochastic abstraction optimise the articulation of intuitions and the construction of new meanings? Meanings in the domain: What articulations of informal intuitions of stochastic behaviour do we observe? How do the structures of the domain support the forging of situated meanings?

The study uses an iterative design methodology, which cycles between the design of computer-based tools and the observation of children, between the ages of 9 and 11 years, as they use these tools. The thesis identifies initial meanings for the behaviour of various stochastic phenomena and traces how new pieces of knowledge, especially relating to long term random behaviour, emerge through the forging of connections between the internal and external resources.

SÁNCHEZ, E. (1996). _Conceptos teóricos e ideas espontáneas sobre la noción de independencia estocástica en profesores de Bachillerato. Un estudio de casos_. (Theoretical concepts and spontaneous ideas about stochastic independence in secondary school teachers. A case study). Ph.D. Departamento de Matemática Educativa, Univerisidad Nacional de México. Supervisor: Dr. Jesús Alarcón.

Research has shown that students usually violate normative principles in tasks related to stochastic independence. Students' answers tend to be based on some erroneous spontaneous ideas, which we have identified. The present study is concerned with the following question: What happens when the students have learned the definitions of stochastic independence and they have worked with them in the context of standard course of probability? Do they have better results with independence tasks or do spontaneous ideas persist in spite of their learning?

Four mathematics teachers who were postgraduate students in mathematics education took part in the study. These teachers participated in a course on probability and education, where they revisited the most important concepts of a first course on probability. After this course, individual interviews were held between the researcher and each teacher. The interviews were filmed and transcribed. Observations were made of the document the students used in the process of problem solving, the theoretical concepts they learned about stochastic independence and conditionality, their capacity for symbolic representation of probabilistic ideas and any emergence of non-normative conceptions.

Analysis of the data suggests that the formal learning of these concepts is not enough to eliminate students' approaches based on spontaneous ideas of independence. There were several misconceptions that they retained despite their studies. Our observations found that students showed a tendency to think more on qualitative than quantitative ideas of probability. It seemed that they preferred the subjective model of probability to frequentist or classical models.

Vila, M. C. (1993). _Conceptions manifestées par les Žlèves dans una épreuve de simulation d'une situation aléatoire réalisée au moyen de matériel concret_ (Students' conceptions when solving a random simulation task with the help of manipulative material). Ph.D. University Laval, Quebec. Supervisor: Dr. Claude GAULIN.

This is an exploratory piece of research into Brazilian students' conceptions about the simulation

of a simple random situation. After surveying the research literature, different pre-experiments were carried out with students with two main aims: (1) Studying the students' conceptions during a simulation experiment carried out with concrete devices; (2) testing the conjecture that students' conceptions during the simulation experiment are more complete when their probabilistic Level (according to Green's research) is higher.

To achieve these aims, tests taken from Green were completed by 518 students at 3 different educational levels and in 4 different schools. The tests assessed the acquisition of some probabilistic concepts, and allowed the classification of subjects according Green's levels. Among the 518 subjects, 11 subjects in each of the Green's Levels 1 to 3 were selected to participate in an interview.

The 33 protocols were analysed for students' conceptions on the production and validation of a model, as well as for their conceptions about some stochastic notions underlying the proposed simulation. With respect to our first aim, we have identified 5 main conceptions concerning the production of a model and 7 conceptions concerning the validation of the model. In addition, 5 other conceptions have been identified concerning the prediction of the next outcome in a series of random experiments, and also 6 conceptions concerning the estimation of long runs of results from urn draws. We have realised that correct stochastic conceptions are necessary but not sufficient for a subject to construct successfully a model of a random situation. With respect to the second goal, it seems clear that the conceptions are more complete when the Green level is higher.

Winstead, M. S. (1996). _The development of an instrument to measure two constructs of mathematics teachers' attitudes toward teaching statistical concepts_. Ph.D. University of Tennessee. Supervisor: Dr. Donald J. Dessart.

The teachers' attitude toward statistics and probability (TATSP) scale was developed to measure secondary mathematics teachers' attitudes toward teaching statistical topics in the regular high school curriculum. The scale was based on Fischbein's theory of reasoning. The relationship between a teacher's beliefs about teaching statistics. attitudes about teaching statistics, and behaviours involving teaching statistics were consistent with Fischbein model. The 24-item TATSP scale consists of two subscales to measure teachers' perceived importance of and liking of teaching statistical topics.

A 43-item pilot TATSP scale was constructed to solicit evaluative beliefs about either the importance or liking of teaching statistical topics, and tested with 32 high school mathematics. The scale was reduced to 24-items and tested with 58 teachers from 11 public high schools. The TATSP scale was reliable and valid. The internal consistency estimate was 0,92 for the scale and 0,85 and 0,94 for the importance and liking subscales, respectively. Test-retest correlation were all satisfactory. Construct and criterion-related validity were established. Correlation of total scale score with self-reported coverage of statistical topics was 0,55. About 72 percent of the teachers were correctly classified as members of the low or high coverage group using scale scores.

It was concluded that teachers who like statistics cover more statistical topics in their classrooms. Also high school mathematics teachers who are knowledgeable of statistics cover more topics in their mathematics classes. Teachers who graduate from college recently had completed more statistics courses than their more experienced counterparts.

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5. MULTIMEDIA AND NEW EDUCATIONAL ENVIRONMENTS.

OTTAVIANI, M. G. (Ed.), (1998). _Multimedia and new educational environments. Statisticians

and experts exchange views. Proceedings of the Scientific Seminar held in Rome, Italy, 1996_. Rome University "La Sapienza".

Multimedia in education is still a novel area of research, and much ground still has to be tried to find the right balance between technology and the different teaching/ learning approaches. Experience and constant adjustments will help identify the most appropriate means of transferring the basis, concepts and culture of statistics, taking into account the type of student and the level to be reached. This booklet includes the papers presented at the Seminar held in Rome on July, 21, 1996 and attempts to trace efforts and progress made in Italy in this sector, as well as make these known outside the country so that a comparison can be made with progress elsewhere, With this scope in mind, Italian and English version of the papers are provided. Free copies of the booklet can be obtained from Maria Gabriella OTTAVIANI, ottavian@pow2.sta.uniroma1.it

Table of contents:

OTTAVIANI, G. Introduction

Galliani, L. Multimedia communication and models of learning environments.

Interactive multimedia technology offers a new opportunity to recompose the three models of educational communication which to date are separate: An "institutional" model of school systems, "relational" referring to interpersonal communication, including mediated communication and a "discrete" model of the contexts referring to social organisations and enterprise. On the other hand, knowledge and experience for young people increasingly occurs in a "communicative environment" determined by media which have removed distinctions between areas, "cultural objects" and "symbolic metaphors", constructed by integrating science and technology, as well as divisions between the natural, social and artificial environments.

OTTAVIANI, M. G. The computer and teaching statistics.

The rapid introduction and widespread of the computer in almost every sector of human activity might have led us to believe that teaching too would soon be influenced by this and that education too would have been considerably changed by this novelty. However, to date this is not the case and we find ourselves faced with two separate worlds which for the large part are not at all integrated and which go along at two different speeds. Indeed, while technology is developing at a breathtaking rate, changes in teaching methods, following the application of new tools, are remarkably slow. This may also be traced to the fact that new technology urges not only heavy financial investment. It is also needed professional experience, time to implement the project and appropriate educational strategies to encompass new technology.

Camillon, F., & Pedroni, M. Hipertexts and teaching statistics: Navigation strategies

Navigation in the educational hypertext is the reader's route to learning and this route, through the hypertext, becomes itself the focus of study and design on the part of the author, or rather of the person who inserts their skills and knowledge in the material contained in the hypertext. This implies that navigation is not just a technical problem: Designing the interface, make chides regarding presentation of contents on the screen and the mental reasoning and logical process underlying the material to be taught, must be considered simultaneously when preparing instructional hypertext.

Di Cicacio, A. Teaching basic statistics following a multimedia approach.

This paper emerge from our experience of applying new multimedia teaching techniques to

statistics in the Faculty of Economics, University of Urbino. Our efforts in this area derive from the attempts to introduce the use of statistical software in teaching introductory statistics, to enable the student to apply notions covered during lessons and drills. The experience led us to perceive the enormous potential offered by the introduction of the PC in teaching statistics, while at the same time noting the almost total lack of hypermedia products to teach scientific subjects.

Steffani, S., & Torriero, A. A multimedia approach to teaching mathematics for finance.

The adoption of multimedia technology would permit the realisation of flexible educational systems, which are characterised by the individualisation of the different ways of learning, according to personal study habits, and by the possibility of articulating contents as well as by the plurality of methodology, or the variety of teaching methods, other than those of verbal communication. The second part of this report describes the problems and the methodology regarding the realisation of a multimedia course in the phase of development on the part of a group of Italian universities.

Borra, S. Multimedia products for statistics and economics.

In education in recent years an enormous range of multimedia products have been developed thanks to greater access to multimedia hardware as well as the sprouting of information technology labs in schools and universities. Clearly the increasing use of multimedia in education must go hand in hand with the search for new educational approaches, superior to standard kinds of teaching, Thus, numerous universities have started research project for the non commercial production of educational multimedia material and to assess their pedagogic efficacy through pilot experiments. The examples selected here are only some of the more general products available for teaching university courses.

Stoppoloni, S. Multimedia and teaching in a statistics research bureau.

In recent years the Italian Institute of Statistics has faced a dual challenge: a) The increasing training demands on the part of the national statistics' system; b) the need of change and innovate statistical surveys to fill the need of different types of statistical data. Giving a solution to these needs have face the statistical research institute to organising and cultural aspects of its work. In this paper, different issues to be taken into account when deciding to use multimedia in training programs are discussed.

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6. OTHER PUBLICATIONS OF INTEREST

Cunfang, T. (1996). On total probability formula teaching. _International Journal of Mathematical Education in Science and technology_, 27(5), 772-774.

The total probability formula is a focal point of probability theory teaching as well as a difficulty. By using it we can calculate the probability of composite events from the probabilities of simple events. Explaining the formula and effectively analysing the train of thought for solving problems are a difficulty of teaching.

Curtis, D. A, & Harwell, M. (1998). Training doctoral students in educational statistics in the United States: A National Survey. _Journal of Statistics Education_, 6(1).

The purpose of this study was to examine doctoral students' preparation in statistics in the field of education. A national survey was conducted of twenty-seven quantitative methods (QM) programs. One QM professor from each program was identified and asked to describe and

evaluate the training of QM and non-QM doctoral students at his or her institution. Professors were also asked to rate the skills of their QM students in areas such as mathematical statistics and computing on a scale from "Weak" to "Strong." Results are discussed in terms of training future doctoral students.

Fox, W. P., & Fowler, C. W. (1996). Aiding undergraduate understanding of covariance and correlation. _Primus_, 6(3), 235-244.

The authors describe the use of graphical exercises to explain the concepts of covariance and correlation as they are used in an undergraduate course on probability and statistics. Students seem unable to grasp the concepts and interpretation, although they can perform the necessary calculations to provide values for both the covariance and the correlation coefficient. Provided are examples that help to illustrate the two key concepts of covariance and correlation. These examples show the importance of understanding the meaning of correlation. Graphical methods are used to support the numerical approaches.

Graham, A. (1996). Sampling-bottle party games with a graphics calculator. _Teaching Mathematics and Its Applications_ , 15(1), 33-36.

As a way of introducing certain topics in statistics, such as sampling, one helpful strategy is to invite students, to play a suitable game that embodies some of the key elements and questions of the concept being taught. This can help to lay a foundation of the key ideas of the topic and provides the teacher with something to build on in follow-up lessons. The example described here is a sampling game originally based on a sampling bottle, but here played on a graphics calculator.

Hollis, P. J. (1997). Ideas for improving statistical education. _International Journal of Mathematics Education in Science and Technology_, 28(4), 569-573.

This paper looks at ideas that have been tried in an effort to dispel some of the negative feelings that students bring with them to introductory statistics courses at university Relevance, involvement, interaction, use of computers and videos were investigated and the students' responses monitored. Students enjoyed a break from a standard lecture/tutorial and responded well to participating in experiments, provided that the tutor was enthusiastic. Videos were also appreciated as an alternative mode of presentation, although to gain maximum benefit from videos they must be properly integrated into the course. In an assignment aimed primarily to promote relevance, one group of students found it difficult to see the relevance of statistics to their course as they had difficulty finding suitable data, but another group, who collected and analysed data on a topic of interest, became very interested in the analysis and results. Even though all ideas were inevitably not a complete success at the initial implementation there was ample positive feedback to appreciate the need to keep trying new ideas in order to simulate interest in introductory statistics.

Kennedy, K., & Schumacher, P. (1996). Teaching with an interdisciplinary approach: Three examples of integrating computer programming and statistics. _Computers in the Schools_, 12(3), 57-70.

The paper proposes three general problems that are theoretically important to statistics, and the topics are particularly interesting because they illustrate important programming techniques. The three topics would be introduced in an undergraduate statistics class in a theoretical way, but the same ideas can be illustrated concretely in a programming course directed to teaching structure programming techniques. The three selected topics are. (1) The generation of probability distributions from the uniform distribution, (2) the traditional concept of 95% confidence intervals, and (3) the bootstrapping technique of 95% confidence intervals.

Kotiah, T. C. T. (1996). Statistical variation in a calculus setting. _International Journal of Mathematical Education in Science and Technology_, 27(6), 841-848.

The concept of the variance of a function of a continuous random variable is exploited to define the variance for an ordinary (deterministic) continuous function. Application of Chebyshev's inequality provides bounds for this function that can be used as a check on the standard calculus derivation of their global maximum and minimum. Other benefits include a richer variety of examples for assessing the accuracy of Chebyshev's probability bounds and a more thorough understanding of the interrelationships between calculus and statistics.

Love, T. E. (1998). A Project-driven second course. _Journal of Statistics Education_, 6(1).

I trace the development of a new course in modern data analysis involving a wide spectrum of statistical techniques. Because the course is based entirely on case studies, real-data settings, and student projects and is computer-intensive, a series of challenges facing many instructors are addressed. In a single semester, students explore data using tools from EDA, multiple regression, analysis of variance, time series analysis, and categorical data analysis. The focus is on understanding and forecasting in a variety of data settings, learning how to summarise relationships and measure how well these relationships fit data, and how to make meaningful statistical inferences when the usual assumptions do not hold. The course emphasises what the statistical process is all about: how to conduct studies, what the results mean, and what can be inferred about the whole from pieces of evidence.

Mitic, P. (1996). Probability distributions proof and computations. _The Derive Newsletter_, 24, 34-36.

The use of DERIVE to perform relevant algebraic computations in the context of probability distributions is discussed, with particular reference to some common distributions. Problems with using DERIVE in this way are noted, and some partial solutions are suggested.

Rumsey, D. J. (1998). A co-operative teaching approach to introductory statistics. _Journal of Statistics Education_, 6(1).

Many of today's university undergraduate curricula include two seemingly conflicting themes: (1) Increase the quality of teaching to include emphasis on pedagogical elements, such as active learning, in the undergraduate statistics classroom; and (2) cope with a decrease in teaching resources. In this paper, a means by which a department of mathematics or statistics can maintain and increase its standards of teaching excellence in introductory statistics while coping with ever-increasing budgetary pressures is proposed. This process involves promoting what we call co-operative teaching, applying the concepts of co-operative learning to a group of instructors.

Sáenz, C. (1998). Teaching probability for conceptual change. _Educational Studies in Mathematics_, 35, 233-254.

This work presents a theoretical proposal for a methodology for the teaching of probability theory. The theoretical proposal has a dual inspiration: (1) The epistemological approach of Lakatos regarding the quasi-empirical nature of mathematical theories; (2) the perspective of conceptual change for the teaching-learning process, as formulated by Strike and Posner. The scientific content taught and the didactic methods used in the classroom should, according to this proposal, respect and conform to this dual inspiration. We also present an evaluation of the methodology in a real context: six Spanish high school classes of students aged 14-15. The main purpose of the research was to answer this question: Is our didactic proposal more effective than traditional

methodology? We operatively identify the concept of traditional teaching, and establish several indicators of effectiveness: the mastery of elementary probability calculations, the quality of intuitive reasoning in probability, and the conceptual and attitudinal change produced. We found significant differences on all indicators, except for attitudinal change, in favour of the group that followed our proposal.

Short, T. H., & Pigeon, J. G. (1998). Protocols and pilot studies: Taking data collection projects seriously. _Journal of Statistics Education_, 6(1).

Although there is consensus among statistics educators that student data collection projects are of substantial value, we feel that the planning and piloting phases of data collection are often neglected. We ask our students to write protocols or detailed plans for how the data will be collected, and to plan and conduct pilot studies before embarking on full scale data collections. We present examples and results from situations including college freshman introductory statistics courses, graduate statistics courses, and teacher training workshops.

Warner, B. A., Pendergraft, D., & Webb, T. (1998). That was Venn, this is now. _Journal of Statistics Education_, 6(1).

Basic probability concepts are difficult for some students to understand initially. Through the use of a Venn diagram disguised as a pizza, we will discuss how to explain introductory probability concepts. Students are able to answer probability questions, including conditional

probability, by simply looking at a picture. This tool not only enhances learning but retention as well.

Warson, J. M. (1997). Data handling: An introduction to higher order processes. _Teaching Statistics_, 19(1), 12-16.

An activity is described which allows students with a range of abilities to become involved in data analysis and informal inference while working in self-selected small group environments. Two classes of grade 6 participated in the described activity.

Wellenreuther, M. (1997). Hypothesenpruefung, theorieentwicklung und erkenntnisfortschritt in der mathematikdidaktik. ein plaedoyer fuer methodenpluralismus. (Hypothesis testing, theory development and scientific progress in mathematics education). _Journal fuer Mathematik-Didaktik_, 18(2-3), 186-216.

The learning and understanding of mathematical concepts can be facilitated through detailed textual or oral explanation. Here explanation has two different meanings: Explanation as didactic explication of mathematical ideas or explanation as explication of conditions under which some people develop mathematical ideas. The main goal of mathematics instruction is two delineate explanations in such a way that students don't have to make additional inferences in producing a coherent text base. To construct such explanations the application of the theory of text comprehension of Kintsch is being applied to the verbalisation of mathematical concepts. The core of real-science explanations are hypotheses. Empirical science has to test such hypotheses in prospective studies in a way that eliminates alternative explanations. After that the contribution of different research methods to scientific progress is discussed. Four different research methods are differentiated: (1) Diagnostic/descriptive research of learning behaviours, attitudes and strategies, (2) research of mathematics instruction (teaching and student behaviour) (3) experimental research as prospective research and (4) developmental research. It is concluded that all four types of research have their own goals And it seems unfortunate to prefer one type at expense of others.

7. COMPLEMENTARY SHORT REFERENCES

AZCARATE, P., & CARDENOSO, J. M.. (1996). El lenguaje del azar. Una visión fenomenológica sobre los juicios probabilísticos (Language of chance. A phenomelogical view on probabilistic judgments). _Epsilon_, 35, 165-178.

Chambless, M. S., Blackwell, S., Redding, C., & Oswalt, A. (1998). A data "eggs"ploration. _Teaching Children Mathematics_, 4(8), 448-451.

Johnson, M. L., & Kotz, S. (Eds.) (1997). _Leading personalities in statistical science_. New York: Wiley.

HENRY, M. (1994). _L'enseignement des probabilités, perspectives historiques, épistémologiques et didactiques_ (Teaching probability: Historic, didactic and epistemologic perspectives). IREM de Besançon.

Meyer, R. A., Browning, C., & Channell, D. (1995). Expanding students' conceptions of the arithmetic mean. _School Science and Mathematics_, 95, 114-117.

MORTENSEN, P. (1984). The art of planning a course in applied statistics for business and economics. In Brown, R .C. (Ed.), _Proceedings, Quantity and Quality in Economic Research I_. New York: University Press,.

MORTENSEN, P. (1986). On a new approach to an introductory course in statistics for business and economics including some experience. In Davidson, R, & Swift, J. (Eds.), _Proceedings of the Second International Conference on Teaching Statistics_ (pp. 415-4424). University of Victoria.

MORTENSEN, P., & Boyle, R (1990). PACE and STATLEV two examples of software packages developed with the particular purpose of teaching introductory business statistics. In Vere Jones, D. (Ed.), _Proceedings of the Third International Conference on Teaching Statistics_, Dunedin, New Zealand.

MORTENSEN, P. (1991). _The art of teaching business statistics_. Deakin University, Melbourne.

Roberts. H. S. (1996). Should statistics be divorced from mathematics? _The New Zealand Mathematics Magazine_, 33(3), 17-19.

Pothier, Y. M., & Nickerson, C. M. (1997). Our heritage: Learning data-management skills meaningfully. _Teaching Children Mathematics_, 4(2), 82-89.

Scavo, T. R., & Petraroja, B. (1998). Adventures in statistics. _Teaching Children Mathematics_, 4(7), 394-401.

Taylor, J. V. (1997). Young children deal with data. Teaching Children Matthematics_, 4(3), 146-149.

Zeisel, H., & Kaye, D. (1997). _Prove it with figures_. New York: Srpinger-Verlag.

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8. ICOTS 5 PROGRAM OF TOPICS 4-8

The Fifth International Conference on Teaching Statistics will be held in Singapore, from June 21 to 26, 1998. Below is the program for Topics 4-8. More information is available from the web site: http://www.nie.ac.sig:8000/~wwwmath/icots.html

Session 4. Statistical education and the wider society

Convener Anne HAWKINS, ash@maths.nott.ac.uk

4.1 Statistical Societies. Organiser Helen MacGillivray, h.macgillivray@fsc.qut.edu.au

HAWKINS, A. The Royal Statistical Society's outreach initiatives.

Tweedie, R. Roles for societies in statistical education.

MacGillivray, H. Tightrope walking, educational issues and statistical societies.

4.2. Statistical literacy - Statistics long after school. Organiser Anne SEVIN, USA asevin@frc.mass.edu

MCKENZIE, J. Computer literacy.

Jerry Moreno. Statistical literacy - Statistics long after school.

PFANNKUCH, M., & Wild, C. Investigating the nature of statistical thinking.

Moritz, J. Statistical literacy and adolescent risk.

Taylor-Halvorsen, K. Graphical literacy: What does the average citizen need to know about graphs.

4.3. Statistical education publications. Organiser David GREEN, d.r.green@lboro.ac.uk

Goodall, G. Teaching Statistics. The first twenty years.

Ene-Margit Tiit. Experiences in publishing a statistics journal in Estonia.

Dietz, E. J. The Journal of Statistics Education: The challenges and opportunities of the electronic medium.

OTTAVIANI, M. G. INDUZIONI: The Italian review on teaching statistics.

GREEN, D. R. The 'Teaching Statistics' mailbase.

Moreno, J. The Statistics Teacher Network Newsletter.

4.4. Statistics education for legal contexts. Organiser Peter Hawkins, UK Peter_Hawkins@lawcol.ccmail.compuserve.com

Hawkins, P. & HAWKINS, A. Lawyers and likelihoods.

Gastwirth, J. What I wish judges and lawyers knew about statisitical inference.

Gray, M. W. Teaching statistics to an audience of one: The judicial reception of statistical

evidence.

Robertson, B., &Vignaux, G. A. Don't teach statistics to lawyers!

Finkelstein, M. Teaching statistics to lawyers and judges.

Porter, A. Statistical literacy for law students: Six hours to teach!

Session 5. An international perspective of statistical education.

Convener James Ntozi, isae@mukla.gn.apc.org

5.1. Statistical education in the African region. Organiser Vitali Muba, Fax + 0015 61398190821

Ogum, G. E. O. Statistical education in Nigeria: Problems and prospects.

de Wet, J.,& Steffens, F. E. Teaching of statistics to historically disadvantaged students. The South African Experience.

Binyavanga, K. Statistics education in south african medical training institutions.

Gitari, N. Challenges of teaching statistics as a numeral subject at secondary school level in a rural district - Laikipia, Kenya.

Nsowah-Nuamah N. N. N. The science statistics: An introductory lecture to the first year statistics students at tertiary institutions.

5.2 Statistical education in the Asian region. Organiser Ana Maria Tabunda, stat@nicole.upd.edu.ph

Wang, S. C., & Wong, W. K. Teaching statistical analysis for universities: A principled approach.

Maarof, F. Application of statistical packages in teaching introduction to statistical analysis.

Yuang-Tswong, L. Evaluation on a descriptive statistics curriculum unit in the high school mathematics curriculum.

Lee, T. R. A study on the multimedia courseware for introductory statistics.

5.3. Statistical education in Spanish speaking regions. Organiser Teresita TERAN, Argentina maverick@citynet.net.ar

TERAN, T. Are we preparing teachers and students in statistics toward the next century?

Lac Prugent, N., & Gallese, E. Interdisciplinary teaching facing the future challenges.

Kohan, D. R. Teaching probability and inference to students of bioengeneering in Argentina.

Sánchez Cobo, F. T., & ESTEPA-CASTRO, A. The curriculum of stochastic in non-university education in Spain.

5.4. Statistical education in other developing regions. Organisers: Alan Rogerson, Australia

arogerso@mgs.vic.edu.au, & Manmohan S. Arora, msarora@del2.vsnl.net.in

Ferrari, G. Teaching statistics in newly independent states: the case of Kazakstan.

Rozga, A. Statistical education in transition countries.

Mina, F. M. Recent developments in the teaching of statistics in Egypt; An evaluative study in the light of future trends in the area.

Villar Icasuriaga, A. The teaching of statistics in Uruguay for children aged 11-13 years old.

Carneiro J. P., & Lopes da Silva, P. A. Statistics education in Brazil.

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

Convener Rolf BIEHLER, rolf.biehler@post.uni-bielefeld.de

7.1 Software designed for statistics education.Organisers Robin Boyle, Australia rgboyle@deakin.edu.au and Peter S. Mortensen PSM@hdc.hha.dk

Finzer, W. Dataspace. A computer learning environment for data analysis and statistics based on dynamic dragging, visualization, simulation, and networked collaboration.

Davies, N., Lees, R., Smith, S., & O'Neill, R. Integrating Microsoft Windows applications with statistics modules.

Boyle, R. PACE2000: Software designed for teaching statistics at introductory-intermediate level.

Pange, P. J. Using new technologies in the teaching of SPSS.

Cicchitelli, G., & Galmacci, G. The impact of computer programs in the learning of descriptive statistics: the case of DSTATS.

Carter, L., & Mougeot, M. Use of Excel in a first course in statistics for mathematics students.

HUNT, N., & Lees, R. Learning probability concepts using spreadsheets.

Bordier, J., Bergeron, A. & Beaulieu, M. C. Simulation and formal manipulation: Complementary approaches for studying random events with computers.

McDougall, M., Mustard, J., Ridley, G. A computer-aided learning package for hypothesis testing.

Militky, J., & Rep, C. Teaching of regression models building by ADSTAT package.

Bacelar-Nicolau, H., Nicolau, F. C., Ramos, L., Mira, C., Dias, O., & Crespo, G.
Leasp97: An improvement in teaching and analyzing new methodology on probabilistic clustering models.

7.2 New conceptions in teaching experiments using technology. Organiser Mike SHAUGHNESSY, mike@fpa.lh.pdx.ed

WATSON, J. Professional development of teachers using CD-ROM technology.

GODINO, J. D., & BATANERO, C. Building and experimenting a model for the meaningful instruction in data analysis.

Alper, P., & Raymond, R. Some experience comparing simulation and conventional methods in an elementary statistics course.

SHAUGHNESSY, J. M. Immersion in data handling: Using the Chance-Plus software with introductory statistics students.

Finzer, W. F. Teaching experiments - Novel aproaches with technology classroom experiences with dataspace-technology in the service of statistical concept development.

Finch, S., & Cumming, G. Assessing conceptual change in learning statistics.

7.3. The use of graphics calculators in the teaching and learning of statistics. Organiser Peter Jones, pjones@swin.edu.au

Jones, P. What is a graphics calculator and why the interest?

BURRILL, G. Technology, statistics and the secondary classroom.

LIPSON, K. Using the TI-83 in a liberal arts statistics course.

Bilotti-Aliaga, M. Changing the focus from statistical methods to statistical thinking with a TI-83 (College level).

Situmeang, R. A calculator like the TI-85 can speed up the teaching of statistics significantly.

7.4 Multimedia, WWW and statistical videos in teaching statistics. Organiser Robin Lock, rlock@vm.stlawu.edu

Petocz, P. Effective video-based resources for learning statistics.

Puranen, J. WWW and teaching statistics - A teachers point of view.

MORRIS, E., & Le Voi, M. Sorting the wheat from the chaff: evaluating a large corpus of computer-based statistics teaching resources.

Cumming, G. StatPlay: Multimedia for statistical understanding.

Di Ciaccio, A. Hipermedia and WWW for the teaching of statistics.

Galmacci, G., & Cicchitelli, G. Network facilities for teaching statistics: A data archive driven by interactive software.

Giusti, A., Petrucci, A., & Polverini, F. Visual statistics: A multimedia approach for the teaching of elementary statistics.

MacRae, S. Introducing statistical principles by interactive multimedia.

7.5 Visualization as an educational tool - statistical graphics. Organiser Laurence Weldon, weldon@cs.sfu.ca

Cleveland, W. Trellis Display: A Framework for Displaying Multivariable Data.

Ganesh, S., & Ganesalingam, S. Teaching basic statistical concepts using computer display tools.

Weldon, L. Simulation models, graphical outputs, and statistical discovery.

7.6. Research in using technology for statistics teaching. Organisers: Cliff KONOLD, konold@srri.umass.edu , & Rolf BIEHLER, rolf.biehler@post.uni-bielefeld.de

BATANERO, C., & GODINO, J. D. Understanding graphical and numerical representations of statistical association in a computer based environment.

BIEHLER, R. Students - statistical software - statistical tasks: A study of problems at the interfaces.

Noss, R., & PRATT, D. Expressions of control in stochastic processes.

MORRIS, E. Link: The principled design of a computer assisted learning program for correlation.

Session 8. Other determinants and developments in statistical education

8.1 Cultural/Historical factors. Organiser John TRURAN, jtruran@arts.adelaide.edu.au

TRURAN, J. The development of the idea of the null hypothesis in research and teaching.

PARZYSZ, B. Recent changes in the teaching of statistics and probability in secondary schools in France.

GATTUSO, L., & Lavoie, P. An historical exploration of the concept of average.

8.2 Learning factors. Organiser Robert DELMAS, delma001@maroon.tc.umn.edu

Jackson, J. A., & King, M. L. the importance of the role played by the student in introductory statistics education: moving beyond the student as customer.

LECOUTRE, M. P. New experiments on learning and transfer in isomorphic (analogous) uncertainty situations.

GLENCROSS, M. J. Understanding of chance and probability concepts among first year university students.

DELMAS, R. C., GARFIELD, J., & Chance, B. Assessing the effects of a computer microworld on statistical reasoning.

Clayson, J. Confessions of a constructionist: Fifteen years of undergraduate interactions - for better or for worse.

8.3. Gender factors. Organiser Megan CLARK, megan.clark@isor.vuw.ac.nz

Pierce, R. Calculate the possibilities: A summer program for young women.

FORBES, S. An index of mathematical and statistical achievement for comparing gender differences over time.

8.4. Competitions and projects as a positive force in statistical education. Organiser Linda J. Young, biom025@unlvm.unl.edu

MacGillivray, H. Developing and synthesizing statistical skills for real situations through student projects.

Boland, P. Promoting the use of statistics in secondary school projects in Ireland.

Loi, L. S., & Yuan, W. The use of statistics in undergraduates' projects.

Diamond, N. T., & Hallett, R. F. Industry projects in statistics.

STARKINGS, S. The use statistical project competitions to enhance statistical understanding.

Shen, S. M. Mistakes and difficulties encountered by students participating a statistical project competition - The trend of change.

Young, L. Statistics poster and project competitions in the United States.

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9. FORTHCOMING CONFERENCES

9.1. Stochastics work at PME-22, Stellenbosch, South Africa, 12 -17 July, 1998

This conference will be held from 12-17 July 97 at a small university town in the wine growing region of Southern South Africa about 50 km from Cape Town. The theme is "Diversity and Change in Mathematics Education". Details may be found at: http://www.sun.ac.za/pme22

9.1.1. Working Group on Stochastics

There will be three meetings of the Working Group.

The first meeting will be devoted to present information of general interest and reports by group members.

The second session will be devoted to studying the possibility of developing a book on statistical education, which presents the state of arts of research and pedagogical implications. As this is a huge project, an invitation to participate will be made to the members of the International Study Group for Research on Learning Probability and Statistics during the meeting of this group in Singapore. This book is being co-ordinated by Kath TRURAN, John TRURAN and Carmen BATANERO, with Kath(Kath.Truran@unisa.edu.au) as the main responsible.

The third session will be devote to the proposal for developing a specific PME Section in the Newsletter of the International Study Group for Research on Learning Probability and Statistics, which will be the base for an electronic Data Base of annotated bibliographies. More information about these two projects can be found at the web site:

http://www.ugr.es/~batanero/pmegroup

9.1.2. Other Stochastics Activities at the Conference

9.1.2.1. Key-Note Address by Paul Cobb: Analysing the mathematical learning of the classroom community: The case of statistical data analysis.

9.1.2.2. Research Forum on Learning and Teaching Data Handling, co-ordinated by Paul Laridon, University of Witwatersrand, Johannesberg.

Two reports will be presented:

Ainley, J. Nardi, E., & PRATT, D. Graphing as a computer-mediated tool. Reactor: Ricardo Nemirovsky.

BATANERO, C., GODINO, J. D., & ESTEPA, A. Building the meaning of statistical association through data analysis activities. Reactor: Michael GLENCROSS.

9.1.2.3. Research Reports

Bezuidenhout, J., Human, P., & Olivier, A. some misconceptions underlying first-year students' understanding of 'average rate' and of 'average value'.

KOIRALA, H. Pre-service teachers' conceptions of probability in relation to its history.

PRATT, D. & Noss, R. The co-ordination of meanings for randomness.

TRURAN, J. Using research into children's understanding of the symmetry of dice in order to develop a model of how they perceive the concept of a random generator.

9.1.2.4. Short Oral Communications

GLENCROSS, M. Developing a statistics anxiety scale.

Magina, S., & Maranhão, M. C. Using databases to explore students' conceptions of mean and cartesian axes.

9.1.2.5. Poster Presentations

AHLGREN, A. K-12 connections in understanding probabaility and statistics.

Plessis, I., & Roux, C. Teaching an introductory statistics course to social science students: a case study approach.

Flores, P., GODINO, J. D., & BATANERO, C. Contextualising didactical knowledge about stochastics in mathematics teachers' training.

Hodnik, T. Teaching statistics in primary school in Slovenia.

9.3. Stochastics Working Group at the III Iberoamerican Conference on Mathematics Education (CIBEM)

Report by Audy SALCEDO, Universidad Central de Venezuela / Universidad Nacional Abierta, audysalc@yahoo.co, audysalc@reacciun.ve

The idea of holding an Iberoamerican Congress on Mathematical education (CIBEM) arose during the VII Interamerican Congress of Mathematical education (CIAEM), which was held in the Dominican Republic in 1987. The Spanish delegation, headed by Dr. Gonzalo Sanchez Vázquez, former president of the Spanish Associations of Teachers of Mathematics, suggested carrying out a Mathematical (Education) conference where specialists from America, Portugal and Spain could meet. The main reasons for the proposal were historical links and common educational problems which offered an important base for exchanging experiences. The first CIBEM took place in Seville, Spain in September, 1990, and the second was held in Blumenau, Brazil, in July 1994.

The III CIBEM is being held from July 26 to July 31, 1998, in the Central University, Caracas, Venezuela. Some objectives of this gathering are:

1. Reinforcing scientific and cultural links among Iberoamerican mathematics educators.

2. Exchanging teaching and research experiences that contribute to the professional. development of the participants and serve to improve their daily work.

3. Reconsidering the impact that mathematical education has for Iberoamerican citizens.

4. Analysing the impact of communications and the new century on basic educational elements: students, content, contexts, resources, activities and evaluation.

5. Promoting discussions and establishing information networks and federations of professionals to connect the different communities of Mathematics educators.

The scientific program consists of plenary and parallel lectures, expert panels, brief communications, working groups and posters. However, the main part of the conference will be devoted to Working Groups. Accordingly, the Organising Committee has proposed a specific working group on statistical education, which is co-ordinated by Audy SALCEDO (Venezuela) and Carmen BATANERO (Spain). Below we comment on the specific aim and program for this group.

In the last years statistics has been widely incorporated into the mathematics curriculum at primary and secondary teaching levels, and at the same time, has enlarged its presence in different university specialities. Many daily life situations require gathering and analysing data for decision making. Citizens are, beyond a doubt, consumers of statistics, which makes it important that they understand the basic statistical concepts.

There is currently a growing number of mathematics educators interested in the teaching, learning, and assessment of statistics. This concern has been reflected in a higher production of didactic materials, educational software, research papers, journals, and conferences on teaching statistics. Beyond the remarkable expansion of statistics, other factors contributing to this interest are the following:

a) The difficulty of the topic, as compared with other branches of Mathematics, which is reflected in philosophical, social, ethical and procedural questions being debated regarding the application of Statistics.

b) The fact that contributions to this field are not only from mathematics teachers, but from teachers in other areas, who use Statistics in their work, from statisticians interested in education (and from) psychologists.

c) The political dimension of the use and possible abuse of statistics and statistical information.

The plurality of points of view on statistical education makes working groups on the topic quite diverse and frequently disconnected. A series of initiatives linking people interested in the topic to contribute together to an improvement of statistical education have been recently established. The most remarkable of these initiatives is the establishment in 1991 of the IASE (International Association for Statistical Education) as a branch of the ISI dedicated specifically to the promotion of statistical education at international level. The year 1998 is specially significant, as the V ICOTS (International Conference on Statistical Education) is taking place.

The Iberoamerican community has not been unaware of these initiatives and many teachers and university lecturers are making remarkable efforts in the field of statistical education. The purpose of this working group is to analyse the specific problems of statistical education in our community; to provide statistical educators the opportunity to meet and exchange their work, and to study the establishment of links with international groups of statistical education.

The following invited papers will be presented during the 1998 sessions:

Dr. Ignacio Méndez, Universidad Autónoma de México. Statistics and scientific method.

Dr. Jorge Luis ROMEU, Suny - Cortland, Syracuse, NY. Experiences of international colaboración with Ibero-American countries.

Estela Kaufman. Universidade Santa Ursula (Brazil). Is this game fair? Emergence of combinatorial and probabilitic reasoning in children

Roberto MEYER, Universidad de Santa Fe, Argentina. Experiences of a stochastics research group, in the context of the curricular reform in Argentina.

Audy SALCEDO, Universidad Central. Universidad Nacional Abierta, Venezuela. Academic International institutions in statistics education.

Elena Carrera, Universidad Nacional del Litoral, Argentina. Empiric definition of probabilities in secondary education. Computers and the relevance of simulation.

In addition, there will be a panel on "Statistical education problems in Iberoamérica", coordinated by Audy Salcedo, Venezuela. The presenters will be Dr. Claude GAULIN, Universidad Laval, Canada, Pedro Nel PACHECO, Universidad Nacional, Colombia, Nelly León Universidad Pedagógica Libertador, Venezuela. Twelve brief contributed research reports on statistical education have also been accepted for presentation.

The working group will start a network of statistical educators in Ibero-America, who plan to work on producing a monograph to summarize the work carried out in the Ibero-American community of statistical education.

9.4. PME-NA XX, Twentieth Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education, North Carolina State University, Raleigh, North Carolina, USA, October 31 - November 3, 1998

Program Chair: Dr. Sarah B. Berenson (berenson@unity.ncsu.edu)

Conference Coordinator: Dr. Wendy N. Coulombe (wncoulom@unity.ncsu.edu)

http://www.ncsu.edu/pmena98/

9.5. 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. Provisional topics are: Human Resources; Environment; Management and Administration; Production; Inventory and Logistics; Marketing; Finance; Insurance; Planning and Control; Quality, Reliability and Safety; Information Systems and Official Statistics; Sample Surveys; Research and Development; and Travel and Tourism.

Particular attention will be paid to the application of new technologies in Business and Industry such as Data Mining, Data Warehousing, Symbolic Learning, Neural Networks, Genetic and Fuzzy Algorithms, Computer Graphics, Knowledge-Based Systems, and Decision Support Systems

Chairs:

Professor Jacques Janssen, CADEPS-ULB (Solvay Business School), Av. F. Roosevelt, 50, BP 194/7,B-1050 Brussels BELGIUM,janssen@ulb.ac.be

Professor Helena Bacelar-Nicolau Professor Fernando Costa Nicolau, Lab. Estatistica e Analise de Dados Faculdade de Psicologia e C. Educaçao Faculdade de Ciencias e Tecnologia, hbacelar@fc.ul.pt

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

9.6. Contributed Paper Meetings at the 52nd Session of the International Statistical Institute Helsinki, Finland, 10-18 August, 1999

Any person actually participating in the Session may present one contributed paper in the Session. Contributed Paper Meetings will be arranged by the Local Programme Committee. To assist in this, authors are requested to classify their papers according to the indicative list of topics below.

Teaching basic statistics

Educating statistical majors

Statistical education

Teaching statistics for non-statisticians

5. Statistical literacy

Application for the Submission of a Contributed Paper is to be returned to CONGREX, the official congress office of the 52nd ISI Session, by January 10, 1999. Detailed instructions on how to prepare a manuscript will then be sent to each author. Instructions to authors will also be published on the homepage of the Session at http://www.stat.fi/isi99, in December, 1998.

9.7. Training of Researchers in the Use of Statistics

IASE Round Table Conference, Meiji University, Tokyo, Japan, 2000.

Scientific Committee

Carmen Batanero, Spain, Chair

Theodore Chadjipadelis, Greece

Joan B Garfield, USA

Anne Hawkins, UK

Yuki Miura, Japan

David Ospina, Colombia

Brian Phillips, Australia

Local Organising Committee

Yuki Miura, Education Committee, Japan Statistical Society, Chair

Toshiro Shimada, Meiji University

2000 will be the year of the IASE Round Table in Japan on the topic*: Training Researchers in the Use of Statistics*. This meeting will be held at the Meiji University which is located in the central area of Tokyo, after the International Congress on Mathematics Education (ICME 9). Carmen Batanero will be the Chair of the Scientific Committee of the Round Table. The Statistical Education Committee of the Japan Statistical Society, chaired by Professor Yuki Miura, will provide the local organisation. The following are possible topics and issues to be discussed at this Round Table Conference:

(1) Statistical competencies that researchers in different disciplines should acquire in their initial training; (2) Statistical training of researchers in specific fields, such as Medicine or Education; training of official statisticians; (3) Assessing/ identifying frequent errors in the use of statistics; consultation as a teaching/ learning process; (4) Researchers' attitudes towards statistics; comparing researchers' beliefs on the role of data analysis in experimental research with the current possibilities of data analysis; (5) Statistics as a language of communication; statistical analysis published in research papers; informal statistical learning from reading research literature; (6) Technology: Teaching the use of statistical software to researchers; its educational potential and its dangers; (7) Design/ evaluation of courses for training researchers in particular statistical topics and learning problems; (8) Continuous training of senior researchers.

More information can be obtained from Carmen Batanero, Departamento Didáctica de la Matemática, Facultad de Educación, Campus de Cartuja, 18071, Granada, Spain. E-mail: batanero@goliat.ugr.es