NEWSLETTER OF THE INTERNATIONAL STUDY GROUP

FOR RESEARCH ON LEARNING PROBABILITY AND STATISTICS

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Table of contents:

1. NOTES AND COMMENTS

Thanks to all of you who sent me summaries of their papers and feedback on the previous issue. I enjoyed hearing from you and learning about your current work.

As you will notice, I have added a new section on recent dissertations concerning teaching and learning stochastics. I want to encourage those who have done a dissertation or who know other dissertations related to this topic to send me summaries to be included in future issues of the newsletter.

In addition, please send me any papers you have written or any relevant papers or articles you have come across that we have not yet mentioned.

If there are any corrections or additions to the newsletter, please post them to the entire list of members by using the email address alias: stated_list@goliat.ugr.es

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2. NEW MEMBERS

M. Jesús Cañizares

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Campus de Cartuja

18071 Granada, Spain

M. J. Cañizares is a lecturer at the Facultad de Ciencias de la Educación of the University of Granada. She teaches Mathematics and Mathematics Education to future primary teachers and is preparing a doctoral dissertation about secondary students' proportional reasoning and their strategies in computing simple probabilities. She is co-author of a book "Azar y Probabilidad: fundamentos didácticos y propuestas curriculares" (Chance and probability: didactical foundations and curricular proposals).

Angel Gutiérrez

Universitat de Valencia

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Angel Gutierrez is a senior lecturer at the Department of Mathematics Education at the University of Valencia, Spain, where is teaching and supervising research at the Doctoral Program in Mathematics Education. His main research interest is Geometry, in particular the Van Hiele levels. On this topic he has published papers or chapters in several Spanish books, in the Journal for Research in Mathematics Education, and in proceedings of PME Conferences. This year he is organizing the 20 PME Conference at the University of Valencia. He is currently supervising a doctoral dissertation on students' understanding of averages.

Candelaria Espinel

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Candelaria Espinel is a Senior lecturer at the University of La Laguna, Spain. She teaches Mathematics, Statistics and Mathematics Education to future primary teachers. She has published papers related to the teaching of statistics in different Spanish Journals and in proceedings from

PME Conferences.

David S. Moore

Department of Statistics

Purdue University

West Lafayette, IN 47907-1399, USA

David Moore is a professor of Statistics at Purdue University in West Lafayette, Indiana, USA and recently served as President of the International Association for Statistical Education. His publications include research papers in statistical theory as well as articles on statistical education. He has authored or co-authored several popular college-level statistics textbooks. Dr. Moore is a pioneer in the development of statistics instruction by video, has served as chair of the American Statistical Association section on Statistical Education, and was a member of the ICOTS 4 Program Committee.

Rafael Roa

Facultad de Ciencias de la Educación

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18071 Granada, Spain

Rafael Roa is a lecturer at the Facultad de Ciencias de la Educación at the University of Granada. He teaches Mathematics and Mathematics Education to future primary teachers and is preparing a doctoral dissertation about combinatorial reasoning in students with a strong preparation in mathematics. He has published different papers on Mathematics Education in Spanish Journals. He plans to attend PME and ICME this year.

Richard Scheaffer

Department of Statistics

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Professor Scheaffer received his Ph.D. in statistics from Florida State University, whereupon he joined the faculty of the University of Florida and has remained there ever since. Now Professor of statistics, he was chairman of the Department for a period of 12 years. Research interests are in the areas of sampling and applied probability, specially with regard to applications of both to industrial processes. He has published over 40 papers in the statistical literature and is coauthor of four textbooks covering aspects of sampling, probability and mathematical statistics. In recent years, much of his effort has been directed toward statistics education throughout the school and college curriculum. He was one of the developers of the Quantitative Literacy Project in the United States that formed the basis of the data analysis emphasis in the mathematics curriculum standards recommended by the National Council of Teachers of Mathematics. He continues to work on educational projects at the elementary, secondary and college levels. Dr. Scheaffer is a Fellow of the American Statistical Association, from whom he has received a Founder's Award.

3. CHANGES IN E-MAIL ADDRESSES

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4. PUBLICATIONS BY MEMBERS

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

Jalal Alemzadeh and Jorge L. ROMEU (To be presented at the SUNY, CIT96 Conference)."A Statistical Analysis of an Experiment to compare Traditional vs. Laboratory Approach in Teaching Introductory Computer Programming Concepts".

During the Spring of 1995 an experiment in teaching introduction to Computer programming concepts was developed. It implemented two teaching approaches: traditional lecture vs. laboratory. Several performance measures were collected throughout the course. Among them are: common tests, quizzes and homework/projects. In this experiment we assess, via statistical analysis, the effects of these two teaching approaches on students' learning, retention and success rates. We analyze statistically the data collected, we test several hypotheses based on them and we give conclusions drawn on the analyses results.

BATANERO, C., Navarro-Pelayo. V. & GODINO, J. D. (To be published). "Effect of the implicit combinatorial model on combinatorial reasoning in secondary school pupils". _Educational Studies in Mathematics_

Elementary combinatorial problems may be classified into three different combinatorial models (selection, partition and distribution). The main goal of this research was to determine the effect of the implicit combinatorial model on pupils' combinatorial reasoning before and after instruction. When building the questionnaire, we also considered the combinatorial operation and the nature of elements as task variables. The analysis of variance of the answers from 720, 14-15 year-old pupils, showed the influence of the implicit combinatorial model on problem difficulty and the interaction of all the factors with instruction. Qualitative analysis also revealed the dependence of error types on task variables. Consequently, the implicit combinatorial model should be considered as a didactic variable in organizing elementary combinatorics teaching.

CALLENDER, J. T. and Jackson, R. (1995). _Exploring Probability and Statistics by Spreadsheet_. Prentice Hall.

This is an introductory text which offers a fresh approach to understanding Probability and Statistics. Most recent texts have used dedicated software packages where the analysis is semiautomatic, which obscures the underlying concepts and is thus not an ideal learning medium. However, with spreadsheets, this is not the case as the user must set up the analysis. Probability

theory is fundamental to the teaching and understanding of statistics and spreadsheets are an ideal medium for applying probability theory, particularly the Laws of Probability. Furthermore, the easy to use graphical facilities of spreadsheets are an excellent aid to learning, giving an intuitive grasp of difficult concepts, such as the Central Limit theorem.

FALK, Ruma (1996). "A classic probability puzzle". _Teaching Statistics_, 18(1), 17-19.

A classic probability puzzle, presenting an absurd result, is analyzed. Clearing the confusion caused by this problem sheds light on basic concepts of probability theory.

FISCHBEIN, Efraim & Schnarch, Ditza (To be published). "The evolution with Age of Probabilistic Intuitively Based Misconceptions". _Journal for Research in Mathematics Education_.

The purpose of this research was to investigate the evolution, with age, of probabilistic, intuitively based misconceptions. We hypothesized, based on previous research with infinity concepts, that these misconceptions would stabilize during the emergence of the formal operation period. Responses to probability problems by students in Grades 5, 7,

9, 11 and by prospective teachers indicated, contrary to our hypothesis, that some misconceptions grew stronger while others grew weaker with age. Only one misconception investigated was stable across ages. An attempt was made to find a theoretical explanation of this rather strange and complex situation.

ESPINEL FEBLES, M.C. & Caballero Gil, P. (1995). "The Mathematics that protect identification numbers from errors". _SUMA_, 20, 77-84 (Spanish).

With this paper, we intend to make the students reason about the mathematics implied in identification numbers such as NIF, ISBN or EAN. Modular arithmetic is used to fix the check digit and simple algorithms let the computer discover many possible mistakes in identification numbers of cards, products or persons. The more usual coding schemes detect single errors (when a digit is confused with another). However, they do not discover other types of errors that, although less usual, are possible. In this paper, some errors detection probabilities are computed for the identification numbers presented. Algebra and divisibility help us to choose more secure coding schemes. These applications can be used to increase the interest of the students in Probability Theory and, in general, in Mathematics.

STARKING, Susan (1995). "ISI Conference, Beijing, 1995. A review". _Teaching Statistics_, 18(1), 2223.

VALLECILLOS, A. (To be published). "Students' conceptions of the logic of hypothesis testing". _Hiroshima Journal of Mathematics Education_.

In this paper we present the results from a theoretical and experimental study concerning university students' conceptions about the logic of statistical testing. The theoretical study discusses epistemological issues concerning Fisher's and Neyman-Pearson's approach to hypothesis testing and their relationship to the problem of induction in experimental sciences. The experimental sample included 436 students from 7 different university majors. Following the analysis of student's arguments we identify three main conceptions: a) the test of hypotheses as a decision rule which provides a criterion for accepting one of the hypotheses; b) the test of hypotheses as an inductive procedure which allows us to compute the " a posteriori" probability of the null hypothesis and c) The test if hypotheses as a mathematical proof of the truth of one of the hypotheses.

5. NEW HANDBOOK ON ASSESSMENT IN STATISTICAL EDUCATION

Iddo GAL (university of Haifa, Israel) and Joan GARFIELD (University of Minnesota, USA) are pleased to announce that the International Statistical

Institute and IOS press (both in the Netherlands) will jointly publish their book "The Assessment Challenge in Statistics Education". The book will consist of 18 chapters written by authors from Australia, Canada, Israel, New Zealand, Spain, United Kingdom, and the USA. Chapters discuss conceptual and pragmatic issues in assessing statistical knowledge and reasoning skills of students at all educational levels. The book is organized in four sections: Assessment goals and frameworks, Assessing conceptual understanding, Innovative models for classroom assessment, and Assessing the learning of probability. The book is scheduled for publication in early 1997.

6. RECENT DISSERTATIONS

Carr, J. A. (1994). _Students' ideas on averages and dispersion. A Qualitative study involving year seven and eighth students_. Master Thesis. University of Waikato.

This is a study of students ideas of statistics. The subjects of the investigation are intermediate school students aged 10-12 years. The approach of the study is exploratory, using qualitative approaches in an attempt to reveal student's ideas about data, which was displayed for and by them in various ways. The students were encouraged to participate from the beginning of the study by attempting their own research investigation where they took part in the collection, display and analysis of their data. This exercise was carried out in a "typical" classroom by the researcher in the presence of the regular class teacher.

The data collected for this study included audio taped conversations of student working on activities, observational notes, a teacher questionnaire, students' written material and auto recorded in-depth individual interviews.

The investigation was influenced by the constructive view of learning, in which the emphasis is on the individual actively constructing meaning from incoming stimuli and generating likes to previously known information. The project was concerned with both the prior and the new constructions that the study group held in relation to measures of central tendency and dispersion. These concepts were imbedded in a variety of display formats which the students were asked to talk about.

The research revealed varying degrees of students awareness related to measures of central tendency and dispersion. This was illustrated as the study group discussed the displays comprising of bar graphs, line plots, stem-and-leaf graphs and boxand-whisker graphs. Appropriate use of students' vernacular was noted, however, in general the students did not convey their ideas well.

ESTEPA, A. (1994). _Students' preconceptions regarding statistical association and its evolution as a result of a teaching experiment based in a computer environment_. University of Granada, Spain. Supervisor: Carmen BATANERO.

Statistical association is a main topic in Statistics, as a prerequisite for the learning of many statistical concepts and procedures. It is also obvious the connection between the concepts of association and causality, on which experimental scientific method and decision-taking under uncertainty are supported. Nevertheless, association and causality do not always coincide, and furthermore, the detection of association is not an intuitive ability, even in adults. In this Thesis a didactic analysis of the notion of association is carried out comprising the following points:

In the first chapter, we present the epistemological study of the notion of association and its relationships with causality, together with a summary of the psychological research regarding association judgments. This analysis was the basis to build assessment instruments of students' conceptions, to interpret the data from different phases of our research work, and to plan the teaching experiment that was carried out. The second chapter presents a study of preconceptions, carried out in a sample of 213 pre-university students, which represents an original contribution in various ways: a) we extend the levels of strategies proposed in other research work into 2 x 2 contingency tables to higher tables; and propose a new classification of these strategies, by using the concepts and theorems implicit therein; b) we establish similar classification of strategies for solving association judgments in scatter plots and sample comparison; c) four different misconceptions regarding statistical association have been identified: 1) Deterministic or functional conception 2) Local Conception 3) Unidirectional conception and Causal Conception of association. In the third chapter we describe a teaching experiment, based on computers. The assessment of the change in the students' conceptions is based on a quasi-experimental design with pre-test and posttest, using two parallel questionnaires. We obtained a general improvement in students' association judgments and strategies, although unidirectional and causal misconception still remained in some students after teaching. This study was completed by an analysis of the participating students' capacity to solve problems, using a computer, and a comparison of their procedures in paper and pencil tasks. Finally, we studied the learning process for a pair of students, using the analysis of their interactions with the computer and the observation of their work during practice sessions. This study allowed us to identify different "acts of understanding statistical association, which is a first step towards the analysis of he meaning of the concept and to the design of didactic proposals aiming to its understanding.

Aline Grossman has recently finished a Master Thesis on combinatorial reasoning, supervised by Efraim FISCHBEIN (University of Tel -Aviv). Based on this thesis, they have sent me a paper with the title "Schemata and intuitions in combinatorial reasoning", submitted to _Educational Studies in Mathematics_. This is the summary of the paper.

The problem which inspired the present research referred to the relationships between schemata and intuitions. These two mental categories share a number of common properties: ontogenetic stability, adaptative flexibility, internal consistency, coerciveness and generality.

Schemata are defined following the Piagetian line of thought, either as programs of processing and interpreting information or programs for designing and performing adaptive reactions. Intuitions are defined as self-evident, global, immediate cognition.

Following previous findings (Siegler, 1979; Wilkening & Anderson, 1982; Fischbein et al., 1996), our main hypothesis was that intuitions are always based on certain structural schemata. In the present research this hypothesis was checked with regards to combinatorial problems (permutations, arrangements with and without replacement, combinations). The subjects -school students and adults- were asked to evaluate, globally, the solutions, not to compute. Resorting to subsequent interviews it has been found that the subjects' reactions were typically based on binary,

multiplicative (tacit) operations- usually inadequate ones-even when more complex operations were needed. The effect of using, always, multiplicative operations indicates consistently, the intervention of a compression process. Intuitions, even when expressed as instantaneous guesses, are, in fact, manipulated (correctly or incorrectly) by structural schemata acting "behind the scenes". This implies that, in order to influence, didactically, the students' intuitions, one has to identify and act upon those schemata on which they are based.

Naidu, R. (1994). _Do computer simulations make teaching and learning the law of long run probability and the central limit theorem more successful?_. Master Thesis. Centre for Science, Mathematics and Technology Education Research. University of Waikato. Supervisors: Andrew BEGG and Jeremy Gehrke.

Computers spreadsheets are a powerful and creative tool for the study of statistics. Computer graphics are effective in conveying and understanding of fundamental concept of the Law of Long Run Probability and the Central Limit Theorem. Direct experience through hands on experimentation is need for students to obtain a feeling for the basic concepts. The visualization and interaction features of the computer then help facilitate learning of these two laws. Students found the computer simulation lessons interesting, easy to understand, enjoyable and relevant.

This report describes the background and rationale for the project and the instruction strategy utilized. The general purpose of this study was to explore the use of computer simulation programs in

teaching the law of Long Run probability and the central limit theorem in the seventh form statistics course. This study was based on the belief that the learning of probability concepts may be facilitated by the study of computer simulations and simulation is an important problemsolving approach. The approach was based on simulation, including extensive use of spreadsheet. During the project, students used, modified and created spreadsheet to produce computer simulations. Graphical display of results offered great advantages, as students were able to visualize more complete features than would have been possible from a theoretical considerations. An exploratory qualitative case-study investigation of the effects that the use of computer simulation programs might have was conducted. Two seventh-form and two sixth form mathematics were selected for this investigation. Several different data collection methods were used- interviews, classroom observation, and field notes. Results showed that computer simulations gave opportunities to investigate the statistical concepts, to explore by trial-and error concepts like random variation and bias, law of averages and the central limit theorem. The active participation in the development of simulation programs seemed to facilitate learning by stimulating interest and motivation. The computer gave students better access to the topics they were learning than a teacher-direct theoretical approach-.

Toohey, P. G. (1995). _Adolescent perceptions of the concept of randomness_. Master Thesis. University of Melbourne School of Education. Supervisor: Kaye Stacey

An investigation into adolescents' perception of the concept of randomness is undertaken, by firstly coming to term with the varied use of the term random and its many manifestations. The definition and tests of randomness that are in operation in mathematics align with an evaluation of what these tests indicate about the concept, provides the starting point for this paper. An extensive literature review, centered around the works of Piaget, Konold, Falk, Fischbein and Green, is conducted and the appropriateness of the tasks used by these researchers is discussed. A pilot

study is developed and trailed, leading to the main questionnaire, conducted on 75 adolescent boys between Year 7 and Year 11 at a Catholic boys school in Melbourne.

The findings of the main study include the existence of a component perspective of randomness comprising notions of equal likelihood, multiple possibilities, model, causality and unpredictability. The sixth component encompasses randomness been attributed to situations where the causal factors are either unknown or too complex to contemplate. Young adolescents appear to be better at detecting randomness than their older counterparts, and this is possibly due to them being confined to notions of randomness from a product perspective. Year 10 and 11 students displayed a broads set of contextual

interpretations of randomness, but their level of understanding diminished as the process perspective of randomness was introduced.

Attributions of randomness based on two dimensional spatial displays are thoroughly investigated and two further perspectives of randomness are identified- local and global. Local perspectives of randomness are based on the spatial arrangements of markers while global perspectives are reliant on the frequency distribution of the markers. A third influencing factor is identified, namely clustering, but is not investigated.

Green's assertion that primary school age children improve their perception of randomness with age is challenge on the basis of the findings in this survey, which indicate that the adolescents' perceptions diminished with age as a result of the factors mentioned above.

TRURAN, J. (1992). _The development of children's understanding of probability and the application of research findings to classroom practice_. Master Thesis. University of Adelaide. Department of Education. Supervisors: Jack Rowell & Chris Dawson

This thesis represents the endeavors of a secondary teacher to explain some difficulties experienced when teaching probability and to propose some directions for improvement. After examining the underlying mathematics, the research findings, and some current practices. interviews with 32 children aged between 8 and 15 are summarized. The thesis concludes with a proposed teaching sequence. Treating a random variable as a function defined on a set of outcomes does not include the idea of random generators like dice, which are significant in children's' probabilistic experiences. A more complete model is proposed.

Subjective, experimental and symmetric probabilities are all seen as appropriate ways for beginners to allocate probabilities. The usual definition of independence is appropriate only for independent events, not functates. Distinct meanings for these two uses of independence are defined.

Research into the teaching of probability is summarized, and secondary textbooks used in South Australia and Victoria are examined to assess current teaching practice in these states. This practice is compared with that advocated by other influential or creative writers.

Research relevant to the clinical interviews is summarized. The interviews themselves show how technical probabilistic terms are used by naive children. They suggest developmental stages of children's understanding of the symmetry of random generators. This show that children's predictions of outcomes arising from successive independent trials appear to be related more to previous predictions than to previous outcomes or its previous predictive success. Few children showed deep understanding of the independence of random generators, but those who did came

from all age groups. When comparing probabilities, many children did show the well-known inconsistencies when comparing proportions but the interviews provide evidence that they were in fact comparing probabilities and not just proportions.

In Chapter 4 a sequence for the teaching of elementary probability is presented which incorporates the findings of the study. A textbook prepared by the author which conforms with most of these principles is presented. An assessment of its value following limited use with adult distance education students is also given.

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7. NEW JOURNAL: SPREADSHEET USER

This is a new Journal, published by the Mathematics Centre of Sheffield Hallam University, whose focus is in teaching with spreadsheet on Science, Engineering and Business courses.

This Journal does include papers on the teaching of Statistics by Spreadsheet. Previous issues have covered things like Contingency Tables, Regression, etc. The Journal is published in May and November each year.

More information is available form John T. CALLENDER; Mathematics Centre; School of Engineering Information Technology; Sheffield Hallam University; Pond Street; Sheffield S1 1WB; U.K.; J.T.CALLENDER@SHU.AC.UK.

Below we include the summary of a paper included in v.2, n.2, November 1995.

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8. OTHER PUBLICATIONS OF INTEREST

Arachchige. L. (1995). "A multivariate plot for spreadsheets"._ Spreadsheet User_, 2(2), 16-21.

The approach to multivariate exploratory data analysis presented here is easily comprehensible, provides a single solution and can be implemented using spreadsheet package. The multivariate projection suggested is based on the extraction of the information contained in the deviations and means of the variables to determine the projection axes and to graphically present the data. Two sets of data with known group structures and another two sets with unknown structures are used to illustrate the method. Some uses of the method will also be discussed.

Bobbitt, S. (1995). "Effects of a visible author in statistical texts". _Journal of Educational Psychology_, 87(1), 47-65.

The effect of a visible author on women's experience reading statistical texts were examined among 47 female college students who read texts that differed in the extent to which the author revealed attitudes and personality. For these women, author image and initial self-efficacy for statistics were related to cognitive engagement, feelings of accomplishment, and intrinsic motivation. Implications for text construction and methodology in research on the interaction of cognition and affect during learning tasks are discussed.

Claudette, M. & Christian, E. (1994). "Metacognition and competence on statistical problems". __Psychological Reports_, 75, 1403-1408.

This papers show a relation in 38 undergraduate students between statistical competence and metacognitive knowledge of tasks and strategies in statistics. Perceived competence appeared separate from metacognitive knowledge and cognitive performance.

Gerber, R., Bouldon-Lewis, G. & Bruce, C. (1995): "Children's understanding of graphic representation of quantitative data". _Learning & Instruction_, 5, 77-100.

In their formal education, children are required to learn to use a range of quantitative representations in subjects across the curriculum. Previous research that focuses on the use of information processing and traditional approaches to cognitive psychology concludes that the development of an understanding of such representations of data is a complex process. An alternative approach to investigate the experience of children as they interact with graphic representations of quantitative data in their ownlife-world. This paper demonstrates how a phenomenographic approach may be used to reveal the qualitatively different ways in which children in Australia primary and secondary education understand the phenomenon of graphic representations of quantitative data. Seven variations of the children's understanding were revealed. A detailed outcome space demonstrate how these seven variations are structurally related.

Flores, A. (1995). "Connections in proportional reasoning: levers, arithmetic means, mixtures, batting averages and speeds. _School Science and Mathematics_, 95(8), 423-430.

The lever is used to give an alternate physical representation of, and as a means to connect, situations that involve weighted averages and inverse proportionality, such as arithmetic means, mixtures, batting averages and speeds. Geometric representation of the situations are also provided as another way to make connections.

Meyer, R. A. (1995). "Expanding students' conceptions of the arithmetic mean". _School Science and Mathematics_ ,95(3), 114-117.

This article presents four activities designed to help elementary and middle school students develop a concept of mean.

Poulton, E. C. (1994). _Behavioral Decision Theory: A new approach_. Cambridge University Press.

This book consists of the following chapters: outline of heuristics and biases; practical techniques; apparent overconfidence; insight bias; small sample fallacy; conjunction fallacy; regression fallacy; base rate neglect; availability and simulation fallacies; anchoring and adjustment biases; expected utility fallacy; bias by frames; simple biases accompanying complex biases; problem questions; training; overview.

Onwuegbuzie, A. J. & Seaman, M. A. (1995). "The effect of time constraints and statistics test anxiety on test performance in a statistics course". _Journal of Experimental Education_, 61(2), 115-124.

The performance of students who completed a statistics examination under time limits was compared with that of students under no time limits. Another purpose was to determine whether students high or low in statistics test anxiety were affected differentially by these two examination conditions. The results suggest that differences between high and low-anxious students in evaluative situations are caused by differences between them in motivational disposition and attentional focus.

Kosonen, P. & Winne, P. H. (1995). "Effects of teaching statistical laws on reasoning about everyday problems". _Journal of Educational Psychology_, 87(1), 33-46.

The law-of-large-numbers was taught in regular classroom settings and students' abilities to solve

ill-structured everyday problems were tested. Students learned a good deal about how to reason statistically, and these gains generalized over different structures of problems and topics. The results support a revival of formalist views of transfer, that teaching formal rules about inference making can improve reasoning and support transfer.

Thompson, B. (1996). "AERA Editorial policies regarding statistical significance testing: three suggested reforms". _Educational Researcher_, 25(2), 26-30.

The present comment reviews practices revolving around tests of statistical significance. First, the logic of statistical significance testing is presented in an accessible manner; many people who use statistical tests might not place such a premium on the tests if these individuals understood what the test really do, and what the tests do not do. Second, the etiology of decades of misuse of statistical tests is briefly explored; we must understand the bad implicit logic of persons who misuse statistical tests if we are to have any hope of persuading them to alter their practices. Third, three revised editorial policies that would improve conventional practice are highlighted.

Wainer, H. (1992). Understanding graphs and tables. _Educational Researcher_, 21(1), 14-23.

Quantitative phenomena can be displayed effectively in a variety of ways, but to do so requires an understanding of both the structure of the phenomena and the limitations of candidate display formats. This article (a) recounts three historic instances of the vital role data displays played in important discoveries, (b) provides three levels of a theory of display to help us better measure both display quality and human graphically, and (c) describes three steps to improve the quality of tabular representations.

Zhonghong, J. & Potter, W. D. (1994). "A computer microworld to introduce students to probability". _Journal of Computers in Mathematics and Science Teaching_, 13(2), 197-222.

This paper describes a simulation-oriented computer microworld called CHANCE used to overcome the limitations of physical material for experiments in introductory probability. A teaching experiment conducted with four middle school and high school students is discussed.

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9. INTERNET RESOURCES OF INTEREST

Tim ARNOLD is including a paper about statistics education and the Internet in the IASE matters pages of Teaching Statistics. This include information about teaching aids available to anyone with web access: courses sites, datasets, information from US government, and general educational resources.

Flavia JOLLIFFE edits an education section in RSS News, the newsletter of the Royal Statistical Society which is published monthly from September to June. Starting with December 1995, the education section is now being made available on the world wide web.

Several short articles about statistical education activities in countries other than the UK have appeared in this section and others are in the pipeline, many of them written by members of this study group. These too are being placed on the world wide web. In addition expanded and updated versions of the articles are to be brought together in a single publication to be distributed to those schools and colleges having associate membership of the Society.

The World Wide Web address to use is:

http://www.maths.ntu.ac.uk/rss/index.html

More information is available for Flavia: F.R.Jolliffe@greenwich.ac.uk

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10. INFORMATION ON PREVIOUS CONFERENCES

ENCONTRO PAULISTA DE EDUCACAO MATEMATICA. Sao Paulo. Brazil, January, 27-30, 1996.

The proceedings of this conference have been edited in Portuguese by Romulo Lins, Sociedad Brasileira de Matemática (Atual Editora), and contain the following papers related to statistical education:

Countinho, C. & Henry, M. "Estudo da relacao entre frequencia e probabilidades em jovens de 16 a 20 anos" (Study of the relationships between frequencies and probability in 16 to 20 years-old students). (pp. 151-156).

Queiroz, C. & Coutinho, C. "Introducao ao concepto de probabilidade para adolescentes (12/13 anos)". (Introducing the concept of probability to 12-13 year-old students). (pp. 165-169).

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11. FORTHCOMING CONFERENCES

CIT96 CONFERENCE, May, 21-24, 1996: Leveraging Learning, Using and Affording Technology, SUNYOswego CIT is a continuing forum for instructional technology in SUNY for faculty and instructional support professionals.

You can obtain more information and the conference program via the web page:http://www.oswego.edu/cit96 or by emailing to SUNY training center: train@va.itec.suny.edu

Tartu Conference on Computational statistics & Statistical education. July, 1996. Conference secretary: Elvi Ehasalu, J.Liivi 2, Tartu EE2400,

Estonia. Tel: 372 7 465 453, Fax: 372 7 433 509, Email:elvi@madli.ut.ee, etiit@madli.ut.ee, tooding@madli.ut.ee

Three statistical conferences are being held in Sydney in July 1996 under the umbrella of SISC'96 (SYDNEY INTERNATIONAL STATISTICAL CONGRESS). More details of this and registration forms can be obtained from http://www.dms.csiro.au/sisc/index.html

"20 PME": International Group for the PSYCHOLOGY OF MATHEMATICS EDUCATION, Valencia, Spain, July 9-12, 1996. Organized by the Department of "Didactica de la Matematica" at the University of Valencia.

Proposal for a Discussion Group at PME 20, Valencia: _The Learning and Teaching of Probability and Statístics_ John M. TRURAN; Kathleen M, TRURAN (University of South Australia).

Formal stochastics is a relatively recent activity, especially in schools, and effective pedagogical skills are not yet widely spread. Much recent research has focused on establishing children's understanding of parts of the topics. More general theories are slowly emerging, but are still not widely accepted. This discussion group will aim to

provide a forum to assist the increasing number of researchers in this field to see the broad picture within which to set their own work. Shaughnessy (1992) presented a wish list for future research in stochastics that included both conceptions and misconceptions held by both students and teachers, assessment issues, cross-cultural studies and the effect of metacognition in decision making under uncertainty.

Some of these issues were addressed at the Fourth International Conference on the Teaching of Statistics in Marrakech in 1994 and in a Discussion Group at PME in Lisbon in 1994 chaired by Kath Hart. These discussions, and also the papers presented to PME in Lisbon and at Recife in 1995 have shown that current work often addresses some of these issues but tends to concentrate on either probability or statistics, and much less often on the links between the two.

It is proposed, therefore, that the two meetings of the discussion group will look especially at forging links between probability and statistics. The first meeting will address the "pure" issue of conceptions and misconceptions in both topics. The second will address the "applied" issue of the learning in service courses of stochastic concepts by secondary and tertiary students who want to use statistics as a tool in other disciplines. Issues of assessment and metacognition and cultural background will be of special relevance here.

**** If you are planning to attend PME and you would like to participate in such a group, please contact to John TRURAN: jtruran@arts.adelaide.edu.au

"8th INTERNATIONAL CONGRESS ON MATHEMATICAL EDUCATION (ICME) ", Seville, Spain, 14-21 July 1996.

Program for ICME8 topic group 9:

TG9 Description: This topic group aims to highlight the issues involved in, and to provide directions for the future of, the teaching of statistics and probability at the secondary level. The program will include an overview of the state of the art of these topics, discussions on children's understanding of the basic concepts of probability and statistics, general issues such as the curriculum, assessment, teacher training, the use of technology and how research may affect how these topics are taught in the future.

Session 1

Session 1(a): State of Art in Teaching Probability at Secondary level

Organizer Tibor Nemetz

Speakers

Tibor Nemetz & Manfred BOROVCNIK:An overview of the Teaching of Probability in Secondary Schools.

Susan FRIEL: Children's understanding of graphs at Junior Secondary level.

Mike SHAUGHNESSY: Emerging Issues for Research on Teaching and Learning Probability & Statistics.

Session 1(b) Data analysis in secondary schools. Organizer Brian PHILLIPS, Australia

Speakers

Susan STARKINGS: An International Overview of Data Analysis within the Mathematics Curriculum

Gail BURRILL: Curriculum Issues in United States Schools

Shir-Ming Shen: Data analysis in secondary education in Hong Kong - curriculum, examination and project

Teresita Teran: An argentinian experience of statistics teaching for masters of high school

Session 2. General issues in teaching probability and statistics in Secondary Schools.

Speakers:

Iddo GAL: Assessing students' interpretations of data: Conceptual and pragmatic issues

Anne HAWKINS: Teachers of Statistics - Needs and Impediments

Kay LIPSON: Technology and the teaching of statistics

Forum: How statistics and probability can best be incorporated into the overall school program? Panel: Peter HOLMES, Chair (UK), Rolf BIEHLER (Germany), Carmen BATANERO (Spain)

Further details can be obtained from Brian PHILLIPS. E-mail: brp@swin.oz.au.

ICOTS 5, SINGAPORE, JUNE, 1998.

Place: Nanyang Technological University, Singapore, June 21 - 26, 1998

Theme: Statistical Education - Expanding the Network

General Objectives: The major objective of ICOTS 5 is to provide opportunities for educators throughout the world to expand their network in statistical education and encourage a worldwide exchange of ideas. In particular the conference aims to create opportunities for networking:

- technology with modern methods in the teaching of statistics

- school and tertiary level statistical education at all levels

- the wider community with statistical educators

- statistical education with the forefront of statistical practice

- the exchange of ideas for teaching statistics between and within

developing and developed countries

- educational research results and the practice of teaching and learning statistics

It is planned to include keynote speakers, invited speakers, contributed papers, workshops and forums for the exchange of ideas, demonstration lessons, round table sessions, poster sessions, book and software displays, hands-on computer sessions and many opportunities for communication and exchange of experiences and ideas. In particular it is intended to have some 'networking opportunities in which the time and opportunity is provided for participants to develop links between people in several areas.

The conference will focus on the following main topic areas:

-Statistical education at the school level -Statistical education at the tertiary level -Statistical education for people in the workplace -Statistical education and the wider community -Statistical education in developing countries -Research into teaching and learning statistics -The role of technology in the teaching of statistics

-Other determinants and developments in Statistical Education

The local organizing committee have plans well under way and the international program committee, IPC, has a draft program prepared.

People interested in being involved in the program as session organizers or in other key ways should contact the IPC Chair Brian Phillips.

Expressions of interest for hosting ICOTS6 in 2002 are also being sought.

Contacts

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