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THE JOURNAL OF STATISTICS EDUCATION:

The first issue of this new, electronic journal became available in July, 1993. The premier issue contained several items of interest, so I am reprinting some items from the table of contents:

David S. Moore, "A Generation of Statistics Education: An Interview with Frederick Mosteller"

ABSTRACT: This interview was conducted for JSE at the Harvard Department of Statistics on December 18, 1992. The topics discussed include the history and future of statistics education, the use of video and computers in teaching statistics, the role of data analysis in statistics textbooks, innovation in the classroom, and graduate education.

George Cobb, "Reconsidering Statistics Education: A National Science Foundation Conference"

ABSTRACT: Recent survey data demonstrate an acute need for curricular resources in statistics. The first half of this paper summarizes and compares a dozen current or recent NSF projects, most of which are developing such resources. Nearly all these projects involve activities for statistical laboratories, at least implicitly, although the labs are used in a variety of ways: for analysis of archival data sets, for hands-on production of data for analysis, and for simulation-based learning. These three kinds of labs are compared in terms of their complementary sets of advantages. This paper grows out of a small conference which brought together NSF Program Officers, Principal Investigators and Co-PIs of the projects, and a half-dozen other teachers of statistics. The second half of the paper develops four themes from the conference: (1) Questioning standard assumptions, (2) Resistances to change, (3) Total Quality Management, and (4) Educational Assessment. These themes are (a) offered (modestly) as useful guides to thinking about teaching statistics, then (b) exploited (shamelessly) to argue for a scorched-earth assault on our introductory courses.

Joan B. Garfield, "Teaching Statistics Using Small-Group Cooperative Learning"

ABSTRACT: Current recommendations for reforming statistics education include the use of cooperative learning activities as a form of active learning to supplement or replace traditional lectures. This paper describes the use of cooperative learning activities in teaching and learning statistics. Different ways of using cooperative learning activities are described along with reasons for implementing this type of instructional method. Characteristics of good activities and guidelines for the use of groups and evaluation of group products are suggested.

J. Tim Arnold, "The Structure and Philosophy of the *Journal of Statistics Education*"

ABSTRACT: *The Journal of Statistics Education* (JSE) has a unique structure and an inclusive philosophy that have technical consequences for readers and authors. This paper, a message from the journal's managing editor, explains why the JSE was built to have its unique structure, the format of information available to readers, and the effect the philosophy will have. The paper's Appendix outlines three groups of readers and associated methods of accessing the journal. The Appendix also describes the purpose and contents of the associated JSE Information Service.

"Teaching Bits: A Resource for Teachers of Statistics" Joan Garfield and J. Laurie Snell

ABSTRACT: This column features "bits" of information sampled from a variety of sources that may be of interest to teachers of statistics. Joan Garfield will be abstracting information from the literature on teaching and learning statistics, while Laurie Snell will be summarizing resources from the news and other media that may be used with students to provoke discussions or serve as a basis for classroom activities or student projects.

Copies of articles may be obtained by accessing the Journal of Statistics Education Information Service on Gopher, or by subscribing (free of charge) by sending the following message:

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subscribe jse-announce FirstName LastName
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to the following email address:

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listserv@jse.stat.ncsu.edu
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Note: the journal is looking for high quality manuscripts on any aspect of statistical education.

I have been organizing a diverse and exciting program for the forthcoming meeting of the **Fourth International Conference on Teaching Statistics (ICOTS 4)**, to be held in Marrakech, Morocco from 25 to 30 July, 1994. Here is a listing of the current roster of presenters and paper topics:

ICOTS 4 Program for Session 5:
Research on teaching and learning statistics and probabilistic concepts

Speaker: **Carmen Batanero**, Departamento de Didactica de la Matematica. Facultad de Educacion, Universidad de Granada, Spain.
Title: The use of multivariate methods to analyze students' stochastical conceptions

Speaker: **Rolf Biehler**, Universitat Bielefeld, Institut fuer Didaktik der Mathematik (IDM), Germany
Title: Probabilistic thinking, statistical reasoning and the search for causes: Do we need a probabilistic revolution after we have taught data analysis?

Speaker: **Manfred Borovcnik**, Universitat Klagenfurt, Institut f. Mathematiik, Austria
Title: Analogies in Stochastics

Speaker: **Efraim Fischbein**, Tel Aviv University, Israel
Title: Intuitive Evaluations Concerning the Probability of Simple and Compound Events.

Speaker: **Iddo Gal**, University of Pennsylvania, USA.
Title: Difficulties in reasoning about sampling and variability.

Speaker: **Joan Garfield**, University of Minnesota, USA.
Title: Implications of research for teaching statistics

Speaker: **Brian Greer**, School of Psychology, Queen's University, Belfast, Northern Ireland
Title: Readiness of teachers in Northern Ireland to teach Data Handling.

Speaker: **Chris Hancock**, TERC, Cambridge, Massachusetts, USA
Title: The Role of Data Structure in Statistical Thinking

Speaker: **Flavia Jolliffe**, School of Mathematics, Statistics, Computing University of Greenwich, London
Title: Research on concepts: a summary of methodology and results.

Speaker: **Marie-Paule Lecoutre**, Groupe Mathematiques et Psycholgie C.N.R.S. and University Rene Descartes, Paris, France
Title: Cognitive models and problem spaces in "purely random" situations.

Speaker: **Kay Lipson**, Swinburne University of Technology, Australia.
Title: Understanding the role of computer-based technology in developing fundamental concepts of statistical inference.

Speaker: **Jane Watson**, University of Tasmania, Australia
Title: Assessing Statistical Concepts in the School Curriculum

I am currently exploring the possibility of organizing papers into groups by topics followed by a discussant who will summarize and comment on the papers. I have not yet received permission to offer this alternative format, but please let me know if you are interested in serving as a discussant for a group of paper.

Note: there is still time to submit a proposal for a contributed research paper. Send me a title and abstract by December 15, 1993.

ARTICLES SUBMITTED BY MEMBERS

Brian Greer sent a copy of:

Teaching Data Handling within the Northern Ireland Mathematics Curriculum. Emerging Ideas on the Teaching of Statistics and Probability in Schools: A Review of the Literature by Brian Greer and Rene Ritson, School of Psychology, Queen's University, Belfast. Published by Northern Ireland Curriculum Council, Stranmillis College, Belfast BT9 5DY, Ireland.

This comprehensive booklet contains four main sections: <u>Background</u> (including sections on the history of probability and statistics, modern views of probability, the role of computers, probability and statistics in our lives), <u>Insights from research</u> (including the development of probabilistic thinking, teaching experiments, teachers' knowledge and conceptions), <u>Pedagogical issues</u> (including teaching data handling in schools, practical activities in teaching data handling, and training of teachers), and <u>Exploiting resources</u> (including specialized equipment, software, games, video, and data sources). The booklet concludes with a lengthy reference list as well as list of useful addresses.

Cliff Konold sent copies of two recent papers

Random Means Hard to Digest, by Ruma Falk, Hebrew University and Clifford Konold, University of Massachusetts. To appear in *Focus on Learning Problems in Mathematics*.

Abstract: Different sequences are reproduced or memorized with varying degrees of difficulty, depending on their structure. We obtained preliminary support for the hypothesis that difficulty of encoding is correlated with the perceived randomness of the sequence. Since the randomness of a sequence can be defined by its complexity, namely, the length of the shortest computer program for reproducing the sequence, we suggest that introducing randomness in terms of complexity may foster students' understanding. Subjective complexity, however, is maximal for sequences with exaggerated alternations, as is apparent-randomness. Thus, misperceptions of randomness cannot be corrected by the complexity approach. They can only be better understood.

Understanding the Law of Large Numbers, by Clifford Konold, Arnold Well, Jill Lohmeier, and Alexander Pollatsek, University of Massachusetts. To be presented at the Fifteenth Annual Conference of the North American Chapter of the International Group for the Psychology of Mathematics Education, October, 1993.

Abstract: Twelve students answered questions involving the distribution of sample means both before and after an instructional intervention. Correct performance improved on these problems but dropped on problems having to do with the distribution of samples.

Papers presented at IASE

Rolf Biehler, Cliff Konold, and Manfred Borovcnik presented papers at the first meeting of the International Association of Statistical Education, held in Perugia, Italy this past August.

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Here are abstracts of their papers and addresses for obtaining copies of papers:

Cognitive Technologies for Statistics Education: Relating the Perspective of Tools for Learning and of Tools for Doing Statistics

Rolf Biehler, Universitat Bielefeld, Institut fur Didaktik der Mathematik, Postfach 100131, D-33501, Bielefeld, Germany

Abstract: This paper starts from the software dilemma in statistics education. On the one hand, we have professional statistical systems that are very complex and call for high cognitive entry costs, although they flexibly assist experts. On the other hand, custom designed educational software is of necessity constrained in order to enable students to concentrate on essential aspects of a learning situation. Nevertheless, as these programs are often not adaptable to teachers' needs, they are often criticized for being too constrained. They offer limited support for flexible data analysis, and to satisfy the variety of demands one would need a collection of them. This paper argues in favor of a more systematic approach for defining key elements of software that can support both doing and learning statistics.

Intuitive Strategies for Teaching Statistics

Manfred G. Borovcnik, Dept. of Mathematics, University of Klagenfurt, Sterneckstra-e 17, A-9020, Klagenfurt, Austria

Abstract: Individual thinking is driven by intuitions which have nearly no counterpart in the concepts which one learns from theory. This is especially true for stochastics teaching as is the main cause that it is not very effective. The author reports about powerful strategies that might bridge the gap between individual intuitions and formal concepts. This gives a clear insight into difficult concepts and changes the behavior of the learner.

Understanding Probability and Statistical Inference through Resampling

Clifford Konold, Scientific Reasoning Research Institute, Hasbrouck Laboratory, University of Massachusetts, Amherst, MA 01003, USA

Beginning with the question of how probability ought to be integrated into the new approach to teaching statistics emphasizing the use of real data, this paper describes two software tools developed as part of the NSF-funded Chance Plus project, highlighting aspects that emphasize the relation between probability and data analysis. Results are also reported from a primarily test site, a high school in Holyoke, Massachusetts.

Articles of Interest in *Teaching Statistics*

The Autumn 1993 issue of *Teaching Statistics* contains some articles and reviews of book written by or about study group members. (For anyone wishing to subscribe to the journal, write to *Teaching Statistics*, Department of Probability and Statistics, University of Sheffield, Sheffield S3 7RH, U.K.)

Proportions and products - what do students know? **Flavia Jolliffe**, University of Greenwich, London, U.K, and Fay Sharples, University of Waikato, Hamilton, NZ.

Abstract: It is sometimes said that learning probability at an introductory level is not difficult since many probability questions are just questions about proportion. However, students often perform badly on probability questions and one reason for this might be an inadequate familiarity with proportions. In order to investigate this, a self-completion instrument was developed to measure understanding of proportion. The instrument was administered to students in the UK and in New Zealand. The errors made by students and the implications of there errors are discussed.

There is a book review by Mary Rouncefield of *Teaching Statistical Concepts* by **Anne Hawkins**, Flavia Jolliffe and Leslie Glickman.

There is also an in-depth book review by Alan Graham of *Chance Encounters: Probability in Education*, edited by Ramesh Kapadia and **Manfred Borovcnik** (which contains several chapters written by study group members).

The newsletter of the **International Association for Statistical Education** is also included in the journal. This newsletter contains a summary of statistical education projects in North Carolina and a paper by **Manfred Borovcnik**, "Why Teaching Probability and Statistics is so Difficult".

The previous issue of *Teaching Statistics*, Summer 1993, contained a research report on the work of **Carmen Batatnero** and colleagues at the University of Granada, in Spain.

Presentations at the Joint Statistical Meetings

There were several sessions on statistical education at the Joint Statistical Meetings in San Francisco, August, 1993. One invited paper session was on the topic of Assessment Issues Related to Teaching and Learning Statistics, where the following papers were presented:

What Should We Assess?

Joan Garfield, 140 Appleby Hall, 128 Pleasant St. S.E., Univeristy of Minnesota, Minneapolis, MN 55455.

Abstract: Changes in educational assessment are currently being called for, both within the field of measurement and evaluation as well as in particular disciplines such as statistics. Traditional assessments of statistical knowledge may succeed in providing instructors with a method for assigning letter grades but rarely reveal information about how students actually understand and can reason with statistical ideas or apply their knowledge to solving statistical problems. As statistics instruction at the college level begins to change in response to calls for reform there is an even greater need for appropriate assessment methods and materials to measure students' understanding of probability and statistics and their ability to achieve more relevant goals such as being able to explore data and to think critically using statistical reasoning. This paper summarizes current trends in educational assessment and relates these to the assessment of student outcomes in a statistics course. A framework is presented for categorizing and developing appropriate assessment instruments and procedures.

Feeling Certain about Uncertain Things: Assessing Affect and Attitudes in Statistical Learning

Iddo Gal, Lynda Ginsburg, Graduate School of Education, University of Pennsylvania, 3910 Chestnut St. Philadelphia, PA 19104-3111

Abstract: While many teachers of statistics are likely to focus on transmitting knowledge, many students are likely to have trouble with statistics due to non-cognitive factors, such as (math) anxiety or negative attitudes towards statistics, which can impede learning of statistics, or hinder the extent to which students will develop useful statistical intuitions and apply what they have learned outside the classroom. This paper explores the role of attitudes in the learning of statistics, examines existing instruments for assessing attitudes ad beliefs of students, and provides suggestions for methods teachers can use to gauge where students stand on some non-cognitive factors.

Issues in Assessing Conceptual Understanding in Probability and Statistics

Clifford Konold, SRRI, Hasbrouck Lab, University of Massachusetts, Amherst, MA 01003

Abstract: Research has shown that adults have intuitions about probability and statistics that, in many cases, are at odds with accepted theory. The existence of these strongly-held ideas may explain, in part, why learning probability and statistics is especially problematic. One objective of introductory instruction ought to be to help students replace these informal conceptions with more normative ones. Based on this research, items are currently being developed to assess conceptual understanding before and after instruction.

The following papers were presented at AERA in April, 1993:

Student Misconceptions in Probability Problem-Solving, by Ann Aileen O'Connell and James E. Corter, Columbia University Teachers College.

Abstract: For this study, the probability problem-solving processes of 104 graduate students enrolled in different sections of an introductory probability and statistics course at an urban college of education were analyzed for the presence and type of errors occurring in their work. The importance of prerequisite language and algebra skills to probability problem-solving was shown by the fact that difficulties in interpreting information contained in the text, as well as an inability to distinguish between the algebra of sets versus the algebra of real numbers were found to lead to computational difficulties for some students. When the probability concepts involved are not understood, students may invent procedures or strategies in order to attempt a solution.

Conceptual Understanding of the Arithmetic Mean, by Marjorie Roth Leon and Judith S.. Zawojewski, National-Louis University.

Abstract: The present study had four purposes: a. to investigate children and adults' understanding of four component properties of the arithmetic mean, b. to determine the relative difficulty of these four component properties of the mean, c. to determine the differential potential of varied problem formats to facilitate understanding of the arithmetic mean, and d. to discuss differences between different types of methods for contributing to research about, and investigating understanding of the arithmetic mean. 41 fourth graders, 60 eighth graders, and 40 college students completed a 16-item test that presented the four properties in story and numerical formats. Results indicated that a. mastery of all properties increased with age, b. story format was superior to numerical format, and c. certain properties were easier to master than others.

Many of you may wonder what happens to all these papers you send me: working papers, drafts, presentations, articles, etc. I have overstuffed drawers filled with these papers, along with shelves of conference proceedings, books, and journals; all containing information on the topic of statistical education. In order to organize and make this information more accessible to others, I applied for and received a small grant from the National Center for Research in Mathematical Sciences Education to set up Stat-File, a computerized database of research on teaching and learning statistics. This database was set up using Filemaker Pro 2, and so far has close to 500 entries. Each entry contains complete bibliographic information, key words, and a brief abstract. When the remaining papers have been entered and the information reviewed and modified as needed, a hard copy of the information will be printed and distributed at cost to interested researchers. At some point I would like to invite colleagues to preview the bibliography and see if I'm missing any important papers. Let me know if you'd be interested in helping with this project.

Change of Date for Assessment Conference

A message from Iddo Gal and Joan Garfield: The date of our proposed Conference on Assessment Practices in Statistical Education, originally planned for November 11-12, 1993, has been changed. We had asked NSF for funding for the workshop, and this past June received very favorable reviews on our preliminary proposal. We were encouraged by NSF to go ahead and submit a full proposal, and indeed did so earlier in July, but were subsequently informed by NSF that their current timeline for processing and reviewing proposals will not enable them to give us a final answer sufficiently ahead of the conference. We were advised to postpone the conference until summer or fall of 1994. To make sure this conference is able to bring together a large enough and diverse group of experts and interested colleagues, we have tentatively scheduled a new date for the conference: September 23 and 24, 1994. Please let us know if you are interested in attending this conference (send messages to Joan at the address on the cover of the newsletter). We will keep you posted about future developments.