

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

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New Members: We Are Growing!

Since the production of the last newsletter in June, we have acquired many new members. Some came to an informational meeting at the International Conference on Teaching Statistics (ICOTS) this past July, in Morocco. Some learned about the group through newsletters of other organizations or at a conference on assessment in statistics education. Others had been in the group before but had been dropped from the list when I last asked people to tell me whether or not they wanted to remain on the mailing list.

We now have **115 members**, an increase of 42 members or 57% from the 73 members we had last spring! Therefore, I am once again attaching a roster of names, addresses and email addresses. I'm sure there will be a whole new set of errors, so please check the information carefully and send me an email message if there are any errors.

Welcome, to all of the new members!

Search for a New Newsletter Editor

Having completed seven years as chair of the study group and newsletter editor, I would very much like to have someone else take over my duties. It would also be good for this group to have the benefit of a new leader! When members of the study group met at ICOTS 4, new member John Truran thought he might be interested in serving as newsletter editor. However, since that time he has learned that departmental constraints prevent him from becoming editor at this time.

Is there anyone else interested in assuming leadership for this study group?
Please let me know!

The requirements for this job are to write and distribute a newsletter a few times a year. In order to obtain material for the newsletter, you need to search current journals in education, statistics, and psychology as well as conference proceedings and bulletins, send for copies of papers, and exhort members to send you copies of their current work. This is a wonderful opportunity for someone to take on a leadership role in the statistics education research community. In anticipation of leaving this position, I have already agreed to serve as co-editor for a new newsletter for the American Statistical Association's Section on Statistics Education and will continue to abstract and summarize articles for the electronic *Journal of Statistics Education*.

Research Roundtable for 1996

The International Statistics Institute (ISI) will sponsor a four-day roundtable conference following the ICME meeting in July, 1996. The conference will be held in Granada, Spain, and will focus on Research on the Role of Technology in Teaching and Learning statistics. Carmen Batanero and Juan Godino, of the University of Granada, are serving as local organizers, and Joan Garfield is program chair. A program committee is currently developing guidelines for submission of proposals. Papers will be published in an edited book following the conference. A call for paper proposals will be issued in December, 1994.

Assessment and Statistics Education

A working roundtable conference on assessment and statistics education, organized by **Iddo Gal** and **Joan Garfield**, funded by the National Science Foundation, was held at the University of Pennsylvania in September, 1994. This two-day conference included 36 individuals representing the areas of mathematics education, statistics, educational assessment, and curriculum development. Teachers of statistics at the elementary, secondary, and college level were also included, as were directors of major statistics curriculum projects at all educational levels.

Five working groups met to discuss issues related to assessment of student learning of data analysis and probability, issues involved in large scale assessment, training of teachers to use alternative assessment, and the role of technology in assessing student learning. Various publications and reports will be forthcoming based on discussions and working group reports. Iddo and Joan are also editing a handbook on Assessment and Statistics Education which includes chapters on many of these topics as well as examples of good assessment practice. For more information, contact Iddo or Joan (see address list attached).

Research Papers at ICOTS 4

This year there were more research papers presented at ICOTS than in any of the other program areas. Twenty-three papers, by authors from 11 different countries, were presented in five sessions of invited and contributed papers in the Program: Research on Teaching and Learning Statistics and Probabilistic Concepts. There were additional research papers presented in other some of the other sessions.

Because of the growing interest in research in this area, plans have been made for two collections of research papers presented at ICOTS. The first will be an unedited, collection of full-length papers, copied, bound, and distributed at cost. Details on how to purchase this collection will be included in the next newsletter. The second collection will be an edited set of papers published by a commercial publishing company. **Brian Greer** is heading this effort.

Because of the large amount of material in this newsletter, I will print abstracts of ICOTS papers in the next newsletter, to be distributed in January. See previous newsletters for lists of some of the research papers presented.

PUBLICATIONS BY MEMBERS

Shaughnessy, J. Michael. (1993). Connecting Research to Teaching: Probability and Statistics. *The Mathematics Teacher*, Vol. 86, No. 3, 244-248.

This article summarizes research on teaching and learning probability and statistics and provides practical suggestions for teachers based on implications of the research. Sections focus on adolescents' conceptions of uncertainty (including Green's assessments of students' understanding of probability), Judgmental Heuristics (summarizing work by psychologists Kahneman, Slovic, and Tversky), the Outcome approach (defined by Konold), and attempts to change probabilistic beliefs and conceptions (including studies by Shaughnessy, delMas and Bart, and Konold). The article concludes with a section entitled "Is there a 'right' way to teach probability?" where the author offers three suggestions.

Batanero, M.C. Estepa, A. Godino, J.D., and Green, D.R. (in press) Judgments of Association on Contingency Tables: An Empirical Study of Students' Intuitive Strategies and Preconceptions. *Journal for Research in Mathematics Education*.

Abstract: In this paper we describe an experimental study of students' strategies in assessing association in contingency tables. We compare our results with previous research on 2X2 and 3X3 tables. We also present an original classification of students' strategies from a mathematical point of view, which allows us to determine concepts and theorems in action. Correspondence analysis is used to show the effect of task variables of the items on students' strategies and, finally, a qualitative analysis of strategies is presented in order to identify students' conceptions concerning statistical association.

Batanero, M.C. and Godino, J.D. (1994) A methodology to study the students' interaction with the computer. *Hiroshima Journal of Mathematics Education*. Vol. 2, 15-24.

Abstract: The students' interaction with the computer poses new problems of research in Mathematics Education and also offers new methodological resources. One of these is the possibility to employ the recording of the students' interaction with the computer as a technique to gather data on the processes that the students follow to solve the proposed tasks. In this work, different example of the use of these records in research on Mathematics Education are analyzed, showing the diversity of the obtainable data and the dependence of the same with respect to the "roles" carried out by the computer and the student. We end by presenting the method of analysis of these records that we have used in our own research, that combines qualitative and quantitative elements and can be easily adapted to other research.

Batanero, C., Godino, J.D., Vallecillos, A., Green, D.R., and Holmes, P. (1994) Errors and difficulties in understanding elementary statistical concepts. *International Journal of Mathematics Education, Science, and Technology*. Vol. 25, No. 4, 527-547.

Abstract: This paper presents a survey of the reported research about students' errors, difficulties and conceptions concerning elementary statistical concepts. Information related to the learning processes is essential to curricular design in this branch of mathematics. In particular, the identification of errors and difficulties which students display is needed in order to organize statistical training programmes and to prepare didactical situation which allow the students to overcome their cognitive obstacles. This paper does not attempt to report on probability concepts, an area which has received much attention, but concentrates on other statistical concepts, which have received little attention hitherto.

Lesser, Lawrence. (1994) *The Role of Counterintuitive Examples in Statistics Education*. Doctoral Dissertation, University of Texas at Austin.

The purpose of this study was to develop a theoretical model for the use of counterintuitive examples in the introductory non-calculus based statistics course at the college level. The study critiqued and then reconciled "Traditional" and "Alternative" perspectives. The Traditional perspective attempts to minimize possible confusion and frustration by avoiding such examples while the Alternative perspective uses them to motivate and engage students in critical thinking, active learning, metacognition, communication of their ideas, real-world problem solving and exploration, reflection on the nature and process of statistics, and other types of activities encouraged by current reform movements. The study delineated specific criteria and conditions for selecting and using counterintuitive examples to achieve numerous cognitive and affective objectives. Problematic issues addressed include difficult in constructing assessment instruments and a multiplicity of terminologies and typologies.

Garfield, Joan (1994) Research Report: A New Working Group on Research in Statistical Education. *Teaching Statistics*, Vol. 16, No. 2, 60-61.

This report describes the formation and plan of work for a new working group organized by the National Center for Research in Mathematical Sciences Education. Reports are summarized for subgroups whose discussions focused on the topics of Statistical Content for School Mathematics, Learning Statistics, Teaching Statistics, and Assessment of Statistical Learning.

Here is the Table of Contents and list of abstracts for Volume 2 of the electronic Journal of Statistics Education

Volume 2, Number 1 (July 1994)

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Regression"

Margaret Mackisack, "What Is the Use of Experiments Conducted by Statistics Students?" (50K)

ABSTRACT: This paper describes a situation where systematic use is being made of data collected by students as part of a class project and advocates the wider use of such projects. The immediate learning benefits to the students involved in carrying out projects have been widely canvassed recently, and this paper reports some experiences with a particular type of project. Advantage is also taken of these projects as a source of material for problem-based learning in applied statistics at all levels, and some specific reasons for the potential importance of such material are advanced.

Joan B. Garfield, "Beyond Testing and Grading: Using Assessment to Improve Student Learning" (35K)

ABSTRACT: Changes in educational assessment are currently being called for, both within the fields of measurement and evaluation as well as in disciplines such as statistics. Traditional forms of assessment of statistical knowledge provide a method for assigning numerical scores to determine 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 (e.g., Cobb 1992), 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.

Mark Ferris and Don Hardaway, "Teacher 2000: A New Tool for Multimedia Teaching of Introductory Business Statistics" (19K)

ABSTRACT: This article explores the use of multimedia in an introductory business statistics course through a new computer vehicle called Teacher 2000. Traditional educational processes are reviewed and reinterpreted in light of technological advances in computing, video, and software. These advances provide new opportunities to educators. To highlight the potential of a multimedia approach in statistics, an example is developed that explains how professors and students might interact and use this new technology. Software developed by one of the authors is used to showcase multimedia potential.

Stephen Eckert, "Teaching Hypothesis Testing With Playing Cards: A Demonstration" (8K)

ABSTRACT: In elementary statistics courses, students often have difficulty understanding the principles of hypothesis testing. This paper discusses a simple yet effective demonstration using playing cards. The demonstration has been very useful in teaching basic concepts of hypothesis testing, including formulation of a null hypothesis, using data as evidence against the null hypothesis, and determining the strength of the evidence against the null hypothesis, i.e., the p-value.

Nicholas P. Maxwell, "A Coin-Flipping Exercise to Introduce the P-Value" (12K)

ABSTRACT: The p-value can be introduced with a coin flipping exercise. The instructor flips a coin ten times and has a student call each flip. The students record their thoughts after each flip. The instructor reports that the caller calls every flip correctly. In this exercise students intuitively reject a null hypothesis because the p-value is too small. Students are reassured to learn from this concrete example that they intuitively followed the logic of statistical inference before they studied statistics.

INSTRUCTIONS FOR RETRIEVING FILES: To retrieve the items listed in the table of contents, send e-mail to archive@jse.stat.ncsu.edu with the one-line message: send filename
The "filename" is replaced by the name of the file you wish to receive, as listed in the table of contents. (The filename is of the form jse/v2n1/name) You can type more than one send command in your mail message, as long as each command is on its own line. For information regarding other access methods for JSE, send the message: send access.methods

Other Publications of Interest

NCRMSE Research Review: The Teaching and Learning of Mathematics, Spring 1994, Vol. 3 No. 2.

This publication from the National Center for Research in Mathematical Sciences Education at the University of Wisconsin, Madison, focuses on Statistics and School Mathematics. The lead article describes the work of the newly formed working group on statistics, headed by **Susanne Lajoie**. A second article reviews two research studies sponsored by NCRMSE. The first, "Statistics in Middle School: An Exploration of Students' Informal Knowledge" was completed by **Victoria Jacobs** and **Susanne Lajoie**. The second, "How do Group Composition and Gender Influence the Learning of Statistics?" was complete by **Susanne Lajoie** and **Nancy Lavigne**.

Teaching Statistics at its Best. (1994) Edited by David Green. Teaching Statistics Trust, University of Sheffield, England.

This is a collection of the "best" articles from Volumes 6-14 of the journal *Teaching Statistics*. A previous collection of "the best" articles from Volumes 1-5 was published earlier, edited by Peter Holmes. Forty-eight articles are grouped into 7 sections: Statistics in the Classroom, Students' Understanding, Teaching Particular Topics, Practical and Project Work, Using Computers, Statistics in Other Subjects and at Work, and Miscellany (which includes articles on sport judgments, fishy statistics, and statistics of safe travel). This collection is complete with "Footies" cartoons by Andrejs Dunkels.

Teaching and Using Statistics. (1994) Edited by Neville Davies, Royal Statistical Society, London. This is a collection of 16 papers from four workshops organized by the Royal Statistical Society. The papers are grouped into two sections: Using Statistics and Teaching Statistics.

Beins, Bernard C. (1993) Writing Assignments in Statistics Classes Encourage Students to Learn Interpretation. *Teaching of Psychology*. Vol. 20, No. 3, 161-164.

Abstract: Students in four statistics classes received different amounts of guidance and instruction in interpretive skills. Students who wrote press releases free of statistical jargon acquired better computational and interpretive skills than did students in a traditional class. Emphasis on interpretation was not associated with greater conceptual knowledge. Writing assignments appear to focus students' attention on the context and rationale for the statistics.

Slooman, Steven. (1994) When explanations compete: the role of explanatory coherence on judgments of likelihood. *Cognition*, 52, 1-21.

Abstract:

The likelihood of a statement is often derived by generating an explanation for it and evaluating the plausibility of the explanation. The explanation discounting principle states that people tend to focus on a single explanation; alternative explanations compete with the effect of reducing one another's credibility. Two experiments tested the hypothesis that this principle applies to inductive inference concerning the properties of everyday categories. In both experiments, subjects estimated the probability of a series of statements (conclusions) and the conditional probabilities of those conclusions given other related facts. The results showed that when the fact and the conclusion had the same explanation the fact increased people's willingness to believe the conclusion, but when they had different explanations the fact decreased the conclusion's credibility. This decrease is attributed to explanation discounting; the explanation of the fact had the effect of reducing the plausibility of the explanation for the conclusion.

Citations in JRME

The July, 1994 issue of the *Journal for Research in Mathematics Education* contains a list of research on mathematics education reported in 1993. Each citation includes a one-sentence summary and grade level of students in the study. Listed below are the citations related to statistics:

Journal Articles

Huberty, Carl. J.; Dresden, Janna; and Bak, Byung-gee. (Summer 1993). Relations among dimensions of statistical knowledge. *Educational and Psychological Measurement*, 53, 523-532.

Students should be tested in more than one domain and should develop conceptual understanding and skills in computation. (College)

O'Dell, Jerry W.; and von Kluge, Sylvia. (April 1993). Mathematical difficulties in statistics. *Psychological Reports*, 72, 495-498.

A general decline in mathematical ability was found, especially with items involving mathematical reasoning and algebra. (College)

Ross, John K.A.; and Cousins, J. Bradley. (March 1993) Patterns of student growth in reasoning about correlational problems. *Journal of Educational Psychology*, 85, 49-65.

Correlational reasoning skills increased with age and could be improved with instruction. (Grades 4 - adult)

Dissertations

Joram, Elana. (November 1993). What people really know about probability and statistics: The effects of problem characteristics on beliefs. (University of Toronto, 1990). *DAI*, 45A, 1732. (DANN78740)

Three sets of experiences explored the effects of different types of beliefs on responses. (Adults)

Taylor, Sharon Elise. (November 1993) An exploratory study of the statistical competencies of certain future elementary and middle school teachers. (Texas A&M University, 1993). *DAI*, 54A, 1715-1716. (DA9328809)

Students were lacking in statistical competencies and held misconceptions regarding statistical topics. (Elementary and middle school preservice teachers)

IASE

The International Association for Statistical Education (IASE) was formed in 1991 as a new section of the International Statistical Institute (ISI). David Moore is currently the president, and Anne Hawkins is the President-elect. There is an electronic archive of IASE information, available through the Journal of Statistics Education Information service, containing names and addresses of IASE members, updated information on IASE publications (such as proceedings of ISI roundtables on Statistics Education as well as all ICOTS proceedings) meetings, IASE application forms, and more.

For information on this archive, send the following e-mail message (exactly as given):

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IASE members receive free subscriptions to three ISI publications (including *International Statistical Review*) as well as discounts on journals including *Teaching Statistics*.

The first IASE meeting was held in Perugia, Italy in August 1993. Proceedings of that first meeting are now available for the cost of postage. For information send an email message to statli@ipguniv.unipg.it.

IASE will sponsor sessions at the next ISI meeting to be held August 21-29 in Beijing, China and will sponsor the roundtable conference in Granada in July, 1996.

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