

NEWSLETTER FOR THE INTERNATIONAL STUDY GROUP ON  
LEARNING PROBABILITY AND STATISTICS CONCEPTS

Volume 2, Number 3

October 1989

Joan Garfield, Secretary and Editor  
340 Appleby Hall  
128 Pleasant Street S.E.  
Minneapolis, MN 55455  
USA

Notes and Comments

A new academic year has begun, and because it has already been so busy this newsletter was delayed in being produced.

We have a large group of new members and many interesting projects to report on. But first, please note the change in my address as listed above. Our college has moved into a newly renovated building, resulting in a change of address. I found out that some people did not receive the last issue of this newsletter (May, 1989). If you did not receive it please let me know and I'll mail a copy to you.

New Members

Our study group has grown tremendously: we have added 15 new members. I'd like to welcome the following new members to our study group:

J. H. Maindonald  
Applied Mathematics Division  
D.S.I.R.  
Private Bag  
Auckland, New Zealand

Mr. Maindonald has published several articles on statistical education in New Zealand mathematics and statistics magazines.

Another group of new members are involved in a newly funded National Science Foundation (NSF) Grant, headed by Cliff Konold at the University of Massachusetts, Amherst. These people are involved in teaching statistics at the high school or college level:

Wynn Abranovic  
School of Management  
University of Massachusetts  
Amherst, MA 01003  
USA

George Cobb  
Department of Mathematics  
Mount Holyoke College  
South Hadley, MA 01075  
USA

\* \* \* \* \*

The production and mailing of this newsletter are supported by the Division of Science, Business, and Mathematics of the General College, University of Minnesota.

NEWS3.1

New Members, continued:

Hy Edelstein  
15 Ahwaga Avenue  
Northampton, MA 01060  
USA

Al Gagnon  
452 Prospect Street  
Chicopee, MA 01020  
USA

Nina Koch  
168 Village Park Apartments  
Amherst, MA 01002  
USA

Sandy Pollatsek  
Department of Psychology  
University of Massachusetts  
Amherst, MA 01003  
USA

Mike Sutherland  
Statistical Consulting Center  
Graduate Research Center  
University of Massachusetts  
Amherst, MA 01003  
USA

Arnie Well  
Department of Psychology  
University of Massachusetts  
Amherst, MA 01003  
USA

The NSF project, tentatively called "Chance Plus," will develop software and curriculum over a three-year period to help students develop statistical thinking. Materials will be targeted for students at the precollege or college level. In addition, a research component of the project will investigate through clinical interviews with students, the effectiveness of the materials in facilitating student learning. A statistics concepts instrument will be developed and used to evaluate student learning.

-----  
A second group of new members are involved in a Statistics and Data Modeling Working group (SDM), headed by Susan Jo Russell at Technical Education Research Centers in Cambridge, Massachusetts. This group is a part of a larger set of working groups whose charge is to describe how new technologies should be developed and exploited in order to reform mathematics education. The SDM group is looking specifically at how technology should contribute to statistical education. The group already produced a draft report which will be modified and then become part of a larger report from all working groups. (Jim Kaput and Tom Romberg are coordinating the working groups.) New study group members from the SDM working group are:

Rebecca Corwin  
Technical Education Research Centers  
1696 Massachusetts Avenue  
Cambridge, MA 02138  
USA

Susan Jo Russell  
Technical Education Research Centers  
1696 Massachusetts Avenue  
Cambridge, MA 02138  
USA

Jim Swift  
651 Egret Circle  
Apartment D 503  
Delray Beach, FL 33444  
USA

(Actually, Jim is a returning member to the study group.)

Several members of the SDM working group are involved in related NSF grants. Andee Rubin heads the "Reasoning Under Uncertainty Project" out of BBN in Cambridge, which was briefly mentioned in last September's newsletter. Susan Jo Russell heads the "Used Numbers' Project", which is developing curriculum modules for grades K-6 which focus on data analysis. The modules guide teachers and students as they grapple with "messy" data sets which arise from real-life problems. Students use a variety of tools, including data bases and graphing software to organize and analyze their data.

Susan Jo is also involved in another NSF-Funded project: "Constructing Concepts of Average." This project examines how people aged 9 through adult make sense of data distributions, examine the features of these distribution, and use measures of center to describe and compare data sets. Later on the project will design and test prototype software aimed at helping students to develop and compare data sets. Later on the project will design and test prototype software aimed at helping students to develop a solid understanding of average.

Chris Hancock is working with Jim Kaput (at Southeastern Massachusetts University) on a project called "Hands on Data: Direct Manipulation Environments for Data Organization and Analysis." This project aims to sketch a developmental model of skills and concepts needed in order to work with and understand data, to develop a set of examples of the next generation of data tools, and to develop and assess teaching strategies which use these tools. They have already developed an exciting software program called "Tabletop" which is an interactive environment for creating, organizing, exploring and analyzing attribute data.

-----  
Two other members were added to the study group at the annual meeting of PME-NA in New Brunswick, New Jersey last month. They are:

Karen Rothschild  
Literacy Res. Center  
University of Pennsylvania  
3700 Walnut Street  
Philadelphia, PA 19104-6216  
USA

George Bright  
Department of Curriculum and Instruction  
University of Houston  
Houston, Texas 77204-5872  
USA

-----  
Correspondence from Members

Anne Hawkins suggests that members be listed with their e-mail addresses (if they have one). If members send me these, I'll print out a new list of members and e-mail addresses. My address is PQA6031CA.ACSS.UMN.EDU

Judith Jackson notified me of her change in address, and added that she would be interested in hearing from members interested in her research area: the understanding of probabilistic concepts among students ages 16-19. Her new address is:

Boothroyd  
Widdop Rd  
Heptonstall  
Hebden Bride  
West Yorkshire HX7 7AT  
UK

Flavia Joliffe has been working for several years on the assessment of statistic concepts and will be giving an invited paper on this topic at ICOTS 3. The paper will be part of a larger session on assessment of performance in probability and statistics. She provides some comments on the Popular Statistics series published by Dekker, which was mentioned in the May newsletter. She notes that the books are quite good for bedtime reading by statisticians. Here are her comments:

"S. Kotz and D.F. Stroup. Educated guessing: how to cope in an uncertain world. (1983) No.2.

A book for the layman. Covers probability, information theory, decision making. Interesting examples, many real-life USA. Covers paradoxes. Of some interest for specialists.

M. Hollander and F. Proschan. The statistical exorcist: dispelling statistics anxiety. (1984) No. 3.

A number of vignettes describing a situation and how to examine/solve it. Covers reliability, sampling, estimating probabilities, and more. No algebra, but explains concepts fairly well. Slightly annoying in its triviality, but might just stimulate interest in statistics.

R.J. Brook, G.C Arnold, T.H. Hassard, R.M. Pringle (eds.) The fascination of statistics. (1986) No. 4.

Thirty separate chapters by slightly more contributors, mostly from New Zealand. These contributions are grouped into sections of probability, condensing complex data, hypothesis testing, estimation, experimental, prediction, and modeling (sic), with a short run-in to each section. Authors were asked to write in a readable fashion for non-experts. Inevitably there is variation, both in the interest level and in the amount of basic knowledge needed to understand the material. Possibly the least appealing section, though one of the longest, is on condensing complex data.

A useful background reader and source book of ideas, but for the teacher more than the student.

---

#### Articles of Interest

Susan Jo Russell gave me a copy of "What's Typical" by Janice R. Mokros and Susan Jo, published in Hands On!, Spring 1989. This article describes the research conducted as part of the NSF projects described earlier in this newsletter: "Constructing Concepts of Average" and "Used Numbers Project." Results of interviews exploring concepts of central tendency are described and summarized.

While meeting with the Chance Plus Team, I obtained copies of two articles by project members. I have reprinted the abstracts of each article below.

"Understanding Conditional Probabilities" by Pollatsek, Well, Konold, Hardiman, and Cobb; published in Organizational Behavior and Human Decision Process, 1987.

Abstract:

In two experiments, subjects were asked to judge whether the probability of A given B was greater than, equal to, or less than the probability of B given A for various events A and B. In addition, in Experiment 2, subjects were asked to estimate the conditional probabilities and also to calculate conditional probabilities from contingency data. For problems in which one conditional probability was objectively larger than the other, performance ranged from about 25-80% correct, depending on the nature of A and B. Changes in the wording of problems also affected performance, although less dramatically. Patterns of responses consistent with the existence of a causal bias in judging probabilities were observed with one of the wordings used but not with the other. Several features of the data suggest that a major source of error was the confusion between conditional and joint probabilities.

Understanding the Effects of Sample Size on the Variability of the Mean, by Well, Pollatsek and Boyce, to be published in Organizational Behavior and Human Decision Making.

Abstract:

In the first three experiments, we attempted to learn more about subjects' understanding of the importance of sample size by systematically changing aspects of the problems we gave to subjects. In a fourth study, understanding of the effects of sample size was tested as subjects went through a computer-assisted training procedure that dealt with random sampling and the sampling distribution of the mean. Subjects used sample size information more appropriately for problems that were stated in terms of the accuracy of the sample average or the center of the sampling distribution than for problems stated in terms of the tails of the sampling distribution. Apparently, people understand that the means of larger samples are more likely to resemble the population mean but not the implications of this fact for the variability of the mean. The fourth experiment showed that although instruction about the sampling distribution of the mean led to better understanding of the effects of sample size, subjects were still unable to make correct inferences about the variability of the mean. The appreciation that people have for some aspects of the law of large numbers does not seem to result from an in-depth understanding of the relation between sample size and variability.

-----  
I recently received a copy of the American Statistical Association 1988 Proceedings of the Section on Statistical Education. There are several papers of interest organized according to topics. The topics of particular interest are on enhancing teaching with technology, statistics in the public schools, using innovative examples to enhance the teaching of statistics, and aspects of teaching and evaluating undergraduate statistics courses. There are multiple papers listed for each of these topics.

Last month at PME-NA I chaired a symposium on "Alternative Conceptions of Probability." Three papers were presented, followed by reactions of two discussants.

The papers were:

"An Outbreak of Belief in Independence" by Cliff Konold

"Reasoning about Chance Events: Changing Students Conceptions of Probability" by myself and Bob delMas

"Probability and Curriculum" by Andrew Ahlgren.

The discussants were Jim Landwehr (of the ASA-NCTM Quantitative Literacy Project) and Michael Shaughnessy. All papers and discussants' comments will be included in Part II of the conference proceedings - to be published this month. I would be happy to send copies of the set to anyone interested.

The current issue of Chance magazine includes a book review by Stephen Fienberg of News and Numbers by Victor Cohn, Iowa State University Press, 1989.

This book purportedly "offers a guided tour to the key ideas in statistics people should understand if they are to deal with scientific reports or just everyday news involving numbers. And he really does it without formulas and the usual tables and displays." Fienberg found it a delightful and well-written book.

While at PME Mike Shaughnessy shared a new book with me; Risks, Odds and Likelihood in Everyday Life by Siskin and Staller, Crown Publishers. (I think he told me that a student of his found it and shared it with him.) The book is a collection of probabilities estimated for a variety of real-world events of interest. It would be a good source of topics to motivate student interest and discussion.

This morning's paper mentions a similar book: Probabilities in Everyday Life by McGervey, Ivy Books.

That's all the news for now. Be sure to send me copies of any papers you present or publish, and information on your research activities.

The next newsletter will come out in January, 1990.