

*October 1991*

International Study Group for Research on  
Learning Probability and Statistics

Newsletter  
Volume 4, Number 3

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

E Mail: PQA6031@CA.ACS.UMN.EDU  
or PQA6031@UMINACCA.BITNET  
Fax: (612) 626-7848

Notes and Comments

I've received some positive feedback on the May issue on assessment, as well as some information sent in by members. Thanks go to Peter Holmes at the Centre for Statistical Education in Sheffield, who sent me some copies of guidelines for teachers to use in assessing students' statistics projects. Thanks also to Flavia Jolliffe who sent some additional references on assessment of student projects. If you have any suggestions for another theme issue for the coming year, I would like to hear them.

Leslie V. Glickman - A Tribute

Anne Hawkins & Flavia Jolliffe have sent me the following:

Readers will be saddened to hear that Leslie Glickman, a member of this group, died suddenly on July 28th, just two days after we three had submitted the finished manuscript of "Teaching Statistical Concepts" to our publishers.

After lecturing at the City of London Polytechnic for 15 years, Leslie had moved to a similar post at Brighton Polytechnic in January 1990, and was soon making a valued contribution to his new department. We first came to know Leslie in 1984 through the UK working group on probabilistic concepts and intuitions in which he played an active part. When this group stopped meeting, we three continued to work together and later, as a result, decided that we would write a book.

As his co-authors, we will remember Leslie as an unassuming man, meticulous in his work, generous in his appreciation of others' efforts, and sensitive and economical in his criticisms. He was more than willing to consider and try out, as well as to originate, new ideas. He was good-natured and fun to work with, and our meetings with him were always congenial affairs.

We shall miss Leslie both as a colleague and as a friend, and it is undoubtedly the case that the area of statistical education will also feel the loss. He still had so much of value to contribute. With the manuscript completed, he was full of plans for future projects: writing other materials on probability researching and developing a new idea in statistical graphics, and further work on statistical concepts and intuitions with us.

Leslie's enthusiasm for probabilistic understanding and the work of the early probabilists is demonstrated in the articles which he wrote for "Teaching Statistics". His desire to make statistics accessible to a wider audience was obvious from the quality of his writing and the concern that he had for his students. His last e-mail message to us, which ironically we did not receive until after we had heard of his death, contained a fitting epitaph: "The challenge for us is how to balance 'statistical practice' and 'statistical theory' in our presentation of the discipline of statistics."

From the eulogies given at his funeral it is clear that Leslie was also a greatly respected member of the Jewish community. He leaves a wife and an 18-year old daughter, and "Teaching Statistical Concepts" will be dedicated to them in his memory.

New Members

We welcome the following new members to the Study group:

Mrs. Julianna Szendrei  
Rakoczi uca 23, VI.20  
H-1191 Budapest  
HUNGARY

CS

Ljubiana is a leader in mathematics education in Hungary, whom Claude Gaulin introduced to the study group.

David Cassell  
"Coromande"  
26 Inwood Road  
Cringeford, Norwich  
NR4 6AA  
GREAT BRITAIN

David is engaged in a master's thesis on statistical understanding of 11-18-year olds. He has been setting up conceptual maps of statistics content and testing them for validity.

Ann Watkins (awatkins@vax/sun.edu)  
Department of Mathematics  
California State University, Northridge  
Northridge, CA 91330

Ann was in the study group several years ago, and thought the group had gradually disappeared. We welcome her back.

#### Recent Papers Seen in by Members:

**"Factors affecting probabilistic judgments in children and adolescents,"** by Efraim Fischbein, Maria Samad Nello, and Mario Sciofis Marino, to be published in *Educational Studies in Mathematics*.

**Abstract:**  
Six hundred and eighteen pupils, enrolled in elementary and junior-high-school classes (Pisa, Italy) were asked to solve a number of probability problems. The main aim of the investigation has been to obtain a better understanding of the origins and nature of some probabilistic intuitive obstacles.

A linguistic factor has been identified: It appears that for many children, the concept of "certain events" is more difficult to comprehend than that of "possible events". It has been found that even adolescents have difficulties in detaching the mathematical structure from the practical embodiment of the stochastic situation. In problems where numbers intervene, the magnitude of the numbers considered has an effect on their probability: bigger numbers are more likely to be obtained than smaller ones. Many children seem to be unable to solve probability questions, because of their inability to consider the rational structure of a hazard situation: "chance" is, by itself, an equalizing factor of probabilities. Positive intuitive capacities have also been identified: some problems referring to compound events are better solved when addressed in a general form than when addressed in a particular way.

**"Data Analysis as a Tool and Object of the Didactics of Mathematics"** by M.C. Batanero, J.D. Godino, and M.A. Vallecillos, presented at V-TME conference, Italy, June 1991.

**Abstract:**  
The aim of this work is to attract the attention of the researchers of didactics of mathematics towards two nuclei of interest:

1. The comparison of the present role of data analysis in research as regards to its possibilities. From this comparison the necessity of a change in attitudes towards statistics and of a greater

participation of the researchers in the processes of research design and data analysis is deduced, as a means of improving the overall quality of research.

2. The design of formation plans in statistical reasoning and data analysis for doctoral and master students based on a previous study of difficulties, biases and obstacles concerning this conceptual field among the researchers.

To summarize, in this work we want to underline the fact that the use of the statistical tool in experimental and social sciences, in general, and in the didactics of mathematics in particular is converted, in this field of knowledge, in a specific object of the study, due to the mathematical nature of the concepts and to the didactic processes implied.

**"Combinatorics and Its Teaching: Analysis of Teachers' Responses to a Survey"** by M.C. Batanero, V. Navarro-Pelayo, and J.D. Godino, paper presented at the XV PME Conference, Italy, 1991.

**Abstract:**  
In this work teachers' responses to a survey about combinatorics and its teaching are analyzed. Participants were 22 in-service teachers and 14 trainee teachers who respond to questions concerning actual teaching methodology, suggestions for change, and student's difficulties and interest in combinatorics.

The answers show that this subject is actually exposed alone, with few connections to other topics, except probability and Newton's formula. Teaching practices are mainly based on the use of the textbook, reinforced with solving complementary problems. Very little use is being done of didactic resources like games and manipulative materials.

Out of eight topics in the Spanish mathematical curriculum for this grade (15 year old pupils), Combinatorics is, in the opinion of those teachers, the first subject in order of difficulty and the third for the interest that pupils show in it. The use of combinatorics in other mathematical subjects and in other sciences is not sufficiently appreciated, especially in the prospective teachers, who recognized that their training in this subject has been insufficient.

Finally, we present information about the following aspects: content being taught, time spend for it and its planning, types of problems proposed to the students and their relative difficulty in opinion of those teachers and suggested changes for teaching of the subject.

The result of the analysis that we exposed constitutes and approximation to the teacher's conceptions of the subject and also allows us to infer the effect of teaching experience on the same.

**"Randomness is well-enough understood to be understood"** by Alexander Pollasek and Clifford Konold, to be published in *Journal of Behavioral Decision Making*. This is a response to a paper by Aylon, Hunt and Wright: "Psychological Conceptions of Randomness", published in the same Journal in 1989. The Pollasek and Konold paper disagrees on some key issues relating to research on misconceptions in statistics.

#### Project STARC

Two of our members, Ildo Gal and Karen Rothschild, have just completed the first year of their NSF-funded project, STARC: Learning and Teaching Statistical and Quantitative Concepts and Skills. The project is conducted by the Literacy Research Center at the University of Pennsylvania, and has two main goals: studying acquisition of statistical and mathematical concepts and skills by children, and development of training materials for teachers.

Project STAR-C is designed to address the following questions: 1) What strategies do children of different ages use to reason about data, e.g., in visual displays of in tables? 2) What meanings, correct or incorrect, do children attach to commonly used statistical terms, such as "average" or "sample"? 3) How does informally acquired knowledge of certain everyday situations and events affect statistical reasoning? For example, does knowledge about sports contribute to the development of statistical understanding? 4) What mathematical skills are necessary to learn statistical concepts and solve statistical problems? and 5) What is the scope of teachers' statistical knowledge?

To address these issues, individual interviews, class discussions and group assessments are being conducted with children in grades 3, 6, 9, and 12, drawn from urban and suburban schools in the Philadelphia region. School teachers are also being interviewed about their knowledge in statistics.

Research findings are being used to guide the Project's staff in development of video workshops and companion training materials on teaching and learning statistics, to be used in staff development programs. Findings regarding developmental trends in acquisition of statistical and mathematical concepts and skill are used to inform teachers and curriculum developers about contents, sequencing and continuation of curricular topics in statistics and mathematics.

Other papers of interest:

**"Development of Judgmental Heuristics and Logical Reasoning: Training Counteracts the Representativeness Heuristics,"** by Franca Agnoli in *Cognitive Development*, 1991.

Abstract:

The foundations of adult reasoning about probabilities are found in children's reasoning about frequencies. Adult probabilistic reasoning is impaired by heuristics based on typicality or representativeness, but development of these heuristics in childhood has not been studied. Previously, typicality has only been shown to enhance children's reasoning. In experiment 1, however, children in Grades 3, 5, and 7 overwhelmingly judged subclasses to be larger than inclusive classes when the subclasses were typical of a given scenario. In Experiment 2 children explained these incorrect responses by reference to the frequency of the subclass in the context or by reference to the method by which the subclass is generated, in accordance with the representativeness heuristic. The same children explained correct responses by describing the inclusion relationship. Even when asked to select the most frequent class from three alternatives including typical and atypical subclasses and an inclusive class, children frequently selected the incorrect typical subclass. Experiments 3 and 4 investigated whether children could be taught to reason logically and to suppress the use of the representativeness heuristic. Both immediately, and 10 days after a brief training, children responded correctly more often. Furthermore, children's explanations of their answers when they were untrained emphasized the typicality of the representative subclass, but after training they emphasized logical relationships. The results are attributed to a representativeness heuristic that is acquired early, and overcome through experience and training in logical thinking.

**"When a Coincidence is Suspicious: The Role of Mental Simulation"** by Dale T. Miller, William Turnbull, and Cathy McFarland. *Journal of Personality and Social Psychology*, 1989.

Abstract:

Five studies examined Kahneman and Miller's (1986) hypothesis that events become more "normal" and generate weaker reactions the more strongly they evoke representations of similar events. In each study, Ss were presented with 1 of 2 versions of a scenario that described the

occurrence of an improbable event. The scenarios equated the a priori probability of the target event, but manipulated the ease of mentally simulating the event by varying the absolute number of similar events in the population. Depending on the study, Ss were asked to indicate whether they thought the event was due to chance as opposed to (a) an illegitimate action on the part of the benefited protagonist, or (b) the intentional or unintentional misrepresentation of the probability of the event. As predicted, the fewer ways the events could have occurred by chance, the less inclined Ss were to assume that the low-probability event occurred by chance. The implications of these findings for impression-management dynamics and stereotype revision are discussed.

**"The Conjunction Fallacy?"** by George Wolford, Holly A. Taylor, and J. Robert Beck. *Memory and Cognition*, 1990.

Abstract:

Tversky and Kahneman (1983) showed that when subjects are asked to rate the likelihood of several alternatives, including single and joint events, they often make a "conjunction fallacy" that is, they rate the conjunction of two events as being more likely than one of the constituent events. This, they claim, is a fallacy, since the conjunction of two events can never be more probable than either of the component events. In addition, they found that prior training in probability theory does not decrease the likelihood of making this fallacy. We argue that in some contexts, an alternative that contains the conjunction of two events can be more probable than an alternative that contains only one of the conjunction's constituent events. We carried out four experiments in which we manipulated this context. The frequency of making a conjunction fallacy was affected by the manipulation of context. Furthermore, when the context was clearly specific, prior to training in statistics influenced the ratings.

**"Commentary on Wolford, Taylor and Beck: The Conjunction Fallacy?"** by Maya Bar-Hillel. *Memory & Cognition*, 1991.

Abstract:

Although  $P(A \& B | X)$  can never exceed  $P(A|X)$  (the conjunction rule), it is possible for  $P(X|A \& B)$  to exceed  $P(X|A)$ . Hence, people who rank  $A \& B$  as more probable than  $A$  are not necessarily violating any normative rule if the ranking is done in terms of the probability of these events to yield an event  $X$ . Wolford, Taylor, and Beck (1990) have argued that this indeed is what happens in some problems (e.g., Tversky & Kahneman's (1983) Linda problem). The claim made here is that the Linda problem is hard to reconcile with this interpretation: that there is little if any evidence that subjects utilize this interpretation; and that in any case, representativeness can account for all Linda problem results.

An additional article I have not been able to locate is:

**"Development of Probability Thinking in Children 5 to 12 years old"** by Shulamith Krilber and Hans Kreitler, published in *Cognitive Development*, Volume 1.

If anyone has this article, I'd appreciate a copy. Thanks!

The International Study Group for Research on Learning Probability and Statistics will sponsor a:

Research Roundtable August 10, 1992  
Quebec, Canada

At the request of several members of this study group, a research roundtable, sponsored by the study group, is being organized to be held prior to the ISI Roundtable Conference and ICMIE next August in Quebec. The goal of this research roundtable is enable researchers from around the world to become more familiar with and better understand each other's work and to have ample opportunity to discuss their work. This also allows for opportunities for research studies to be looked at together so that broader implications may be discussed. Instead of a traditional conference where people present their own research followed by limited discussion, the goal of this session is to encourage broad discussion of various research studies including how they relate to the following questions:

1. What are the underlying philosophical and psychological frameworks used to guide research?
2. What do we know about how students understand particular concepts?
3. What have we learned about how to teach statistics?
4. How is the use of technology affecting students understanding of statistics?

There are two main ways to participate in this conference: as someone whose research is discussed and/or as someone who interprets and discusses other's research. Unlike a traditional conference, we will not have people present papers describing their most recent projects. Instead, we will ask people to submit 1 to 3 papers describing various research studies which may have been disseminated previously. These papers will be collected and distributed to members of the roundtable in late spring. People serving as discussants will take a group of related papers and present an interpretation and discussion of these papers, which will be followed by a group discussion of the work. Although the researchers who submit papers to be discussed will not be presenting their own work, it is essential that they be present at the session in order to respond to questions and clarify material as needed.

If you are interested in attending the proposed research roundtable, please indicate which way (or ways) you would like to participate by returning the following portion of this page to me or by sending me a message via e-mail, by December 1, 1991.

If you have suggestions relating to the organization or structuring of this conference I'd like to have them as soon as possible. Obviously, if there is not enough indication of participation, we will not hold the session.

INTERNATIONAL STUDY GROUP RESEARCH ROUNDTABLE  
QUEBEC, CANADA AUGUST 10, 1992

1. I will submit 1-3 papers to be interpreted and discussed.
  2. I will interpret and discuss research papers.
  3. I will submit papers to be discussed and also discuss other papers.
  4. I would like to attend but only wish to participate in the large group discussion.
- \_\_\_\_\_ I plan to also attend the ISI roundtable conference on teaching statistics.

Name: \_\_\_\_\_

PLEASE RETURN BY DECEMBER 1, 1991 TO:

Joan Garfield  
340 Appleby Hall  
128 Pleasant, St. S.E.  
Minneapolis, MN 55455  
USA