NEWSLETTER OF THE INTERNATIONAL STUDY GROUP

FOR RESEARCH ON LEARNING PROBABILITY AND STATISTICS

VOLUME 9, NUMBER 1, JANUARY 1996

CARMEN BATANERO

Secretary and Editor

Departamento de Didáctica de las Matemáticas

Facultad de Educación

UNIVERSIDAD DE GRANADA

batanero@goliat.ugr.es

Table of contents:

1. NEW EDITORS AND NEW E-MAIL ADDRESS

In this year 1996 I am replacing Joan Garfield as the secretary of the study group and editor of the newsletter, assisted by my colleagues J.D.Godino and A.Vallecillos. During the past eight years the group has grown and has been transformed.The information provided by Joan has helped all of us improve our research work. Certainly Joan has set a standard that will be hard for us to reach. As my first task I would like to express our acknowledgment of her remarkable work.

This newsletter is the first to be distributed from the University of Granada.This has required to change the e-mail address alias for the list of members. Please be patient as we experiment with this new list. If there are any corrections or additions to the newsletter, please post them to the entire list of members by using the e-mail address alias: stated_list@goliat.ugr.es

2. NEW MEMBERS

Carlos Carrión Pérez

Centro de Formación del Profesorado

Departamento de Matemáticas; S. Juana de Arco, 1

35004 Las Palmas (Spain)

ccarrion@dma.ulpgc.es

Carlos is a lecturer at the Centro Superior de Formación del Profesorado in the University of Las Palmas de Gran Canaria, Spain. He teaches Mathematics, Statistics and Mathematics Education to future primary teachers. He is preparing a teaching project on Mathematics Education with special emphasis on Statistics and Computers including didactic software for teaching statistics.A preliminary version of this software is going to be presented atICME-8.

Roseinnes Daniel Phahle

Department of Statistics

Vista University, Private Bag X1311

Silverton 0127 ; South Africa

PHHLE-RD@marlin.vista.ac.za

Senior Lecturer in Mathematics at Vista University (South Africa). Interested in Statistics Education for two reasons:(1) I would like to see Statistics become a separate subject in South African schools; and (2) making the teaching of Probability and Statistics accessible and attractive to students such as I am now teaching, that is, students with socio-economic-educational disadvantage. I have no previous research in Probability or Statistics.

Howard Edwards

Dept. of Statistics, Massey University Albany

Private Bag 102904, North Shore MSC; New Zealand

e-mail: H.Edwards@massey.ac.nz

http://fims-www.massey.ac.nz/stats/howard.html

BSc(Hons), MSc(Dist), PhD, Canterbury. Royal Society of New Zealand Young Scientist's Award (1980). Thomas L Saaty prize for the most outstanding applied paper in the American Journal of Mathematical and Management Sciences (1987). Research Interests include the use of Bayesian statistical methods for ranking and selection problems focusing on the use of computer-intensive methods such as Gibbs sampling, and the design of computer software to facilitate the

use of such techniques in practical situations. He is also interested in the use of sequential sampling methods in these and other areas, and in the general area of statistics education.

Regis Gras

Institut Mathematique, Universite de Rennes I

Av. Gal Leclerc; Campus de Beaulieu

35042 Rennes Cedex, France

Regis.Gras@univ-rennes1.fr

  He is a lecturer and researcher in Mathematics Education. He has supervised several doctoral dissertation on this topics, some of which are related to the teaching of Statistics. His research team is developing new data analysis techniques with special emphasis on their applications to Mathematics Education. He has coordinate the organization and edition of the proceedings of the "Colloque Méthodes d'analyses statistiques multidimmensionnelles en Didactique des Mathématiques". Some of his papers have been published into Educational Studies in Mathematics, Recherches en Didactique des Mathematiques, Informatique, Mathematique et Sciences Humaines, etc.

----

3. CHANGES IN E-MAIL ADDRESSES

 This is the e-mail for Jan Gunnar:

JanGunnar.Moe@hials.no

Dr. Iddo Gal

Dept. of Human Services

512 Eshkol Tower; University of Haifa

Haifa 31905 ISRAEL

Internet: iddo@research.haifa.ac.il

----

4. PUBLICATIONS BY MEMBERS

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

 BATANERO, Carmen; ESTEPA, Antonio, GODINO, Juan, D. & GREEN, David, R. (1996): "Intuitive strategies and preconceptions about association in contingency tables" _Journal for Research in Mathematics Education_, 2-20.

The aim of this research was to identify students' preconceptions concerning statistical association

in contingency tables. An experimental study was carried out with 213 pre-university students, and it was based on students' responses to a written questionnaire including 2x2, 2x3 and 3x3 contingency tables. In this article, the students' judgments of association and solution strategies are compared with finding of previous psychological research on 2x2 contingency tables. We also present an original classification of students' strategies, from a mathematical point of view. Correspondence analysis is used to show the effect of item task variables on students' strategies. Finally, we include a qualitative analysis of the strategies of 51 students, which has served to characterize three misconceptions concerning statistical association.

BEA,Wolfgang (1995) _Analysen aus kognitionspsychologischer und didaktischer Perspektive._ Frankfurt: Neu Bei Peter Lang (Stochastic thinking analyses from cognitive psychological and didactic perspectives". (ISBN: 3-631-48844-0

As we understand stochastic thinking as any cognitive activity when coping with uncertainty, it plays an important role in daily life, especially in decision situations. Therefore, a widespread quality improvement in stochastic thinking would be a major contribution to the generation of decision and action competence. The book's goal is to provide suggestions about how such a quality improvement can be achieved.

Contents:

Chapter 1: Introduction

Chapter 2: Cognitive psychological foundations of stochastic thinking: the heuristic approach and the cognitive approach.

Chapter 3: Practical relevance of stochastic thinking..

Chapter 4: Approaches for quality improvement of stochastic thinking

Chapter 5: Training of conditional probabilities

Chapter 6: Summary and evaluation.

GRAS , Régis & Totohasina, André (1995). " Conceptions d'eleves sur la notion de probabilite conditionnelle revelees par une methode d'analyse des donnees : implication - similarite - correlation" (Student' conceptions on conditional probability revealed by a data analysis method : implication-similarity-correlation). _Educational Studies in Mathematics_, 28m 337-363.

The introduction of notions of probability, above all conditional probability, poses a thorny problem in didactics due to student's preconceptions (Fischbein § al., 1991), stemming from the concrete references indispensable for this introduction. These preconceptions may be reinforced by conceptions which become epistemological and especially didactic obstacles. Using a new method of data analysis - statisticalimplication - and a method of post-correlative treatment, we reveal these conceptions using student's work, and make explicit the procedures of problem solving used, that are a reflection of these conceptions.

GRAS, R. & Totohasina, A.(1995): "Chronologie et causalité, conceptions sources d'obstacles

épisitémologiques á la notion de probabilité conditionnelle"._ Recherches en Didactique des Mathématiques, 15(1), 49-95.

The difficulties that students meet with during first learning of the notion of conditional probability arise from obstacles of diverse nature. We have identified two misconceptions which explicate some of these difficulties: a chronological conception and a causal one which both opposite against reversibility necessary for dealing with the Bayes' formula. Through a questionnaire presented to students and with the help of multidimensional analysis, we ratify the existence and function of these misconceptions which persist till University. We bring to the fore, for example, a connection between causal misconception and confusion between the increase in information and the probability one.

VALLECILLOS, Angustias (In press). University student's understanding of the logic of statistical tests. _Recherches en Didactique des Matematiques_, 15 (3), 1-30.

This paper presents the results of a theoretical and experimental study concerning the understanding of university students about the logic of statistical testing. The theoretical study discusses epistemological issues concerning Fisher's and Neyman-Pearson's approaches to hypothesis testing and their relationship to the problem of induction in experimental sciences. The first part of experimental study has been carried out on a sample constituted of 436 students in 7 different university specialties. In the second part of the study a series of seven clinical interviews have been analyzed. As a consequence of the analysis we identify four main conceptions a) The test of hypothesis as a decision rule which provides a criterion to accept one of the hypotheses; b) The test of hypothesis as a procedure for obtaining empirical support for the hypotheses under investigation; c) The test of hypothesis as a mathematical proof of the truth of one of the hypotheses and d)The test of hypothesis as a inductive procedure which allows us to compute the "a posteriori" probability of the null hypothesis.

---

5. JOURNAL OF STATISTICS EDUCATION

Volume 3, Number 3 (November 1995); ISSN: 1069-1898

Jim Albert, "Teaching Inference About Proportions Using Bayes and Discrete Models" (64K)

ABSTRACT: Teaching elementary statistical inference from a traditional viewpoint can be hard, due to the difficulty in teaching sampling distributions and the correct interpretation of statistical confidence. Bayesian methods have the attractive feature that statistical conclusions can be stated using the language of subjective probability. Simple methods of teaching Bayes' rule are described, and these methods are illustrated for inference and prediction problems for one and two proportions. We discuss the advantages and disadvantages of traditional and Bayesian approaches in teaching inference and give texts that provide examples and software for implementing Bayesian methods in an elementary class. --JA

KEY WORDS: Baseball; Bayes' rule; Conditional probability; Prediction; Prior distribution.

Christopher Ferrall, "Interactive Statistics Tutorials in Stata" (33K)

ABSTRACT: This paper discusses a set of programs written in the statistical package Stata that is designed to support interactive student tutorials. The tutorial package has several desirable features, including customized tutorials, full student interaction, checking of student answers, repetition of practice problems using randomly chosen values, and a simple way to gauge student comprehension even when students run the tutorials at home. As an example, a tutorial used in an undergraduate econometrics class is discussed. The example illustrates Monte Carlo experiments on the linear regression model that allow students to demonstrate the validity of various formulas for the sampling distribution of ordinary least squares estimates.

KEY WORDS: Teaching aids; Econometrics; Monte Carlo experiments.

Sue GORDON, "A Theoretical Approach to Understanding Learners of Statistics" (66K)

ABSTRACT: This paper provides examples of students' reflections on learning statistics. The Mathematics Learning Centre, where I teach, offers help to students experiencing difficulty with basic mathematics and statistics courses at university. The excerpts are drawn from surveys or interviews of these and other students studying statistics at the University of Sydney. Activity theory, which is based on the work of Vygotsky, provides a helpful conceptual model for investigating learning at the university level. From the perspective of activity theory, learning is viewed as a mediated activity in a socio historical context. In particular, the way a student monitors and controls the ongoing cognitive activity depends on how that individual reflects on his or her efforts and evaluates success. In Semenov's words, ``Thought must be seen as a cognitive activity that involves the whole person'' (1978, p. 5). Students' interpretations of their learning tasks and the educational goals for their self-development are discussed within this theoretical framework. --SG

KEY WORDS: Activity theory; Adult learners; Goals of learners; Experiences; Perceptions of context; Goals of statistics education.

R. Kirk Steinhorst and Carolyn M. Keeler, "Developing Material for Introductory Statistics Courses from a Conceptual, Active Learning Viewpoint" (38K)

ABSTRACT: For traditionally trained statistics teachers, developing active learning material is difficult. We present representative active learning materials that we have used over the last several years. We also give examples of exam questions that we have used to test conceptual understanding gained through the class exercises. --RKS

KEY WORDS: Conceptual learning; Authentic assessment.

Teaching Bits: A Resource for Teachers of Statistics (30K)

ABSTRACT: This column features "bits" of information sampled from a variety of sources that may be of interest to teachers of statistics. Joan GARFIELD abstracts information from the literature on teaching and learning statistics, while Laurie Snell summarizes articles 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. --JG

Robert J. MacG. Dawson, "The `Unusual Episode' Data Revisited" (26K)

ABSTRACT: A certain dataset, giving population at risk and fatalities for an unusual episode," has been used for some time in classrooms as an elementary exercise in statistical thinking, the challenge being to deduce the context of the data. Unfortunately, the ``solution" has frequently been circulated orally, with few details. Moreover,discrepancies have been found between the dataset and the ``solution," which would render the exercise somewhat artificial. This paper investigates the discrepancies and includes a fully-explained version of the dataset for classroom use. --RJMD

KEY WORDS: Elementary statistics teaching; Categorical datasets; Survival data; Classroom exercises.

---

6. RECENT DISSERTATIONS

Bennet, D. J. (1993) _ The development of the mathematical concept of randomness: educational implications. Ph. D. New York University. Supervisor: Kenneth P. Goldberg. UMI N. 93176357

The evolution of the concept of randomness is explored through the method of historical research from antiquity to the formalization of the notion. The thesis is divided in five chapters: I: Introduction; II: Chance or Randomness in antiquity; II. Randomness in the middle ages, the renaissance and the enlightenment, IV: random sampling and simulation experiments in the development of statistical theory, and V: The concept of randomness made precise. Finally, educational implications are examined in light of the increased emphasis on probability and statistics at all levels of the curriculum. Recommendations are made for the presentation of notions of randomness and chance in the classroom. The importance of correct intuition and active learning in the instruction of the concept of chance are emphasized.

OJEDA, Ana Maria (1994). _Understanding fundamental ideas of probability at pre-university levels_ King's College London. Supervisor: Kathleen Hart.

This work investigated some fundamental ideas of probability when taught at pre-university levels. A preliminary inquiry focused on the idea of chance and combinatorics. Then an exploratory study with English children aged 10-11 and 14-16 years involved several interrelated probability ideas. Two questionnaires were used and interviews were done to clarify some interesting answers. Among the problems identifies, there was the difficulty in assessing conditional probabilities. After a traditional teaching of this topic, Mexican students aged 16-22 were given a questionnaire presented in four forms. The results were used for designing didactic material which took into account the influence of the context. Then, using the same questionnaire, the understanding of conditional probability was studied after a teaching based on the didactic material. Although the results of the second sample were quantitatively the same as those from the first sample, 72% of the students used the tools taught and 6% applied Bayes' theorem successfully. However, the recognition of conjunction of events remained a difficulty to overcome.

Totohasina, A. (1992)._Implicative method in data analysis and application to analyze students' conceptions of conditional probability. Ph.D. de Rennes, I. Supervisor: REGIS GRAS.

The expansion of the informational concept of cohesion by A. Larher, in her thesis, gives an interesting extension of the statistical implication theory founded by R. GRAS. While ¡t retains its non symmetrical originality and its capacity to deal with modals variables, this theory belongs nowadays to the category of probabilistic clustering methods in data analysis. Our present work studies, by simulations, the probability law of implicative cohesion of a class of variables. For reducing the number of variables in cases of possible "superabundance", we offer two methods in using this theory. The application of these methods, concurrently with other classical ones, to study the acquisition of conditional probability concepts by students, allowed us to bring to the fore three conceptions of this notion: the causal, the cardinal, and the chronological. The analysis of problem solving procedures and of didactic contracts reveals the robustness of these three conceptions. susceptible to erect them in epistemical obstacle and naturally to compromise the operativeness of Bayes' theorem. The treatment of a "multiple-choice" questionnaire, crossed with a formal problem, raffles this. A proposition in didactic engineering of introducing the notion - is done, taking justly the control of these three conceptions into account, and implementing two graphical significants .

VALLECILLOS, Angustias (1994) _A theoretical and experimental study of students' errors and conceptions about the tests of hypotheses. Ph. D. University of Granada, Spain. Supervision: Carmen Batanero Bernabeu and Rafael Pérez Ocón.

In this thesis a theoretical and experimental study concerning statistical tests of hypotheses and their learning by undergraduates has been carried out. The first chapter analyses the statistical, historical and philosophical components of the topic. A summary of previous investigations, as well as the research problem, theoretical framework and methodology is also presented. The second chapter describes a questionnaire on conceptual and procedural knowledge about hypotheses testing, whose construction was based on an "a priori" analysis of the content. The validity and generalizability of the questionnaire are discussed, using the results of a pilot sample.

An experimental study to determine conceptual and procedural errors in the learning of the topic was made using a sample of 436 undergraduates. The results of this study is presented in the third chapter, where multivariate analysis is used to show the interrelationships among different errors and to identify factors associated with the whole understanding of hypotheses testing. Correct and incorrect conceptions concerning key concepts in hypotheses testing are also explained. In the fourth chapter an in-depth study of the concept of significance level is carried out through personal interviews to a smaller sample of students. This study relates the misinterpretations of the significance level to misconceptions about other main concepts in hypotheses testing.

7. OTHER PUBLICATIONS OF INTEREST

Beattie, K. (1995). "Training in the law of large numbers and everyday inductive reasoning: a replication, with implications for statistics course design". _International Journal of Mathematics Education in Science and Technology_, 26(6), 795-808

This study investigated the effect of a previously successful lesson in the law of large numbers on the everyday inductive reasoning of 64 Australian higher education students with humanities and science backgrounds. It also tested one aspect of Reigeluth's Elaboration Theory of Instruction. Word problems were used to test reasoning. The results closely replicated several] of Fong, Krantz and Nisbett's findings with American subjects and supported Reigeluth's theory, although they raise a question about the effectiveness of formal statistics course training in the local population.

A possible salience or demand effect, and the interaction between moral development and the willingness to generalize statistical heuristics are discussed. Several new approaches to the teaching of introductory statistics are suggested.

Mokros, Jan and Russell, Susan Jo (1995): "Children's concepts of average and representativeness". _Journal for Research in Mathematics Education_, 26(1), 20-39.

Whenever the need arises to describe a set of data in a succinct way, the issue of representativeness arises. The goal of this research is to understand the characteristics of this through eighth graders' constructions of "average" as a representative number giving a data set. Twenty-one students were interviewed, using a series of open-ended problems that called o children to construct their own notion of representativeness. Five basic constructions of representativeness are identified and analyzed. These approaches illustrate the ways in which students are (or are not) developing useful, general definitions for the statistical concept of average.

Ross, J. A. & Smyth, E. (1995). "Thinking skills for gifted students: The case for correlational reasoning". _ Roeper Review_, 17(4), 239-243.

Thinking skill are an integral component of programs for gifted learners. Research on correlational reasoning demonstrates that the ability to solve correlational problems is unlikely to develop without well designed instruction. Several successful programs (in whole class. cooperative learning, and computer formats) and their implications in programming for gifted students are discussed.

Omar Rouan & Richard Pallascio (1994): "Conceptions probabilistes d'éléves marocains du secondaire". _ Recherches en Didactique des Mathématiques, 14(3), 393-428.

The following article presents a research in mathematics education about probabilistic conceptions of Moroccan students of 18-19 years old. The article is about the analysis and interpretation of part of the data, collected during the experiment in this research.In the experiment, we used a questionnaire and several interviews that we prepared from a set of works done in the field, and from social phenomena as sports, games... The results of this experiment laid us to formulate a group of hypothesis concerning the conceptions that individuals may have about probability notions.In the conclusion, we can find several trails of research based on the hypothesis brought out from the analysis and interpretation of the results.

Perry; M. & Kader, G.(1995)."Using simulation to study estimation". _Mathematics and computer education_, 29(1), 53-64.

Estimation of a population parameter based on random samples is fundamental statistical problem considered in undergraduate statistical duration.In an introductory course, estimation is frequently presents as methodology with, at best, cursory attention given to the underlying concepts. On the other hand, a more advanced treatment may approach subject with formal mathematics; the student masters mathematical derivations and proofs but again without developing an intuition for

the concepts modeled by the mathematics. Some instructors have found that simulation provides a powerful tool to enhance conceptual understanding as well as a tool for finding answers.This paper will extend these pedagogical ideas to show how computer simulation models may be used to study the "quality" of an estimation procedure and concurrently subtle concepts of randomness and convergence.Special emphasis is given to the use of graphical representations. These ideas have been used y the authors in a mathematical statistics class as well as in introductory intermediate courses.

---

8. INFORMATION ON PREVIOUS CONFERENCES

PME XVIII. University of Lisbon, Portugal, 1994

Posters and short oral communications:

Leridon, F. E. & GLENCROSS, M. J. "The stability of alternative probability conceptions".

The research uses questionnaires adapted from Green (1982) with 1200 pupils. A novel sequential path statistical analysis is used. The outcome of this analysis questions statements about the stability and persistence of alternative conceptions.

TRURAN, K. "Children's understanding of random generators".

This research investigates the thinking processes and affective ideas children use when confronted with familiar and unfamiliar random generators. Examples of results based on gender and culture will also be discussed. Preliminary finding indicate that children predict different results depending on whichever random generators is used in a game.

Research reports included in J.P.Matos and J. F. Ponte (Eds): _Proceedings of the PME XVIII_. University of Lisbon:

Amir, G. & Williams, J. "The influence of children's culture on their probabilistic thinking". (v.2, pp. 24-31).

This research examines the influence of children's culture on their probabilistic thinking. In their first stage 38 11-12 year old children were interviewed. The interviews included discussion of their concepts of chance and luck, their beliefs and attribution, their relevant experiences, and their probabilistic thinking. Interpretations of the concept of chance and luck were varied, often not involving randomness. Several distinct type of reasoning were identified. In some cases religion and superstitious beliefs appear to influence their inclination to use probabilistic thinking. Certain heuristics and approaches were common: the outcome approach , representativeness, availability, the equiprobability bias. Some children did not understand coins and dice as random devices.

ESTEPA, A., GREEN, D. R., BATANERO, C. & GODINO, J. D. "Judgments of association in contingency tables: an empirical study of students' strategies and preconceptions". (v.2, pp. 312-319).

In this paper an experimental study of students' strategies in solving a judgment of association in contingency tables is presented. The classification of these strategies from a mathematical point of view allows us to determine concepts and theorems in action and to identify students'conceptions concerning statistical association in contingency tables. Finally, correspondence analysis is used to show the effect of task variables of the items on students' strategies.

Pesci, A. "Tree graphs: visual aids in casual compound events" (V 4, pp. 25-32).

In the study an analysis of tree graphs as graphical representation which can work as visual aids in the understanding and in the solution of causal compounds events is proposed. It is reported how tree graphs can describe, in figural terms, the conceptual relationships involved and stimulate the use of adequate calculation procedure. It is then examined how tree graphs are used by 13-14 year old students to solve two problems with different characteristics. After a prior study of the two problems and a description of the theoretical background in the classes where the investigation was carried out, an analysis of the results achieved is proposed and the most significant errors are examined.

OJEDA Salazar, A. "Students' understanding the idea of conditional probability" (v.4, pp. 177-184).

In this work the answers of students aged 16-22 years given to questions concerning the idea of conditional probability are analyzed. The general performance they showed to support their answers depended on the instructional environment to which they were exposed. It was confirmed also that it is more difficult to answer questions in which the conditioning event is supposed to happen later than the conditioned event, than when the conditioning event happens either simultaneously or before the conditioned event.

TRURAN, J. "Examination of a relationship between children's estimation of probability and their understanding of proportion". (v4, pp. 337-344).

There is some debate as to whether asking children to compare two urns containing different proportion of balls of two colors is a test of probabilistic understanding, of perceptual responses, and of proportional reasoning. This paper reports the results of clinical interviews with 32 children aged from 8 to 15. It argues that children's' language does indicates that they are fully aware of the probabilistic nature of such situations and that, in the case of certain and impossible events, where proportional reasoning is not possible, some children can be seen to be moving spontaneously towards using formal mathematical language. Strategies used in more general cases are shown to be far more idiosyncratic than have been reported in other research. It is suggested that there is room for further research to see whether probability scales can provide a useful unifying approach for learning consistent with for comparing proportions.

WATSON, J. & Collis, K. F. "Multimodal functioning in understanding chance and data concepts" (v4, pp. 369-376).

This paper present some of the results from the pilot stages of a large project studying Australian

children's' understanding of concepts related to chance and data. The model used for the analysis of the responses is that developed and extended by Biggs and Collis (1982, 1991). The appearance of multimodal functioning in some responses and its relationship to the level of functioning within the concrete symbolic mode are of particular interest. The specific topics covered in this report include comparison of two groups from graphical presentation, interpretation of bar chart and decision-making about the fairness of dice.

The Lisbon Discussion Group on Probability and Statistics (reported by John TRURAN):.

This was organized by Kath Hart after the official closing time, so there is no official documentation. The group met twice. In the first session each person presented a summary of what they were doing. Participants included Alan Bell, Tony Orton, Jane Watson, Gilead Amir, Ana Maria Salazar, Kath and John Truran. The group agreed not to keep the discussion group going because no-one could go to Brazil the following year.

PME XIX. Universidade Federal de Pernambuco. Recife, Brazil, 1995.

Research reports included in L. Meira and D. Carraher (Eds): Proceedings of the 19th PME Conference. Universidade Federal de Pernambuco:

Cai, J.(1995). "Beyond the computational algorithm. Students' understanding of the arithmetic average concept".(v3, pp. 144-151).

The study examined 250 sixth grade students' understanding of the arithmetic average. It was particularly designed to provide in depth information about students' knowledge of arithmetic average with respect to computational algorithm and conceptual understanding through conducting a fine-grained cognitive analysis of students' written responses. Results of this study showed that 90% of the students knew the "add-then-up-and-divide" algorithm for calculating average. However , only about a half of the students showed evidence of having conceptual understanding of the concepts. This study suggests not only that the arithmetic average concepts is more complex that the simplicity as the computational algorithm suggest, but also implies that the average concepts should be taught beyond the computational algorithms.

Wilensky, U. (1995). "Learning probability though building computational models.(v3, pp. 152-159).

While important efforts have been undertaken to advancing understanding of probability using technology, the research reported is distinct in its focus on model building by learners. The work draws on theories of Constructionism and Connected Mathematics. The research builds from the conjecture both the learner's own sense making and the cognitive researchers' investigations of this sense -making are best advanced by having the learners build computational models of probabilistic phenomena. Through building these models learners coma to make sense of core concepts in probability, Through studying the model building process and what learners do with their models researchers can better understand the development of probability learning. This report briefly describes two case studies of learners engaged in building computational models of

probabilistic phenomena.

Short oral communications and posters:

Coutinho, C. & Henry, M. (1995): "Representation of the link between frequency and probability on teenagers".

We carried out a questionnaire on the link between frequency and Probability. That survey took place in France on pupils of 16 to 18 and in Brazil on university first year students. It resulted that the same wrong ideas were expressed by both French and Brazilian teenagers. . As a consequence, no significant difference on that point could be explained by different elements such as language, culture or the way of life. On the contrary, we observed the same epistemological obstacles that could be studied more precisely in the future.

9. FORTHCOMING CONFERENCES

TARTU CONFERENCE ON COMPUTATIONAL STATISTICS & STATISTICAL EDUCATION (Second announcement), June 2nd to 8th, 1996, Tartu, Estonia.

Preliminary program for June 3rd to 6th

1. Jaromir Antoch (Czech Republic) Changes in Computational statistics and teaching statistics.

2. Rolf Biehler (Germany) Requirements to software tools for learning Data Analysis.

3. Manfred Borovcnik (Austria) Impact of computers on statistical education.

4. William Eddy (U.S.A.) Dynamic graphics in Statistics.

5. Anne Hawkins (GB)

6. Carlo Lauro (Italy) Visualization in Multivariate Statistics

7. Seppo Mustonen (Finland) Using SURVO in teaching.

8. Peter Naeve (Germany)

 CONTRIBUTED PAPERS SESSIONS, SOFTWARE DEMONSTRATION, POSTER SESSION PANEL DISCUSSION 'The state of art in computational statistics'. S. Mustonen and P. Naeve.

 June 8. Workshop 'STATISTICS AT SCHOOL' oriented to pre-university level ofstatistical education using statistical software. Invited lecturer Manfred Borovcnik.

SOCIAL PROGRAM

June 2 Tour of old Tallinn

3 Conference Reception

4 Evening walking tour of Tartu

5 Conference Dinner

6 Concert

8 Farewell party

INTERNATIONAL PROGRAM COMMITTEE:J. Antoch, R. Biehler, G. Kulldorff, S. Mustonen, E. M.Tiit, L. M. Tooding

 CALL FOR ABSTRACTS

Papers, concerning the intersection of the fields mentioned in the title of the conference are preferred. Persons wishing to present a paper are requested to send an abstract.Software demonstration is available. Presentations will be accepted on the basis of abstracts which will be published before the Conference, and authors will be notified within one month if accepted. DEADLINE for receipt of abstracts is 1st March 1996.

ABSTRACTS SHOULD BE SENT to the Conference secretary: Elvi Ehasalu, J.Liivi 2, Tartu EE2400, Estonia. Tel: 372 7 465 453, Fax: 372 7 433 509, E-mail: elvi@madli.ut.ee, etiit@madli.ut.ee, tooding@madli.ut.ee

 PROCEEDINGS of selected papers will be published after conference.

 CONFERENCE FEES The Conference fee will be 70 DEM (participants) and 40 DEM (accompanying persons) if paid before 15th March 1996. The fee is 90 DEM and 50 DEM after this date. This covers the welcoming party, coffee (during breaks), organisation and materials (including Abstracts).

 ACCOMMODATION

TARU Hotel -- 120 DEM single, 150 DEM double.

PARK Hotel and PRO Hotel -- 50 DEM single, 75 DEM double. The prices include breakfast. If you are interested in low budget, University dormitories, 12 DEM single, 20 DEM double. Please inform the Conference Secretary about your accommodation needs before April 1st.

GETTING TO THE CONFERENCE

Tallinn is well connected internationally by air and sea. The major air routs to Tallinn are from Helsinki, Stockholm, Vilnius, Moscow, Copenhagen, London, Frankfurt, Hamburg and Amsterdam. The major sea routes to Tallinn are from Helsinki and Stockholm. If you would like to travel through the Baltics by train, the Baltic Express runs daily between Tallinn (stops in Tartu) and Warsaw, connecting Estonia with central Europe (Vienna, Berlin, Prague etc.).

From TALLINN come to TARTU by bus or train - buses almost every hour from the bus station (autobussijaam), or trains every three hours from the train station (raudteejaam) Conference participants should: ARRIVE to TALLINN 2nd June 1996. PLEASE INFORM the Secretary in advance of the time and place of your arrival.

REGISTRATION FORM. AND COMPLEMENTARY INFORMATION IS AVAILABLE FROM ROLF BIEHLER (rolf.biehler@HRZ.Uni-Bielefeld.DE) or from the Conference secretary:

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

One session at the congress is to be on Statistical Education with the title Broadening Horizons This will include information retrieval and long term objectives in teaching statistics.

Prior to the conference there is to be a workshop on statistical education, 5-7 July 1996. There will be four sessions:

I. Graphical perception and other psychological aspects of learning statistics.

II. Multimedia

III. Teaching statistics at tertiary and secondary levels - where are the interactions?

IV. Applied statistics - bringing 'gown ' and 'town' together.

Up to date information on the workshop and the education session at SISC'96 can be obtained by subscribing to the e-mail list StatEd_List.This can be done by sending the one line message subscribe StatEd_List to maiser@efs.mq.edu.au. This list has been primarily set up to aid in planning for the workshop but also to foster discuss of statistical education primarily, though not exclusively, at the tertiary level.

"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.

A call for papers has been submitted with the first announcement, including the following deadlines for different types of personal presentations: short oral communications and poster presentations (March, 1st, 1996). Information is available from the Conference Chair, Angel Gutierrez, Universitat de Valencia, E.U. Magisterio, Apartado 22045, 46071 Valencia (Spain), E-mail: angel.gutierrez@uv.es

In addition to individual presentations there are also some working and discussion groups at the PME Conference. John and Kathleen Truran are sending the following proposal for a discussion group at PME.

Proposal for a Discussion Group at PME 20, Valencía: _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 CONFERENCE ON MATHEMATICAL EDUCATION (ICME) ", Seville, Spain, 14-21 July 1996.

Brian PHILLIPS Is organizing ICME-8 topic group 9 comprising two sections on "Statistics and Probability at the Secondary Level".This session 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 overviews 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, how research may affect how these topics are taught in the future and there will be a forum discussion.

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

PME 21 at Lahti Adult Education Centre, Finland, July 14-19, 1997. Lahti is 100 km north of Helsinki and can be reached from the international airport by direct express bus. Contact: Erkki Pehkonen: pehkonen@bulsa.helsinki.fi.

PME-NA 1997 will be held October 18-21 in Bloomington/ Normal, Illinois. For additional information contact Jane Swalford, Department of Mathematics, campus box 4520, Illinois State University, normal, IL, 61709-4520 USA. (swalford@mathe.ilstu.edu

"ISI 51st Biennial Session", including IASE meeting, Istanbul, Turkey, August 1997.
Information is available form the ISI Permanent Office: 428 Beatrixlaan, P.O. Box 950, 2270 AZ
Voorburg, The Netherlands. The next ISI meeting is at Istanbul, Turkey, 1997. The statistics
education sessions are being organized there by Annie MORIN.(e-mail: annie.morin@irisa.fr)

"ICOTS-5", June 1998. The main conference that the International Association for Statistical
Education, IASE, organizes is the International Conference on Teaching Statistics, ICOTS which
is run every four years. The next conference will be held in Singapore, June 21-26, 1998. The
theme of the conference is 'Statistical Education - Expanding the Network'. Anyone interested in
organizing sessions at ICOTS 5 should contact me. We are also interested in expressions of
interest to host ICOTS 6 in 2002.

 Information is available from Brian PHILLIPS, School

of Mathematical Sciences, Swinburne University of Technology, PO Box 218 Hawthorn, 3122,
Australia. E-mail: brp@swin.oz.au