NEWSLETTER OF THE INTERNATIONAL STUDY GROUP

FOR RESEARCH ON LEARNING PROBABILITY AND STATISTICS

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1. NOTES AND COMMENTS

Happy New Year 1997!

After my first year editing the newsletter, I would like to thank you for your positive feedback and, specially those who contributed information for the newsletters. I would also like to encourage those I have not heard from to let me know what you are doing. Please send me any papers you have written or any relevant paper that I have not yet mentioned in the newsletter.

The newsletters are now available from the Journal of Statistics Education Information Services

(http://www2.ncsu.edu/ncsu/pams/stat/info/infopage.html). This option could be interesting for recovering past issues or for printing more easily the newsletters.

If there are any corrections or additions to the newsletter, please post them to the entire list of members by using the email address alias: stated_list@goliat.ugr.es.

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2. NEW MEMBERS

Pilar Azcárate Goded

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Pilar is a senior lecturer at the University of Cádiz, Spain. She teaches Mathematics Education to future primary teachers and is teaching and supervising research at the Doctoral Program in Education. She has published papers related to teaching probability in Spanish Journals and the book "Estudio de las concepciones disciplinares de futuros profesores de primaria en torno a las nociones de aleatoriedad y probabilidad" (Study of future primary teachers' conceptions concerning randomness and probability), based on her recent doctoral dissertation.

Vasile Berinde

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Editor of the journal "Lucrärile Seminarului de Creativitä Matematicä". He teaches Probability and Statistics, and is very interested to become a member of our International Group. He intends to send a circular message to other colleagues from several universities in Romania in order to recrute other interested people.

Eliseo Borrás

eliseo@sylow.algebr.uv.es

Everyone remember the wonderful work done by Eliseo during the local organisation of TG9 at ICME 8, Sevilla. In addition, Eliseo is author of several papers about teaching probability and he is presently finishing his doctoral dissertation on probability.

Jose M. Cardeñoso Domingo

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Jose M. is a lecturer at the University of Granada, Spain. He teaches Mathematics Education to future primary teachers. He has published papers related to teaching probability and mathematics education in different Spanish Journals and is preparing a doctoral dissertation about primary teachers' conceptions concerning randomness and probability.

Michal Eisenberg-Mashiach

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Orit Zaslavsky

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Michal Eisenberg is preparing her research proposal for her doctoral thesis, under the supervision of Professor Orit Zaslavsky. She is interested to focus on combinatorial thinking from a developmental and cognitive perspective.

Yasar Ersoy

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Yasar presented papers at the IASE Round Table Conference (Granada, 1996) and ICME 8 (Sevilla). He is presently organizing a Satellite Conference and workshop to ISI 51st Session to be

held in Bolu, Turkey.

Kay McClain

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She, along with Paul Cobb, are part of an OERI collaborative project which will be investigating students' understandings of probability and statistics at the middle grade level. During the 96-97 school year they are reading the current literature and planning a classroom teaching experiment which they will conduct in the fall of 97. In 97 they will be working with 7th graders and then in 98 they will work with the same group of students as 8th graders. They are collaborating with Koeno Gravemeijer of the Freudenthal Institute and Erna Yackel of Purdue University.

M. Francisca Moreno

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Francisca has done a doctoral thesis in Statistics. She teaches mathematics and mathematics education to future teachers at the University of Almería, Spain. Very recently a Doctoral Program in Education has been approved in this university, from which she is the coordinator. She is author of different books and papers in mathematics education.

Erica Morris

Computers and Learning Research Group

Institute of Educational Technology

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She is in the second year of her PhD which concerns students' understanding of correlation and the design of a computer assisted learning program.

Bernard Parzysz

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He works at the Institut Universitaire de Formation des Mâitres (IUFM) de Lorraine, and at the maths department of the University of Metz (France). He teaches mathematics, probability and statistics, to university students and to preservice maths teachers, to which he also teaches mathematics education. As a researcher, he belongs to the DIDIREM team (University of Paris 7), and is doing research on the 'frequentist' approach of probability which is now taught in senior high school.

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3. CHANGES IN E-MAIL ADDRESSES

Peter Holmes: ph@maths.nott.ac.uk

Melvin Wilson: melvin.r.wilson@umich.edu

Uri Wilensky: uriw@media.mit.edu

Michael Wood: woodm@pbs.port.ac.uk

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4. NEWS FROM MEMBERS

Prof M.J. GLENCROSS, University of Transkei, is just starting a research project with the tittle: "Understanding of chance and probability concepts among first year university students".

A test of chance and probability concepts has been developed. The test contains 17 questions: the first part of each question is multiple-choice with 4 or 5 options; the second part (open-ended) asks the student to say why s/he choses that particular answer. The test has been piloted on a sample of 25 volunteer students. Data capture and analysis are currently under way. For the beginning of 1997 they plan to administer the test to first year statistics students, interview a small (10%) group of students as a follow up to the open-ended questions and to probe for students' understanding of the concepts addressed in the test. They also plan to administer the test again at the end of the year as a check on conceptual development.

Avigail HARTMAN has presented a paper on probability in the 'Mediterranean Conference on

Mathematics Education and Applications' in Cyprus. She has also presented information concerning our group in the conference.

Ted HODGSON, Montana University, organised a discussion group on stats education at the recent PME-NA in Florida and recommended to all participants that they subscribe to the newsletter and the International Study Group.

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5. PUBLICATIONS BY MEMBERS

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

GAL, I. & Baron, J. (1996). "Understanding repeated simple choices". _Thinking and Reasoning_, 2(1), 61-98.

This article reports the results of a study that examined college and high school students' reasoning regarding random experiments with dice and balls in an urn. Students were asked to bet on two events that had different probabilities and to generate or evaluate a strategy for betting on repetitions of the experiment. Large numbers of both high school and college students demonstrated misunderstandings of the probabilities involved in the experiments. Although some students seemed to understand the concept of independence, they failed to use it when generating or evaluating betting strategies.

SCHEAFFER, R.L. (1996). _Activity-Based Statistics. Students Guide and Instructor Resources_. New York: Springer.

Collection of hands-on activities covering the following concepts: exploring data; random behaviour; sampling distributions; sampling; estimation; testing; modelling and projects.

HAWKINS, A. (1996). "Common variance". Presented at the Royal Statistical Society Local (East Midlands) Group, March 1996.

This paper outlined some of the trends that have been observed in recent years in the field of statistical education, while highlighting he very real variance that nevertheless still exists in teachers' approaches to the subject. Differentbeliefs about what constitutes 'basic' statistics, and about how the subject fits into the curriculum, serve to fuel the debate about how best to teach statistics. So too do differing views about the role of the 'professional' statisticians that education aims to produce. In some cases, research into statistical education has itself contributed to explaining the observed variance. Extreme points of view express models of statistical education. While they may embody some elements of truth, if followed through too rigidly they can lead to a narrow and incomplete approach to statistical education. Progress in statistical education needs to be based on reason, moderation and sound research, not on blind faith in some guru who preaches 'Statistics only my way!'.

HAWKINS, A. (1996). "Can a mathematically-educated person be statistically illiterate? ". Presented at the Nuffield Conference on 'Mathematics for the New Millennium - What Needs to be Changed, and Why?', October 1996.

This paper was illustrated with research findings, as well as less formal observations, showing that at present the simple answer to the question is 'yes'. This is an undesirable state of affairs both for individuals and also for society at large. Statistical literacy clearly encompasses a great many competencies that are now considered to be necessary life-skills. 'Statistics for All' is a feature of compulsory education in England and Wales, as it is elsewhere. This suggests that just as numeracy is seen to be a goal of mathematical education, so too is statistical literacy. Is it counter-productive, however, to incorporate statistical education predominantly within mathematics education, when the two disciplines require the acquisition of some fundamentally different reasoning processes? If statistical literacy is not to be achieved through mathematics education, however, what are the alternatives? In attempting to answer the question posed in the title of this paper, it is important also to explore its corollary -Would we be prepared to consider that someone had been 'mathematically-educated' if they were statistically illiterate? 'Statistics for All' is not a satisfactory goal for the next millennium. e must ensure that everyone receives an education that provides ideas, skills and inclinations to use these that are commensurate with statistical literacy. Our real goal for the next millennium must be to find ways to provide 'Statistical Literacy for All'.

HAWKINS, A. (1966). "The RSS Centre for Statistical Education". _ RSS'96 Conference_, September, 1996.

Statistics itself has been with us for many years and so, therefore, has its teaching. However, there has been a marked growth in interest in the processes of statistical education during the past quarter of a century. It is these twenty-five years that represent the emergence of the discipline of statistical education. This presentation set the scene for the establishment of the RSS Centre for Statistical Education by exploring the national and international precursor events during this period. It went on to describe the Centre's remit and the challenges and opportunities that face it in its initiatives. Priorities for statistical education, and hence for the Centre, were discussed and examples of the work of the Centre were given demonstrating how it is contributing to the advancement of statistical literacy.

HODGSON, T. (1996). "The effects of hands-on activities on students' understanding of selected statistical concepts." To appear in the _Proceedings of the 18th Meeting of the North American Chapter of the Psychology of Mathematics Education_.

The use of investigative, hands-on activities is increasingly common in statistics education. The extent to which these activities facilitate students' understanding of statistics, however, is an open question. his research examines the effects of hands-on activities on students' understanding of probability distributions, sampling distributions, and the Law of Large Numbers. The data suggest that although hands-on activities facilitate the formation of correct or partially correct understandings,they can also promote the formation of misconceptions. Novices inability to discriminate between salient and non- salient features of hands-on activities may be a source of these misconceptions.

6. RECENT DISSERTATIONS

AZCÁRATE, P. (1995). _El conocimiento profesional de los profesores sobre las nociones de azar y probabilidad. Su estudio en el caso de la educación primaria_. Ph. D. University of Cadiz, Spain. Supervisors: Rafael Porlan and Federico PALACIOS.

Randomness and probability are both relevant topics within probabilistic knowledge. In this thesis we carry out a didactic analysis of these notions, including, a historical-epistemological and a psycho-didactic study.

The results allow to base a proposal of desirable professional knowledge for primary school teachers. Secondly, we present an empirical study concerning the ways in which a group of future primary teachers conceptualise randomness and probability.

Through a complex methodological strategy, in which qualitative and quantitative techniques are combined, through questionnaires and interviews, we attempt to characterise and classify the teachers' different ways of thinking. The analysis and interpretation of the textual reasons, exposed by the subjects, is carried out from a system of categories elaborated from the initial theoretical study, which represents an original contribution. Five different ways of conceptualisation have been identified in teachers' thinking about randomness: tendencies toward Determinism, Indecisive, Standard, Causality and Uncertainty.

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7. TEACHING STATISTICS SPECIAL SUPPLEMENT

A special supplement of this journal has been devoted to the 1995 Annual Conference of The Association of Statistical Lecturers in Universities (ASLU). This is the list of contents:

HUNT, N. "Teaching statistical concepts using spreadsheets".

Horsewood, N. "Teaching applied statistics using spreadsheets".

MC.CLOSKEY, M. "Assessment of CAL materials".

Redfern, E. "Current progress of the STEPS software".

Lievesley, D. "The use of data in teaching statistics".

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8. OTHER PUBLICATIONS OF INTEREST

Grabowski, B.L. & Harkness, W.L. "Enhancing statistics education with expert systems: More than an advisory system" ._ Journal of Statistics Education_, 4(3).

This article reports on the results of two studies that investigated the effectiveness of different uses of expert systems in large introductory statistics classes. hree groups of students were compared: those who used an expert system created by the instructor of the course, those who created their own expert system, and those who did not use any at all.

Grunberg, D., & Brown, T.A. (1995). "The Monty Hall dilemma". _Personality and Social Psychology Bulletin_, 21(7), 711-723.

This paper examines people' in the Monty Hall Dilemma. In a series of five studies found that people misapprehend probabilities. It discusses the findings in relation to illusion of control, perseverance and the status quo bias.

Pratt, D. (1995). "Young children's active and passive graphing". _Journal of Computer Assisted Learning_, 11(3), 157-159.

Reports on the graphing work of children aged 8-9 years, who have access to portable computers across the curriculum.

Sahai, H., Khurshid, A. & Misra, S.C. "A second bibliography on the teaching of probability and statistics" ._ Journal of Statistics Education_ , 4(3).

This article presents an extensive collection of references on the teaching of probability and statistics. The bibliography includes articles published in statistical and subject-matter journals and in conference proceedings.

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9. COMPLEMENTARY SHORT REFERENCES

Carr, C.K. (1996). "Teaching statistics in the middle grades". _The New Zealand Mathematics Magazine_, 33(1), 33- 38.

du Feu, C. (1996). "Inconsistencies in the presentation of statistics". _Mathematics in School_, 20-21.

Hruta, M.E., Flaberty, M., McGivney, J. & McGivney, R. (1996). "Coin tossing". _Mathematics Teacher_, 89(8), 642- 645.

Henry, M. (1994). _L'ensegneiment des probabilites. Perspectives historiques, espitemologiques et didactiques_ . Besancon: IREM.

Kung, G., & Mitchell, R. (1996). "A simulation problem with many solutions". _Mathematics and Computer Education_, 30(2), 130-138.

Norberg, T. (1996). "The central limit theorem in action". _International Journal of Mathematical Education in Science and Technology_, 27(1), 154-157.

ORTÍZ, J.J., BATANERO, C. & SERRANO, L. (1996). Las frecuencias relativas y sus propiedades en los textos españoles de Bachillerato. _EMA_, 2(1), 19-36.

PARZYCKS, B. (1994): "Jeux de cadres en probabilités". _Actes de la École d'Éte de Didactique des Mathématiques_, Saint-Sauves d'Auvergne, 117-118.

PARZYCKS, B. (1994): "Notation et sens: une étude de cas (sur les notations de la probabilité conditionnelle)". _Bulletin de l'APMEP_, 392, 45-48.

PARZYCKS, B. (1993): "Des statistiques aux probabilités: exploitons les arbres". _Reperes-IREM_, 10, 91- 104.

PARZYCKS, B. (1993): "Enseigner les probabilités en Prémiere + enseigner les

probabilités en Términale". _Les Probabilités au Lycee_, Ed. IREM univ. Nancy 1, 7-17; 55-67.

PARZYCKS, B. (1990): _"Un outil sous-estimé: l'arbre probabiliste". _Bulletin de l'APMEP_ ,372, 47-54.

PARZYCKS, B. & Szwed, T. (1984): _Statistiques_. Université Paris 7.

Rhiel, G.S. & Chaffin, W.W. "An investigation of the large-sample/ small-sample approach to the one-sample test for a mean (sigma unknown)" ._ Journal of Statistics Education_, 4(3).

Vonder, C. & Engebretsen, A. (1996). "Visual representation of mean and standard deviation". _Mathematics Teacher_, 89(8), 688-692.

Ward, J.H., & Fountain, R.L., "More problem solving power: exploiting prediction models and statistical software in a one-semester course" ._ Journal of Statistics Education_ , 4(3).

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10. CD-ROM FOR PROFESSIONAL DEVELOPMENT OF TEACHERS

Jane WATSON, University of Tasmania, sends the following information about "C&D PD CD" for professional development of teachers.

The "C&D PD CD" is part of a multimedia professional development package for teachers of Chance and Data which was produced at the University of Tasmania, funded by an Australian government program through the Australian Association of Mathematics Teachers (AAMT). The CD-ROM was written to complement two other sources of information for teachers: David Moore's book, _Statistics: Concepts and Controversies_, and extracts from the CoMap video series _Statistics: Decisions through Data_. These two resources cover well the statistical background required by teachers, particularly at the middle school level. The CD-ROM provides other materials for motivation, curriculum development and classroom planning.

The content on the "C & D PD CD" is presented in five sections associated with five divisions in the Chance and Data curriculum: (1) Data Collection and Sampling, (2) Data Representation, (3) Chance and Basic Probability, (4) Data Reduction, and (5) Inference. Within each of these sections materials are presented in relation to the Grade 5-9 curriculum, the Grade 10-12 curriculum, classroom lessons, examples of student reaction to concepts, suggestions for use of probability simulation and data handling software, newspaper articles for motivation and classroom use, video

snippets from Australian television and cross-curricular links. As well, each section provides reference to parts of the accompanying book and video.

Among the resources provided on the CD-ROM are extracts from the NCTM _Standards_, Australian curriculum documents, the Australian Curriculum Corporation's _Chance and Data Investigations_ (lessons), as well as the software _ProbSim_ and _DataScope_ devised for Macintosh computers by Cliff Konold.

The purpose of the package is to provide virtually everything an Australian teacher would need for background to plan and deliver a Chance and Data program from Grades 5 to 12. As well, teachers who have taught the topic before may find particular aspects of which they were not aware previously, for example movies of students' responses to difficult concepts, newspaper articles to illustrate suspicious practice, or ideas for software use. Although the project was funded to support Australian teachers, educators in countries with similar curricula in Probability and Statistics may find the material of use.

Currently the "C&D PD CD" is being trialed around Australia and reviewed by statistics educators around the world. Enquiries about its ultimate commercial availability should be addressed to:

AAMT Inc., GPO Box 1729. Adelaide 5001 Australia

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11. NEW RESOURCES AT INTERNET

Annie Selden <JS9484@tntech.edu> sends us this summary about Research Sampler:

MAA Online, the electronic newsletter of the Mathematical Association of American, has a new Teaching and Learning Section. It consists of the Research Sampler column by Annie and John Selden and Innovative Teaching Exchange, edited by Bonnie Gold, both of which appeared regularly in UME Trends: News and Reports on Undergraduate Mathematics Education, during its seven-year existence.

The Research Sampler surveys mathematics education research primarily at the collegiate level. It's first offering is "Of What Does Mathematical Knowledge Consist?", which takes as its starting point the deliberations this past summer in Seville of the ICME-8 Working Group on Forms of Mathematical Knowing. Research Sampler columns will appear once every three months. They can be found at http://www.maa.org/t_and_l.

Our column will appear regularly every three months. We think it is quite a step forward for the Mathematical Association of America to emphasize pedagogy and mathematics education research in such a prominent way. We would appreciate your comments/reactions.

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12. INFORMATION ABOUT PREVIOUS CONFERENCES

TARTU CONFERENCE

Rolf BIEHLER, has sent me a very complete information about the conference, from which I have extracted the following summaries:

Anton, P., Arnqvist, P.,& Uvell, S. "Teaching statistics through problem- based learning".

A pedagogical method, that during recent years has reached an increasing amount of popularity among Universities all over the world is PBL - Problem-Based Learning. At Umea University in Northern Sweden we offer students a Study Programme in Mathematical Statistics leading to either a BSc- (3 years) or a MSc- (4 years) exam. Our aim is that the graduating students would be well prepared both for a continuation at the PhD-level and for a life as professional statisticians outside of the University. We describe our experiences in teaching Mathematical Statistics through PBL.

Bibby, J. "Visions of IT in statistical education".

This paper looks into the second and third decades of the next century, asking questions such as:What technologies will be available around the year 2020? What will be the likely learning and teaching styles? What can be done now to steer developments in the right direction - and what is meant by "right direction"? We classify current developments according to the "School of 2020 Vision" to which they belong, and argue for clearer specification of total costs, including the costs of tensions created.

BIEHLER, R. "Requirements for software tools to better support students' learning to practise flexible data analysis".

The paper begins with a general analysis of the type of software support that will be useful to teach and learn statistical data analysis. The current dilemma consists in the following: Tools that are specifically designed for students usually limit the students' capabilities too much, whereas professional tools are often too complex and were not designed with regard to the knowledge and abilities of beginners. Besides, many tools do not take into account specific requirements from the perspective of learning. In the MEDASS project, we have developed a system of basic requirements for such tools extending from basic features to more advanced support for students. From this perspective, we will take a critical look at some existing student and professional tools and sketch some ideas for further developments.

Blejec, A. "Use of computer simulations in teaching statistics".

Teachers of statistics are usually faced with a problem how to explain certain difficult statistical concepts to their students.Computer simulations seem to help in such situations. In these cases, the students are able to expect in advance what is the desired result of analysis and can see the discrepancy by themselves. What software do we need for computer simulations? We must use programs with greater graphics interactivity, programs with different random number generators and possibility of access to intermediate results in statistical analyses, for example S-PLUS or XLisp-Stat. In some cases, we must use a plain programming language and prepare separate programs, which can be specialised for specific teaching tasks.

BOROVCNIK, M. "The impact of computers on statistical education".

The extension of computerised tools for the explicit calculation of statistical procedures has sprung off from statistical practice. Education in statistics slowly changes towards the same direction. However, a new opportunity opens for education to include applications more realistically than ever before. This has the impact of motivating students as well enabling a deeper understanding of statistical concepts. After a general overview on the increasing possibilities resulting from statistical software, the presentation will cover a discussion of didactic aspects of software, an elaboration of the impact of software on conceptual understanding of learners, the consequences on calculations, the role of the exploration of data for statistical practice and individual understanding, and, finally, the impact on statistics on the whole as a scientific discipline.

BOROVCNICK, M. "Case studies in applied statistics - the role of systems analysis and computers".

A true understanding of statistical concepts depends both on a theoretical mathematical perception of the logic of the various procedures and on the matching of a model situation to a real situation from practice. Thus, after a sound education in the mathematics of statistics a seminar in consulting seems to be a must. At Graz Technical University jointly with the Joanneum Research Institute for Applied Statistics and Systems Analysis, in such a practical seminar the students had to work through all the steps of a bigger project which had already been solved for the industry. The advantages of such a completed project were the partial confirmation that a solution seems reasonable (not all real problems can be solved satisfactorily for the clients, a risk which seemed unacceptable for the education situation of the students) and the cut-off of the data generation phase. In the presentation, the steps of the seminar will be reviewed.

BOROVCNIK, M. "A closer look at exploratory interactive modelling".

At first sight, Exploratory Data Analysis (EDA) marks only a change in techniques compared to classical statistics. However, there is more to EDA than new techniques. EDA is characterised by an interactive search for a model, a process driven by substantial knowledge of the subject matter. With no assumptions about the data, even the overall assumption of a random sample may temporarily be dropped, the data are explored for patterns and deviations from such patterns. To make such an exploration a promising procedure, there has to be an ongoing tight connection between intermediary results of direct inspection of the data and the context where the data come from. Furthermore, this connection must not be blurred by statistical techniques which cannot be directly read off and understood. Typical for such an approach is also the interactive progress in modelling, the interpretation of intermediary results decides about the further steps of exploration. Finally, the only justification for the results found is not a statistical significance label but an insight from the pattern or the deviation from such patterns which are found by exploration and explained by contextual knowledge.

Carlsson, M. "Applications of cognitive theories of learning in a short course in statistics- a model of teaching with introducing questions".

The aim with this study is to map out educational theories and teaching methods which encourage meaningful learning of theoretical subjects in different education and to describe and evaluate a teaching model, which builds on dialogue and communication. The method is - through observation in the classroom, examination and course evaluation. Communication in the form of dialogue and formulated questions and the need of knowledge was observed and written down. The result of the dialogue in the classroom was observed and registrated by a particular observer.

Eddy, W. F. "Dynamic graphics for statistics".

For most statisticians the ideas of dynamic graphics have been linked to the ideas of interaction. Here, we discuss why not all dynamic graphics can be interactive. Then, we describe a hardware/software system we have developed for generating dynamic non-interactive graphics. Finally, we describe three specific applications in some detail: A) a study of a portion of a continuous manufacturing process; B) a study of the space-time changes in the incidence of the disease mumps over the continental United States during a twenty year period; and C) a study of air traffic over the continental United States during a single twenty-four hour period.

HAWKINS, A. "Statistical education - past, present and future".

We will outline a number of the more significant trends in statistical education that have emerged during the past twenty years in response to these new challenges. These include moves towards more applied statistics, more project work, more use of Exploratory Data Analysis techniques, less reliance on algorithmic derivations, and more dependence on technology. Of course, statistical education does not only respond to change - it can also be a major factor in bringing about that change. Students taught using these different approaches tend to bring a different set of skills to their subsequent practice of statistics, and hence people's perception of the nature of statistics evolves. The view that statistics is an essential part of numeracy (and literacy) has accompanied 'Statistics for All' curriculum developments at school level in a number of countries. For such developments to be securely implemented, however, there must be appropriately-trained teachers, relevant teaching methods and materials, and valid assessment techniques. There is also a need for further research in order to extend understanding of what is 'appropriate', 'relevant' and 'valid'.

HAWKINS, A. "Statistical education - how far have we come? Do we know where we are going?".

An overview of developments in the use of technology in the teaching of statistics and probability is given, with a bias towards English-speaking contexts. This will include consideration of the use of technology for demonstrating concepts, for providing students with training in statistical skills, and for 'doing' statistics for specialists and non-specialists. The rationale for innovations, and the degree to which their implementation has been evaluated will be explored. Consideration will be given to research findings which could have some bearing on our understanding of what technology might be beneficial; and when and how to integrate it with the rest of the statistics teaching and learning process. Some of the potential difficulties associated with an increasing dependence on technology in teaching statistics and probability will be highlighted. There will be some 'fantasising' about future trends, and an attempt will be made to derive a (research) agenda that will support developments into the next millennium.

Jevremovic, V. "Statistical methods at the Faculty of Civil Engineering at the University of Belgrade".

In this paper we present the subjects of a course of lectures concerning statistical methods. We discuss the problems of developing the way of statistical thinking and understanding for an audience of graduate students. One of these problems arise from another distribution and could not be applied successfully when we have relatively small distribution and could not be applied successfully when we have relatively small sample from another distribution. The problems of unbiased and effective estimation of the mean, of the standard deviation, of the coefficient of correlation are envisaged. We illustrate also some situations when the maximum likelihood method is misleading. We give few comments about the use of statistical software.

Jevremovic, V. "Statistical souvenirs".

Some methods, used before the computers have taken the major role in data analysis, are presented in this paper. Some of them are: polar and triangular diagrams, Lorentz's line and the parameter of concentration, graphical finding of the mode of an unimodal distribution with the given histogram, etc. The interpretations of the results or the proof of these methods use the ideas of classical geometry. All the stated methods could be useful as an illustration and help in developing the statistical way of thinking

Juritz, J. M. " Teaching the design of experiments using statistical packages".

The best way to learn to how design an experiment is to design and perform one oneself. We describe a number of simple experiments that can be performed easily and cheaply, but nonetheless require many issues that arise in the design of experiments to be carefully considered. We show how statistical packages can be used both for the preliminary design and the subsequent analysis. The merits of various packages for performing this task will be compared.

Kharin, Y. "Teaching statistics using software system TEACHSTAT".

Belarussian State University is one of the leading universities in former Soviet Union in the field of statistical education improvement. To rise quality of statistical education, special system of teaching statistical software TEACHSTAT is developed in Belarussian State University. Teaching statistics by TEACHSTAT includes two stages. In first stage (fundamental training), the students have lectures and seminars on "Probability Theory and Random Processes", "Mathematical Statistics", "Statistical Modelling and Simulation" plus individual exercises by STATMOD-T, STAN-T. In second stage (special training), the students have lecture courses "Statistical Data Analysis", "Statistical Analysis of Time Series", "Statistical Forecasting" and correspondent computer practical works based on STAN-T, MULTISTAN-T, DYNSTAN-T.

Lauro, C. "Visualization of multivariate data: Uses and misuses".

Aim of this paper is to give an overview of the most classical multivariate displays, pointing out

their advantages as well as misuses in practical data analysis and in teaching statistics. Pursuing this aim we present how a multivariate data set can be firstly explored by means of simple tools, such as a scatterplot matrix, which allow to understand bivariate association; then conditional plots will be introduced in order to visualize more structured association. Three-dimensional plots will represent association models, so as contours plots. In the second part of our lecture we will discuss some classical factorial method for qualitative data, in their descriptive uses as well as in modeling more complex data structures. We will show how factorial planes can be used in order to visualise dependence (or interdependence). Additionally we will show how important is to represent the quality and the reliability of objects in a graph. The information content of graphics will be enlarged, also by taking into account some results concerning with stability of results.

Mustonen, S. "SURVO as an environment for statistical research and teaching".

Survo is an integrated interactive system for statistical analysis, computing, graphics and report generating. It also includes unique features related to spreadsheet computing, matrix algebra and computer aided teaching. It provides tools for making of application programs in various special areas. The open structure of Survo allows calling any other program and using it while staying in Survo.

Naeve, P. "Making S-PLUS an environment for communicating ideas".

A new way to communicate ideas expressable in an algorithmic form is proposed. We call it revivyable paper. A prototypic system for enabling this new form of communication are described.

NEMETZ, T & Hives, Z. "Computer aided introduction to statistical decision in schools".

It is generally accepted that the emphasise of statistical instruction in schools should be concentrated on forming proper way(s) of statistical thinking.Making children familiar with the nature and possibilities of statistical decisions, instead of providing teaching recipes. The best way towards these goals goes through experience, hands-on-data manipulations, and discovery teaching methods. This way, especially the data-management part of it, is rather time-consuming. The goal of this presentation is to report on our two-decade experience in this respect.

Niglas, K., & Saks, E. "Basic course in statistics for students of social and educational sciences with SPSS for Windows".

In 1994, a project was able to select between four different statistical packages: Statgraphics, Excel, Minitab (DOS) and SPSS/PC+ (DOS). We thus chose Minitab for our first course. A survey conducted at the end of this first course showed the following: The overwhelming majority of students considered the course both interesting and of value in developing their analytical skills. This was also regarded to be of value for their later work. Students had a positive impression of the teaching methods and materials employed. Graphics were considered important and were

limited in the version of Minitab employed. This situation changed in 1995 when SPSS Inc. provided the Windows version on a trial basis. Not only were graphics of high quality, the "point-and-click" approach enabled to concentrate the course fully on statistical concepts and on data rather than typing the syntax in order to execute a program.

Pelt, J. "Procedure visualization in statistics".

Graphical display of the data sets is one of the appealing methods of explorative analysis. Especially in the cases when we can dynamically project or transform data. Such animation of statistical procedures allows us to get deeper insight into ways how the different procedures work and how the results depend on input data. In our presentation we show how the animation can be used to explore the influential points in regression, determine robustness of certain estimation procedures, demonstrate how a posteriori distributions depend on parametrized a priori distributions (in Bayesian context).Even from this limited set of examples we can conclude, that procedure visualization can be effectively used to lessen black-box-magic anxiety of end-users and students.

Puranen, J. "Computer assisted instruction: Some experiences".

There are many ways, in which the instructors utilise computers in the classroom. By now I have a large collection of statistical short stories, from which I build up my lessons. I use the local statistical package Survo. Survo has good selection of statistical and graphical tools. So it has been possible to add plenty of graphics and real time simulations to these stories. Survo gives me an excellent tool for creating, updating and organising the stories. In the teaching situation I can easily leave out some stories or exchange the order of the stories. In my talk I will show samples of my teaching series and tell about the students' reaction to this approach.

Rautopuro, J. "Manual calculations and computer-aided calculations in the teaching of elementary statistics".

During the autumn 1995 an experiment in Basic Course in Statistics was carried out at the University of Joensuu. All students were given the same lectures but laboratory studies were divided into three different groups: Manual calculation group - all exercises were made manually with the assistance of the teacher, Computer group - all exercises were made by using SPSS for Windows-package with the assistance of the teacher, Traditional group (control) - all exercises were made at home and inspected by the teacher once a week. In the beginning and at the end of the course a questionnaire was given to the students. The aim was to clarify the attitudes and opinions concerning statistics as a subject, computer-aided teaching, and manual calculations. The progress of the students was measured in two exams during the course. Some empirical results of the experiment are presented.

Ricketts, C., & Shalliker, J.A. "Randomisation, Monte Carlo, and Bootstrap methods on a Spreadsheet".

Computer-intensive approaches to statistics are more acceptable to many students than

mathematical methods. This is partly because of the mathematical background of the students and partly because the computer-intensive approach does not hide any steps from them. Modern spreadsheets, such as Excel, contain the facility to generate random numbers and to record macros (programs) for randomisation or resampling by recording the steps undertaken. A simple edit of the macros allows the process of randomisation or resampling to be repeated any number of times. In addition, the graphical capabilities of the modern spreadsheet allow the generation of randomisation or bootstrap distributions in a few simple steps. Monte Carlo tests can also be performed because the random numbers generated by a spreadsheet can be readily transformed to represent values from most common probability distributions.

Shvyrkov, V.V. "When computational statistics can be a contributor to statistical education".

To enable students to understand the principle problem of statistics, statistical education must, first, concentrate its attention on the critical analysis of the unwarranted (untested) assumptions of conventional statistics. Second, statistical education must be built upon the following truth (axiom): "The knowledge of an effect depends upon and involves the knowledge of the cause" (B. Spinoza). In statistics, effect is a sample and cause is a population. To be consistent with the above axiom, when it is applied to the statistical analysis, Fisher¥s philosophy (population is not known a priori) must be replaced by the New Quality philosophy, NQP (population is known a priori).The NQP formulates a population in terms of axiom employing the monistic approach. On the basis of this approach, the new statistics has been created; and at this stage computational statistics can make a great contribution to statistical education.

Stene, J. "A Graduate course in applied statistics with SAS for economics students".

This is a one term course (about 14 weeks) and is placed in the graduate part of the economics study, scheduled to 5 years. One aim of the course is to deepen their skills in statistics and their understanding of the theoretical statistical background of several central statistical procedures used in the program package SAS, e.g. PROC REG and PROC GLM, and of the output from these procedures. Another aim is to develop the students' programming skills and ability to data manipulation. A further aim is to learn the students to use the SAS manuals profitably.

Tiit, E.M. "Why computational statistics and statistical education?"

Computers are so common in our every-day life, that we do not speak about computerisation any more. Computational statistics is a methodology for the sorting, filtering, processing, integrating and displaying of statistical data. The parameters characterising the size and the complexity of the information to be processed and displayed has increased steadily. To cope with this computational statistics has to use the most contemporary facilities of computers and the newest results of theoretical statistics. As statistics makes information useful for people, then in the information age education should involve statistical education as a compulsory element.

Tooding, L.M. & Koskel, S. "Teaching elementary statistics by MsOffice software".

The authors have taught matematical statistics and data analysis at Tartu University to the students

of pedagogical and social sciences, mathematics and history. These courses give basic knowledges about mathematical statistics and help students to apply statistical methods in their studies and their job in future. For practical works we use software of Microsoft PowerPoint, Microsoft Excel and Microsoft Word - to comments and to draw up the results. We find that the software makes statistics more attractive and enjoyable for the students.

Traat, I. "Experiences in computer-based teaching of survey sampling".

The aim of the first course of Survey Sampling is to make student aware on the existence of different sampling designs and on the randomness created by these designs. During the course students have to understand that with skillful planning of the survey it is possible to increase its effectiveness - to decrease variability of survey estimates, to reduce survey costs and duration time. Students have to learn that different sampling designs require different estimators, optimal for the observed design. They have to learn to find the precision of the survey estimators. All this is possible with the help of Survey computer programs received from the authors of programs and used at the University of Tartu since 1993.

Velsker, K. "Teaching descriptive statistics and probability theory at primary school".

It is necessary to re-establish elements of probability theory and mathematical statistics in the programme of mathematics at Estonian school. Pupils have to be acquainted with the notion of randomness during longer time period. Therefore it is reasonable to consider basic notions of probability in a concentric or spiral way. On first two levels it is good to follow the problem-orientedteaching. At primary school it is within pupils' powers to learn the ways of collecting statistical data, their presentation, and primary analysis including standard deviation. In addition to this it is essential to teach some notions from probability theory - random event, its probability, random variable, its distribution with some basic characteristics like expectation and variance.

Antoch, J. "Making MATLAB and MAPLE/MATHEMATICA an environment for teaching (computational) statistics".

The lecture concentrates on some possibilities offered bythe computing environments: MATLAB and MAPLE/MATHEMATICA, for teaching (computational)statistics, resp. for prototyping of new ideas by students. Integration of the possibilities of these environments, not their ``antagonism", will be of primary aim. The basic ideas will be illustrated on several classical models taught in (basic) courses of statistics as: estimation of parameters in linear regression (in linear model) and construction of related procedures; calculation of the ARL (average run length) in quality control; calculation of ranks test and respective critical values etc.

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13. FORTHCOMING CONFERENCES

1. 51 st Session of the International Statistical Institute 18-26 August 1997, Istambul

This meeting will be held under the auspices of the President of the Republic of Turkey and the

responsibility of the State Institute of Statistics of Turkey.

The Session is to provide a forum for the international exchange of knowledge between participants, and also aims to encourage the international integration of statistics by estabishing worl-wide relations between statistical societies and other official organizations concerned.

Information avaible from ISI97@die.gov.tr

Internet: http://www.die.gov.tr/ISI/isi ~i.html

2. PME WORKING GROUP

The PME Working Group on Probability and Statistics is planning its activities for the meeting in Finland in July 1997. We are conscious that three major chapters on aspects of stochastics teaching are about to, or have been, published. These chapters, and the general interest at this time in the teaching of stochastics, mean that there is likely to be increasing interest by both teachers and researchers in this field.

Our current plans are to try to produce a "Short Guide to the Literature on Teaching and Learning Stochastics", which could be of assistance to those wanting to enter what is rapidly becoming a very large body of literature. Preliminary plans will be made via our e-mail listserver in the next few months.

Readers who wish to become involved in this project, regardless of whether they intend to attend PME, are invited to contact Carmen Batanero <batanero@goliat.ugr.es> to have their names placed on the e-mail list.

3. The Fifth International Conference on Teaching Statistics - ICOTS-5

Place: Nanyang Technological University, Singapore,

Dates: June 21 - 26, 1998.

Web Site: http://www.nie.ac.sg:8000/~wwwmath/icots.html

Theme: Statistical Education - Expanding the Network

Contacts:

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General objectives:

> To provide opportunities for educators throughout the world to expand their network in statistical education and encourage a worldwide exchange of ideas. In particular the conference aims to create opportunities for networking:

* technology with modern methods in the teaching of statistics;

* school and post secondary statistical education at all levels;

* the wider community with statistical educators;

* statistical education with the forefront of statistical practice;

* the exchange of ideas for teaching statistics between and within developing and developed countries;

* educational research results and the practice of teaching statistics.

It is planned to include keynote speakers, invited speakers, contributed papers, workshops and forums for the exchange of ideas, demonstration lessons, round table sessions, poster sessions, book and software displays, hands-on computer sessions and many opportunities for communication and exchange of experiences and ideas. In particular i t is intended to have some 'networking opportunities' in which the time and opportunity is provided for participants to develop links between people in several areas.

The conference will focus on the following main topic areas:

1. Statistical education at the school level. Convener. Lionel Pereira-Mendoza, Singapore, pereiraml@am.nie.ac.sg

2. Statistical education at the post-secondary level. Convener: Richard Scheaffer, USA, scheaffe@stat.ufl.edu

3. Statistical education for people in the workplace. Convener: Kerstin Vannman, Sweden, kerstin.vannman@ies.luth.se

4. Statistical education and the wider society. Convener: Anne Hawkins, UK, ash@maths.nott.ac.uk

5. An international perspective of statistical education. Convener: James Ntozi, Uganda, isae@mukla.gn.apc.org

6. Research in teaching statistics. Convener: Joan Garfield, USA, jbg@maroon.tc.umn.edu

7. The role of technology in the teaching of statistics. Convener: Rolf Biehler, Germany, rolf.biehler@post.uni-bielefeld.de

8. Other determinants and developments in statistical education. Convener: Guiseppe Cicchitelli, Italy, pino@stat.unipg.it

9. Contributed papers. Convener: Shir Ming Shen, Hong Kong, hrntssm@hkucc.hku.hk

10 Poster sessions. Convener: Peng Yee Lee Singapore, leepy@am.nie.ac.sg