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Edited by

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Presenters in topic group 4 at ICME-9

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INTRODUCTION

In August 2000 the Ninth International Congress on Mathematical Education (ICME-9) was held in Tokyo, Japan. On behalf of the International Association for Statistical Education (IASE) Topic Group 4 (TSG4) entitled 'Teaching and Learning Statistics' sessions were held at the above conference. The aim of this topic group was to elucidate problems, with potential solutions, involved in the teaching and learning of statistics at all levels of education.

The format of the sessions allowed speakers to put forward their own countries, and in some cases joint countries, research findings. Many issues were brought to light with possible methods of teaching proposed. At the end of each talk delegates had the opportunity to ask speakers questions on their presentations. These questions were not only interesting and the replies informative, but showed that the delegates at ICME-9 have a real concern over the way students learn statistics. Two sessions did not appear to be enough time for all the issues raised to be fully explored, however, many delegates carried on discussions well after the sessions had ended. The speakers presented issues on a variety of topics and gave their views from many different cultures. The findings from the research carried out was diverse, from many levels of education and in total added to the flavour of the sessions content and debate.

Here is a brief outline of the talks and the authors full contact details are at the end of this booklet.

Paper Title: Structural Equation Models Relating to Attitudes about Achievement in Introductory Statistics Courses: A Comparison of Results form the USA and Israel

Joe Wisenbaker, Janice Scott University of Georgia USA & Fadia Nasser Tel Aviv University, Israel. Contact person is Joe Wisenbaker < joe@coe.uga.edu >

Joe started off the session by giving an overview of the difficulties that many students, particularly those in the social and behavioural sciences, encounter while taking introductory statistics courses. Those identified were classified as cognitive factors such as mathematical ability and background, and non-cognitive aspects of statistics education. Comparative results of students from Israel and the USA were then presented. It was clear that further research in this area would be desirable.

Paper Title: The Teaching and Learning of International Statistics in Transitional Country: Case of Ukraine

Ruslan Motoryn, Kiev National University of Economics, Ukraine <statist@kneu.kiev.ua>

Ruslan presented the Ukraine's prospective in statistical education. He described the syllabus content of his country's courses. The transition from planned to market economy in areas of productive forces was described. Ruslan wanted to convey that help from developed countries was required for transitional countries to appreciate and use the techniques available. Resources in these types of countries was still very sparse and that statistical education was still of a formal nature and very mathematical in content. He was sure this was going to change in the near future. Advice form other countries would be much appreciated.

Paper Title: Conceptual Challenges facing A-Level Statistics Students: Teacher and Examiner Perspectives

James Nicolson & Gerry Mulhern, Queen's University Belfast, UK
<j.r.nicholson@qub.ac.uk> <g.mulhern@qub.ac.uk>

This study investigated students' conceptual challenges among A-Level statistics teachers and examiners. This was carried out by using a questionnaire, which was either written, or via semi-structured interviews. The questionnaire comprised of two sections: (i) free-response questions and (ii) an attitude scale which was designed to assess agreement with specific statements regarding possible conceptual challenges. 49 participants completed the questionnaire and these results and findings were presented to the delegates.

Paper Title: How do we Arouse Students' Interest in Statistics?

Hiroaki Hirabaysshi, Osaka Women's junior College, Japan <skyfine@ka2.so-net.ne.jp>

Hiroaki stated that many students in his college disliked statistics and that in order to arouse students' interest appropriate teaching material needs to be developed. He outlined why it was thought that these students lost interest in statistics. This presentation centred on using computerised statistical models used for estimation purposes, which proved to be entertaining. These models were very complex in their mathematical structure and that by using computers the student’s fear of statistics was reduced and interest in the subject was revived.

Paper Title: The use of a Multimedia Tool in Teaching Factor Analysis to Business School Students. Is there a Statistical Significant Improvement?

Corinne Hahn & Patrick Dassonville, Chambre de Commerce et d'Industrie de Paris, France <chahn@schamp.ccip.fr>

Corinne's paper was about the teaching of factor analysis to students from a non-scientific background. This was not considered an easy task to do and that new ways of teaching this topic should be considered. The first stage in this project was to create a multimedia tool and the second was to evaluate the efficiency of this tool. Corinne gave a brief introduction on the teaching of statistics in French Business Schools and then went on to describe the pedagogical programme integrating the multimedia tools developed. Two groups of students were followed one using the multimedia tool the other group using traditional teaching methods. The findings of this piece of research were describe in full outlining the advantages and disadvantages. The project overall was seen as a success and advocated the use of the multimedia tool.

Paper Title: Assessing and Fostering Children's Statistical Thinking

Graham Jones, Cindy Langrall, Ed mooney & Carol Thornton, Illinois State University, USA, Bob Perry, University of West Sydney, Australia, Ian Putt, James Cook University, Australia & Steven Nisbet, Griffith University, Australia <jones@ilstu.edu> <b.perry@uws.edu.au> <Ian.Putt@jcu.edu.au> <snisbet@gu.edu.au>

In this presentation Graham Jones discussed how the teams research had built and used a cognitive model to support instruction in data exploration. The talk examined the formulation and validation of a framework that described students' statistical thinking on four processes. He also described and analysed various teaching experiments with young children that used the framework to inform instruction. The team's conclusion is that more research to build learning trajectories that link different levels of children's statistical thinking identified in the framework.

Paper Title: Multimedia and Multimedia databases for teaching Statistics

Hans-Joachim Mittag, University of Hagen, Germany <joachim.mittag@fernUni-hagen.de>

Nowadays the use of multimedia resources and WWW supported learning environments is a crucial issue in education that was presented by Joachim. His talk was supported by his own multimedia techniques that are used in Germany. He advocates that statistics seems particularly suitable for illustrating the benefits of a multi-media based teaching. In particular the modularisation of many courses bodes well in this environment. This use of animated textbooks with on line help is useful for students to learn at a distance. For the full potential of this technique to be usefully employed a

systematic co-operation between different educational institutions, co-ordinating their development and exchanging ideas will be necessary for (a) its future development and (b) the implementation of such techniques.

Paper Title: Co-constructing Statistical Knowledge

Carolina Carvalho & Margarida Cèsar, University of Lisbon, Portugal <ccarvalh@fc.ul.pt> <mcesar@fc.ul.pt>

Carolina and Margarida's research was carried out in Portugal but the findings that were presented were certainly understood and emphasised with by delegates at the session. The main focus of this research was to analyse peer interactions in order to understand their role in students' performances when they were solving statistical tasks. A deep analysis of their discourse was presented. The way in which students solved tasks proved to be interesting and illuminated many aspects of learning statistics. It was found that above all peer interactions was the most powerful way of implementing new strategies for solving problems. Portuguese educational authorities supported this study and further work into this is ongoing at the present moment in time. The authors would be more than happy to receive enquires or other research into this area.

Paper Title: Teaching Statistics in the first years of the University with emphasis in the solution of problems

Elena T. Fernández de Carrera, Universidad Nacional del Litoral, Argentina <ecarrera@fbcb.unl.edu.ar>

Elena says that all professionals should be qualified to design an investigation, gather data with previous planning and analyse the results, he also finds indispensable to be able to understand the current scientific literature. To be able to carry out all this he/she should have knowledge of Statistics. She concludes that It is evident that this teaching approach also requires challenges in the way of evaluating. It requires questions where the student reveal to understand the main statistical concepts of the problem, the key ideas, the big ideas, to interpret a problem and to choose the appropriate statistical tools that are more adequate to the data. It also requires that anybody can read the paper, understand it and why not carry out critical observations of the same one.

Paper Title: Demonstrative Prototype of the Statistical Methods.

Maria da Graca Pereira, Florianopolis, SC, Brazil: <mgp@matrix.com.br>

Maria describes the introduction of hypermedia technologies in statistical methods as well as their applications in the training of students. The electronic book uses theoretical methods to calculate means, medians and variance for samples and provides a deep knowledge about statistical methods. Consultation sessions allow the student to learn

the theory and practice to solve statistical problems. An hypertext system represents the information, in a different way from others usually employed because it is presented as a non-linear mode and, therefore, allowing to take advice with information in agreement with user interests. The paper also discusses publications that suggest the benefits of hypermedia systems applications in personal training models.

Paper Title: Conduct and Presentation of a Statistical Survey: An effective way of increasing the popularity of a 'Dry' subject

Saleha Naghmi Habibullah, Kinnaird College for Women, Pakistan
<salehahabibullah@hotmail.com>

Saleha says that teaching and learning of statistics at the undergraduate level, a moderate amount of training in small-scale data-handling seems to be an indispensable part of an introductory program in statistics. She tells how in the Pakistani system of statistical education, there is very little emphasis on the conduct of practical projects involving collection and analysis of real data and how the Department of Statistics at Kinnaird College for Women, Lahore initiated a series of small-scale statistical surveys back in 1985. Combining information with other items of interest, such a program provides an effective forum for increasing the popularity of a discipline that is generally considered to be a tough and "dry" subject. This paper throws light on various segments of the most recent one of these programs.

Paper Title: Students' intuition and doing mathematics. An example in probability

Gabriel Yanez Canal, UIS-Bucaramanga- Colombia, Mexico <gyanezc@prodigy.net.mx>

Gabriel claims if it is accepted that the concepts of probability are complicated, it should be also accepted that they are very near to the daily life of common people. Anyway, everybody has to face a variety of situations of uncertainty that can cause either anxiety or joy. As the idea is to teach these concepts to the students, the best way to do is it to have fun when carrying it out. This paper reports the experience with a group of students who are preparing to become high school teachers, in the world of probability by talking about soccer. With this sport as a reference a question is posed such that when students are asked about it, it not only allows an interesting probabilistic analysis, but also takes them, when solving it, to other mathematics concepts like limits and derivatives. The whole situation is presented: its position as conjecture, attempts of answering that include computer work and graphics up to its formal proof.

Summary of the papers

Common questions at the sessions focused on the following areas:

1. How much mathematics is needed to be able to do statistics?

2. Developing and transitional countries need help to move into the new realm of statistical education being advocated by developed countries.

3. That appropriate use of technology could enhance the students understanding of statistics.

4. Co-operation between educational institutions, the development and exchange of ideas is paramount to the successful implementation of multimedia resources.

5. Research, from various countries, should be presented and that knowledge gained from these studies can be used to enable educators to improve their own teaching material and methods of delivery. All that agreed further research into how students learn statistics would be advantageous and that new innovative ways of teaching statistics is desirable.

One of the main issues that came out of the conference is the use of new technology. The way in which statistical understanding may be effected by the use of new technology was discussed to determine whether or not this technology, which has been developed according to certain pedagogic principals, is proving to be effective medium of instruction. Papers at the ICME-9 conference highlighted issues associated with the use of this new technology as a method of instruction. Much of the work that has been carried out in this areas focuses on students who have little or no formal instruction in statistics, however, the findings are appropriate to student who are following courses in mathematics and/or statistics.

A well attended topic group with much food for thought being presented and a lively discussion took place with the delegates. It was certainly appropriate that the IASE is involved in these statistics sessions at ICME conferences. There is a keen interest by delegates in statistics and statistical education. Hopefully in the year 2004 the next ICME conference will have more sessions in this area.

For completeness I have also included the papers submitted for the ICME-9 sessions but the authors, due to various reasons, were unable to attend.

Susan Starkings
Chief Organiser TSG 4 ICME -9
November 2000

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