SHARING EXPERIENCES IN THE TRAINING OF RESEARCHERS[1]

Keywords: *statistics education research; training researchers; doctoral and masters' programmes.*

1. INTRODUCTION

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This collection of short articles has been written by statistical education researchers who have agreed to share their experiences of training researchers in this area. The contributors come from several different countries and include both those who are relatively new to this field as well as those who have been working in it for several years. Some of them write about their own experience in becoming a statistical education researcher and some give information and advice about the training of other researchers.

Several contributors state that researchers in statistical education need knowledge in both statistics and education. In making comparisons it is important to realise that in some countries PhD students attend taught courses as well as writing a thesis, in others the award of a PhD is based on a thesis alone. Clearly some teachers feel the need for research results in statistical education, and it is encouraging that some are likely to make use of the results of their own research in the classroom. By providing something of a global picture of a variety of situations it is hoped that these contributions will help both to identify some of the problems in training researchers and to suggest ways of dealing with these problems, and hence will help to increase the number of statistics education researchers and the status of statistics education research in the world. In its turn this should improve the teaching and understanding of statistics at all levels.

The articles by Joan Garfield and Lionel Pereira-Mendoza are concerned mainly with PhD supervision. Joan describes the supervision experience of recent US doctoral students in statistics education. Most of them had come into statistics education because of their experience in teaching statistics, and those who had completed their research were teaching. Joan notes that it appears to be easier to do statistical education research within mathematics education, a situation which occurs in many countries, but it is encouraging that there are plans for the development of formal programs in statistics education in the US. Lionel gives his thoughts and advice as regards PhD supervision based on his own experience as a supervisor, concentrating particularly on what he feels is important in supervising someone working in the area of statistical education.

Carolina Carvalho, David Green and Chris Reading tell us about their own research. David and Chris give very honest accounts of their development as statistical education researchers. Both have been fairly isolated as researchers but stress that it is important to have contact with other researchers. David ends with some recommendations for those undertaking statistical education research. Carolina gives an account of her doctoral research in which she looked at the role of peer interaction in the study of statistics in the 7th grade in schools in Portugal. Her results suggest that working together is beneficial to pupils. She points out that teacher training is important as it is not always easy for teachers to introduce new methods.

Ernesto Sánchez, and Michel Henry and Bernard Parzysz tell us about statistics education research training in their countries. Michel and Bernard discuss the situation in France and how changes in the teaching of probability and statistics at school level drive research. They think that those doing research concerned with teaching these subjects should have an academic background in them, but should also have some training in didactics. They describe the IREM network in France which links research on the teaching and learning of mathematics and teacher training and has within it a working group on statistics and probability. Ernesto writes about the position in Mexico. As yet there is little activity as regards research in statistical education, and what there is tends to come via mathematical education and teaching experience. He comments that the students under his supervision perceive statistics to be "hard".

Carmen Batanero writes about the difficulties of setting up what has become a very successful and renowned research group with an associated training program. She gives details of the program in which educational theory and research methods are important components. Carmen hopes that their experience in

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International Association for Statistical Education

Spain will encourage others to set up doctoral programs.

Susan Starkings describes how the statistical support service at her university in London can help statistical education researchers who are not statistical experts. This service is given within a mathematics support section. She remarks that research supervisors do not always have relevant statistical knowledge and that those new to research do not always think through their investigations in full before they start. She too, like several other contributors, makes the point that researchers in statistical education need knowledge of pedagogical issues.

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2. RECENT PHD'S IN STATISTICS EDUCATION

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Statistics Education is a relatively new discipline that is growing in interest and activity. People conducting research in statistics education come from a variety of different areas and often have very different backgrounds, coursework, and training. Over the past year I became interested in learning more about graduate students in the USA who have decided to pursue degrees in statistics education. I conducted e-mail interviews, using a short questionnaire containing open-ended questions, with eight current doctoral students and recent PhD's whose dissertation research focused on statistics education. I wanted to learn about their coursework, their training in research methods, and the topic of their dissertation study. I was also interested in finding out the nature of their experience designing and completing a degree that focused on statistics education. These eight individuals shared with me their reflections on the process of earning a doctoral degree in statistics education and offered advice to future graduate students interested in pursuing this path.

Through word of mouth and personal contact, I obtained the names of these eight individuals who had recently graduated or were in the dissertation process, and all agreed to be interviewed. They were the only ones in this position whom I was able to identify at that time. Each individual has a different story about how they came to be interested in statistics education, how they designed a program that would allow them to develop the expertise needed to do a dissertation in this area, and how they were able to complete the requirements and overcome obstacles along the way.

Most of the people interviewed came to statistics education because of their experience teaching statistics. Many expressed their enjoyment teaching statistics, but also expressed a concern over difficulties students have learning statistics, solving statistical problems, and using statistical thinking, which led them to study and pursue research in this area. Only one person chose this area because of her advisor's research interests. Two people indicated that they specifically planned to teach statistics at the college level and thought that this degree would best prepare them. These eight individuals entered graduate programs in statistics, mathematics education, or educational psychology programs. Based on their experiences, it appears to be somewhat easier to design a statistics education focus within a mathematics education department than in other departments. Many students outside of mathematics education either had to combine programs (e.g., statistics and education) and have co-advisors, or switch advisors to find one that approved of a dissertation in statistics education.

One interesting distinction between students in the three different areas has to do with the type of job preparation they receive. Most mathematics education programs are focused on teacher education (i.e., teaching those who will prepare math teachers) while the combined programs of statistics and education are focused on training individuals to be teachers of statistics themselves, typically at the college level. Students in Educational Psychology are prepared to teach quantitative methods (to graduate students in Education) and to conduct research in the area of educational statistics.

The coursework taken by these people varied according to the type of department they were in. For example,

students in Educational Psychology programs took mostly courses in that department (e.g., statistics, measurement, and learning) and were less likely to take courses in mathematics education. Students in mathematics education programs appeared to have more varied programs with courses in educational psychology and statistics in addition to mathematics education. Several people found their coursework in psychology or learning and cognition to be the most helpful in preparing them to do research in statistics education, while others noted their coursework in statistical methods was particularly valuable. Most of the students across programs valued preparation in both quantitative and qualitative research methods.

Getting a dissertation topic approved was often a hurdle, and a few students experienced reluctance from their advisor to agree to a focus on a statistics education topic, feeling that this would limit their job possibilities. In the cases where students had co-advisors, getting approvals from two advisors and two departments was often challenging and took extra time. Most of the people interviewed were the first person to design a statistics education program and dissertation either at the institution or with their advisor. One person commented: "My biggest obstacle was that since no one had done this before I was on my own for a lot of it in deciding what courses I should take and what an appropriate dissertation looked like."

Being connected to the wider statistics education community via meetings and newsgroups has been very helpful to many of the people interviewed. One person commented "I would especially like to acknowledge how wonderful the statistics education community has been about welcoming me into the fold. I have met some terrific people and made some great connections and look forward to continued work with these people."

Others wish there could be more recognition of and validation for statistics education as a legitimate area for study and research. "As more students pursue degrees in statistics education it is important to identify faculty members as advisors who have comfort and expertise in both fields, education and statistics." "While looking for a job, I was asked a few times what exactly a statistics education degree was. I had the most success in answering this question by saying that it was like a mathematics education degree."

Those who have finished degrees are teaching in a variety of settings, and appear quite satisfied with their decision to focus on statistics education. One person remarked, "I am very happy I chose the field I did. My teaching and my research feed off each other, which is very meaningful to me… I'm excited by the 'newness' of the field. There are so many directions in which we can go and I am happy to be near the beginning of that exploration."

Since conducting these interviews I have learned of at least two other USA graduate students, both in departments of mathematics education, who are working on dissertations focused on statistics education. These studies examine middle school or high school teachers' knowledge and understanding of statistics, an emerging area of interest to statistics education researchers. With more formal programs in statistics education beginning to be developed (e.g., at the University of Minnesota beginning in Fall 2002), the statistics education community should begin to provide a more consistent and complete training to prepare and support future teachers and researchers in this emerging discipline.

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3. TRAINING FUTURE RESEARCHERS IN STATISTICS EDUCATION: REFLECTIONS FROM THE SPANISH EXPERIENCE

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The Doctoral Programme in Mathematics Education at the University of Granada was started in 1988, with only three lecturers in charge of teaching the courses and supervising research, one of them coming from the Department of Statistics and with no experience in educational research. Fortunately we counted on the help of a very experienced French research team in mathematics education: professors, Michéle Artigue, Ives Chevallard,

Regine Douady, André Rouchier, coordinated by Guy Brousseau, who travelled to Granada to teach some of the courses and helped in the orientation of the theses during the first four years of the programme. Starting the doctoral programme would have been quite impossible without their help and no doubt the influence of the French school in our research work is still visible.

There have been different regulations for doctoral programmes in Spain throughout this period. From 1988 to 2000, students were asked to complete 320 hours of regular course work and seminars, over two years part-time, with the possibility of spending up to 90 hours in the second year producing a preliminary written research monograph (similar to a Master's thesis). In the new regulations, the amount of course work is reduced to 200 hours in the first year and the second year is dedicated to producing a compulsory research monograph weighted as equivalent to 120 hours of taught material.

When the student has finished these two years and his/her research work is approved, he must work on a PhD. D. dissertation (original research, supervised by an expert in Mathematics Education or a related field), which usually takes 2-4 more years to complete. This Programme is offered within a Mathematics Education Department and most of the students who throughout these years have presented a thesis (24 at the moment) as well as other students who are currently at different stages in their research, are mathematicians. A few students have come from Education or Physics. In the last few years we have received South American students with other backgrounds, although the majority of them still have backgrounds related to mathematics. Nine students have finished their doctoral thesis in statistics education, and all of these specialised in statistics during their University studies or had been teaching statistics for a number of years before entering the programme.

3.1 CONTENTS OF THE PROGRAMME

Although some students have had experience in educational research and in teaching mathematics or statistics, the majority of them have needed to complement their theoretical knowledge about education and mathematics education. Two courses (together lasting 60 hours) on the Theory of Mathematics Education include four main components: Mathematics (Statistics) Education as a Scientific Discipline, Epistemological Foundations, Teaching and Learning Theories and Curricular Theories

The number of specific courses in statistics education has increased from only a 30 hours course in statistics education in the period 1988-1994 to 3 different courses (didactics of probability; didactics of data analysis; didactics of inference) with a total of 100 hours in the period 2000-2002. The basic content of these courses is: Current situation of Statistics Education: Epistemology of Stochastics: Cognitive development: The stochastic curriculum: Research into students' understanding and learning: Other research: attitudes, social factors, comparative studies, case studies, textbooks.

The main methodological content of the courses, which have ranged between 120 hours (in the 1988-1990 programme) to 60 hours in the 2000-2002 programme are: Research paradigms: The Research Process: Data Collection: and Data Analysis.

3.2 STARTING A RESEARCH GROUP IN STATISTICS EDUCATION

Starting in 1988 a doctoral programme with only three possible supervisors forced us to concentrate the research topics on three basic research lines: Numerical Thinking, Theory of Mathematics Education, and Statistics Education. Two of the lecturers in charge of the programme had carried out their dissertations in pure statistics and had extensive experience of statistics consultancy work in different experimental research areas, the field of statistics was familiar to them in its different facets: teaching, applied and theoretical research. That experience has also made them conscious of the problems in understanding and applying statistics and of the interest in carrying out didactical research in this area.

The fact that, after finishing their dissertations, our colleagues stayed in our department or other cities close to Granada (Jaén, Melilla) served to increase the "critical mass" of lecturers who had specialised in statistics education and who could collaborate in supervising new students. From a few initial problems: association, combinatorics, the test of hypotheses, we gradually moved to other areas, such as probability or the normal distribution. Nine doctoral dissertations have been finished in statistics education in this period and three more are currently in progress.

The doctoral programme at the University of Granada has received a great deal of support from Spanish and other European academic authorities and this has served to fund visits from the principal mathematics and

statistics educators who have given us courses and discussed with us our research in progress. Statistics education research received particular support through different funded projects from the Spanish Ministry of Education. The IASE decisions to hold the ICOTS-4 conference in Marrakech and the 1996 IASE Round Table Conference in Granada served to consolidate and give impetus to our work. These meetings helped us to establish new valuable contacts and collaborations that still continue.

The list of theses, projects and publications carried out in the group is available from our web page http://www.ugr.es/local/batanero, which is also linked to the IASE and other statistics education web servers.

3.3 FINAL REFLECTIONS

Having finished the training of all the members in our own department (where there are now 18 lecturers with a PhD in mathematics or mathematics education), and also the training of other colleagues in Andalusian universities (3 in Jaén, 2 in Cordoba, 2 in Malaga) we focus now on the education of young students and South American colleagues, who in the last years were increasingly successful in getting a grant either from their own countries or from the AECI (Spanish Agency for International Co-operation), or OEI (Organisation of Ibero-american States) or other institutions. A number of doctoral dissertations by colleagues from Argentina, Colombia, Chile, Mexico and Venezuela are being prepared in Granada. When returning to their countries these colleagues usually take over responsibility for Master's or doctoral programmes in education or in mathematics education. It is, then, very likely that this collaboration can serve to spread mathematics and statistics education research in South and Central America.

In this brief report we have reflected on our particular experience in the training of researchers in statistics education from a mathematics education doctoral programme, which was started with a lot of effort, but has gradually been developed to be the main research programme in mathematics education in Spain and includes the largest statistics education research group in Spain. International collaboration was very important at different stages to start up the doctoral programme, and orientate the first theses. We hope this experience can encourage other researchers to start new programmes even with modest initial resources and in this way can serve to extend the interest towards statistics education research.

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4. ACCEPTING A CHALLENGE

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4.1. FINDING A FIELD OF KNOWLEDGE THAT WOULD ALLOW A PSYCHOLOGICAL PERSPECTIVE: THE CASE OF STATISTICS

Working in a Department of Education, in charge of Science and Mathematics teachers' pre-service and in-service training in Portugal, awoke in me the need to undertake an investigation that could be used again later by teachers in the classroom and at the same time go beyond the realisation of an academic study – a doctoral thesis.

In 1994/1995, I was confronted with César's (1994) studies, namely the results of her doctoral thesis about the advantages of peer work and the many questions which remained unanswered regarding this way of conceiving the appropriation of knowledge and the mobilisation of competencies. In an attempt to answer some of these questions I carried out research for a doctoral thesis (Carvalho 2001).

When I decided to study pupils from the 7th grade, as this was the first of three years that form the last cycle of compulsory education in Portugal during which instances of disinterest, retention and dropping out frequently

happen, it seemed fit to choose a curricular unit of the Mathematics subject that had been introduced with the Reform of the Educational System undertaken in Portugal during the '80s.

Choosing the Statistics curricular unit, which in Portugal is always part of the Mathematics curriculum, both in basic and compulsory levels – nine years – and in the secondary level – three years – seemed interesting because: (a) it is a topic of the Mathematics program that has hardly been studied by Portuguese researchers; (b) it allows the creation of tasks that help in understanding the dynamics of interactions produced by the pupils when working collaboratively; (c) it explores didactic contents with situations that are close to pupils' real-life situations, thus encouraging greater motivation and adherence to the proposed tasks; (d) it holds an increasingly important position in present society, which will eventually be reflected in school programs, (e) it contributes to the development of more critical, reflective and participating citizens.

4.2. THE INVESTIGATION: A CONTRIBUTION TO STATISTICS EDUCATION.

The investigation "Peer interaction: Contributions towards the promotion of logic development and statistical performance in the 7th grade" focuses on the study of peer interactions in the Mathematics classroom, namely after the 7th grade curricular unit of Statistics has been taught. The problem under study is the understanding of the progress that occurs when pupils work in dyads on various tasks, both in terms of logic development and in terms of statistical performance. Tasks such as using a formula to calculate a quantity are said to be "usual" tasks, whereas solving problems are "unusual" tasks.

From this problem, the following main objectives were defined: (a) to verify whether pupils, when working in dyads and solving unusual Statistics tasks (Experimental Group), show more progress in their logic development in comparison to pupils who do not try this form of work or tasks (Control Group); (b) to verify whether pupils, when undertaking unusual Statistics tasks (Experimental group), show more progress between the pre-test and the post-test in comparison to pupils who do not try this form of work (Control Group); (c) to analyse certain frequent mistakes and difficulties in usual and unusual Statistics task-solving; (d) to investigate which are the most frequent solving strategies that are used by pupils when carrying out unusual Statistics tasks; (e) to identify the type of dyad that accounts for a clearer evolution of pupils in relation to their logic development, that is, between the first and second application of the Collective Scale of Logic Development, l'ECDL (Lautry 1979, Londeix 1985), and in relation to their statistical performances (between the pre-test and the post-test); (f) to state the forms of interaction dynamics used by the dyads that facilitate solutions, whether successful or not.

The chosen methodology was based on an empirical plan of a *quasi-experimental* nature, with a control group and an experimental group. The empirical work was carried out during two consecutive school years, the second year being to replicate the study on a different group of pupils. At the start of the school year, the pupils of the two schools where the investigation was undertaken solved a Collective Scale of Logic Development (E.C.D.L.) and two usual Statistics tasks that served as pre-test. Pupils' performances were the criterion for the creation of the control group and the experimental group, keeping in mind that the unit for the group creation was the class unit. At different moments and for each one of the classes belonging to the experimental group, the pupils worked in dyads to solve three unusual Statistics tasks and participated in a general debate with the researcher. One week after the dyad work had finished, the pupils belonging to both groups undertook the usual Statistics task, corresponding to the post-test. At the end of the school year, they solved the Collective Scale of Logic Development again.

The main results of this study show that, if we compare their pre-test and post-test performances, the pupils belonging to the experimental group, who worked in dyads with unusual tasks during three sessions, show clearer progress regarding logic development as evaluated by the Collective Scale of Logic Development, as well as a more pronounced evolution in their performance concerning usual tasks. We also find that in the year of the study replication, these results are more pronounced. Another finding shows that the type of dyad we create tends to account for a pattern of subject performance. The dyads we considered as being of Type IV, which are heterogeneous regarding logic development and the pre-test task performance, are those that seem to produce more progress in subjects' statistical performances. However, the data obtained are not so clear as far as logic development is concerned. This investigation also produced another result: Statistics content presents difficulties to pupils and even those working in a different manner, like the experimental group pupils, still face hindrances when solving certain post-test items. Similarly, when pupils' performances are analysed differently, namely through interaction analysis, we find that the way many pupils master statistical knowledge is confined to an instrumental knowledge, that is limited to using a procedure or resorting to an algorithm. Finally, we were also

able to identify the different solving strategies used by pupils in unusual tasks, such as the trial and error solving strategy, the strategy of graphical representation with and without statistical support, the arithmetic solving strategy and the algebraic solving strategy.

The recommendations that arise from this study point towards a revision of the way pupils have been working on Statistics in the Mathematics class. Dyad work is one of the possible ways of changing these practices but, in order to do so, so that we enhance all the potential of pupils and thus facilitate the process of knowledge appropriation and the mobilisation of competencies, we should not team up pupils in dyads at random.

4.3. CONTINUING A TRAJECTORY: OUTLOOK FOR THE FUTURE

For a long time the literature has defended how important and necessary it is that Statistics teaching stops emphasising calculations and techniques, but we often find a different reality in the classrooms. In my opinion changing this reality is one of the great challenges of the future.

However, this is not an easy task when we are Mathematics teachers and are teaching Statistics and when we have never tried another method, or had pre-service or in-service training that makes us feel less uncomfortable with new working methods or contents which sometimes we do not know how to manage, such as group work or resorting to new technologies. Therefore, pre-service and in-service teacher training is a priority.

Collaborative work was shown to be a working method that allowed pupils to enrich their repertoire of statistical competencies, but there is still much to learn about how the nature of the tasks and the instructions that are associated with these affect pupils' performances.

The fact that similar difficulties to those detected by researchers from other countries were found in Portuguese students suggests that we must strive in order to understand better how statistical knowledge is appropriated by students. We must meet the need to create multidisciplinary teams with researchers from different fields as well as teachers (that is teams whose members have various perspectives) to look into these problems and enrich the analyses and understanding we have of them.

REFERENCES

Carvalho, C. (2001). *Interacção entre pares: Contributos para a promoção do desenvolvimento lógico e do desempenho estatístico, no. 7° ano de escolaridade* (Contribution to promoting logical development and statistics achievement in 7th grade children). Unpublished Ph.D. Univerisdade de Lisboa.

César, M. (1994). *O papel da interacção entre pares na resolução de tarefas matemáticas: O trabalho em díades vs. trabalho individual em contexto escolar* (The role of pair interaction in solving mathematical tasks: Working in pairs vs. individual work). Unpublished Ph.D. Universidade de Lisboa.

Lautry, J. (1979) Notes sur la utilization de l'ECDL. *Feuillets Documentaire du SAIO de Rouen, 127/8,* 4-23.

Londeix, H. (1985) Les relations entre Psychologie génètique et psychologie differencielle: l'analyse d'une test opératoire, l'ECDL. *L'Orientation Scolaire et professionelle, 14 (2),* 105-144.

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5. LESSONS FROM THE PAST

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5.1. GETTING STARTED

From my teenage years I had wanted to be a mathematics teacher, and when I graduated I was very fortunate to obtain a 3-year Assistant Lecturer post in a College of Education. I had previously only studied a small amount of probability and statistics and was now faced with teaching these subjects to future primary school teachers whose own mathematical backgrounds were often quite limited. The probability which I had studied was very formal and mainly combinatorics, and statistics had hardly featured at all. In preparing my lectures I came across the 'Birthday Problem' which intrigued me and I introduced it to the class, but the mathematics was unconvincing, being too much of a challenge for most. That was a first valuable lesson – mere proof won't convince people! It was during this course that an even more revealing experience occurred. A mature student drove in daily on a busy road on which accidents frequently occurred. In his view every time he successfully arrived at college the chance of his having an accident *next* time was increased. This provoked a lively discussion! Was it logical? Ignoring a variety of real-world factors it would be concluded that the student was wrong – an example of the 'Gambler's Fallacy'. This was the first time I had consciously come across a probabilistic misconception. I had always thought that faulty calculation was the basis of erroneous results. A second valuable lesson! A third lesson was the realisation that mathematics – and probability in particular – provided a *model* of reality and was necessarily limited in its applicability. This was something my traditional university mathematics training had completely failed to reveal.

So much for my early experiences, which came to an end with the completion of my three-year post. Following a short period working in industry I took up school teaching, where the probability was minimal and formal. In 1972 I embarked on a part-time MEd at London University (Chelsea College). There was a course on Piagetian psychology given by Joan Bliss, who had worked with the great man – although she did not mention 'La genèse de l'idée de hasard chez l'enfant' (Piaget and Inhelder, 1951). At Chelsea College Geoffrey Matthews, Professor of Mathematics Education (the UK's first such appointment), was directing the CSMS project (Concepts in Secondary Mathematics and Science, 1974-79) the first major research project in the UK of its kind. Despite all this, probability (and statistics) education did not feature in the MEd course, reflecting the nature of the school curriculum at that time, so I gained my MEd in 1974 with little thought of probability.

When I took up a lecturing post at Loughborough University I determined to embark upon research and naturally consulted researchers at Chelsea College who encouraged me to investigate probability concepts in UK 11-16 year olds, which the CSMS project had not done. Armed with one paper which contained just one relevant reference, in 1976 I set out on a long path of discovery …

In 1975 an English translation of Piaget and Inhelder's pioneering book appeared. Although relatively clear – by Piagetian standards at least – the book was for me disappointing, having little that I could see related to mathematical concepts in the UK 11-16 education. However, in the same year (1975) a much more exciting and relevant publication appeared 'The Intuitive Sources of Probabilistic Thinking in Children' – by Ephraim Fischbein – a remarkably talented researcher.

5.2. THE CHANCE AND PROBABILITY CONCEPTS PROJECT

The late 1970s were a good time for educational research in the UK and I successfully applied for a substantial grant from the Social Science Research Council, for a three-year project (1978-81) entitled 'Chance and Probability Concepts Project' to investigate concepts in 11-16 year-olds. This was extended with a further grant and the final report was submitted in 1982 and acknowledged as "a most competent and carefully worked study" which was encouraging. It was only at the first ICOTS conference (in 1982) that I realised that the large scale testing which I had undertaken was unique in the field.

What were the problems encountered? This project involved giving two approximately 50 minute tests to about 4000 school pupils, in classes of about 25, over a one-year period, in a radius of about 50 km of Loughborough (a town 25 km south of Nottingham). This required a team of five trained interviewers and entailed

considerable organisation. However, it was easy to recruit very capable people with previous school teaching experience. The real problem – only recognised as such with hindsight – was not having any academic partners. There was no lecturer colleague interested in the work, and my very able research assistant was essentially an administrator and I had no research students (this had not been considered). At the time I did not know of anyone in the world who was working in this field. This isolation was not seen as a problem at the time but has undoubtedly reduced the potential impact and extension of the basic research.

5.3. SUBSEQUENT WORK

The success of the original project encouraged me to widen the work, so as the project neared its conclusion I prepared a submission for a similar investigation into statistical concepts – arguably more relevant and important for the average citizen than the more specialised probability concepts. The bid failed. I have never fully understood this – one factor was it had become more difficult to get grant money, and another factor was that statistics – data handling – had next to no place in the secondary school curriculum. The bid was perhaps ahead of its time (or maybe flawed!).

As a consequence of this I turned my attention to probability concepts in 7-11 year olds, and following up the various ideas which emerged from this and the 11-16 year old work, reported at subsequent ICOTS and elsewhere (Green 1983, 1988, 1991), but not as fully as it should have been. This was in part because I had diversified into other aspects of mathematical education involving IT (for example, consultancy work for the Department of Education and Employment, and a fruitful and rewarding collaboration concerning dynamic geometry). In retrospect, what I should have done early on was make a concerted effort to work at length with the then current researchers (such as Fischbein, Falk and Konold). Only much later did I begin to do this – for example with a rewarding collaboration with Godino & Batanero – by which time my many other commitments (to administration, committees, national bodies) limited the time which could be devoted to this. I wonder what might have happened had I made some different decisions early on!

5.4. LESSONS LEARNED

Reviewing my own experiences and mistakes, I present below a list of the lessons and warnings for others to note. I hope at least some of them will prove relevant and helpful – I even hope to learn from them myself!

1. Initially work with the guidance of other experienced researchers.
2. Get to conferences – not just to find out what is going on around the world but, most importantly, to make personal contacts.
3. Read the literature widely - realise that there will be workers in other fields with overlapping interests so a wide range of journals will be worth perusing.
4. Seek funding to allow travel to visit other workers in the broad area, and try to develop joint projects, for prolonged collaboration.
5. Don't try to broaden your own research too soon – specialise.
6. Get a sabbatical to give yourself adequate time to develop your research ideas.
7. Make an effort to attract PhD students – perhaps through contacts with other workers in the field. Aim to build a team.
8. Don't be too influenced by early failure – try to find out why a research bid fails.
9. Make sure that research is properly written up and published in good time.
10. Avoid too much extraneous work: administration, committees, national bodies, etc.

REFERENCES

Fischbein, E. (1975). *The intuitive sources of probabilistic thinking in children*. Dordrecht, Netherlands: Reidel.

Green, D. R. (1983). A survey of probability concepts in 3000 pupils aged 11-16 years. In D. R. Grey, P. Holmes, V. Barnett & G. M. Constable (Eds.), *Proceedings of the First International Conference on Teaching Statistics,* (Vol. II, pp. 766-783). Sheffield, UK: Teaching Statistics Trust, Sheffield University.

Green, D. R. (1988). Children's understanding of randomness: a survey of 1600 children aged 7-11. In R.

Davidson & J. Swift (Eds.), *Proceedings of the Second International Conference on Teaching Statistics*, (pp. 287-291). Victoria, Canada: University of Victoria.

Green, D. R. (1991). A longitudinal study of pupils' probability concepts. In D. Vere-Jones (Ed.), *Proceedings of the Third International Conference on Teaching Statistics* (Vol 1, pp. 320-328). Voorburg, Netherlands: International Statistical Institute.

Piaget, J. & Inhelder, B. (1951). *La genèse de l'idée de hasard chez l'enfant.* Paris: Presses Universitaires de France.

Piaget, J. & Inhelder, B. (1975). *The origin of the idea of chance in children*. London: Routledge and Kegan.

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6. YOUNG RESEARCHERS' TRAINING ON TEACHING STATISTICS AND PROBABILITY IN FRANCE

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The teaching of probability and descriptive statistics at secondary level goes back to the 1960's. After a very abstract period during the 1970's, linked to the so-called "modern math" period, the teaching of probability progressively evolved during the 1980's. The combinatorial approach to probability, fitting in with situations of equiprobability, was replaced in 1991 by an introduction linked with the stabilisation of frequencies. The statistical tools for describing populations were introduced in 1986, as early as the beginning of junior high school (12 year-old pupils).

Recently, in the new curriculum which was set up in 2000 at senior high school level (15 to 18 year-olds), the statistical approach to the understanding of random processes has been reinforced and numerical experiments are proposed as the main access to probabilistic and statistical knowledge, by means of simulations in a computer environment. Probabilistic laws are then understood as mathematical models for concrete situations involving chance, models whose properties mirror those of distributions of frequencies of studied events, when the experiment is repeated a large number of times.

This evolution in the aims of teaching which takes into account the link between statistical processes and the theory of probability, requires a quick adaptation of mathematics teachers and implies coping with a high demand for training. This training must be based on thorough research work on the teaching of these areas of knowledge and abilities. It must also be based on experimentation in class situations, in particular with problem solving and on a didactical analysis of the learning conditions.

Until today such works are badly needed. Thus a training program for researchers on the teaching of statistics and on the planning of research should be part of the main aims of the community of researchers in mathematical didactics.

But in France, this question does not fit in with the structures of scientific research. PhDs centred on the teaching of a given subject do not enable young researchers to follow a normal academic career within this area. They are often compelled to join an educational science research team, the aims of which are quite different, since they are interested in general pedagogical questions, or in educational psychology, or sociology, or philosophy and history of education, rather than in questions of didactics.

It seems obvious, as is proved by many training actions, that in order to develop research centred on the teaching of a given subject, it is necessary for the researcher to be a "specialist" of this subject up to a level including a master's degree. This of course is also true for the teaching of statistics and probability. Most of the

researchers should come from an academic background training in mathematics including statistics and probability, or from some specialised colleges such as ENSAE (École Nationale de Statistique Appliquée à l'Économie) or INSEE (Institut National de la Statistique et des Études Économiques).

The curricula in educational science include some elements of descriptive statistics, together with bases for the use of estimation and hypothesis tests, but this level of probability is not conceptually sufficient. Complementary training should be given to enable these young researchers to focus on the teaching of statistics. It is necessary that every researcher should receive a basic training in the didactics of sciences up to the postgraduate level, which is when young researchers are initiated to practising research. This is an ambitious and open perspective.

But the aim of developing research programs on the teaching of statistics faces another major difficulty, which is the almost total lack of research directors in this domain in France, since there are fewer than five specialists altogether.

There is, however, a structure which works on the link between research on the teaching and learning of mathematics and teacher training : the IREM network (Instituts de Recherche sur l'Enseignement des Mathématiques), which exists in every one of the 25 French academic centres. This network created a national working group in 1991, the "Statistics and Probability" commission. This group is composed of about 15 members. It works on the implementation of the new curricula in statistics and probability at senior high school level (15 - 18 year-old students). The commission has produced documents and books for teachers based on classroom experiments, which are analysed and discussed from a didactical point of view. The commission is also a place where secondary school and university teachers, interested in the development of research on the teaching of statistics, can get training through research.

New questions are now appearing. For instance the question of teaching randomness as early as junior high school (12 year-olds), or even at primary school. Today, the relations between statistical reality and random situations, simulations with computers and probabilistic models, are the centre of the commission's work.

A first PhD thesis (presented in June 2001 at the University of Grénoble) was a result of this research work. It focuses on the introduction of random situations in general school through various activities in a computer environment (more precisely a dynamic geometry software : cabri-géomètre II). Random situations of "repeated Bernoulli trials" have been given to the students of the experimental classes, and simulations on computers have been used. The students' behaviour has been subjected to didactical analysis, centred on the relation between the experimental situation and the theoretical model of the Bernoulli urn.

This thesis should be the first of a series, prepared by young researchers or by in-service teachers, provided that the didactical community decide to promote such research. The help of IASE will be invaluable (meetings, conferences, exchanges of information and documents, assessments of research programs ...). In particular the IASE Newsletters are of the utmost importance.

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7. EDUCATING A RESEARCHER IN STATISTICS EDUCATION: A PERSONAL REFLECTION

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As Garfield has noted in her contribution above, Statistics Education is a relatively new discipline. Also, since statistics is truly interdisciplinary some of the issues associated with the education of researchers in statistical education are different from the education for researchers in other disciplines. One of the key differences is the background of doctoral candidates. They may not come to a programme with a statistics background. This presents a different challenge from the education of a researcher in mathematics education, say, where the student would usually have a mathematics background as well as experience as a mathematics teacher.

The following is based on my experience with a recent student who graduated with a PhD in statistics

education. However, it is clearly informed by previous supervisory experiences; nothing develops in a vacuum. Generalising from one subject is not a good research technique. However, I am sharing this so it may be useful to you if you are about to embark on supervising a student in this area.

Before proceeding further I need to describe the PhD process locally in Singapore, since it is different from that in the USA and Canada. In those countries a PhD has a "large" coursework component and a dissertation. The students gain their education both through the formal courses they take as well as the dissertation experience. Locally, the main focus is on the thesis. In fact, until very recently there were no required courses as part of the programme, although more recently a "small" coursework component has been included. However, the primary focus is on the research undertaken for the thesis - basically a British model. In addition, many students are here for 3 years on scholarship (this has been recently extended to 3.5 years to accommodate the fact that they will be taking some coursework). After this, while they can extend their period of study, the scholarship finishes and they are often not in a financial situation to continue at their own expense.

Given this background, what personal reflections can I include that might help a supervisor? I have focused on two that seem to be fundamental when training a statistics educator.

The first, and maybe most important, concerns the background of the student. If students pursue a programme in statistical education, often their background can inhibit their perceptions of statistical education, particularly if they have studied mathematics. With a mathematics background a view has been developed where logical reasoning, based on axioms, can be used as the basis from which valid conclusions can be drawn. Even if they have a science background, one of the key tenants of their experience is the reproducibility of experimental results. If an experiment is replicated under identical conditions then one will get the same results. When students are faced with statistical education, particularly in the area of probability, they are reasoning under uncertainty. The scientific education students have received previously can inhibit their ability to accept this "alternative" reality.

Consequently, the initial experiences given to students needs to be different. Their initial reading and reflection needs to fundamentally re-orientate their thinking. Any graduate student starts their programme by examining the literature. *It is particularly important for a supervisor to focus the student on the issue of uncertainty and how reasoning in a framework of uncertainly is fundamentally different from other forms of reasoning.* Also, some results in probabilistic situations are counter-intuitive. If a student is to pursue a career in this area it is essential that the nature of this understanding be inculcated into a schema of statistical education.

The second point deals with independent thought. A major focus of the supervision must be to develop the ability to generate and solve problems independently of the supervisor. Many of us have backgrounds as teachers. We also have particular preferences in terms of potential research topics. When students consider selecting supervisors they often seek guidance regarding potential topics. While students have various experiences in independent decision-making rarely have they had any deep experience in deciding on a research topic that they will pursue for a few years. The level of explicit direction requested will vary from student to student and culture to culture. It is particularly important to "pull back" with a view to allowing as much freedom of choice as possible. In fact, my own personal bias is to actively discourage myself from giving direction early in a programme. We all tend to believe we do this but it is particularly difficult not to give direction. Such an approach can be uncomfortable for a student since they may feel they are not getting as much direction as they expect. However, particularly *if when they graduate they are going to pursue academic careers the ability to set their own direction is an important facet of being a successful researcher.*

Clearly, there are other aspects of supervision, but on reflection these seem to me to be the key points, with the first being particularly relevant to the education of researchers in statistical education. I hope they prove useful to you in reflecting on your supervisory practice.

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8. VOCATIONAL TRAINING OF RESEARCHERS IN STATISTICAL TOPICS OF MATHEMATICS EDUCATION. AN EXPERIENCE IN MEXICO

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Even though the activity that we develop in our Department of Mathematics Education is not directly linked to Statistics departments of Mexican educational institutions, in our doctorate program there are some students whose interest is aimed towards research of topics in Statistics Education. On the other hand, as far as we know, our Department is the only one in Mexico that offers doctorate studies and research in this field.

In my particular case, my vocational training is that of a mathematician whose personal interests took him to study Probability and Statistics among the optional courses of the Mathematics degree. My Master's thesis in Mathematics Education is related to teaching models for the learning of probability. My doctoral dissertation (done like the Master's at the Centre for Research and Advanced Studies of the National Polytechnic Institute in Mexico) is about probability too; specifically it is related to concepts of Stochastic Independence. I have also taught Probability and Statistics courses at both high school and university levels. Through these experiences I had the opportunity to familiarize myself with the literature available in the area of Statistics Education, particularly in relation to students' difficulties with and beliefs concerning probability concepts.

As in my case, the three doctorate students under my supervision are not professional statisticians. One of them is a mathematician and the other two are engineers, but they have all specialized in the teaching of Probability and Statistics. They are currently working in topics of Statistics related to Mathematics Education. Their interest comes from their teaching experience and their conviction that statistics is a hard-to-teach and hard-to-learn subject matter.

It may be worth noting that in the courses that these post-graduate students can take as part of their doctoral studies, they may become familiar with other research topics such as those related to the teaching/learning of Algebra, or of Geometry, or topics as diverse as Problem Solving.

I think my experience is representative of what happens in Mexico in relation to the links between the institutions in which Statistics is taught, and those focused towards training researchers in Mathematics Education. It is clear that there is a need for greater collaboration between the research institutions in Mathematics Education and those specialized in training statisticians, in spite of the fact that it is my belief that the latter do not see the problems of Statistics education as a field of research.

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9. REFLECTIONS FROM MY EXPERIENCE

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Given that my PhD, upon submission, had ruled my life totally for one fifth of my existence and seen my supervisor through two restructures, which had him working first at a teachers' college and later at a university, one might wonder what would lead someone to embark on such an adventure.

Following my undergraduate studies in Mathematics and Statistics at the University of New England (UNE) in Australia, I undertook an Honours and Masters of Science program in statistics with a Diploma in Computer Science, on the side, as I needed to estimate some, as yet, untabulated integrals. At this stage, mathematics education operated from within the Mathematics and Computer Science Department at UNE. Although I completed a Diploma in Education, attending some classes at the local teachers' college, in preparation for teaching Mathematics, my first seven years of work involved tutoring in a variety of undergraduate statistics

courses, both theoretical and practical, at UNE.

When university funding was reduced I moved on to teaching mathematics, and subsequently computer science, at a local high school. I always maintained my ties with the university by studying some Australian History, before embarking on a Masters of Education. A requirement of my first unit of study, research methods, was to produce a research proposal and although my initial interest had been to research the use of computers in education, still in its infancy in the mid 80s, a lecturer in Mathematics Education convinced me to change direction and investigate levels of students' statistical understanding. His main interest was in Structured Observed Learning Outcome (SOLO) levels and he was recruiting a number of PhD students to investigate the use of the SOLO Taxonomy in a variety of fields. Recently rereading my research proposal prepared as part of the assessment in research methods, I was amazed at how closely it resembled the finished product, my thesis, so many years later. After one semester of study towards my Masters of Education my future supervisor, a SOLO expert, convinced me to alter my enrolment to a PhD and, as he was a member of the Faculty of Science, that was where my enrolment was initiated. Although, this constituted a relatively painless conception, the gestation and final birth of my PhD was a long slow process.

Early on I was encouraged to read widely and to produce my first two literature review chapters while I was piloting some open-ended questions to use with students in the main study. Although the reading and writing did not seem as interesting as collecting data, at the time, in my later write-up stage I appreciated that these early chapters had already been produced, even though they had to be brought up to date. However, in my next step of collecting data and analysing the responses I was really a little out of my depth. The only contact I had was with my supervisor who, although well versed in the SOLO Taxonomy which I was ultimately to use as a framework, he did not have a statistics background and so I felt that we floundered many times. Having considerably broadened his conception of statistics as our discussions progressed, he would often bring me back to earth when we digressed by quipping 'mean, mode and median'. This may help to explain why I have now developed an interest in the study of variation and the lack of attention that it has received.

By the time I was well into the data collection and analysis stage my supervisor had been relocated to the Armidale College of Advanced Education (the old Teachers College), where teacher training was centred. It was not always easy to find the time to devote to my data analysis whilst trying to hold down a fulltime teaching job, raise a son and play sport - I guess just generally trying to have a life. Although small chunks of time could be grabbed here and there, any reasonable length of time needed to really coalesce one's thoughts was difficult to find. Writing up the study was a little easier, except that you always have this underlying fear that it will never be quite right. During this time my supervisor moved again, this time out to his present location in the Faculty of Education, Health and Professional Studies at UNE.

During all this time I had contact with my supervisor only and at one stage a Master's level class of his which was studying SOLO. I never attended, or presented at, conferences or had contact with other statistics education researchers. At the time I was not aware that this was a problem and have only more recently realized what a great benefit such contact would have been.

Fortunately, or unfortunately, extensions of time were granted whenever submission time loomed. It was only the threat of having to pay another year of fees which finally made me submit, eight years after I initially enrolled. I dedicated my PhD to my poor, long suffering, son, then 18, who had never known a year of his life when I was not studying. It is rather ironic that the only time I was not working for the University was when I was trying to study for a PhD and would have most benefited from being in a University environment.

I continue to live an isolated academic life physically, despite taking up a job at UNE on completion of my PhD. I was actually hired into the Faculty of Education, Health and Professional Studies but my role is to teach about information technology in both pre-service and in-service courses, not an atmosphere which allows too much time for statistics education research. Although this does not allow as much regular contact with researchers as I would like, the use of Information Technology and attendance at conferences and presentation of papers does provide the potential for such much needed contact.

Contact with other researchers in the field of interest, not just PhD supervisor(s), is essential. Those now embarking on PhD programs should ensure that they take advantage of every possible opportunity to attend conferences, workshops and discussion groups and publish papers. Reflecting on my own experience the biggest regret that I have is the lack of contact with other researchers, which resulted from not being amongst a group of statistics education researchers, an isolation that prevented me from sharing ideas with others working in a similar area. Not all statistics education researchers in Australia are in the same isolated position as I found myself when I was studying for my PhD. There are various research projects which are being undertaken and my

advice to prospective candidates would be to ensure closer contact with other statistics education researchers during the entire PhD experience as this will help to give you a more varied perspective on your research findings and interpretation.

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10. STATISTICAL SUPPORT SERVICE FOR RESEARCHERS AT SOUTH BANK UNIVERSITY

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Researchers usually complete their degree programmes by studying a variety of units related to their respective subject discipline. When new researchers take up a post of researching a particular area of interest there are very few, if any, modules or help programmes set up to aid them in their investigation, none more so than with Statistics Education Researchers (SER). Some institutions have recognised a need for and do provide some sessions on various issues, for example on questionnaire design or survey methods. However, this is by no means enough to help the researchers with the statistics they may need in order to collect or analyse data. At South Bank University (SBU) a Statistical Support Service (SSS) is provided to help these researchers with their investigations. SER need help with statistics but also in pedagogical issues that surround the subject matter.

Setting up and running any support service demands a considerable amount of investigation and co-ordination by the organiser(s). The SSS described in this paper was set up after a great deal of discussion and planning had been carried out by me as the organiser and director. A number of factors needed to be taken into account when designing the structure for this support service. For example, one of the important considerations is that a pool of well-qualified and experienced staff is available, and such staff were indeed essential for the smooth introduction and subsequent running of the service.

The Statistical Support Service, launched in March 1999 at South Bank University, aims to provide researchers, lecturers and students with short courses in statistics and data analysis and to give on-going support to these interested parties. The emphasis is on the researchers and their research requirements and support. SER have an extra requirement of using statistics to make recommendations on teaching and learning issues. Research in statistics education is a very new subject discipline and hence the SSS has incorporated sessions related to this emerging discipline.The Statistical Support Service forms part of the Learning and Development Centre (LDC) at South Bank University. Its subject reference point is the Mathematics Support Section of the LDC. The researchers, SER, lecturers and students have not appeared to mind the Statistical Support Service being part of the Mathematics Support Section, hence its introduction and implementation has got off to a good start. Teams of statistical staff are available to give help and advice to all concerned. The main users of this service are researchers with potential data to collect and analyse, although during the last 6 months more enquiries from SER and issues related to statistics teaching pedagogy have become more prevalent.

The problems associated with providing a service of this type are numerous. Having experienced staff on hand to be able to answer the poignant questions is essential. Where these staff come from or have gained their expertise is open to debate in the UK since few statistics degree programmes are being run at the universities and hence the pool of qualified staff is ever diminishing. Staff who can help the SER are even more difficult to find. There could be a real problem in the future when trying to recruit appropriate staff. This is where the new *Statistics Education Research Journal*, in my opinion, can find a real niche hold.

Relevant and up to date handouts explaining techniques are useful for a researcher to work through but generally do not provide enough in depth material and analysis to cover all the areas of researchers' needs. At SBU we do offer certain taught classes on measures of dispersion and hypothesis testing and general survey methods. The researchers and SER then need to formulate their own plans for data collection and subsequent analysis.

The question of on-going support must be addressed and is also an essential requirement of the researcher.

In addition the SER have to be fully conversant with teaching pedagogy as well as learning and assessment techniques. The researcher or SER may have a supervisor who has relevant statistical knowledge, but in most cases, from SBU experience, this is not so and the researchers or SER come to use the service provided by the SSS. This support, while of benefit to the researcher, is not without a cost implication. The salary of the person providing support, and having someone experienced and available at the time required by the researcher are often problems. The SSS at SBU is only provided at certain times and the users of the service have to book an available time slot to obtain help. Much as we at SBU would like to provide this support continuously this is not practical in economic terms.

Relevant software is available for use but the machines that run this software are not housed in the LDC. Hence the researcher or SER must print out any query they have and bring to the SSS. Our computer services department will help with the problems associated with the computers but do not necessarily have the expertise in the software package being used. Some researchers, particularly if they are not fully computer literate, can find this a real stumbling block. Our staff in the SSS have on occasions gone to the computer lab with the researcher needing help. For any new software, i.e. not the general statistical software that is generally used such as SPSS or Minitab, our SSS staff may not be familiar with all the technical details and hence can waste a lot of time on something that is not of a statistical nature. Our experience at SBU is that researchers and SER often embark on a piece of statistical analysis without first considering the questions shown in Figure 1. We use these questions as a basic crib sheet to make sure the researchers and SER have fully thought out their investigations. The questions were originally designed for students doing statistical projects in the UK by the Centre for Statistical Education (Rangecroft et al 1996). While this may sound very trivial to experienced researchers/ statisticians we have found it a useful starting point and it leads onto more in-depth discussions about the investigations.

1. What exactly am I trying to find out?
2. Who or what do I want to find out?
3. What sort of information will I collect?
4. How shall I collect my data?
5. What should I include on my data collection sheet or questionnaire?
6. How long do I have to complete this project?
7. How should I choose my sample?
8. What resources do I have?
9. How accurate must my results be?
10. How big a sample should I choose?
11. How will I analyse my findings?
12. How will I collect together the answers?
13. How do I present my findings?

Figure 1: Questions to be addressed before starting your investigation

While I have outlined the problems we have found here at SBU and that any organisation attempting to provide this type of service should be aware of, the SSS has received good reports form the people that have used the system. We at SBU will continue to offer this service and hope to extend its provision in the next academic year. Should you need any further information or can offer any help regarding our service at SBU then please feel free to contact me.

REFERENCE

Rangecroft, M., Du Feu C. & Pollard, D. (1996). *Using statistics in your project*. London: The Royal Statistical Society.

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- IPM68 Assessment of literacy, numeracy and other life skills. Organiser: Denise Lievesly <d.lievesly@unesco.org>.
- IPM69 Impact of developments in information systems on statistics education (joint with IASC). Organiser: Annie Morin <Annie.Morin@irisa.fr> and Albert Prat
- IPM70 Teaching biostatistics (joint with the International Biometrics Society). Organiser: Elisabeth Svensson <elisabeth.svensson@esa.oru.se> and Els Goetghebeur.
- IPM71 Educational implications of statistical methods and modelling developments in psychometry. (Joint with the European Mathematical Psychology Group). Organiser: Helena Bacelar <hbacelar@fc.ul.pt> and Francesca Cristante.

Interested people are invited to contact the above mentioned organisers or the Chair of the IASE Programme Committee Gilberte Schuyten, Gilberte.Schuyten@rug.ac.be

The 10th International Congress on Mathematics Education, July 4-11, 2004, Copenhagen

The congress will take place July 4-11 2004 - The venue will be the Technical University of Denmark, located in a northern suburb of Copenhagen. The IASE will be collaborating in the organisation of specific statistics education activities in the conference. Chair International Programme Committee: Mogens Niss <ICME10-IPC@ruc.dk>. Chair Local Organising Committee Morten Blomhøj <ICME10-LOC@ruc.dk>. Conference web page: http://www.icme-10.dk/