TOWARDS A DATABASE OF RESEARCH IN STATISTICAL EDUCATION

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SUMMARY

Definitions of research in statistical education are discussed. A system of keywords for categorising statistical education research is outlined. Proposals for a Web-based survey of statistical education researchers to collect details of their research activities in statistical education, and the design of a database to store these details are described.

Keywords: Statistics education research; database; Web survey

1. INTRODUCTION

The development of a project to collect information about statistical education researchers and their research, and to store it in a database, is described in this paper. This project is the author's response to an invitation to teachers in higher education to get involved in activities of interest to the Learning and Teaching Support Network (LTSN) Centre in Mathematics, Statistics and Operational Research in the United Kingdom (Davies, 2000). One of the suggestions made in the invitation was that an international survey of research into pedagogic issues in statistics and operational research would be useful and productive. The dictionary definition of pedagogy is that it is the science of teaching. Teaching and training go hand in hand with learning, and neither teaching nor learning can be completely separated from assessment. Statistical education researchers are concerned with all of teaching. learning, and assessment, so a survey of statistical education research is in fact a survey of research into pedagogic issues in statistics.

In the literature both of the terms "statistics education research" and "statistical education research" tend to be used with similar meanings. However, statistical education research includes research into such topics as statistical reasoning and thinking and so is wider in scope than statistics education research, which implies research into education in statistics. Statistical education research therefore includes statistics education research. The project described in this paper is concerned with statistical education research in the wider sense, but both terms are used in this paper as appropriate. A distinction is sometimes made between statistics and probability, but for the purposes of this project statistical education is taken to include probability education. Indeed many papers on probability education are presented in the meetings organised by the International Association for Statistical Education (IASE).

There are as yet relatively few outlets for publication and presentation of statistical education research activities and results so that researchers tend to feel isolated, and finding out what others are doing is partly a matter of chance. In consequence important research findings do not always get as widely disseminated as they deserve, and unbeknown to one another, researchers could be doing similar studies (ignorant duplication), but without the advantages offered by the discussion and comparison of methodology and by the comparison and pooling of results (deliberate replication). An easily accessible and widely available electronic database giving details of research and researchers in statistical education would be a valuable resource for both current and future researchers in this field, and for those who teach statistics. An international survey to find out who the statistical education

researchers are, and details of their past, current and planned statistical education research could provide the initial input to such a database, and has become the main aim of the survey.

This is an ambitious project and presents several challenges. These include defining statistical education research, consideration of the database, and the implementation of the survey, as discussed in this paper in sections 2, 3, and 4 respectively. It might be argued that in itself the project constitutes statistical education research. Certainly some of the methodology is relevant to statistical education researchers and has wider applicability than in the context presented here. The results of the survey will indicate the directions which research is taking, and perhaps where research is needed, that is, will indicate what shape statistical education research might take in the future. Both the survey and the database will help strengthen the statistical education research community, will help make statistical education researchers more visible as a group, and will facilitate communication and collaboration among researchers.

2. STATISTICAL EDUCATION RESEARCH

2.1. CAN STATISTICAL EDUCATION RESEARCH BE DEFINED?

The author posed the question "What is research in statistics education?" and some supplementary questions at a round table discussion meeting held at the fifth International Conference on Teaching Statistics (ICOTS5) (Jolliffe, 1998). Similar questions were also being asked at the 39th session of the Italian Statistical Society by Ottaviani (1998) at about the same time. Although those who are interested in research in statistical education are likely to recognise when a study falls under this heading, the author is unaware of a definitive statement or description of what such research is. Statistical education research might be defined by examples of the research which is done under this heading, and of areas where further research is needed as suggested in Batanero, Garfield, Ottaviani and Truran (2000) and in the reactions to their paper in the January 2001 issue of the S*tatistical Education Research Newsletter* (SERN). These papers also contain other ideas which help with a definition and this section makes reference to several of these. These papers are publicly available on the Web site http://www.ugr.es/~batanero/sergroup.htm. The kinds of papers suggested as suitable for the *Statistics Education Research Journal* (see the SERJ Web page), and the classification theme outlined in section 3.2 of this paper, are also indications as to what constitutes statistical education research.

Defining what is meant by research in statistical education is not easy as can be seen by considering the study, which was set up in 1993 by the International Commission of Mathematical Instruction (ICMI), on the nature of research in the related field of mathematics education. This resulted in a 576 page book (Sierpinska & Kilpatrick, 1997). As those involved in the ICMI study found in the case of mathematics education research, asking what research in statistics education is leads immediately to a number of supplementary questions, and further thought about these leads to yet more questions. As suggested in Jolliffe (1998), some of the general questions are: "Is there a unity to the different activities which take place under the heading of research in statistics education?", "What are the research questions in statistics education?", "Are there research questions which are specific to statistics education?", "What are the results of research in statistics education?", "What criteria should be used to evaluate research in statistics education?". Questions more directly concerned with teachers of statistics are: "How many teachers have access to research results and how many read these?", "Do research results influence training in the teaching of statistics?", "Are statistics teachers competent to do research in statistics education?", and "Does research positively inform practice?".

In Jolliffe (1998) the author stated that some statisticians are reluctant to recognise statistics education as a field of academic research, and she also suggested that it was timely to proclaim the existence of research in statistics education as a research discipline in its own right. Pfannkuch (2001) put forward the view that statistics is a relatively new discipline in academic programmes and some groups are still "grappling" with it. She thought that this could be a barrier to the acceptance of the new discipline of statistics education research. Batanero et al. (2000) feel that some academics believe

that education as a discipline has nothing to contribute to knowledge. On the other hand Glencross (2001) feels that statistics education is already recognised internationally in its own right and not just as a subset of either statistics or education.

One of the chief aims of statistical education research is that findings would be used to improve teaching practice and students' understanding of statistics and their performance in it (Jolliffe 1998). For Glencross (2001) research in statistics education is research about the teaching and learning of statistics, and he suggests that one of the features of good research is that its results can be implemented in the teaching-learning arena. Konold (2001) feels that teachers ought to be the primary audience for research and that papers presenting the research should be about the educational implications. Batanero et al. (2000) comment that academics working in education need to understand and be understood by politicians and by leaders in industry and schools. It would be interesting to ask respondents to the survey for their views on what constitutes research in statistical education.

Ottaviani (2000) comments that research into statistical education requires the development and use of appropriate statistical methods. This gives researchers in statistical education the opportunity to advance the discipline of statistics itself, and hence become recognised as educational statisticians. If statisticians are involved in educational research in other disciplines (as well as, or instead of, statistics education) the quality of educational research is likely to be higher and the status of such research would be raised. One area where researchers in statistical education might make a useful contribution is in developing methods for evaluating the effectiveness of a particular teaching approach. Batanero et al. (2000) remark that research methods and philosophies change over time, partly because research questions or available techniques change. They note that there is considerable experience as regards undertaking research in statistical education and so we might now be at a stage where it is possible to develop some general principles, including what background knowledge is needed in order to conduct quality research in statistical education. Bacelar-Nicolau (2001) comments that the question of what is research in statistics education has much in common with the more general question of "What is research in other sciences education?" She suggests that a good research topic would be finding features which are common to research in "other sciences" (and statistics) education, and this might lead us to suitable common methods of research and help us search for new and richer approaches. Statistical education researchers might well find it useful to look at research methods used in other areas of educational research.

Glencross (2001) points out that any research takes place within a research paradigm, and that educational researchers tend to distinguish the scientific, critical-theoretic, and interpretative paradigms among the many ones possible. He says that because of the multi-faceted nature of both statistics education and statistics education research, we must accept and tolerate the diversity of research traditions and methodologies that exist.

In a plenary address at ICOTS6 Watson (2002) gave examples of three types of research in statistics education which she described as theoretical, qualitative, and quantitative. She remarked that research in statistics education is more broadly based than classical statistics applied to science. She also commented that when teachers of statistics turn the focus on themselves as statistics educators they run the risk of forgetting some of the fundamental principles of good research.

It is the author's opinion that research in statistical education must be involved with at least one of learning, teaching, and assessment of statistical methods or statistical thinking. Assessment includes studies probing people's understanding of concepts as well as assessment of those studying statistics. More importantly, there obviously has to be an element of research in statistical education research. This could be, for example, an experiment (for example, Hilton & Christensen, 2002), a survey of people or of publications (for example, a survey of internet sites is described in Gal, 2003), an observational study, development of a model or instrument (Garfield, 2003), or even a well thought-out proposal for a research study. The keywords for methodology/type of research shown in the Appendix provide a more comprehensive list of types of research. A paper suggesting that, for example, a particular method of teaching a statistical topic is a good method, is not in itself research, but a report on the implementation of the method in the classroom and some attempt at evaluating its effectiveness, with perhaps suggestions of a research design to evaluate the method more fully, could well count as statistical education research. It is perhaps worth mentioning that classroom teachers do

not always have the opportunity to do randomised experiments and the only evaluation possible might be a comparison with a different method used with different students in a different time period. Such studies can still be of value and are still research. Chance and Garfield (2002) discuss a number of ways of obtaining research data in statistics education research.

2.2. WHO DOES STATISTICAL EDUCATION RESEARCH?

Researchers in statistical education do not yet have a clear identity, although they are starting to make an impact, and with the growth of IASE activities are gaining recognition as a group. Statistics teachers, particularly those at the tertiary level, are probably the most active group of researchers in statistical education, but it is thought that not all of those who teach statistics would describe themselves primarily as statisticians, as, for example, statistics might be taught by a psychologist or a mathematician. It might be said that any teacher of statistics who thinks about how and what they want to teach in statistics courses is a potential researcher in statistical education. The distinction between engaging in the activity of teaching, which often involves developing courses and trying different methods of presentation, and being an active researcher into teaching and learning, is small. Thus if statistics teachers say that they have research interests in statistical education it is not immediately obvious that this is any different from what teachers of statistics might do as part of their normal work, or whether their interest is mainly as consumers, rather than producers, of research.

Statistical education researchers tend to have backgrounds in at least one of mathematics, statistics, psychology, or education. They work in a variety of departments reflecting the multi-disciplinary nature of statistics, and research groups have no natural academic home. A statistical education researcher is often the only one in his or her institution. Researchers also come from many different countries and belong to different cultures. Characteristics of respondents to the survey will be a guide as to what kinds of people do statistical education research, subject to finding potential respondents and to the response rate and resulting biases (see sections 4.1 to 4.3 for further discussion of this).

Some researchers in education, particularly researchers in mathematics education, now participate also in statistics education research, the research tending to concentrate on children and on the learning of concepts. Research done by psychologists on stochastic reasoning is very relevant to statistics education. Some researchers in the area of educational technology, which tends to mean computer assisted learning and, more recently, multi-media learning, are concerned with statistical education. Some developers of software for doing or learning statistics, or for assessing statistical knowledge, do research into the requirements of software and into its effectiveness, and as such are statistical education researchers. Thus just as statistics and education are multi-disciplinary in nature those who do statistical education research are a varied group reflecting this.

To be successful in statistical education research, researchers need to be good at research, but not necessarily good at research in the theory and methods of statistics. They need knowledge of the methodology they are using in their research and of the statistical topics they are researching, and familiarity with the processes of teaching and/or learning, which could be from practical experience or from a theoretical perspective. They also need to work with educators across all disciplines where statistics is used or taught. Cooperation and contact with other statistics education researchers is important, and is likely to improve the quality of the research and make it easier to get funding.

3. THE NATURE OF THE DATABASE

3.1. GENERAL

As the main aim of the proposed survey is to provide initial input to an electronic database, the potential contents of the database and the anticipated requirements of users help determine many other aspects of the study. Society as a whole is fast becoming internet dependent, and although access to the internet is difficult or impossible in some parts of the world, it is thought that the majority of those

interested in statistical education research have the facility to obtain information from the World Wide Web. This is certainly the case for those based in the UK, for whom the LTSN has been set up. This points to placing a database of statistical education research and researchers on the Web, with all the advantages that offers over a printed version, such as ease of searching for items, and flexibility in making changes. This will be hosted on the LTSN Centre in Mathematics, Statistics and Operational Web site (http://ltsn.mathstore.gla.ac.uk).

The author has looked at two databases in fields related to statistical education from a user's perspective. One is the MATHDI (Mathematical didactics) database (http://www.enis.de/MATH/DI/en/quick.html). This is a large database, but a subscription has to be paid in order to have unlimited use of it and it is necessary to enter search-words (König, 2003). This means that users have to have a good idea what they are looking for. The other database is of reviewed educational research in mathematics, statistics, and operational research (http://ltsn/mathstore.gla.ac.uk/resource_collection). It is hosted on the same LTSN Web site as the database proposed in this paper will be. It does not yet have many entries, but it is free and can be searched by title, and by keywords, and contains a list of authors. Texts can also be searched. This is the form envisaged for the statistical education database.

It is thought likely that mostly users would want to search the statistical education database by at least one of researcher, topic of the research, and the methodology used in the research. Consideration of these requirements suggests that the information collected in the survey would best be stored in a relational database having two main tables, one for researchers and one for publications and products. These would be linked through a table containing only pairs of unique researcher and unique publication identification codes (see Figure 1). Publication has to be interpreted broadly to cover both hard copy and electronic versions of research activities. To avoid repetition of data such as an address of an institution common to more than one researcher, or details of conference proceedings containing several papers, the data structure would be simplified by storing data relating to items of this nature in separate files. The design would need to allow for the addition of details of new researchers and new research, and of details relating to past research as they come to light, and to take account of updating, for example of changes of address, and of the need to retain historical data. It would be useful at some stage to extend the database to include research by those who were not active at the time of the survey. Certainly there is no intention to delete details relating to researchers who become inactive.
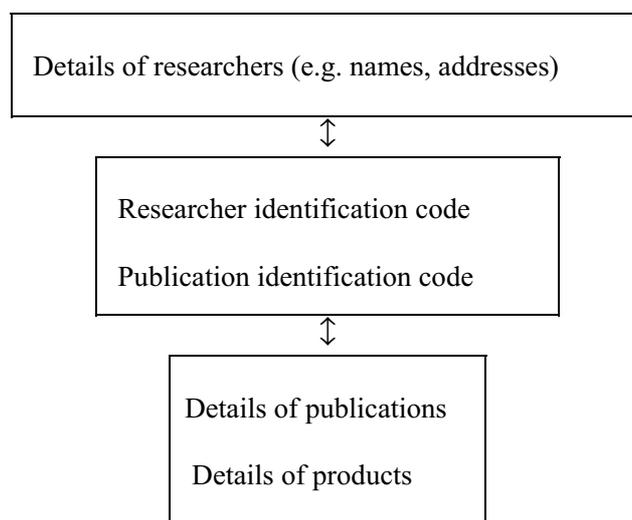

Figure 1: The form of the relational database

3.2 KEYWORDS

It is envisaged that users would search the database via a user interface on a Web page, selecting from given keywords. Information would then be extracted from tables in the database. Respondents

to the survey would be asked to use the same set of keywords to classify their research into categories and to suggest other keywords if those provided were inadequate. In the current working model the main headings are: *Teaching level/stage, Type of student, Syllabus/curriculum, Focus of research, Technology,* and *Research details*. These go from classification of the type of person receiving statistical education (includes statistical literacy), through the content of the education and matters related to delivery, to matters more directly related to the research. Each of these areas is broken down into categories and some categories are further broken down. For example, *Focus of research* has as categories: *Method of delivery/learning, Teaching approach, Assessment*, and *Pedagogic issues*. The Appendix shows the proposed breakdown for *Research details* at the time of writing. This is not thought to be in the final form yet.

The order in which key-words appear in the proposed scheme is fairly arbitrary and the numbering is for administrative convenience only. This classification scheme is experimental to some extent. It is expected that it will evolve over time in the light of experience in using it and in response to users' comments. Some categories might be added. Some fine details have yet to be filled in. For example under *Teaching level/stage* specific stages, ages or age-groups will be determined by the research studies, in continuing professional development for professions other than statistics specific areas of work will be added as required. Finding appropriate keywords has not always been easy and some might be changed. Taking account of the terms used in different cultures and in different countries is particularly difficult as researchers with different backgrounds do not necessarily understand the same word in the same way, and some terms are unique to specific groups. Alternative terms will be given as keywords where these are known. Short explanations of terms will also be given in the hope that this will reduce misclassifications of research and misunderstandings.

To show how the scheme might work two papers given at the 53rd session of the ISI (Blumberg, 2001; Ben-Zvi & Arcavi, 2001) have been classified by the author and depend on her interpretation of their research in consultation with the authors of these papers. Suggested key-words are in italics. The paper by Blumberg (2001) is relatively easy to classify, but showed how it is important to take account of differences in terminology used in different countries. Blumberg did a *survey of post-secondary teachers* and the focus of her research was the *syllabus* followed by *undergraduates* (teaching level/stage) who were *not statistics or mathematics specialists* (type of student). The paper by Ben-Zvi and Arcavi (2001) is less easy to classify and is an example of the use of newer research methods. It involves both a *case study* and *testing* of *seventh grade* students (age 13), is looking at the *method of learning* by the students and also a *data based teaching approach*. From the report in the paper it appears that the students were participants in an *experiment without controls*. The paper also touches on the *curriculum*, and mentions that the research had relied on *cognitive* and *socio-cultural* perspectives. Researchers would be free to choose as many or as few keywords to describe their research as they wished, but would be encouraged to ask if they were unsure about any matters connected with this.

It should be emphasised that no evaluations of the quality of the research will be given on the database, nor, initially, will there be descriptions of the research apart from key words as outlined above. In this sense the database would be a kind of directory. It would complement bibliographies on related topics such as Sahai, Khurshid, and Misra (1996) and Holmes (2002), and would serve a different purpose from the summaries of publications which were published in the *Statistical Education Research Newsletters* and which have been published in this journal. However, the Web offers the opportunity of linking to other sites, so that an obvious development would be to have links to other Web pages, perhaps to those of the researchers, where abstracts or full versions of publications might be available.

4. THE SURVEY

Surveys are usually done for a purpose so it is advisable to think about the final product and dissemination of results at planning stage. The different stages involved are inter-related, and consideration has to be given also to the target population, to the sample design and sampling frame, and to the design and method of administration of the questionnaire. As already stated, the aims of the

survey under discussion are to find out who the statistical education researchers are and details of their research, and the results would be disseminated via an electronic database as discussed in section 3. The implementation of the survey is discussed in this section. As the survey is primarily a fact-finding exercise, questions of inference are of secondary interest.

Ideally anyone who is currently undertaking or planning statistical education research or who has done such research in the past is a potential contributor to the database, which implies a census rather than a survey. In practice a census is impossible as there are no ready-made lists of statistical education researchers. As participation will be voluntary those who are included on the database will be a self selected sample, using their own definitions of statistical education research. However, a broad definition of research would be accepted (see section 2.1 for some discussion of this issue).

4.1. FINDING THE MOST ACTIVE STATISTICAL EDUCATION RESEARCHERS

The first stage in obtaining contact details of statistical education researchers in this project is making announcements on email lists such as Stat-Ed and the Teaching Statistics discussion list (hosted by JISC). Those interested in contributing details of their research will be asked to get in touch. Other announcements might be made in publications such as *Teaching Statistics* and the on-line *Journal of Statistical Education.* Those responding to announcements will be directed to a questionnaire asking for basic details (see 4.3).

As it is possible that not all those who have an interest in statistical education will see the announcements, other lists will be used at a later stage to supplement the list of statistical education researchers obtained through announcements. These include lists of members of the International Association for Statistical Education (IASE) and participants in the International Conferences on Teaching Statistics (ICOTS). Published research is yet another way of finding out who does statistical education research (see also 4.2). Initial contact with potential respondents provides a good opportunity to tell them about the survey and to get their agreement to participate.

Most of the sources of finding statistical education researchers mentioned are biased towards the English speaking world, and this could mean that some important research is excluded. As the project is sponsored by a UK based organisation this is not inappropriate, even if a little insular. It should be emphasised that there is no intention to exclude researchers who write in a language other than English, but it might be difficult to make contact with them in order to ask them to contribute to the database.

Initial contact with potential respondents is planned to be by email. However, email addresses are often out of date and sometimes even a slight difference in an email address can result in non-contact. Another frustration is that servers do not always communicate with one another and can be unreliable, so those who cannot be contacted by email, for whatever reason, would be contacted by post or telephone. Some non-response might occur at this stage, for example because the person is too busy to respond, or is not interested in participating. Further attempts would be made to reach these people.

4.2. FINDING THE ELUSIVE STATISTICAL EDUCATION RESEARCHERS

The more obvious ways of making contact with statistical education researchers mentioned in 4.1 are likely to reach a large proportion of the most active researchers, but there are still likely to be some who are missed, so at a later stage an attempt to reach others will be made. The majority of those who are visible in doing research in statistical education are university teachers or researchers, and it is relatively easy to access lists of these, although such lists are sometimes out of date and are unlikely to indicate those who are statistical education researchers. Many school teachers probably engage in research-like activities, although they do not necessarily realise this or bring their work to the attention of the larger community of statistical education researchers. Finding members of this elusive but important minority group is not easy due to the difficulty of obtaining lists, and the small number in a large number of school teachers likely to be statistical education researchers. It would be impractical on a world-wide basis.

A first step in this later stage could be to amalgamate all lists thought to contain a high proportion of researchers in statistical education, including those used in the initial trawl. See section 2.2 for a discussion of who might be in this group. Some people will be on more than one list, but sorting names on the combined list into alphabetical order, relatively easy to do with lists in electronic form, will make it easier to spot and eliminate duplicates. Misspelt names and matches of name where there are different addresses are likely causes of failure to match. Human beings are fairly good at spotting matches between records where there are slight differences in the information, possibly using external information to help in deciding whether there is a match. Computerised record matching systems have been less successful, but need to take account of the statistical characteristics of the errors which occur in computer records (Copas & Hilton, 1990). The matching problem is easy to state but hard to solve. It would be necessary to contact those on the list so produced, who had not already responded, to identify the statistical education researchers.

Taking into account the lists that are available and the fact that unknown researchers might be considered to be a rare population, a combination of snowball sampling and of screening lists likely to contain names of statistical education researchers would be an appropriate method of building up a list of members of the target population (Kalton & Anderson, 1986). To use snowball sampling in this survey, known researchers in statistical education would be asked for names and contact details of other statistical education researchers. Further researchers discovered in this way would then be asked for names and contact details of other researchers. The process is repeated until the number of additional researchers discovered is negligible (see Figure 2). It could well be a slow process and not yield many more names, but it is thought that it would be worthwhile to make an attempt. In order to make the implementation of the procedure as smooth as possible only those on email will be asked for names of other researchers.

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1. Contact known statistical education researchers for names and contact details of other statistical education researchers.

2. Ask the additional researchers found for names and contact details of other statistical education researchers.

3. Repeat the process until the number of "new" researchers found is negligible.

Figure 2: Using snowball sampling to find researchers

Two obvious problems with snowball sampling are that those researchers who are well known will be on the initial list, and will be named by many other researchers, so that this procedure will be rather wasteful, and those researchers who are isolated and known to only a few are fairly unlikely to be discovered by the procedure. One way of avoiding the naming of those who are already known to be researchers in statistical education is to circulate a list of these when asking for names of other researchers. Checking and dropping duplicates would be a similar process to that done when drawing up the initial list.

It is hoped that occasional announcements publicising the database and a permanent invitation on the Web page for those not already on the database to get in touch would identify additional researchers. It is recognised that there is a risk of bias in this method of finding researchers and non-inclusion of some groups, particularly those without easy access to the internet.

4.3. CAPTURING THE DATA

As pointed out in section 3.1, it is thought that most of the people interested in statistical education research, of whom statistical education researchers are a subset, have access to the internet which suggests that the internet is an appropriate medium for collection of information. It tends to be both quicker and cheaper than the more traditional methods of collecting information by interviewers or by post, and has the advantage of easy conversion to data files. To some extent use of the internet

for conducting surveys is still in its infancy, and little has yet been published in the statistical literature regarding internet-based survey methodology (Ohsumi & Yoshimura, 1999; Witmer, Colman, & Katzman, 1999; Mitofsky, 2001). Papers tend to be given at conferences or published in journals for those in the market research industry or computing (see for example websm.org on Web survey methodology). A paper by MacElroy (1999) gives a useful comparison of the various methods of online surveying.

The initial decision is between email interviewing and Web-based interviewing. In email interviewing there is a choice between including the questionnaire as a plain text message or as an attachment. The former tend to look dull, whereas although attachments look more professional they do not always travel well. The advantage of a Web based survey is that data can be read directly into a database when they are received (Payne & Crawford, 2003), and clicking on a Web address in an email to access a questionnaire is no more effort than opening an attachment, but the questionnaire might be affected by both the software and the hardware used to view it.

It is thought that statistical education researchers would want to be included on the database and to provide updates without undue prompting as it would be in their interests to publicise their work, which suggests that response rates would be relatively high. However, there is a tendency these days to be overwhelmed by the volume of incoming emails, and busy people are just as likely to postpone responding to questionnaires sent via email or to ignore them as they are in the case of paper ones. Response rates in Web surveys tend to be low (Vehovar, Manfreda, & Batagelj, 2001). The response rate in a survey of members of the Teaching-statistics email list, which includes statistical education researchers, was about 27% (Green & Fuller, 1999).

The initial questionnaire to which those expressing interest in taking part in the survey will be directed is hosted on the LTSN Web site. The information required from respondents is mainly factual – contact details, and information about the main areas with which their statistical education research is concerned, using a greatly simplified selection of keywords. There are also questions asking if they are willing to provide further details, and for comments and suggestions. Once researchers have been identified a procedure for contacting them at later dates would be developed in order to update their entries on the database. At a later stage those who indicate their willingness to participate further will be asked for details of their statistical education research publications and invited to classify these according to the full predefined list of keywords (see section 3.2). They will also be asked about their future plans, and their agreement to providing updates would be sought.

As the survey is under the auspices of the LTSN the questionnaires are in English although this could mean the exclusion of some groups (see also 4.1). There is some evidence to suggest that the design of the form has some effect on response rates and the quality of response (Vehovar et al., 2001; Dillman, 2003), and this might need to be investigated. In theory it should be relatively easy for researchers to provide details of their research as many are likely to have lists of their publications in electronic form. However, different people will list their publications in different ways. Researchers might be unwilling to standardise their lists and classify their work into categories unless there is some incentive to do so. Would inclusion on the database as a service for the communities of researchers and teachers be sufficient reward?

At each stage work might be needed to put the responses into the form required and even classifying publications at the last stage. Respondents would be given feedback on how the information they had provided had been changed and in what form it was to be made available to others. Once the database was in existence they would be encouraged to look at it. Hopefully this would encourage them to update and provide more details concerning their own entries.

5. CONCLUSIONS

The Internet has made the world a smaller place, and has made it more feasible for researchers in statistical education to be an interactive community. It is in fact essential that researchers take full advantage of the newest technological developments. Statistical education in itself is undergoing substantial and rapid changes and it is important that research is done into the effects of these changes and that those concerned with providing education and assessing the outcomes are familiar with the

research. References to the research need to be readily accessible. The proposed survey and the resulting database will therefore have an important contribution to make as regards the future of statistical education and of statistical education research.

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APPENDIX: KEYWORDS FOR THE CLASSIFICATION OF "RESEARCH DETAILS"

1. Researcher and Contact Details

2. Methodology/Type of Research
   - 2.1. Experimental without controls
   - 2.2. Comparative study
     - 2.2.1. Concurrent (parallel groups)
     - 2.2.2. Before/after
   - 2.3. Observational
   - 2.4. Case study
   - 2.5. Exploratory e.g. of understanding
   - 2.6. Report and evaluation e.g. of an activity
   - 2.7. Survey
     - 2.7.1. of Students
     - 2.7.2. of Pre-secondary teachers
     - 2.7.3. of Post-secondary teachers
     - 2.7.4. Other
   - 2.8. Literature review
   - 2.9. Expository
   - 2.10. Critique
   - 2.11. Secondary analysis
   - 2.12. Reflective study
   - 2.13. Evidence based
   - 2.14. Systematic review
   - 2.15. Ethnographic

3. Statistical Methods Used in the Research
   - 3.1. Descriptive
   - 3.2. Inferential
   - 3.3. Modelling
   - 3.4. Multivariate
   - 3.5. Qualitative

4. Products and Details
   - 4.1. Written report
     - 4.1.1. Dissertation
     - 4.1.2. Paper
     - 4.1.3. Book/monograph
   - 4.2. Assessment instrument
   - 4.3. Software
   - 4.4. Equipment
   - 4.5. Teaching resource
     - 4.5.1. Text
     - 4.5.2. Student notes
     - 4.5.3. Data
     - 4.5.4. Case study
   - 4.6. Theoretical knowledge
     - 4.6.1. Model of cognitive development, learning or reasoning
     - 4.6.2. Categories of students' errors, conceptions etc.

5. Status of Research and Details
   - 5.1. Published
   - 5.2. Presented orally
   - 5.3. Ongoing
   - 5.4. Planned