
Towards an Electronic Learning Community for Statistics and OR

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Following the advertisement for bursaries in the May issue of Maths, Stats & OR, and the first two workshops for statistics and OR activists held in October, Mike Fuller (Kent), Susan Starkings (South Bank) and Flavia Jolliffe (Greenwich) have agreed to help with activities for the Maths, Stats & OR Network. They will receive equal-valued bursaries from the network funds and their areas of principal responsibility are, respectively:

- Electronic learning community and the evaluation of electronic resources;
- A world survey of the current state of research into statistical education and assessment issues;
- Comparative evaluation, teaching materials and baseline numeracy support.

In practice all three will help each other on all the projects, and early results will be published as soon as possible in the MSOR newsletter. More formal reports will be submitted to refereed journals in the usual way.

I am very pleased to have been awarded a bursary enabling me to be associated with the LTSN Maths Stats & OR Network as a researcher, and I am grateful to my colleagues at the University of Greenwich for supporting me in this activity. I shall be working closely with Sue Starkings and Mike Fuller on a number of projects, and initially shall be taking the lead on an international survey of research into pedagogic issues in statistics and operational research. Pedagogy is the science of teaching, but the other side of teaching is learning, and neither teaching nor learning can be separated from assessment, so the topic of the survey is broad. Finding out who is doing relevant research, and details of this research, and publishing the findings, will provide a useful resource for statistics and operational research teachers, and might encourage others to research and publicise their work. I also expect to be looking at assessment issues, probably focussing on the assessment of the understanding of concepts in the first instance.

What role should information and communications technologies (ICT) play in the promotion of effective learning and teaching in statistics and operational research (OR)? This paper assesses some of the main possibilities. It is based on the talk prepared by the author for the series of regional workshops run during Autumn 2000 under the leadership of Professor Neville Davies and the auspices of the LTSN Maths, Stats & OR Network, as envisaged in an earlier article in this newsletter [1].

The Role of ICT in LTSN Centres

The role of ICT in the former Computers in Teaching Initiative (CTI) subject centres was made explicit in their name. The role of ICT in LTSN centres is less up front, but clearly envisaged in the following quotes from the central network's web site [2]:

"The network will support the sharing of innovation and good practices in learning and teaching including the use, where appropriate, of communications and information technology (C&IT)."

The use of ICT needs to be justified – it is not treated as self evidently “a good thing”.

“The new centres will become the main points of contact within subject communities for information and advice on good practices and innovations in learning, teaching and assessment, and will provide support for the many networks which already exist. The centres will aim to have high visibility within their subjects and ensure they provide both a pro-active and a responsive service to the needs of their communities.”

There is encouragement here to work with the grain of existing structures, provided that they can visibly help deliver the mission of the new LTSN centres, rather than there being a predisposition for all things to be created new.

These thoughts have informed the approach taken here in viewing the potential for and the development of an “electronic learning community” for statistics and OR. But what do we mean by this term?

Electronic Learning Communities

Electronic Learning Communities represent the fusion of two ideas - *Learning Communities*, and *Electronic Learning*.

In one sense there is nothing novel about the concept of the learning community, which could be traced back to the groups of poor scholars in Bologna, or on the banks of the Seine, Isis or Cam, or even to the philosophical academies of classical Greece. Proximity was needed for collaboration in learning. The community and co-operative dimensions of education were explicit in the thinking of the Moravian, JA Komensky (Comenius), in the seventeenth century and in the practice of Danish education developed under the influence of NFS Grundtvig in the nineteenth.

In current thinking, accessibly provided by [3], learning communities are seen as self organising groups with shared educational goals, using active learning methods, operating in a collaborative and mutual way. They are dynamic, open and adaptive. This approach lacks central control, which can be seen as a problem in some contexts, but is surely a strength in the context of the continuing professional development of educators, who are used to behaving autonomously. Another criticism is that the time taken to develop shared goals and activities can be the cause of short-term inefficiencies. However, achieving self-sustaining processes of continuous improvement may well be better achieved in a collaborative framework rather than through an

instructional, top down approach.

Electronic learning has many aspects, though the changes of technology have brought previously disparate activities together, reflected in the move from talking about IT to ICT. Electronic infrastructure can support both pedagogy and independent learning and provide for communication between learners.

Increasingly both statistics and operational research are taught using software, though more often to analyse data than to develop a deep understanding of concepts. The gap between how we practice statistics ourselves as professionals and how and what we teach to students has been reduced with the introduction of software into the classroom. Case studies with data and ideas for its analysis, often available online, are available to provide student with experiences which are realistic if not “real”. If well chosen for their audience, they can motivate learners effectively. One short guide to the range of resources available, with a series of key links to selected sites, is by the author [4]. The growth of such resources now makes it a practical proposition to develop new module proposals using a wide range of materials [5]. It also creates a continuing need for the evaluation of new resources by and for practitioners.

With appropriate guidance about assessing the quality and validity of the information available, learners can use materials from the internet to support resource based learning, most obviously in carrying out projects. There is a tendency for statistics degrees to focus too much on the data analysis aspects of what statisticians do. Graduates will be better able operate as professionals if they have had some experience of the full range of skills that link an initial research idea or organisational need to a finished report or the implementation of a solution, and an understanding of data and information from non-statistical perspectives.

ICT can enhance communication in a number of ways. Email can provide support to learners in between formal face to face meetings. It is widely, though not universally, available. Plain text is limiting however for handling mathematical materials. There are problems of transferring attached documents if the members of the learning community do not all have similar software to read them. Not everyone uses Microsoft Office, but it is difficult to avoid files in its formats.

In the context of professional updating, where the number of people involved in a particular development at any one site is likely to be very small, the value of email is obvious. It can also be supplemented by the use of video conferencing to provide synchronous discussion that

complements the use of email asynchronously. Practical guidance for doing this in British higher education is now available [6].

Another recent development is the creation of virtual learning environments (VLEs), such as WebCT and TopClass. These provide controlled access to course materials and other searchable resources, assessment tools and the tracking of student progress, timetabling facilities for pacing learning, communications facilities and file storage facilities for participants. They also provide maintenance tools for creating and updating learning materials. Their use for a wide range of modules has been developed in pioneer sites, but they are likely to become much more widely available quite quickly. Their potential for staff development use has been outlined by Colin Milligan in a recent report [7]. This should clearly influence the thinking of this LTSN about how to support its community.

What is to be done?

A key function of the regional workshop series to which this paper is linked is to identify what statistics and OR lecturers want the Network to provide. So what follows are personal suggestions about the directions we could take. However soundings at the first workshop suggest that there will be wider support for at least some of these points.

The first point is that there is a great need for dissemination of existing resources and good practice to staff who have not taken a lead in reviewing how learning is to be enhanced in their courses. External pressures both from funding bodies and from student customers with raised expectations will reinforce the case to do this, but professional pride in what we deliver must be fully harnessed too.

Some of this dissemination can be done using appropriate existing email discussion lists. The Mailbase (from November 2000, JISCMail) list teaching-statistics, managed by the author, would be one choice for mainstream statistical education issues, and is not heavily trafficked like its North American counterparts, edstat and apstat-L [8]. Other lists with an educational role can be used for work that falls within their concerns. However there is also a need for a closed list to provide for liaison between the departmental representatives from each relevant group in the United Kingdom and the LTSN team of staff and consultants/advisors.

The area of assessment for statistics and OR courses is seen as challenging [9]. It is also not one that has been well served by internet resources in the past. Yet setting

examinations and devising projects for quantitative disciplines is more time consuming than for most subjects where short essay questions are still widespread. Data based papers that test the ability to interpret statistical computer output in ways that also test understanding of the statistical concepts involved are particularly time consuming to develop. Expertise is also needed to create good multiple choice questions for use in tests, and which can be administered, most often for formative assessment purposes, using a VLE.

For these needs a secure web site providing password controlled access to a pool of tested resources would be provide valuable savings of staff time across the statistics and OR community in higher education.

The other area where, in my judgement, some development work is needed is learning about probability and statistical concepts, as distinct from data analysis. The need here is to work with students who are used to more visual methods of communicating ideas as well as information, and who may be rather less well prepared in more formal mathematical terms than in the past.

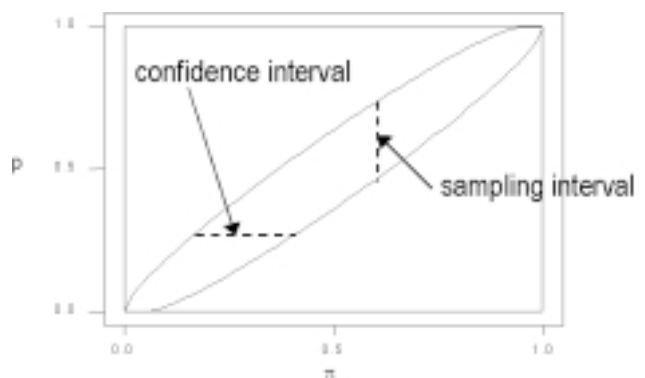


Figure 1: Illustration of confidence and sampling interval

Access to good graphics software can, for example, provide ways of presenting likelihoods so that their relationship to probability density functions can be seen. Another example is how the same mathematics can underpin the distinct ideas of confidence intervals and interval statements of a sampling kind without confusing the two. (An example of the latter point is shown here for 95% intervals for a binomial sample proportion p with parameter p and sample size $n = 50$.) Such ideas are not new, but are underrepresented in many standard text books.

Conclusion

There is considerable scope for the effective use of ICT in delivering the aims of the LTSN for promoting more

effective learning and teaching in the fields of statistics and OR. In particular its use for networked support to staff with these responsibilities inside higher education has considerable potential.

References

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Scottish launch of LTSN Maths, Stats & OR Network

In Glasgow on the 27th of October the Scottish launch of the LTSN Maths, Stats & OR Network took place at the Department of Statistics in the University of Glasgow. After a brief introduction to the Network, Adrian Bowman gave an overview of changes in the use of technology in teaching Statistics over the last twenty years. He also outlined plans for Statistics & O.R. activities within the Network. Ian Ford, Dean of the Faculty of Computing Science, Mathematics and Statistics at the University of Glasgow formally opened the Glasgow site.

Denise Lievesley (pictured), Director of Statistics at UNESCO and the current RSS president then gave a fascinating talk about the challenges facing statistical data collection in an international context.