

WEB RESOURCES FOR TEACHING AND LEARNING STATISTICS

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The Learning and Teaching Support Network is a programme funded to promote good practice in teaching and learning in UK higher education. Subject networks have been established in twenty-four different areas, including one for Mathematics, Statistics and Operational Research. Among all the different activities of this Network, the Web, of course, offers a rich source of primary material and a convenient means of dissemination. The Web provides a vast collection of material on every subject known to man, including statistics. The aim of the LTSN MSOR web site is to offer a convenient and filtered gateway to a wide variety of teaching and learning material. This paper describes some of the resources available in Statistics in particular. Some of the organisational aspects of setting up the website are also mentioned.

BACKGROUND

The Learning and Teaching Support Network is a programme funded to promote good practice in teaching and learning in UK higher education. Subject networks have been established in twenty-four different areas, including one for Mathematics, Statistics and Operational Research. The Network is led by The University of Birmingham which also takes particular responsibility for the Mathematics area. Responsibility for Statistics and Operational Research is split across The Nottingham Trent University and the University of Glasgow, with Glasgow playing a particular role in the technology-assisted aspects of teaching and learning. Within this area, the Web plays a central role, of course. This paper describes the aims of the LTSN MSOR web site¹ and gives some illustrations of the types of resource which it contains.

TYPES OF WEB RESOURCE

The Web provides a vast collection of material on every subject known to man, including statistics. The aim of the LTSN MSOR web site is to offer a convenient, filtered gateway to the enormous variety of teaching and learning material which is available. Convenience is offered through 'one-click' links to lists of different types of material and through sophisticated, but behind-the-scenes, database searching. Filtering occurs mostly through a review process operated by the staff of the LTSN Network, linked to the editorial control which is exercised over the Network's printed newsletter, *MSOR Connections*. Some examples of the different types of resource on the web site are listed below.

Data

There are quite a large number of sites which can provide datasets on-line. Many of these are for research purposes and therefore do not immediately provide ready made sources of teaching material. However, there are a number of value-added sites under development² which automatically produce worksheet questions based on the dataset chosen. This can also allow generation of a different worksheet for each individual. A directory of these is being expanded as they become available.

A good example of a site from which a dataset can be downloaded is NESSTAR³. Users can search for datasets, read documentation, analyse and visualise data before downloading it in a variety of formats (e.g. SPSS, SAS, STATA). At present, datasets may be drawn from UK Office for National Statistics datasets, the Scottish Social Attitudes Survey and some other databases.

Software links and reviews

Of all subjects taught in higher education, Statistics is one of those on which the arrival of widespread information technology has had the most influence. There can be few introductory courses in Statistics throughout the world which do not have some element of practical computer-based work and the many software packages which are available have allowed the emphasis to shift from theory and technique to analysis and interpretation. Teaching departments will

naturally stick with a single system for which local expertise and materials have been developed. The aim of the LTSN website in this area is to carry periodic reviews of the main packages used in teaching and to provide links to suppliers and supporting material. Recent examples include a discussion of the statistical system R⁴ and of the recent changes in one of the most widely used teaching systems, Minitab⁵.

In addition to packages designed for exploration and analysis there are also packages designed to teach the concepts and modes of thinking involved in statistics. Particular examples here include ActivStats⁶ and CAST (review underway) which make use of the full range of multimedia facilities now available.

Applets / demonstrations

With the advent of the Web there came, in time, JAVA, designed as a platform independent language which has been used to particularly good effect in creating dynamic graphical material. Many 'applets' have been written to explain statistical ideas in graphical form and, where these are well designed, they do add great value to more traditional verbal and mathematical explanations. A recent review of applets in statistics⁷ gives some good examples. Of course, JAVA is not the only language in which this can be done and small pieces of demonstration software have been developed in many systems over many years. The XlispStat code available at <http://www.xlispstat.org>⁸ is one example.

Case studies

The first stages of teaching and learning in statistics are, of necessity, often focussed on individual components such as ideas of variability, estimation, confidence intervals, hypothesis testing, etc. However, the end result should be some understanding of statistical thinking as a whole. A good way to promote this is through the use of well chosen case studies in which an overall strategy for model formulation, analysis and interpretation can be described. There are some well known books of good material of this sort and there are also some websites such as DASL⁹ which add descriptions of context to datasets. However, this is an area in which there seems to be a dearth of well developed material in electronic form. The LTSN website hopes to promote contributions in this area. One particular computer-based resource in this area is the collection of STEPS modules¹⁰ which use multimedia to explore a variety of problems from different scientific areas where statistical methods and thinking play a crucial part in reaching conclusions.

On-line courses

While most teaching activity has used the web as an additional resource to more traditional methods, some departments have moved more deeply into the web-based arena by delivering courses entirely on the web. Course management, lecture notes, tutorial work, practical assignments and assessment can all be delivered electronically and weaved together into an on-line course. SurfStat is one example which has been running for several years and reflection on this approach is available on the web¹¹. With increasing attention being devoted to distance learning this is likely to be a growth area.

Glossary

There are many useful individual resources which are now available in electronic form, from sample size calculation to simulation systems. One particular, highly focussed resource which has considerable potential benefit in the context of teaching and learning is a statistical glossary. Some standard packages incorporate these, linked to the particular analysis facilities available. However, there are more general, freely available ones such as the STEPS glossary¹². Well motivated students can learn a lot by judicious browsing and the potential for adding useful links to existing short descriptions must be considerable.

Articles

In addition to the provision of factual information and specific software, it is very helpful to reflect on more general issues of teaching and learning. The LTSN website contains articles

from the *MSOR Connections*¹³ newsletter which aim to do that. Recent examples include a 'Some basic reference for undergraduate statistics education' (Nov. 2001), 'Statistics education – current and future directions' (Aug. 2001) and 'A new way to teach statistics to engineers' (May 2001). The texts of all these are available on the website. An article on 'Some basic references for undergraduate statistics education' (Nov. 2001) has also recently been added to provide pointers to further reading.

ORGANISATIONAL ISSUES

Resource database

The business of managing and updating a web-based collection of resources of this type is quite a complex one. Within the MSOR centre we are moving towards having a single searchable resource database which is stored partly in Glasgow and partly via a shared Virtual Private Network (VPN) drive on a Windows NT server based in Birmingham. The Birmingham database may be edited in Birmingham, Glasgow and Nottingham but a firewall in Glasgow has not allowed the Glasgow database to be available via VPN and instead is administered using our Intranet pages. The technical work with the databases is carried out in Glasgow, so the situation is ideal.

Resources stored in the database have properties similar as those specified by the IMS metadata protocol¹⁴. These resources may be searched and the results returned in HTML or XML format. The fields stored allow a breakdown of the total group of resources into sets and subsets e.g. set 'software' and subset 'software with reviews'.

Web spider

To ensure that the resources in our website are up to date and to locate further websites which may be worth investigating a web spider has been written. This passes through the resource database picking up all the web addresses and checks for '404' and similar failures. At the same time it builds a database of the contents of each page referred to by the resource database. This will allow us to develop a service which will highlight changes to websites. A further task is picking up the web addresses on the pages checked. New pages not already added to the resource database are added to a further table for later investigation.

Interoperability

A key feature of the LTSN subject centre websites is their interoperability. This is leading towards a shared diary which may be viewed as a whole or searched. News is shared in a similar fashion. Further it is hoped that the more extensive LTSN subject centre resource databases and the Resource Discovery Network¹⁵ databases will be searchable from a single portal.

Portal

A Portal is under construction. For a user who has configured the portal, 'keyword tailored' latest news will be displayed. This will include revisions to websites registered in the resources database, entries from the diary and news database and a customised view of the resources available.

DISCUSSION

The main aim of the LTSN MSOR web site is to provide a place where university lecturers can quickly find information and resources of interest. In keeping with the emphasis on 'network', we hope that others in community will indeed find this useful and will contribute ideas and materials to enhance its potential.

WEB REFERENCES

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