

## WWW and TEACHING STATISTICS - A TEACHER'S POINT OF VIEW

Juha Puranen, University of Helsinki, Finland

*There are many ways, in which a teacher of statistics can benefit from the Web. She or he can use it for learning statistics, for learning how to teach statistics or for teaching his students statistics. In this paper I will describe, what I have got from the net, and what I have put on the net.*

### WHAT A STATISTICS TEACHER CAN GET FROM THE NET

The net is full of interesting material for a teacher, for instance:

#### *Home pages for statistics courses*

Usually the home pages for statistics courses function as an information channel between the teacher and the students. Also, they are useful for other teachers, when planning a new course. On these pages one can find

*The syllabus.* It is useful to see which topics and in what order are taught at similar courses in other universities.

*Assignments and exercises.* I suffer from a chronic shortage of good exercises. I enjoy solving exercises set by other teachers and then constructing my own versions of them.

*Handouts.* Many teachers distribute their handouts or transparencies on the net. Usually the text is restricted and if you do not already know the subject, you do not get the point. In many cases the handouts are more useful for other teachers than for the students.

I have several times reacted by thinking: "It is indeed possible to illustrate these phenomena in this way too" or "Yes, you can use this data set in this context too." Multivariate regression analysis provides an example. I had always used non-orthogonal vectors to illustrate the relationships between the explanatory variables. When I first saw the same idea illustrated by way of Venn diagrams, see [http://www.ilir.uiuc.edu/courses/lir493/qm-multi\\_with\\_replacements.htm](http://www.ilir.uiuc.edu/courses/lir493/qm-multi_with_replacements.htm)

I was puzzled. Now I use both methods simultaneously.

#### *Interactive online teaching material*

Due to the recent fast development of projectors, browsers and computers, interactive online teaching has become a good choice. The net contains today a lot of material suitable for interactive classroom teaching and for learning in the micro class or at home.

Two pioneers in this area are:

<http://www.stat.ucla.edu/textbook/> Online Statistics Textbook 'The Study of Stability in Variation' from UCLA, containing many interactive Xlispstat demos. I have used this material in my lessons, and it works well. However, Xlispstat is not installed on every machine on campus, therefore, our students have problems in using it on their own.

<http://frey.newcastle.edu.au/Stats> Hyper-Textbook Library (AU) from Department of Statistics at University of Newcastle, Australia. Which is a quite readable online textbook based on Moore and McCabe.

Lately, several text books have been published on the net. A common feature of these books is the huge amount of text. Since reading from the screen is hard, I wonder if anyone reads them. Is it possible to get a printed version from the publishing department of statistics, or does every student print his own book?

There are many other home pages providing good online teaching material, for example Java applets. From these I have found many good ideas, which I have used on my own pages. Here are some examples:

<http://www.ilir.uiuc.edu/courses/lir493/syll.html> I like the way Wallace Hendricks uses help-windows opening to "Hyperstat Online" by David Lane at Rice University.

<http://www.ruf.rice.edu/~lane/hyperstat/contents.html>

<http://ouvaxa.cats.ohiou.edu/~wallace/class/demon2.html> David Wallace uses gif-animations in visualizing statistical formulas. I believe that this is one way of making the WWW-pages more interesting for the students.

<http://www.clayton.edu/arjomand/class.html> Lari H. Arjomand has added quizzes on his WWW-page. Encouraging interactive activity is an effective way of teaching statistics.

*Pages for background material*

On these pages a statistics teacher can find background material for the lessons.

One of the best known is the CHANCE Database

<http://www.geom.umn.edu/docs/snell/chance/welcome.html>.

It contains info on how statistics is used in daily life, providing lots of examples suitable for use in teaching. Although the cultural backgrounds of USA and Finland are different, several articles have been useful for me.

### *News groups and statistical mailing lists*

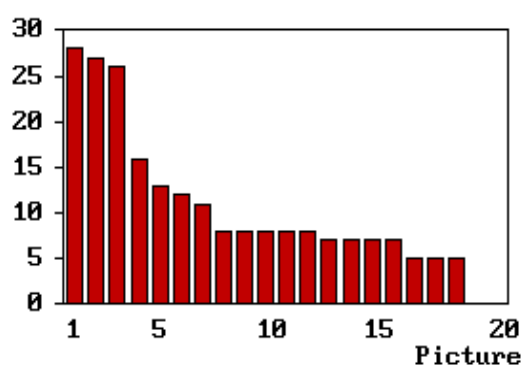
There are three statistics related news groups on the net: sci.stat.consult, sci.stat.edu, sci.stat.math and several mailing lists like apstat-l, allstat and xlipstat . From these, especially from sci.stat.edu and ap-stat, one can find educational material. I have benefited from following the series of answers evoked by a good question. For the list of lists look at: [http://www.stats.gla.ac.uk/cti/links\\_stats/lists.html](http://www.stats.gla.ac.uk/cti/links_stats/lists.html)

## USING WEB FOR TEACHING STATISTICS

### *Background*

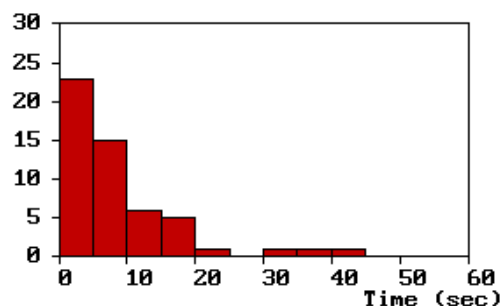
To get information on my students ways of using Web, I made some statistics on weekly access in the spring of 1997. We all know, that this is a risky business, but it can give information, impossible to get by any other means.

In my lessons I use PowerPoint type teaching series. After the lesson I put some series on my home page. The hit statistics for one of the series was:



The majority of the students have taken only a glance at the material. Five students have gone through the whole series containing 18 pictures. In the final course examination I asked the students how they had used the Web. One of the answers is very illustrative. “The series is a good idea, but it is difficult to follow, because the oral presentation of the teacher is missing.”

Recently the proportion of Web users among our students has increased and the access to my home page has increased. In the first week of the Spring Term 1998 my home page had more than 150 visitors, and almost all visitors read several pages. I selected an article of eleven html-pages for analysis and calculated the time in seconds that the students stayed on those pages.



There are a number of sources of errors in the time statistic. Because of caching I cannot notice when a student returns to a previous page and I do not get the time he reads the last page. Some students are connected to proxy servers, which usually caches all popular WWW pages. In these cases I can only see some of his visits. Also, students might print out the pages and then read them at home. Anyway, it seems that the students are, mainly, surfing around and browsing at my pages. Do other teachers have similar experiences?

### *Web and teaching*

My impression is that not all producers of teaching material have considered carefully the link between the material and the learning process. WWW is a very difficult media. Making good WWW-pages is more an art than a science. A readable article on this topic is 'Publishing on the Web Is Different' by Jukka Korpela (<http://www.hut.fi/u/jkorpela/webpub.html>).

A hardcopy version of a book is superior to the Web version on the following scores.

- Opening a book you see two pages, 90 - 120 lines; on the screen you see only 20 - 30 lines.
- You can read a book in bed, on the train, etc;

to use Web you have to go to the micro class and wait for a free computer.

- In a book you can underline words, and add notes, etc;  
using the Web you have to print the pages first.
- A book is linear, and inserted bookmarks are very clear;  
Web is not linear, it is easy to go around but also easy to get lost.
- The students have a long experience in reading books;  
Web is a new experience.
- In books you find beautiful mathematical formulas;  
Web formulas do not usually reach the same high standard.

On the other hand Web gives possibilities, which are unattainable by any other means.

- Web is not linear. You can build your own hypertexts.
- You can construct links between subjects, even to the pages made by another teacher on the other side of the globe.
- You can construct parallel texts for different levels of depth of knowledge.
- In the Web you can show dynamic graphics.
- In the Web you can give on-line assignments to the students.
- Web-pages are easy to update.

Many excellent Web-pages have been spoiled, by

- Selecting colours so that it is almost impossible to read the text.
- Making too long pages, using too big fonts for text and/or formulas.
- Adding too many pictures on the page, so that the downloading takes too long.

Often the only way to read those pages is to print them.

### *My solution*

One way to improve Web pages is to add interactivity and teach the students how to use these pages. I believe that the Web will never be the only media for studying statistics, but it is an excellent add on. Probably, the students will be given printed handouts, to be read first at home, and then multimedia demonstrations and exercises to be followed on the Web. To make the Web teaching methods better than the traditional

methods, we should use those elements, in which Web is superior. We should give the students a reason to stop on my page.

To achieve this I have added gif animations, interactive activities, tools for helping the students to solve their homework assignments, and links to related articles in the Web. *I try to make some screen design as well. It is difficult, since I do not know which browser and which resolution the students are using. Anyhow, I try to design my Web page so, that everything is visible on a 800 x 600 screen. If this is not possible, I try to hide less important topics behind Help-buttons. When pressed this opens a smaller second window with more text and pictures.*

Last fall in a practical course on linear models, I constructed some Web-pages on “Transformations for linearising the relationship between two variables”. A short English version is available at <http://noppa5.pc.helsinki.fi/koe/index.html>. We used it in class for one hour and some of my students took the bait and visited that Web-page several times. I received some very positive comments. Recently, I have constructed Web-pages with problems in probability theory. I will first use these pages on my lesson and then assign some of the problems as homework. I have linked the homework assignments to the pages shown in class, for easy use in problem solving. I believe that many will also solve the additional problems.