Visualization as an educational tool – Discussion (IPM 63)

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Three interesting, yet different, papers on visualization were presented in the section.

Bradstreet, T.E.: Graphical excellence – The importance of sound principles and practices for effective communication

The need for better education of graphical visualization was presented and illustrated with excellent examples.

I couldn't agree more with Bradstreet saying: *"In modern statistical education, greater emphasis needs to be placed on preparing today's students who will be tomorrow's working professionals...".*

Different modes of communication, shown in an example of the pharmaceutical firm, need different visualizations: *internal, external and research communication*. He says: *"... there needs to be a harmonization of the ideas behind graphics for presentation and the graphics for data analysis."* Different graphs are used for different purposes of analysis and presentation. Since people mostly understand simple bar graphs, they tend to be used for external communication with the public.

Default presentations generated by many software packages (especially spreadsheets) are critical and mostly overloaded with *chartjunk*. Software is sometimes limiting human imagination, (people use bad types of graphs simply because they can be easily produced by a computer e.g. 3-D, elliptical graphs...) Paper and pencil graphing is not to be abolished.

Students must get experiences in *manipulation of the anatomy of the graph*, tick marks (too many), grid lines (should be in the background), scales, titles, legends (difficult to change in some software).

Mittag, H. -J.: Emphasizing visualization and activities in teaching introductory statistics by interactive multimedia

The preparation and use of multimedia systems for teaching was encouraged and presented by a well developed example.

Common opinion that *"Statistics has a rather poor image in society"* and *"Statistics is a boring discipline"* was provocatively mentioned at the beginning of the paper. Statisticians love statistics so why don't our students love it too? Are we to blame? Are we "teaching the unwanted to the unwilling"? Multimedia is proposed to make statistics more appealing.

We are facing the problem of *learners' interest*. It seems to me, that people can't understand (statistical) solutions if they don't understand (or have) the problem to solve. Our students are not informed that most of the presented results in the subject they study were achieved or supported with statistical analysis.

"Statistics seems to be particularly suitable for illustrating the new dimensions of multimedia-based learning" I don't quite see why, compared to physics or biology.

Use computers when we need them: "Nobody likes reading of 1000 pages on computer screen". Use computers for visualization of dynamic, changing graphics, interactive and live examples with the on-the-spot data.

A good overview of *didactical guidelines* for development of multimedia-based learning is given in the paper.

The problem of online speed was presented: offline use with online updates and up-to-date data selection is proposed.

HTML seemed to be the standard for future material preparation. Can we say something about programming language for teaching material? Maybe Java?

Is there a problem in time needed for development of dynamic material compared to static graphics in books? Few people can prepare dynamic material compared to static graphics that most authors are able to do. Since a lot of *team work* and efforts are needed for preparation of multimedia systems, international cooperation and localization (*translation to other languages*) of existing materials would provide effective distribution and application of existing material. Effectiveness of visualization was unintentionally demonstrated: we all understood graphics in the left panel on the screen, yet only few understood German accompanying text in the right panel.

Clovis P.: Visualization for teaching all steps of data based scientific research.

A course for teaching statistics is described, with visualization instead of formulas and use of scientific research cycle (project oriented).

In the paper another view of "teaching unwanted to unwilling" problem was exposed, mostly the lack of mathematical skills.

Clovis: *" ... we realized that students were not able to do well in their jobs as professional statisticians. Their knowledge was compartmentalized and they did not know how to synthesize it in order to solve practical problems"*. Students after studies simply don't have enough experiences and they forget.

Organization of the *course in statistical consulting* was mentioned – how can one do that? On the other hand, teaching while consulting can be a good way to avoid the problem of understanding solution without "having" a problem. Consultees are very interested to understand the solution to their particular problem.

Problem with non-mathematically oriented students – aren't the most of our students? Different approach is used in teaching:

Statisticians – skills in mathematics, proofs and mathematical justification

Non-statisticians – no skills in mathematics, intuitive augments, graphical and visual presentations, simulated demonstrations.

Interest to study statistics to understand the papers in which statistical methodology is presented – mostly students want recipes.

The problem of the lack of interest in statistics is also that at their main, favorite subject of studies they are not told that results were obtained with statistics. For example, they don't see the connection between the statement that certain process in nature lasts for e.g. 15 days and statistics or even between percentages and statistics.

Formulas

"Course without formulas" and *"some formulas are necessary"*

Formulas are stories. Students simply can't read them. They can write the inequality for confidence interval but are many times not able to tell which value we want to enclose. Aren't formulas also visualization of ideas, concepts, and processes? Maybe the visualization is not obvious enough?

I can't agree with *"(students) ... will only have to interpret the output".* They should know what is behind that output.