Using eLearning in teaching of statistics and research methodology

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Introduction

Teaching research methodology and statistics is necessary in many empiric sciences with no main statistical focus. Even if the students themselves do not work empirically, they need the knowledge. The reading and understanding of the articles, which describe empiric studies, requires an understanding for statistics and methodology. Likewise, the understanding of theories is based on the understanding for the underlying findings.

The teaching time available for courses for non-statisticians is often limited to a few hours. The courses are mostly offered within the framework of general undergraduate study programs, so that students of several different study areas visit them. The previous knowledge of the students especially in mathematics is heterogeneous. Hence, teaching is a great challenge, concerning the motivation of the students and the selection of contents. The objectives for such courses are the following:

- The students should get a feeling for "how statistical methods work".
- The courses should ensure that the students know the central terminology, the main methodological approaches, the main parametric and non-parametric methods as well as their preconditions.
- The students should learn that differences in results across studies could be caused by several reasons, for example by different methods of measurement and measurement scales, different sampling procedures, etc.
- They should get familiar with a statistical program package, such as SPSS, SAS, STATA, etc.
- They should be able to decide if the author of an article has described the preconditions of the study and the achievement of the data in a comprehensible way, has chosen the adequate statistical methods for analysis, has drawn result-based possible conclusions and has documented the study in way that the results are (in general) reproducible for the reader.

The experience with courses for non-statisticians shows that it is an illusion that the teacher can inspire the students deeply for the theory of probability or mathematical equations. The students are interested to get tools adapted to the demands of their special scientific field. Therefore, from the scientific perspective of the statistician, teaching is a

walk on a tightrope. The course content and the examples have to be chosen in way to "Make everything as simple as possible, but not simpler." (Albert Einstein). On one side, the complexity must be reduced. On the other side, the students have to learn so much that they do not apply the methods and procedures rule-based without thinking but based on understanding. E-learning-products can help to master this challenge.

E-learning products

"An e-learning product is software that is developed for learning purposes taking pedagogical, didactical and psychological aspects into account." (Berger & Rockmann, 2006, 130). The products differ in size, extent and design. An e-learning product could be a single animation, a simulation, static html-pages, or dynamic online courses. Depending on the design the products are suitable for different teaching situations.

- They can be used for course preparation so that the face-to-face course can start on a higher and more homogeneous level.
- The products can be used within blended-learning concepts, for example with an alternating change – one week online learning in a group assisted by a tutor, the other week face-to-face teaching.
- Some products can be used totally stand-alone if there is a high probability that no technical problems occur, because this is one major reason for dropouts. Furthermore, the students should have some experience with self-directed learning, even if the program guides them.

E-learning products can have from the perspective of learning-psychology high potentials. They are not only a combination of learning media – like videos, texts, pictures, etc. - that already existed before (Rockmann & Olivier, 2005). The technology not only makes the linking between these media possible and the easy access to them in one "box". Through the linkage of content equivalent media, the possibility of recording learner performance, the immediate checking of tests etc. different didactical concepts based on different learning theories can be implemented.

- The control concepts implemented in the products range from *program to learner control*. If the *program control* is implemented, the program selects the contents for the learner and manages the whole navigation. If the *learner control* is implemented, the program has to make help-features for learner driven navigation available, for example, by a list of content, searching mechanisms, marking visited pages and bookmarks.
- The content selection and navigation can be *based on the previous knowledge*. In this case, the product has to have mechanisms to register the knowledge in the beginning of the course.

- If the *drill and practice approach* is implemented, the program must include tests and exercises in order to check the level of achievement.
- If the concept supports *different learning media preferences* it must provide redundant information using different media.
- If the product supports *explorative learning*, then it has to include fundamental characteristics of this concept, like search and localization features as well as anchor points; in this case, program control should not be available.

Besides the usage with heterogeneous groups, e-learning products are helpful when the learning groups are very small or spread over many places.

Learning statistics and research methodology – the project ILIS

ILIS is a project of the German universities of Oldenburg and Paderborn (sportwissenschaft-akademie.de/na/sportwissenschaft; 131.234.146.240/na/sportwissenschaft).

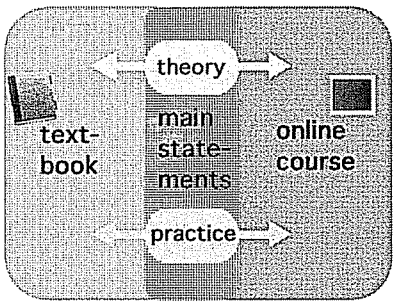

Fig. 1: Linkage between book and online course

New in the overall concept is the integration of textbook and online course. Both media contain the same central statements and main ideas (Fig. 1). Besides this, the online course contains continuing, complementary and more detailed texts, detailed descriptions of experiments, illustrations, videos, animations, simulations as well as training questions and tests (Rockmann & Bömermann, 2006). Exemplarily, figure 2 shows the link (www431) between the textbook (yellow box = central theory statement) and the online course. In the online course the link can be found by searching for the key "www431". The "book"-symbol shows that the link is found.

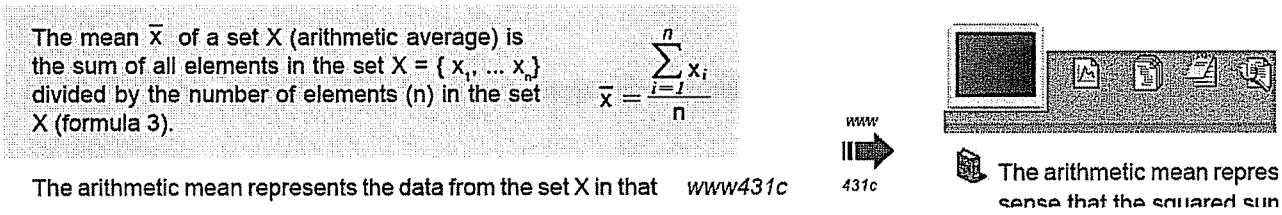

Fig. 2: Hyperlinks

The "link"-sentence from the book is repeated and is followed by additional text and in this case, an animation with exercises (Fig. 3).

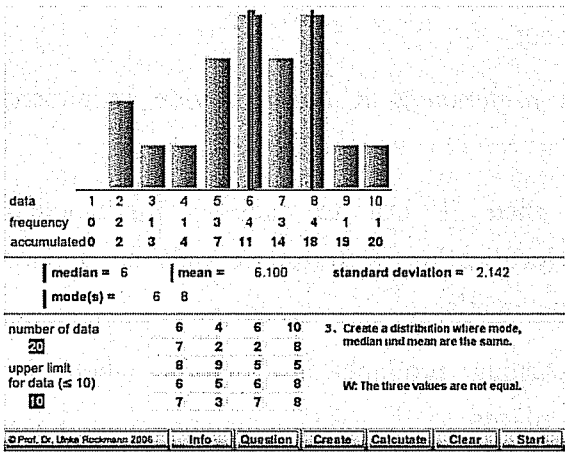

Fig. 3: Animation – measures of central tendency

By using animations and simulations complicated and complex issues can be visualized for and explored by the learners. The animation shown in figure 3 presents ten exercises to the learner concerning the topic "measures of central tendency". The learners have to solve them by generating a data set at fulfils the requirements specified.

The training and test questions available in the course are appreciated, because they provide feedback immediately. Since especially the bachelor students have a tight schedule they like the possibility to learn with the online course at any time. Overall the acceptance of the courses is good if the first inhibition threshold is overcome. Although the students seem to be technically experienced, mainly technical problems occur, like finding the website, managing to get an account, installing missing plug-ins on the computer, remembering the password etc. Therefore especially in the beginning sufficient support must be available to avoid dropouts.

Outlook

One essential problem in the usage of e-learning products at universities is the sustainable availability, the technical and user support as well as the actuality. Many universities are still not well prepared for these tasks. Among the rest, this is also to be ascribed to the variety of the technical solutions used in different scientific disciplines.

Still a lot of research work is necessary, concerning the question, how people learn with the online products. Therefore our students agreed that their protocol data could be also used for scientific analysis of their learning behavior (Rockmann, Thielke & Seyda, 2003).

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