Has the end of chalkboard come?
A survey about the limits of Interactive Pen Displays in Higher Education

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Abstract: This paper tracks the question how the usage of an interactive pen display benefits teaching at universities. The advantages and disadvantages as well as important didactical aspects that need to be concerned in this context are discussed. First results of a survey on the application area of interactive pen displays for higher education purpose that was carried out at Graz University of Technology (TU Graz) in winter term 2007/08 are reflected. Although the results of the survey are surprisingly significant in favour of the interactive pen display overall strategies for a widespread usage at universities are recommended.

1 Introduction

1.1 Teaching and Learning go new ways

Nowadays Web 2.0 technologies are influencing our daily life (O'Reilly, 2006). New opportunities such as Weblogs, Wikis or Podcasts help to bring so called microcontent closer to the user (Maurer & Schinagl, 2006) (Korica et al, 2006). Learning and teaching can be realized in very new and very various ways (Seitzinger, 2006). Stephen Downes named Web 2.0 technologies enhanced learning "e-Learning 2.0" (Downes, 2005) and introduced a new term in 2005 (Nagler et al, 2006) in this way. Since then a number of research has been carried out to determine whether there are benefits for lecturers and students by using such applications (Campbell, 2005). the TU Graz installed a blogosphere (Ebner & Maurer, 2007a), launched Wikis (Ebner et al., 2006) and made first experiences with casting lectures and producing podcasts (Ebner et al, 2007b).

However, how great these possibilities for teaching and learning might be one big gap occurs during this first time of implementation of e-Learning 2.0 at TU Graz. On the one side there are lecturers who teach in a very traditional way, on the other side there are new web based technologies. Taking a serious look at a typical large lecture room nowadays it has become usual that a chalkboard, an overhead projector, a beamer and a network connection is provided. But of course such lecture room equipment is not made for and is far from being perfect to introduce digital technologies for e-Learning components.

The two crucial factors for successful eLearning and use of microcontent in Higher Education for lectures with a high number of participants (more than 100 students) are:

1. Ubiquitous and simple technologies: Lecturers must not be handicapped by new technologies during their usual teaching process. The environment should be as simple as possible, user-friendly and understandable; otherwise it will not be accepted. Time consuming technologies will disturb the whole process and therefore neglected for further use. As Mark Weiser (Weiser, 1991) already wrote in 1991 "the most profound technologies are those that disappear – they weave themselves into the fabric of everyday life until they are indistinguishable from it.", these can be assigned perfectly to teaching and learning processes.

2. Clear didactical concept: The second crucial factor concerns the question how are new technologies integrated in teaching and learning scenarios. A clear didactical approach is a precondition for a successful integration. (Holzinger, 2002)

On base of these premises the TU Graz decided to start a first prototype to investigate how new technologies can enhance the teaching process also in lectures with a high number of students.

By installing a pen display which can be compared with a tablet PC (Tront, 2007) (Anderson et al., 2007) into one of the largest lecture rooms at TU Graz (with a capacity of about 250 seats) the following central research question has been addressed: "Can the use of a pen display enhance the teaching and learning processes of a usual lecture with a high number of students?"

In this paper the didactical scenario, the real-life setting and the results of a questionnaire carried out by more than 100 students are presented.

1.2 Not just give them a new tool

According to the chapter before, the didactical concept is one of the crucial factors. Discussing the fact that the implementation of a new tool for teaching efforts must come along with didactical scenarios; otherwise the new tool will hardly be accepted by teachers and students and cannot be implemented or used in a reasonable way.

There is no perfect teaching tool inherently. The method of teaching should be chosen by the teacher and not the other way round. It depends on the teacher how to use a tool best for his/her own ideas. First of all the teacher must feel comfortable about using the tool then he/she will become more creative by using it. Nevertheless each tool has specific aims and functions and insofar is limited to its usability per se. Furthermore each tool needs a special setting and didactical considerations for its implementation.

In the lecture of interest of the questionnaire the lecturer mainly calculated examples and made drawings. So the didactical suggestion was to execute it more interactively (Hennessy et al, 2007) with the help of prepared hand outs and digital scripts. By using a pen display the handling of interactive scripts should become much easier.

1.3 Pen Display versus Chalkboard

The decision to test a pen display at all preceded some discussions about the expected potentials. Are there considerable advantages or is it just a "new toy"?

Comparing the advantages and disadvantages of pen displays and chalkboards there must be pointed out that independently from the content the biggest difference lies in the fact of digitalisation with all its efforts and limitations. The advantages of the chalkboard can be summarized that it is larger and therefore accommodates more details. The process of creating content takes the same time for the teacher and the student if there are no prepared handouts unlike to the pen display. The disadvantages of the chalkboard are mainly the disadvantages of analogue content; not saveable or capability to copy nor to publish or reconstruct if cleared once. Furthermore the legibility decreases with increasing dimensions of the lecture room. The facts that the teacher in general averts his/her face from the audience when working with the chalkboard may not be neglected from the didactical point of view.

Besides the advantages of digital content (e.g. easy to save, copy, delete, correct or publish and distribute as well as rewriteable) the used pen display is easy to install and connect to the further equipment of the lecture room (e.g. laptop, beamer). It is very user friendly and designed for interactivity. But the surface's resolution could be not sufficient for details. The preciseness of drawing is limited through the thickness of the digital ink and the difference between the position where the pen touches the screen and the position of the digital ink. At last the speed of lecturing could become too fast depending on the quality of prepared scripts used for teaching. In case of "too well prepared scripts" the student may get problems trying to follow the lecturing synchronously and working with some handouts given by the teacher.

1.4 The Sympodium Interactive Pen Display

The TU Graz decided for the Sympodium ID370 Interactive Pen Display mainly because of its 17" large-sized, high-resolution display. The battery-free pen works with electromagnetic resonance technology. The Sympodium™ is permanently installed in the lecture room "HS I" of TU Graz with a capacity of 250 people and a height of nearly 7m. The Sympodium™ is placed on a speakers desk and connected to the teachers table over

the Sympodium™ USB cable (GoWire™ SMART Board software auto-launch USB cable). The USB cable comes with the software that is needed to run the pen display on a computer or laptop with Windows, Linux or Mac OS. The first time a laptop is switched to the Sympodium™ by plugging in the USB cable the software installs itself automatically and is recognised the second time. The laptop is regularly connected to a beamer. The laptop and the Sympodium™ can be used parallel without switching operations. Any activity that is done with the Sympodium™ and the laptop is displayed on the beamer (see figure 1). The finished over-worked documents can be printed as PDF.

Sympodium™ pen display   Laptop   Beamer

Sympodium™ USB cable   VGA cable

source: http://smarttech.com/   source: www.heh-online.de   source: blog.chip.de

Figure 1: Adjustment of the installation – the images of the laptop and the beamer are symbolic ones

2 The survey

2.1 Facts of the didactical scenario

The Sympodium™ pen display was tested in the lecture called "Structural Design 1" and in the same named practical exercise. Both the lecture and the practical exercise were taught by the same teacher. The content of the lecture imparted analytic methods to quantify the reactions and internal forces of statically determined systems: beams, trusses, arches, frames, multi plate systems, 3D-structures and cables. The exercise practiced the theoretical methods to quantify the reactions and internal forces of statically determined systems from the lecture "Structural Design 1" by arithmetical examples. Actual a lot of drawings and process displays by the teacher in classroom were required for these teaching aims (Davis, 2007). Before the lecture started the students had the possibility to prepare for the lecture in classroom by reading and downloading the original lecture scripts from the corresponding TU Graz TeachCenter[1] course (Helic et al, 2005).

The teacher did not get further but a short instruction for handling the major functions of the Sympodium™ by the Office of Computer and Information Services of the TU Graz. The pen display was used for each of the 29 lecture units. The teacher mainly worked with several thicknesses and colours of the pen drawing and writing on prepared PDF-scripts that had been imported to the Sympodium™ presentation software. Page options such as cloning (copy) or fitting in new pages if needed for further explanation additionally to the basic script had been used just as naturally and quickly like turning over a books page.

The lectures had been recorded (Ebner et al, 2007c) by recording the audio with a wireless microphone and screening the laptop display with the software Camtasia Studio 4 (TechSmith) – which results in an identical image of what happened at the Sympodium™ pen display. By recording the process of drawing and calculating, which are fundamental elements of the lecture, these important parts of developing content could be preserved. The pen display affords it and the recording saves it.

Therefore the documents served to the students comprised the original PDF-script, the PDF-script with the Sympodium™ iterations that had been done by the teacher during lecturing and the recordings in different formats (avi Xvid, m4v, mp3 and flash). These documents were provided for watching and downloading at the TU Graz TeachCenter (see figure 2). Figure 3 shows an example of the content of the lecture.

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[1] The TU Graz TeachCenter is an eLearning platform for supporting digital teaching and learning activities at TU Graz. It bases on the so called WBTmaster system, a platform created by the Institute for Information Systems and Computer Media (IICM) at TU Graz under the guidance of Hermann Maurer and Nikolai Scerbakov.
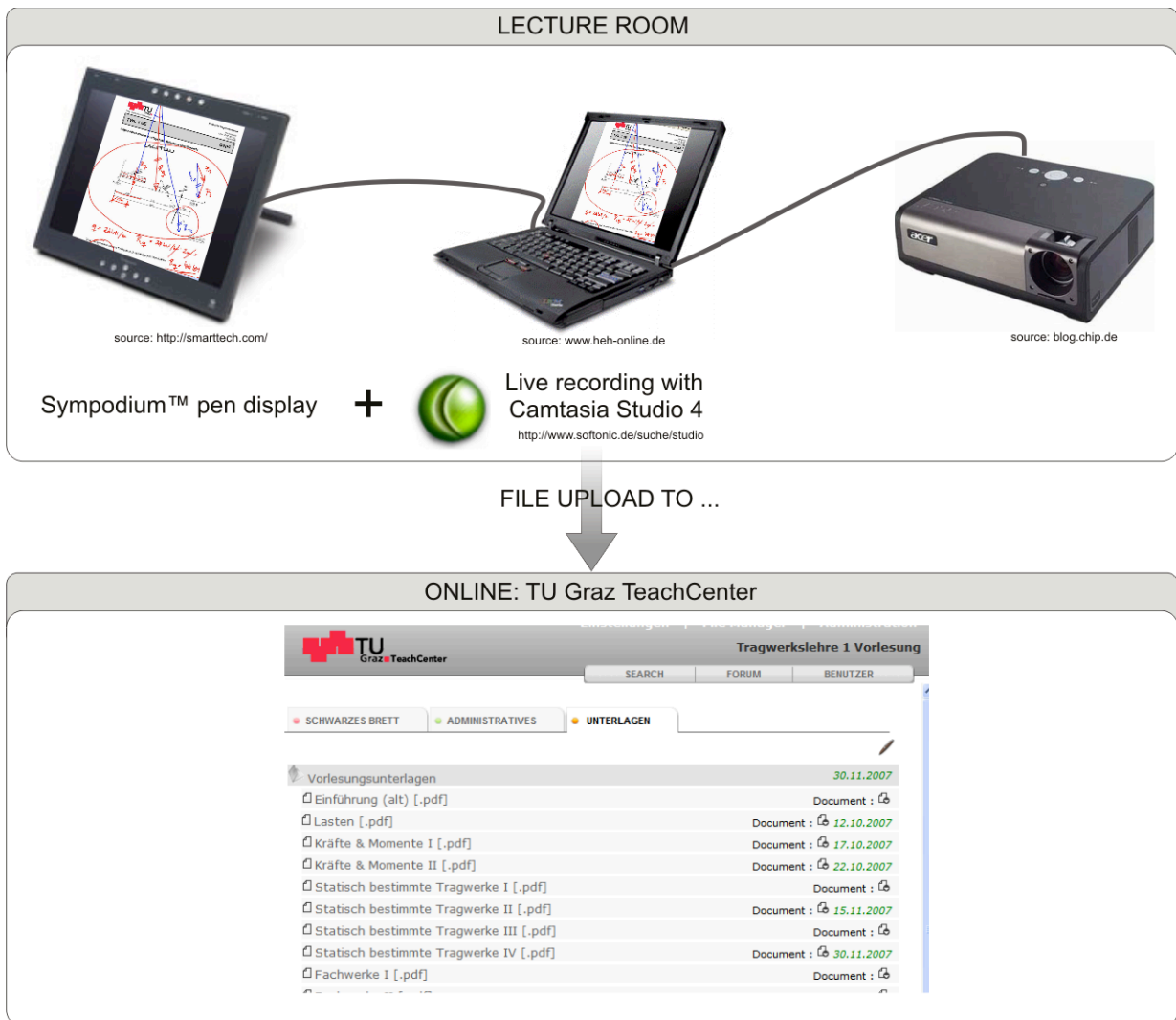
Figure 2: Setting of the lecture; Usage of Sympodium ™, live recording of the teacher's activities and providing documents at TU Graz TeachCenter
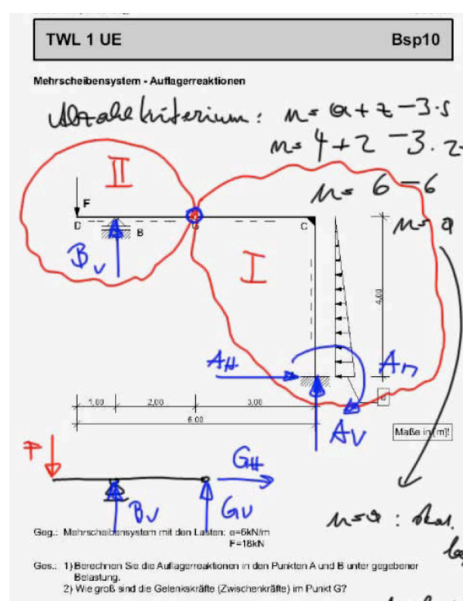

Figure 3: Screenshot from an interactive content drawn with the pen on the display saved as PDF and distributed over TU Graz TeachCenter.

2.2 The survey's intention

The survey was carried out for the two lectures described above. The questions concerning the usage of the pen display were part of a post-test questionnaire. Besides the pen display another main focus of the survey was on the podcast activities offered for the lecture. On the one hand the interest was to find out whether the students accept the pen display as an instrument for teaching and realise the advantages for the special needs of that lecture and on the other hand what experiences had the teacher working solely with the pen display in classroom. The teacher had been interviewed orally. The number of students taking part at the survey was 108. The questions centred on:

- How did the usage of the pen display for teaching purposes seems to the students "totally wrong", "I don't care", "good idea", "perfect"?

- Which medium did the student prefer and why: chalkboard or pen display?

- What was the strongest negative aspect according to the pen display?

- What was the major positive aspect according to the pen display?

The questions asked to the teacher concerned the adjustment of the preparation according to the content itself and the time needed for as well as the live handling of the pen display in classroom during lecture.

2.3 Students results of the survey

Question 1: If you rethink the whole lecture, would you retrospectively prefer the Use of the Pen Display or the Chalkboard?

Participants (N)	Prefer Pen Display	Prefer Chalkboard	Not specified
108	97 (90%)	1 (1%)	10 (9%)

Table 1: Do you prefer Pen Display or Chalkboard?

The results are outstanding clearly (see Table 1). Nearly 90% of the polled students prefer the Sympodium™ pen display opposite to chalkboard. Only one single person decided in favour of the chalkboard, 10 skipped the question. Even more impressing were the answers given to the question concerning whether the usage of the pen display for teaching efforts makes sense or not. With a standard deviation of 0.54 over 62% of the students estimate the pen display to be perfectly qualified for that and 37% said it is a good idea to use it in classroom (see Table 2). Again only one student thinks that it is wrong to use a pen display for lecturing.

Question 2: The use of the Pen Display for lecturing was …?

Answers: 1 = useless; 2 = I do not care; 3 = positive; 4 = absolutely useful

Participants (N)	Mean	Standard Deviation	Median
108	3,60	0,54	4

Table 2: The Use of the Pen Display for lecturing was …?

Table 2 shows a very impressive positive result concerning the use of the pen display. Mostly the students considered the usage as absolutely useful or at least as positive. A question according to their reasons was added?

Question 3: If you prefer the Pen Display for teaching please tell us your personal reason for this decision.

Looking at the answers given according to the most negative and positive aspects it must be said that the qualities of a pen display and its handicaps were obvious. Nevertheless the students found out the better sight and readability to be the primary advantage compared to the chalkboard their answers given were quite multifaceted. Figure 4 shows the details.

The disadvantages of the pen centred on the circumstance that there could be some technical problems with the pen display, laptop or beamer, which in fact occurred one single time as to the beamer. Furthermore some argued that the scripting had turned unclear, confused, or blurred. Only one student mentioned critically that the speed of teaching has increased and another feared the chalkboard to become displaced totally.
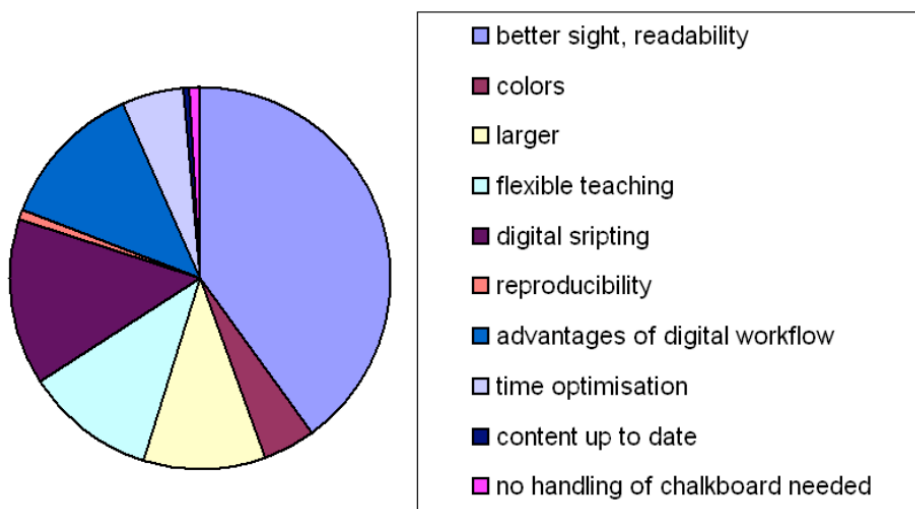
Figure 4: Students results in detail: advantages of the pen display

2.4 Teacher's results of the survey

The teacher's interview arrived at the conclusion that it is very worth to spend some time for special preparations for the scripts for to use the advantages of Sympodium™ pen display highly efficient. The script contained a lot of graphics, basic figures to go on with drawings on them during the lecturing as well as instructions for calculations. As a very positive criterion the easy (auto-) installation and high usability was named. Most of the features were self-explanatory and therefore quick to use. Furthermore the technical faultlessness was a crucial factor for the utter satisfactory usage of the pen display. Only the handling of the interactive pen itself needs time to get used to it. After all it remained hard to place and hit a specific point at the display very precisely.

The teacher expressed emphatically that he liked to use it and that there is a high benefit for his teaching process in the end. Noticed in a subjective way it must be said that once the lecturer has got familiar with the pen display – after the first two lecturers – it seemed that he had never used other tools for teaching before.

3 Discussion

The first experiences with the Sympodium™ pen display results in a highly positive feedback on the part of the students as well as of the teacher. It was highly accepted by students though the answers given were seriously and critically. The didactical setting and the characteristics of the content were adequate for the usage of the pen display. The facts that were responsible for the successful implementation of the pen display in those lectures are the following:

- A large lecture room requires good legibility of the written content taught up to the last chair of the row in the back

- The content was process oriented

- The content was interactive oriented

- The content was well prepared for the pen display options

- The activities in classroom were recorded and therefore reproducible and better comprehensible afterwards

- The students were introduced to the setting

The only realistic limiting factor in the described scenario was the difficulty of placing the interactive pen exactly on a specific point on the display. This might seem of no greater importance at first sight. In case of presenting an interactive PowerPoint slide-show or drawing drafts (as it was done during the lectures described) it can be neglected. Future experiences will tell if the Sympodium™ pen display is helpful for detailed technical drawings too demanded for lectures such as "Mechanical Drawing" or some of the faculty of architecture.

4. Conclusion

In the end it can be concluded that the first attempt to use an interactive Pen Display in a big lecture room lead to a very positive effect for the daily teaching process. Students as well as the teacher marked it as a "very useful" add-on.

However from a research point of view it can be summarized that it was possible to combine new technologies with traditional teaching methods. Podcasting as well as integration of slide shows (Almonte & Gilroy, 2005), animations and internet based resources can be part of the lecture without an additional high effort or costs. Teachers need not to switch between different media technologies and can concentrate on their lecture content.

The TU Graz will enlarge this initiative and reach out for further improvements. On the hardware side: what can be done to avoid the displacing of pens and how can the podcasting turn more automated. On the didactical side: how can further new technologies be integrated to the activities in classroom. Bearing the results of the survey in mind, it will be easy possible to embed microcontent such as in time contributions from microbloging systems or videos on YouTube into everyday lecturing too.

5. Acknowledgements

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