The Wizards of OZ
Supporting Change in Learning and Teaching

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Preface

University teaching has always been an activity reflecting two quite contrary challenges, namely the motivated acquisition of knowledge and skills versus a proof a professional abilities documented by examinations and degrees. This strange mixture of demands was met over centuries by canonical forms of teaching and learning: lectures, exercises, seminaries and practical training, followed or accompanied by examinations. While societies were under a strict pressure of technological change during more than two centuries, the teaching environment was kept stable to an astonishing degree.

The main technical innovation after the invention of lectures and universities in medieval times was the use of printed books, the introduction of blackboards and quite recently copying machines and overhead projectors.

Now computers and telecommunication allow another step that may resolve spatial and temporal unity of the classroom. This is a potential that has to prove its value by experiment.

1 Technical Means of Learning & Teaching at University Levels

The use of telecommunication and computing technology meets several educational demands in post-industrial societies. First, education at academic levels often becomes a necessity in a complex world of decision-making and high-skilled technological interactions. Second education guarantees no longer life long job security. Labor flexibility, as it is demanded, means more and more the ability for life-long learning and studies. Universities still do not reflect these changing demands from society and economy.

1.1 Fragmented Studies

As training on the job is not sufficient in highly complex fields of academically trained labor more and more short sequences of training and productive work will define a job career. As a simple consequence of such an insight, school and university studies can no longer establish complete education. As a consequence these phases should be shortened and institutions have to be opened for on-going education processes - or high level education will be delegated to other institutions.

In fact, we already have experiences with such structures though they are still not dominant. Distance learning, at the British Open University or at comparable institutions, does exist as well as the support of some of these demands in on-going education or add-on

university training. Some universities also offer supplementary studies, but this all may of restricted value if only added to a traditional curriculum - it makes much more sense if it is considered as training after some job experiences. In general, we feel that Universities are not very open to such ideas. This, of curse, fragments the traditional studies into smaller consequent pieces.

1.2 Part-time students

Part-time studies are another example of fragmented education. We must accept the fact that many students especially in, but no way restricted to, informatics and IT-related fields are actually working in these fields during their university studies. The curriculum must reflect the existence of these part-time students. They should be supported much more than it is actually done.

Unavoidably this means also a stronger inclusion of practical experiences into the curricula - either as an underlying assumption, namely that students are already practicing their field of studies to some degree or as an explicit part of the university studies.

1.3 Life-long learning

We actually are in the process of fragmenting education, dispersed over the student's whole lifetime. No longer can we rely on the traditional sequence of "school-university-job". This sequence will loose its character as the standard type of education. Of course self-studies are some answer to the growing demand of adult training, but they show also distinct disadvantages. So the idea of Internet based distance learning is propagated for a revised form of self-studies. It seems to be too early to judge the practicability, but there are promising field studies.

1.4 Fragmenting discipline

If education will become a life long effort, we should not expect that the sequence of education blocks follows traditional curricula as they were constructed by different disciplines. A life long learning process will very naturally assemble different pieces of curricula from different disciplines. It is not difficult to foresee that law and economics or management studies will become standard elements in the life long process for engineers or computer scientists. Contrary many trained in social or cultural sciences will include elements from computer science into their life long curriculum.

This cannot be without influence on the disciplines as they are formed now. New disciplines may arise (like e.g. chemical engineering, media informatics, or media economics) but this will not be the final answer. After some period of adaptation, we will become accustomed to complex mixes of diverse disciplines, which will be based in a variety of disciplines.

1.5 New technologies

With the advent of new technologies there seem to be some answers to the challenge of new educational structures worth to be investigated. In the "Wizards of OZ"-project we

demonstrated that new technologies allow new forms of online-teaching and learning as well as related offline self studies. By the use of computing technology and telecommunications we constructed an environment where spatial and temporal restrictions of teaching were relaxed to some degree. Our first experiences show that new forms of teaching could be (and to some extent must be) founded on traditional forms.

2   The Wizards of OZ Project

OZ is a tele-learning environment for lessons, seminaries, and exercises in computer science at Humboldt-University, where "OZ" means distributed in space (ortsverteilt) and independent of time (zeitversetzt).

Fig.1 Connecting places; one room is at the main campus in Berlin-Mitte, the other at Berlin-Adlershof. This distance is one hour by inner-city train (S-Bahn).

2.1   Connecting places

We use two rooms at different campuses of the university; one is placed at the central campus in Berlin-Mitte, the other at Berlin-Adlershof. The distance between these places is one hour by public transportation. The rooms are connected by the university's internal high-bandwidth, but non-reserved, TCP/IP-over-ATM-connection. Each place is equipped with two data projectors, where one is used as white board mirroring the teacher's or a student's computer screen, while the other shows the teacher and the opposite room inhabitants. Each room has its own control computer that is also used for video or audio streaming. The setup is completely symmetrical in its functions and in fact, lectures are given from Berlin-Mitte as well as from Berlin-Adlershof without special arrangements in advance. The same holds for exercises.

By the use of wireless connected laptops a comfortable degree of freedom for teachers and students is achieved (actually only in one room for experimental purposes). In general,

Fig.2 Teaching in Adlershof

we use low-cost hardware and standard software wherever possible. This was a basic economic decision for the whole project design and we find it well justified after more than two years experience.

Fig.3 Remote listeners in Berlin-Mitte

2.2   Tele Exercises

A focus is on tele-"exercises", which has certain implications on the technical setup: the back channel is very important and the teacher's presentation as well as the student's

computer screens has to be visible on both places. Different modes of use are possible.
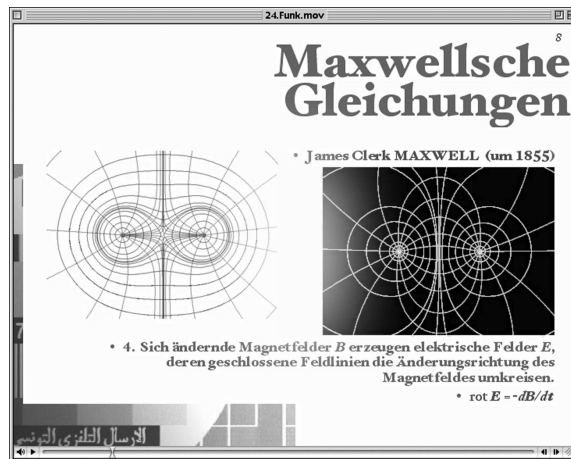

Fig.4 Online- and offline material: PowerPoint slides enhanced by audio-stream

2.3   Online- and Offline Multimedia-Material

The audio-taped lectures are combined with the screen materials, mostly PowerPoint slides enhanced with QuickTime media, so that lectures as well as other stored materials are accessible via Internet and as CD-ROMs. After some experiments with video- and audio-tapes, we decided that audio-enhanced white-board will is sufficient for most purposes of training and repetition. But this decision reflected also bandwidth and storage considerations. Broadband internet connections like DSL- or cable and DVD-storage will allow us to reconsider these design decisions, as we did already in some experimental setup.

3   Some Considerations

• University teaching is standing in a long historical tradition. Despite all obvious problems it has demonstrated over the centuries some inherent positive qualities. Before we expect that new technologies may succeed classical forms of teaching, we should keep in mind that the printing press improved university teaching but it did not turn off lecturing. We may note that lectures are not defined by pupils copying sentences read aloud by a teacher. Lectures exhibit a complex social and cultural context. It is much more likely that technology may enhance lectures than to extinguish it.

• Lectures and exercises must be well prepared - not only by content, but also by the used technology. This means a substantial additional amount of preparation time as well as knowledge and proficiency with the media used.

Fig.5 Online- and offline material: PowerPoint slides enhanced by video- and audio-stream

• There is a certain danger with perfect media demonstrations. Every lecture that reaches at the frontier of scientific knowledge can probably not avoid a touch of incompleteness and a flux from stable basics to yet unsettled fields still waiting for a better didactical treatment. Perfect media finish may give a wrong impression of a closed body of knowledge that may not motivate students for a deeper understanding. Therefore the emphasis on media technology must not be overstretched. It is not TV finish that must reached. Student motivation is much more important than technological perfection.

• Technology should become transparent in the process of teaching and learning. This goal will probably never be reached in a perfect way. E.g. the pages of a book must be turned over again and again while reading: Though this introduces a break in the reading process, we are usually not aware of it. Similarly we accept some technical irritations with computers and telecommunication equipment, but they should never determine the whole work flow.

• Actual technology suffers, at least under the dictate of economic resource planning, from imperfections: insufficient bandwidth for video and audio streams, lack of storage capacities, slow computing speed, or bad codec qualities, to name a few. Even if they improve, we must cope with these imperfect situations for a long time. That means, we must try to use cost-effective solutions: standard equipment, standard software, preferable from public domain, or shareware origin. Open source developments may help to adapt software when necessary.

• The process of teaching and learning is context-sensitive as well as content-sensitive. There is no general form of lectures, seminars, and exercises throughout the disciplines. That means, technological decisions for tele-teaching must be adapted to actual needs. In our case, we found synchronous bi-directional audio to be the most important factor, followed by responsive whiteboard demonstrations. Video quality for teacher close-ups were considered to be much less important. In fact, we omitted this video channel completely in the CD-ROM and web-versions of the lectures (a decision to be postponed with higher bandwidth and larger storage).

• We assume that changing the structure of teaching and learning will not be without influence on the structure of the underlying disciplines. Technology demands a stricter modularization of single courses - and that in turn generates modules for better structured disciplines. Our courses were accepted by diploma students in the computer science department as well as additional courses by students in various fields from egyptology, cultural studies, mathematics, or language studies.

Fig.6 Exercises in Berlin-Mitte

4   Outlook

After more than two years of thorough experiments the installation has reached a state where it is relatively stable, so that it is transferred now for regular use in our teaching activities. Students acted favorably. They are well aware of the organizational advantages of space distributed teaching and they made good use of the CD-ROMs. Last semester, by a poll result among all students of the department the lecture was given a prize for outstanding teaching. This validates our belief that the use of technology must not degrade the quality of lectures and exercises even under otherwise unfavorate conditions.

Appendix - Acknowledgement

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