

Comprehensive virtual mathematics training

A crucial support to bridge the gap for
undergraduate students

D. Zenker, K. Simon, L. Gros, T. Daubenfeld

Faculty of Chemistry&Biology
Fresenius University of Applied Sciences
Limburger Str. 2, D-65510 Idstein, Germany
<http://www.hs-fresenius.de>
dietmar.zenker@hs-fresenius.de

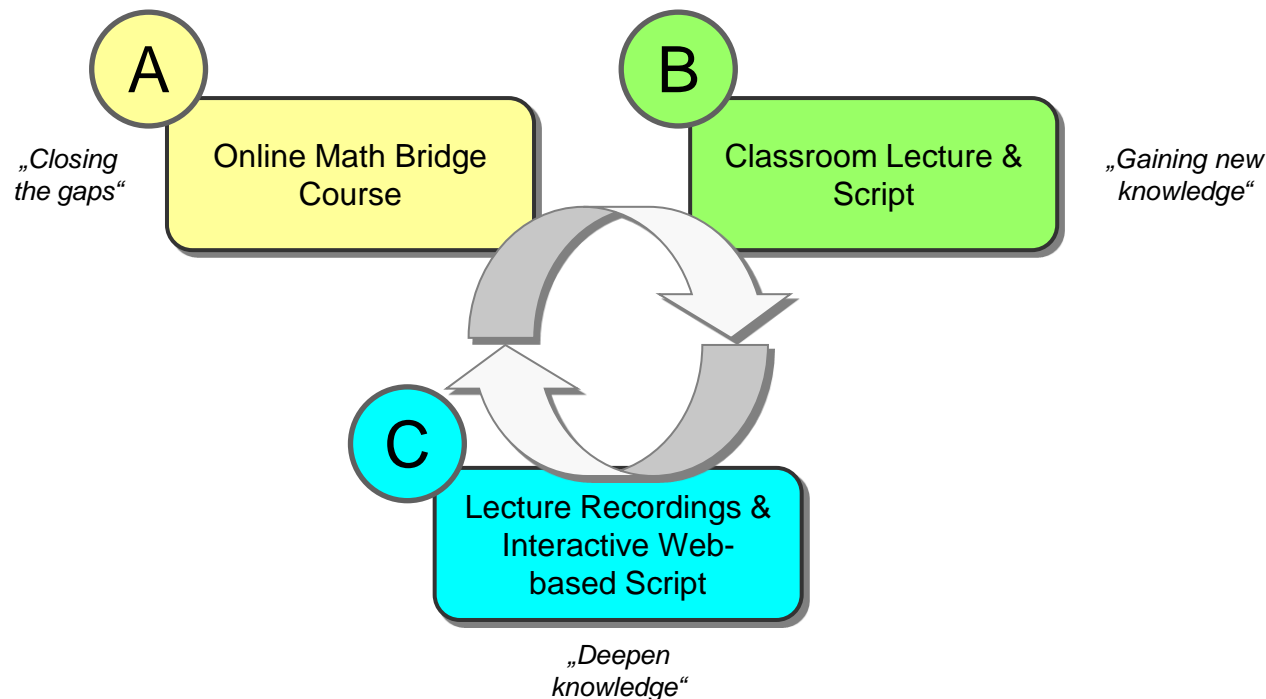
Initial Situation and Challenges

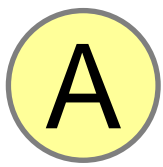
- mathematical literacy of German high school graduates is reported to have declined
 - rising demand for extra-occupational programs brings in students who are not used to abstract mathematical thinking from their everyday working environment
 - mathematical illiteracy is one of the reasons for a rising drop-out rate in natural science and engineering study courses
- it's important to increase the mathematical literacy of first-year students by intensive teaching:
- frequent repetition of learning content
 - intense practice of exercises

How to intensify teaching with limited resources?

- (human) resources (“number of teachers”) are usually limited
- ICT based training and practice („E-Learning“) is a useful tool to overcome this restrictions

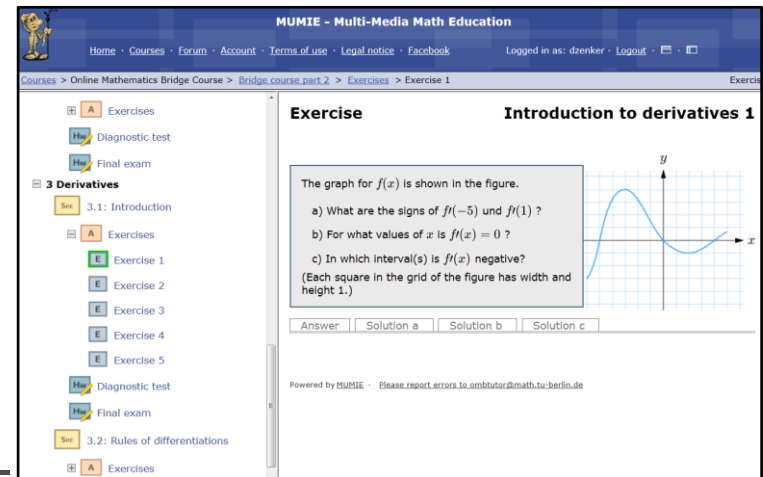
Multi-level approach using ICT in mathematical teaching





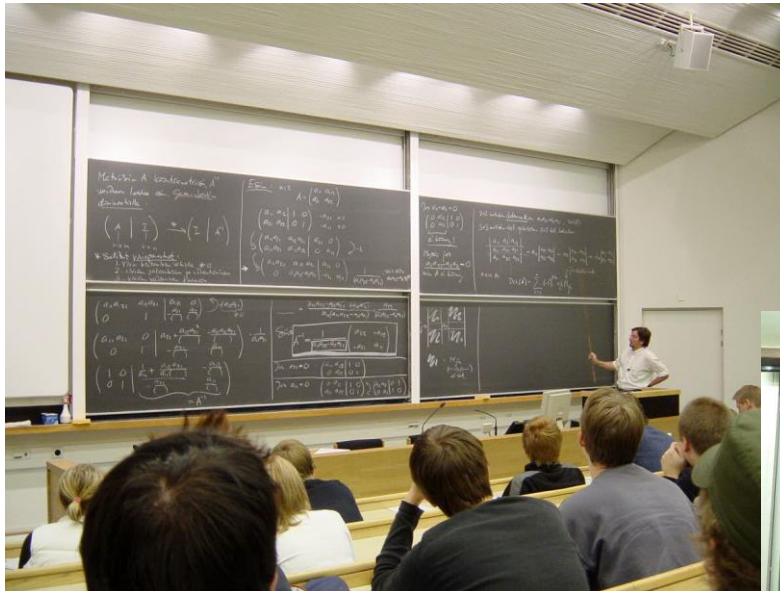
Online math bridge course (OMB)

- a ready-to-use web-based training course that was provided by TU Berlin (<http://www.om-bridge.de>)
- OMB is part of the open-source E-Learning platform MUMIE (<http://www.mumie.net>)
- the course provides material for self-assessment and to cover existing gaps, and supports the math preparation course that is held before start of the semester
- working through the course was no obligation, but recommended for all participants prior to their studies

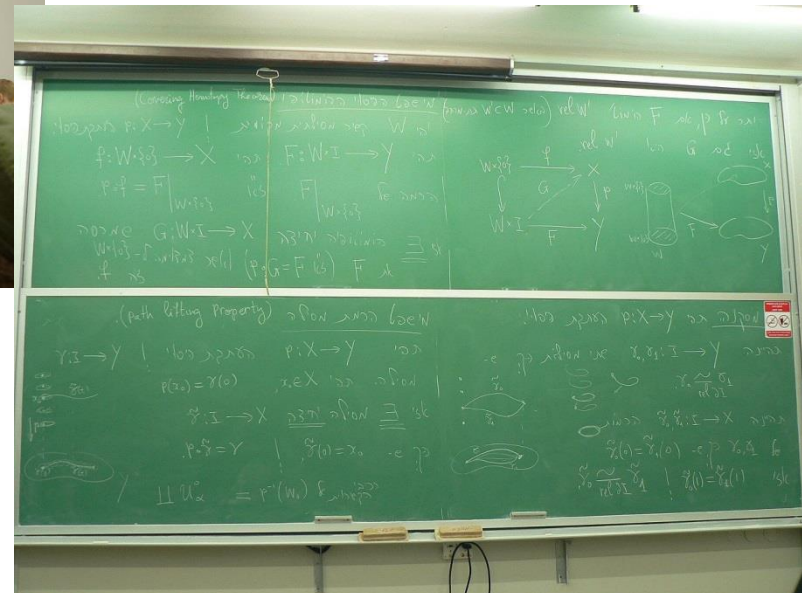




Classroom math lecture - the „classical“ way...



Source: <http://commons.wikimedia.org>



Source: <http://commons.wikimedia.org>

Classroom math lecture - the „modern“ (and better?) way...

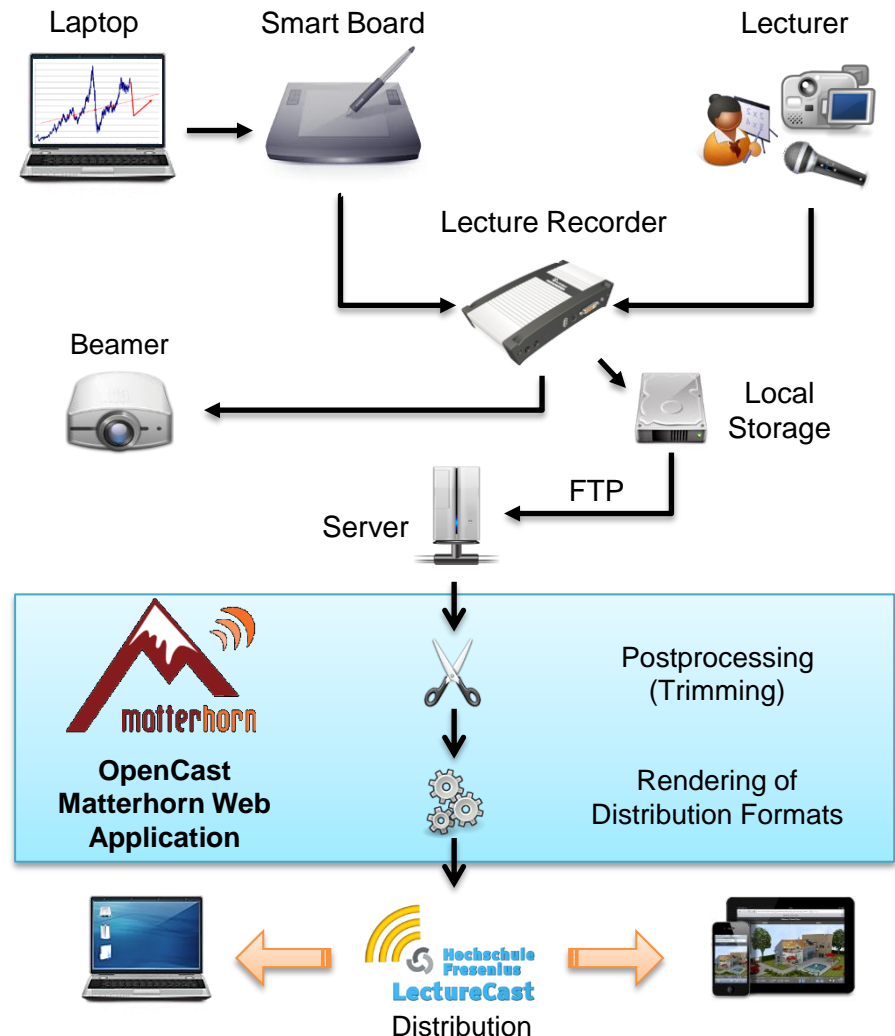
...using a smart board (SMART® Podium Interactive Pen Display) placed on the desk



- static presentations and software demonstrations can be enriched *ad hoc* with calculations, plots or annotations to illustrate complex subject matter
- easy switch between hand writing and software demonstration, e.g. calculation in Excel® or CAS → no „media break“
- teacher is facing the students all the time
- under adverse lighting conditions, beamer projection offers better visibility than chalk on blackboard
- recording of the lecture is much easier

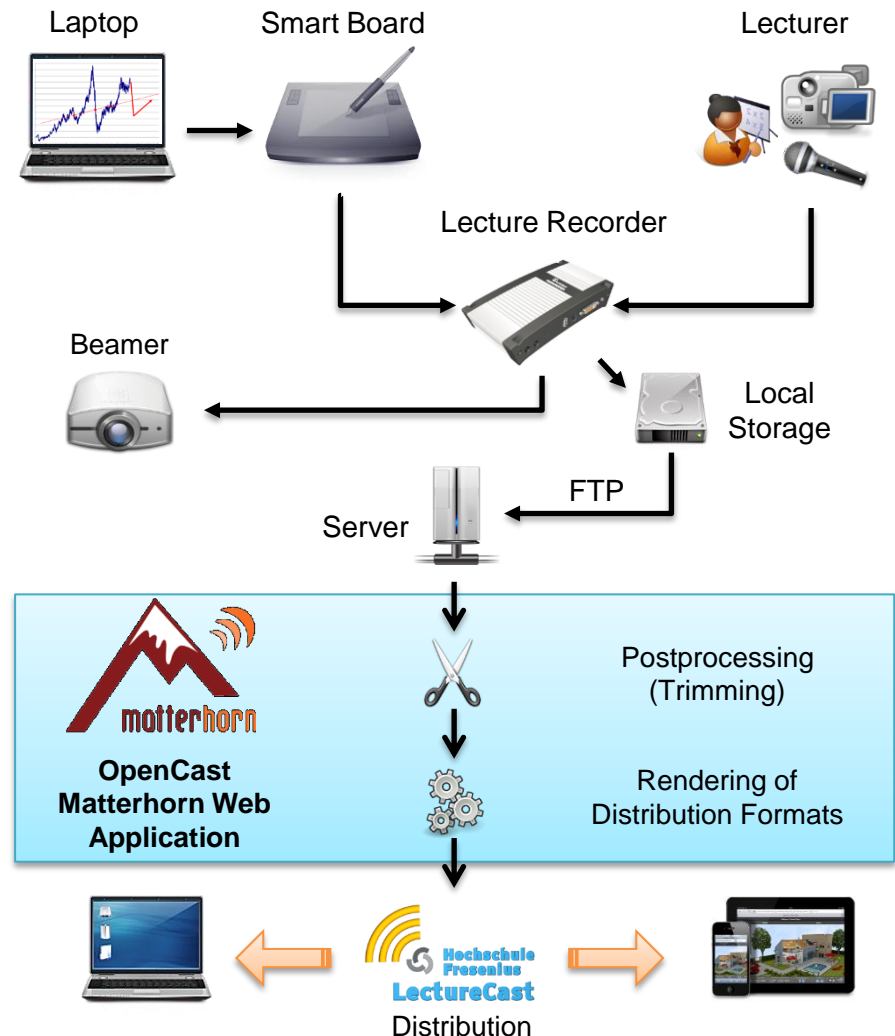
Lecture recording system and automated postprocessing [1]

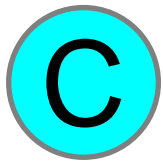
- all actions on the smart board during the lecture can be captured together with the aural explanations of the lecturer, and stored
- upload of the recordings to a media server and further processing with the web-based video management system “OpenCast Matterhorn” (<http://www.opencast.org>)



Lecture recording system and automated postprocessing [2]

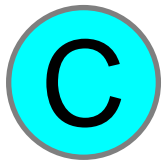
- online trimming of the raw lecture recordings and automatic generation of the final distribution format(s)
- the recordings are made accessible for the students via the in-house learning management system ILIAS





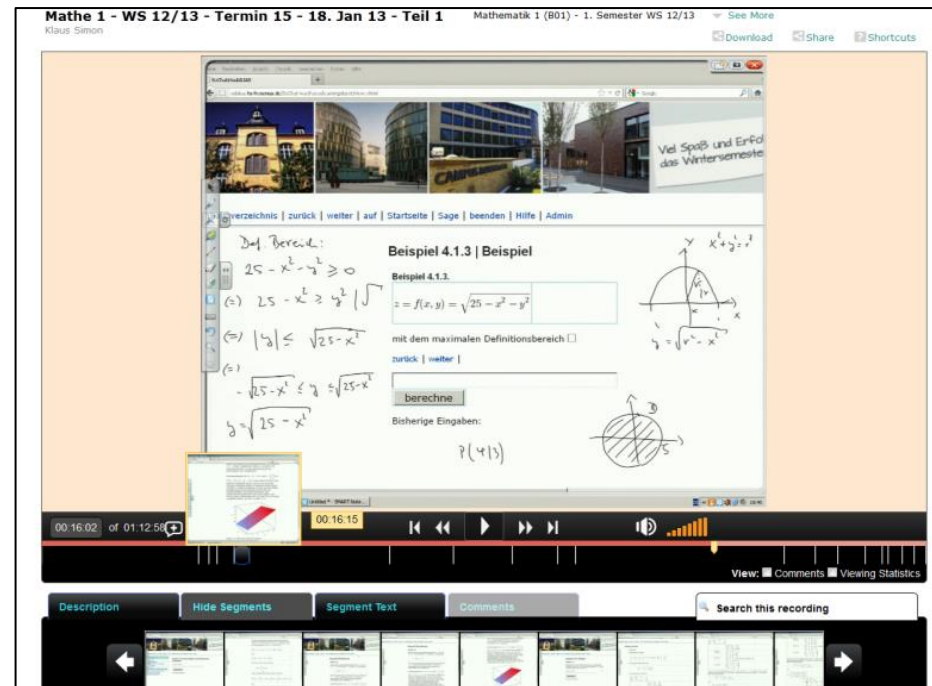
Advantages of the lecture recording and media management system [1]

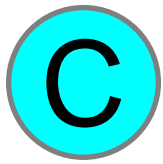
- ease-to-use and intuitive handling for the teacher allows integration in the daily working routine
- recorded lectures can be presented to the students shortly after the lecture in order to give them the opportunity to work through the material again at their own learning speed
- this is especially important for students who follow an extra-occupational program as they cannot be present for each lecture (e.g. due to company restraints such as shift work)



Advantages of the lecture recording and media management system [2]

- the OpenCast Matterhorn system offers a rich media user interface for learners to engage with academic video content, including
 - automatic scene detection & slide preview
 - content-based text search
 - annotation feature for scene-specific comments and discussion





Interactive online script „SciChat“

- a written LaTeX script is transformed by a converter into multiple XML/XHTML documents and enriched with exercises
- these documents are stored in a database and presented to the students via a web interface by an in-house Java web application ("SciChat")
- "SciChat" is linked to a CAS (Maxima): students' response in the exercises are automatically evaluated and specific feedback can be given to the students
- with "SciChat", all examples and exercises that are discussed during the lecture can be repeated and used for training by the students at any time

Startseite | Sage | beenden | Hilfe | Admin

Aufgabe 1.3.4 | Aufgabe

Aufgabe 1.3.4.
(vgl. Gellrich, Bd. 1, S. 221, 4.11) Das Gay-Lussacsche Gasgesetz, das der französische Physiker und Chemiker Joseph Louis Gay-Lussac (1778-1850) im Jahre 1802 aufgestellt hat, beschreibt den Zusammenhang von Volumen und Temperatur eines (idealen) Gases bei gleich bleibendem Druck:

$$V(T) = V_0 \cdot \left(1 + \frac{T}{273^\circ\text{C}}\right),$$

wobei $V(T)$ das Volumen bei $T^\circ\text{C}$ und V_0 das Volumen bei 0°C ist. Für den Ausgangswert $V(0) = 5\text{ L}$ soll die Funktion $V(T)$ im Bereich -273°C bis 100°C gezeichnet werden (50°C auf 2 cm, 1 L auf 2 cm).

a) Wie groß ist das Volumen bei -100°C ?

b) Bei welcher Temperatur ist das Volumen halb so groß wie bei 50°C ?

☐

[zurück](#) | [weiter](#) |

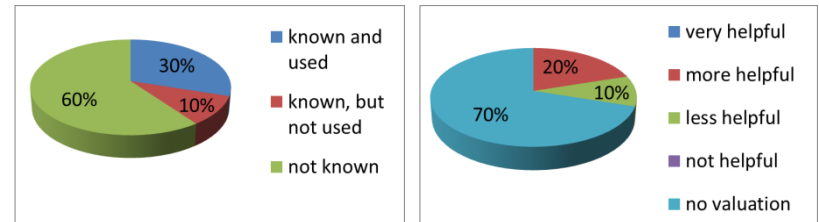
Bisherige Eingaben:

Results

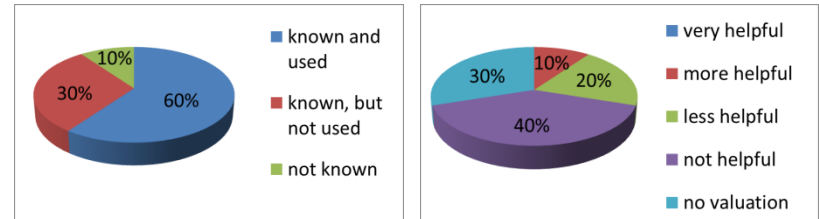
- the described teaching scenario was implemented during the winter term 12/13 and further development and optimisation is still in progress
- in a first mid-term feedback, 14 students from the extra-occupational degree course Industrial Chemistry (B.Sc.) were asked about their usage and opinion of the various offers
- finally, 10 fully completed questionnaires were further evaluated

Usage and opinion regarding...

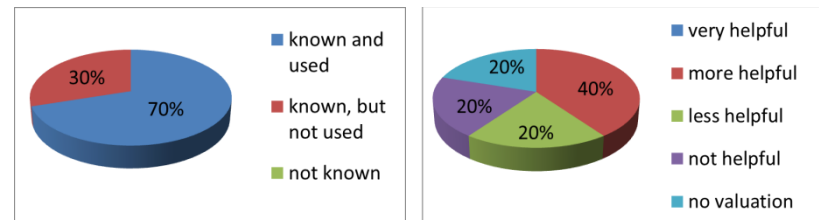
...the Online Math Bridge Course



...the interactive "SciChat" script



...the Lecture Recordings (n=10)



Conclusion and Outlook

- better and earlier information of the students concerning the Online Math Bridge Course
- lecture recordings seem to be more helpful for the students than the “SciChat” interactive script, probably due to the “dynamic” character of audiovisual content in contrast to the more static web-based script
- we consider to connect these two currently separate elements to form a more integrated online learning scenario, e.g. by splitting one recording into several smaller sections and linking them to the corresponding exercises
- combination of lecture recording sections with specific tests in the learning management system to form an alternating arrangement of a theoretical part with a subsequent self-assessment

Acknowledgment

The authors wish to thank the German Federal Ministry of Education and Research (Bundesministerium für Bildung und Forschung, BMBF) for sponsorship in the context of the ANKOM project (<http://ankom.his.de>).



**Thank you very much for
your attention!**

Any questions or comments?

