

Mathematics for Informatics: Case Study of a MOOC Project

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Motivation for video-supported lecture technologies

- Teaching with the aid of the white/black board did not change for centuries.
- Modern approach for course content delivery is needed.
- MOOCs and video lectures represent technology-oriented lecturing, expected at a high-tech university.
- Content delivery can also be resource-efficient.
- Ergonomic approach is enabled even for visually impaired students.

Disadvantages of Classic Teaching

- Energy depletion of the lecturer (stands up hours at-a-time at the board).
- Endless repetition (the content is the same as in the previous cycle).
- Content delivery speed is usually dictated by the lecturer and class schedule, disregarding the students needs.
- Class daytime hours are dictated by the faculty schedule.
- Inefficient time usage (answering a question from one student may be time lost for all the other students who understood the content).
- The lecturer cannot be asked to repeat the last 5 minutes.
- Lack of ergonomics (e.g., text and diagrams on the board cannot be zoomed if someone has visual deficiencies).
- The lecturer lacks the time to bring personal expertise into discussion.

Advantages of Pre-Recorded Lectures

- Students can watch the lecture at any time (even while riding on the bus).
- Content can be replayed (entirely or minute by minute), for as long as it is necessary.
- The video replay speed can be adapted to the student needs.
- The now freed time of the lecturer can be used to discuss cases, examples, experience (expertise delivery, highly valuable).
- Diagrams or any other graphics can be zoomed in: huge ergonomics improvement.
- Questions can be addressed in class (the student only records minute:second in the recording).
- All the lectures can be reviewed before an exam or later, for content refreshment.
- Using modern video editing tools, the contents can be updated easily and fast.

Disadvantages of Pre-Recorded Lectures

- An error detected after the video content is published cannot be corrected live, thus an erratum is needed.
- Students cannot ask live questions and cannot get immediate feedback if they do not understand something.
- In general, advantages outperform disadvantages.

The Content of the MOOC course Mathematics for Informatics

- 1 Grupy: základní definice a ukázky.
- 2 Podgrupy: definice podgrupy, ukázky podgrup, řád grupy, Lagrangeova věta.
- 3 Modulární grupy: definice aditivní a multiplikativní modulární grupy.
- 4 Podgrupy generované množinou a generátor.
- 5 Cyklické grupy a generátory.
- 6 Homomorfismus a izomorfismus.
- 7 Okruhy a tělesa.
- 8 Okruh polynomů, ireducibilní polynom.
- 9 Konečná tělesa.
- 10 Počítání v konečných tělesech.

Content Delivery

- Recorded Lectures (teacher recorded at the whiteboard).
- Screencasts (recordings of the live screen display, with explanation).
- Electronic Board (eINK display, like at the whiteboard, without the teacher in the frame).
- Written Text.
- Slides.
- References to technical literature.

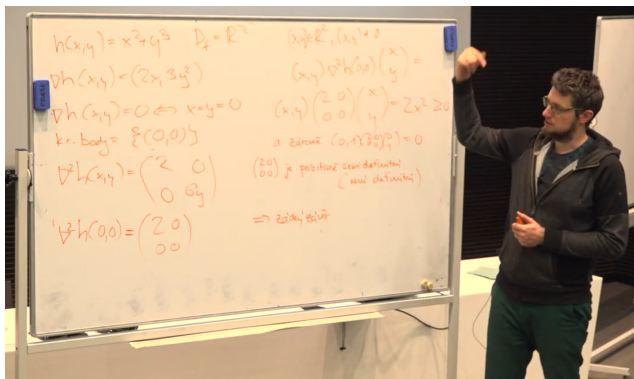
Student-Lecturer Interaction

- Students interact primarily with the portal marast.fit.cvut.cz enables (navigation, reading, etc).
- Quizzes are available at each lecture on the portal marast.fit.cvut.cz.
- Students are explained access to a network simulator to perform virtual labs.
- Video conferencing (Skype, WebEx, SIP, etc).
- On-Line Live Lectures (teaching via audio/video conference).
- System for addressing questions to the lecturer, with the possibility of the lecturer to reply to concrete questions.

Student Examination

- The knowledge of each lecture is tested using an attached set of questions (10 or more).
- The questions are either multichoice or problem solving (an answer can be a number, list, string or any simple data structure).
- The questions are grouped in multiple classes of difficulty and are be given different weights/points.
- Testlets/simlets can be added.
- The whole MOOC course is concluded with an exam covering all the topics.
- The exam is considered as passed if the number of points for each lecture and in total exceeds a given threshold.

Output: Whiteboard



AV Technology

Camera Sony Z90 + wireless mic G4 EW 500 (10 min setup).

Output: PiP on Apple tablet

Řešené příklady - integrály
Připomenutí: tenkrát obecně oblast 1

Budeme uvažovat dva typy oblastí:

- (typ 1) x je z intervalu $[a, b]$ a y je omezené spoj. funkcemi $\varphi_1(x)$ a $\varphi_2(x)$ splňujícími $\varphi_1(x) \leq \varphi_2(x)$ pro všechna $x \in [a, b]$.
- (typ 2) y je z intervalu $[c, d]$ a x je omezené spoj. funkcemi $\psi_1(y)$ a $\psi_2(y)$ splňujícími $\psi_1(y) \leq \psi_2(y)$ pro všechna $y \in [c, d]$.

MI-MPI řešené příklady

MI-MPI: přednáška 15: řešené příklady - integrály a strojová čísla

AV Technology

Camera Sony Z90 + recording rack (40 min setup)

Output: PiP Wacom paper tablet

$$\begin{aligned} 3x + 2y - 6z - 3t &= 7 \\ x - 4z - t &= 3 \\ -y - 3z &= 1 \end{aligned}$$

BIK-LIN: Druhá online konzultace

AV Technology

Camera Sony Z90 + recording rack (40 min setup)

Conclusions

- The MOOC course Mathematics for Informatics was designed as a student-centric course with efficient content delivery.
- Innovative video recording, post-processing, and providing technologies were tested within the university infrastructure with the aim to enable a transfer from classical teaching paradigm to modern ones.
- The resulting course was designed to be useful for both distance-learning or day-time students (in combination with the standard approaches).

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