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## **Video recordings of mathematics lectures by students: some data on usage patterns**

### **Introduction and background on lecture recording**

Lecture video recordings have been a considerable focus of interest in the last years. The practice of recording lectures is not new, but recent developments of the internet have substantially increased the amount of lectures which are available online. Motivation for lecture recordings include: Students cannot process and remember everything that is said during a lecture (Hartley & Cameron, 1967). Thus it would be useful if students could “re-wind” the lecturer and the lecture (Fischer, Werner et al., 2012).

This article tries to assess how students use such recordings. Relevant feedback was obtained from students at the University of Hamburg (Germany), University of Koblenz-Landau (Germany), Technical University Darmstadt (Germany) and PH Vorarlberg (Austria), where some of the author’s lectures were recorded (Gunesch, 2010; Gunesch, 2012). Here we focus on lectures in academia (Apel, 1999), although presumably many points made in this article apply lectures in other settings also. Lectures can be either classical chalk-on-blackboard lectures which are then recorded with video cameras or a blended form consisting of presentation slides plus a video recording. See (Gunesch, 2013) for a more detailed description of the various formats and for a discussion of why lecture recordings of mathematics courses may be very different from lecture recordings of courses in other fields of study.

Apart from recording traditional classroom lectures where the classroom setting is still supposed to be the primary method of teaching the students and the recordings are seen as supplementary, secondary or “extra material”, the newer *inverted classroom model* (Handtke & Sperl, 2012; Fischer & Spannagel, 2012) uses lecture recordings as the primary method of disseminating the content of the course. Also, short internet-only lectures are popular, e.g. (Loviscach, 2013). Regardless of length, recording lectures only make sense if the lecturer embraces the concept of recordings and is at least moderately comfortable with technology (Petko, 2012).

### **Are video lecture recordings actually beneficial to students?**

Students like having video recordings made available to them, and strongly support their continuation (Rust & Krüger, 2011). On the other hand, does the subjective assessment of the recordings’ benefits actually correspond to actual benefits not provided by other means (such as books or lecture

notes)? Do lecture recordings actually help students learn better? Do students' course grades improve? The question how students' use of lecture recordings affects their academic performance (measured by course grades) is hotly disputed in the literature. Zupancic (2002) notes that students who spend a lot of time on the lecture recordings also spend a lot of time on homework. Zimmermann et al. (2013), as well as Pursel and Fang (2012), claim that video usage improves students' learning despite negative correlations between high levels of "download server access numbers" and exam grades.

Some aspects that the research described in this article focuses on are: What types of students actually use lecture videos? Why, how, and where do they watch the lecture videos? Which parts of lecture videos are actually watched? How do students use pauses and reviews when watching? Are students actively learning the course material while watching recordings, or are they "passive consumers"? Do different student populations (here: primary school teacher students and secondary school teacher students) differ in their usage patterns concerning lecture recordings? Course evaluations of a recorded mathematics lecture of the author at the Technical University Darmstadt provide some new insights. These evaluations included an online evaluation with special research questions for this study, plus lengthy personal interviews with some (volunteering) students. The interviews allow correlating behavior with course grades and offer detailed insights, but suffer from (possibly strong) selection bias (students who agreed to be interviewed may have been particularly satisfied with the course, etc.) The online evaluation was anonymous and hence its results cannot be correlated with student grades. The combination of the two shows interesting results. This article summarizes some key findings. Due to space constraints, the data and detailed analysis results will be published separately.

### **Why do students use lecture videos?**

The question is justified since the course, lecture notes, and books already cover the course material completely. In the aforementioned evaluations, students state that:

- Videos are easier to understand than books and lecture notes. Videos contain many informal remarks, and this is very helpful.
- On the other hand, for course material that is already understood by a student, the student finds reading the lecture notes faster than watching the recordings.

Watching video lecture recordings seemed more popular than reading lecture notes when dealing with new or difficult topics.

- The number of students who are in favor of having video recordings of lectures is larger than the number of students who actually use them regularly.

### **Who uses video lecture recordings?**

A common assumption is that weaker students prefer video recordings while stronger students do not. However, the aforementioned interviews show that it may not be that simple:

- Students whose academic performance in the final exam was average or below show high levels of video usage.
- Many students whose academic performance in the final exam was strong show low levels of video usage. Some of these students viewed not a single video recording.
- However (and this is surprising): Several strongly performing students, including some with perfect grades on the final exam, show very high levels of video usage. In particular, some strong students decided to watch *all* of the recordings *again* before the final exam even though they had already understood the course material.

Students' lecture recording usage patterns may be more heterogeneous than thought so far.

### **When and where do students watch the recordings?**

Their behavior is inhomogeneous here also: Some watched after each lecture, some only once before the exam, some did both, some watched only "on demand" when the material was difficult. Locations differed also; some students preferred academic environments, some used "recreational" places (couch, TV), some watched while traveling.

### **A remark on primary school vs. secondary school teacher students**

Primary school teacher students appear to be less interested to learn abstract course material than secondary school teacher students (Kortenkamp, 2015). This may cause (at least initially) lower levels of understanding and retention of such material when learning it for the first time in a course. One conclusion to draw from this might be that the more abstract parts of a mathematics course may need more reviewing and repeating of the abstract parts when the course is taught to elementary school teacher students.

This, in turn, may work better with video lecture recordings than with written course material. Separate research is needed to specifically test this.

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