Lecture Capture: Student Perceptions, Expectations, and Behaviors

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Abstract: The decrease in cost and increase in automation of audio visual systems for the classroom has led to widespread deployment of lecture capture within higher education. While a number of studies have examined the effectiveness of such systems within an institution, no study has characterized student background across institutions. In this paper we describe three different lecture capture systems deployed in three different higher education institutions worldwide. We note particular interesting investigations we have made into how students use these systems, and outline how our current work in the opencast community project will be used to provide more rigorous cross-institution analysis options of lecture capture systems.

Introduction

While the first web-based lecture recording systems were used more than a decade ago, applications for recording and distributing conferences and lectures have been developed for quite some time and are described in other publications, e.g. in (Friedland, et al., 2004), (Hürst & Deutschmann, 2006), (Hürst et al., 2006), (Mertens et al, 2007), (Ziewer, 2006). For the most part, they were developed in the context of research projects or to meet local needs and therefore customized to the particular needs of a certain university.

Only lately has the quality and scalability of such systems reached a level high enough to warrant making lecture recording of strategic importance for universities. Lecture recording offers considerable value for student learning and the student experience, and is being used both as a principle delivery method (e.g. content for fully online or distance education courses) as well as a supplemental resource (e.g. in blended and partially online courses). As an element in distance education this form of content helps to convey to students that they are not alone in the learning process and that both peers and content experts are involved. Several authors have reported on the pros and cons of this kind of learning material, e.g. (Deal 2007), (Lauer & Ottmann, 2002), (Hermann et al., 2006), (Krüger, 2005). The rise in electronic portfolios for both teaching and learning has further underlined the benefit of lecture capture as an evidence-based learning approach. Contemporary thoughts on lecture capture suggest that it is a feasible and cost efficient way for traditional universities to take first steps into the direction of offering e-learning content (Müller et al., 2002), (Zupanic & Horz, 2002) and one of the fastest growing domains in the field of e-learning at universities.

Studies on the usage of lecture recordings focus mainly on local situations and observations at single universities (Rohs & Streule, 2009), (Schulze et al., 2007), (Michael-Brian, 2009). One broader example for a comparison of the usage of lecture podcasts at different German speaking countries can be found in (Breuer & Breitner, 2008). The work presented in this article compares student's perceptions, expectations, and behaviors

while working in lecture capture learning environments. We consider three different cohorts and contexts using three different lecture capture implementations in three different countries:

1. Medicine School students at the Tel Aviv University, Israel, learning in an online distance course (*Introduction to Surgery Clerkship*), which substitute the previous traditional face-to-face learning. A home built system was used to record the lecturer's video and his presentation in real time. These recordings were accessed through the Moodle LMS enabling over 100 students to participate in the learning process.
2. Students in a traditional lecture system using a blended model in a computer science class at the University of Osnabrück, Germany. The virtPresenter system (Mertens et al., 2007) was used, and roughly 200 students were involved.
3. Students in a blended cohort studying Computer Science and Mathematics at the University of Saskatchewan, Canada. The Recollect system was used, and roughly 79 students were involved.

While a rigorous controlled study was not carried out, we notice some similarities between these different groups. In particular, students tend to rate recorded lectures as very helpful and important learning content compared to the other resources they have available to them (see figure 5b and figure 6a). Further, they tend to watch recordings in the later afternoon to evening, and not in the early parts of the day (figure 4b). This behavior can be observed across our institutions. While a comparative evaluation of privacy concerns was not available across the institutions, within an institution different course with different lecture recordings setups report similar experiences (figure 8).

The remainder of this paper is organized as follows; section two of this paper shortly describes the three different lecture-recording systems that were used, paying attention to both the similarities and differences between each platform. Section three outlines each of the studies that were carried out, and includes both qualitative and quantitative results based on questionnaires. Section four summarizes the main observations made and lessons learned, and the work concludes in section five with a sketch of our next steps aimed towards a broader and more controlled study.

Lecture Recording Systems

University of Tel Aviv

The Tel Aviv University Computing Division has been running, for the past 9 years, an academic course video recording project. The main objective of this project is to create a web based "face to face like" learning environment to support the study of traditional face-to-face academic courses where students can extend their learning hours around the clock and catch up in case of absence. Students with learning disabilities and handicaps can gain special benefit out of this such as learning at home in case of mobility problems or customizing the playback volume and speed to match their needs.

The level of content recording, as of last semester, is over 1,000 hours of video recording per semester which is added to the TAU online learning materials reservoir which already contains 5,000 recording hours (over 400 complete academic courses and hundreds of video/audio clips) as learning objects. This recorded academic curicular content is accessed over half a million times each year; a capacity that is achieved by means of a distributed production model, using customized recording techniques by the TAU Computing Division. Content recording is done by staff with no previous relevant technical background as well as by designated students. The content production is based on a large diversity of recording formats that have been developed and modified to meet a specific standard. Major recording formats are based on: audio, desktop capture and audio, lecturer's video and audio, video/audio and desktop capture, all the recording formats require only a few moments of post processing. Since 2009 the Computing Division Educational Digital Media team, in cooperation with the School of Medicine is running a pilot program in which frontal courses were video recorded and fully online courses based on these recordings along other content such as Power Point Presentations were uploaded to the Learning Management System (LMS). The students can attend the courses virtually by these fully online courses which substituted the traditional face-to-face courses. A limited number of the courses are being recorded by an automated process in which they are preschudled to capture the lecturer computer desktop and his audio, (this recording format at this stage is only to support traditional face-to-face studies).

The curricular academic content at Tel Aviv University in general is restricted to be by TAU students. In some cases access is even further restricted only to students that are registered to the course. Only very few recordings (not a complete course) are open to the general public, mainly for publicity purposes. Lectures are recorded either as a support to face-to-face learning or as a part of learning objects in fully online courses. They are

distributed by the usage of various distribution channels such as organizational LMS, courses video website or public over Youtube.

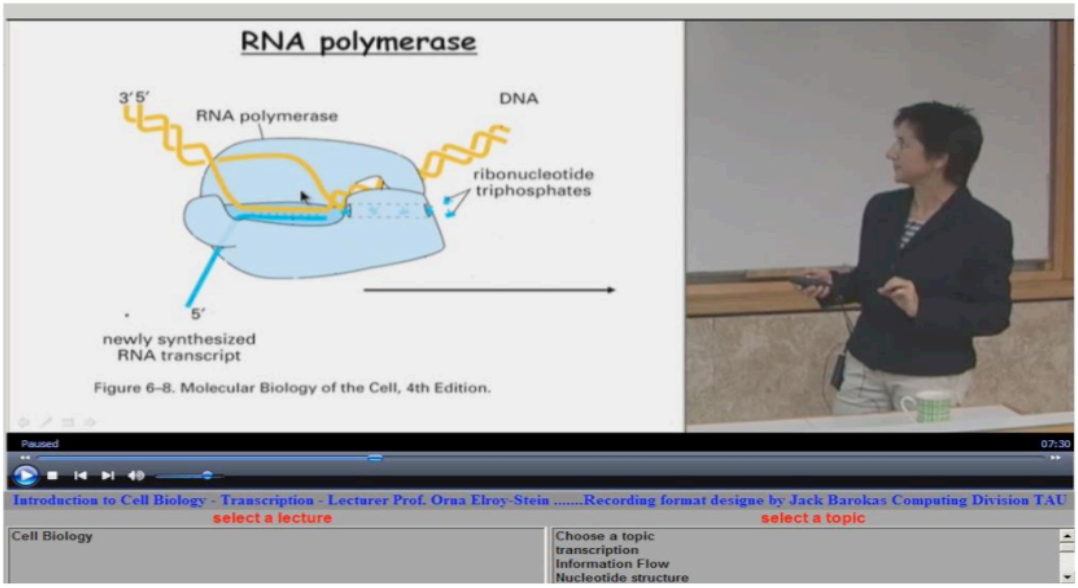

Figure 1: Course recording screenshot. The lecturer's video and her desktop activity are shown in a single video stream live. The format also enables the recording of the lecturer's pointing

University of Osnabrück

The University of Osnabrück is working in the field of automated lecture recording since 2003. The virtPresenter project, an open source lecture recording framework, was started in 2003 as a research project and is now a cost-effective service available to different universities. Having been used by thousands of students, it is a reliable that allows fort he consumtion of fine grained lecture recordings and podcasts that can be integrated and re-used flexible in different ways (Ketterl et al., 2008). Figure 2 gives an overview of the automatic lecture recording and processing architecture on the left side. The right-hand side shows different possibilities to work with the recorded lectures (further information can be found in (Mertens et al., 2007). Most of the recorded lectures are only available to internal students but some lecture series are available for the public over iTunes U, Facebook or YouTube.

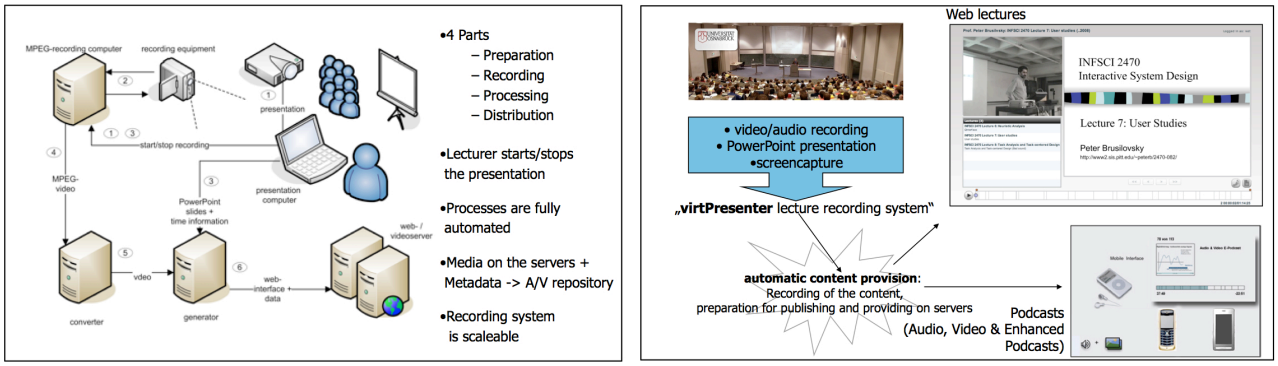

Figure 2: virtPresenter - automatic lecture capture and content usage

University of Saskatchewan

Similar to the University of Tel Aviv and the University of Osnabrück, the University of Saskatchewan has developed and deployed a locally developed lecture capture system called Recollect. In production for the last three years, it makes use of completely automated recordings using low-cost commodity hardware in the classroom. It

provides the ability to record from an arbitrary number of devices, and some rooms are enabled with VGA, multiple-VGA, NTSC, and multiple-NTSC support. It has been used in smaller seminar-style classrooms where audience cameras, instructor cameras, and drop microphones are used, as well as larger lecture halls where multiple VGA sources from tablet-style systems are used.

Video sources are automatically post-processed into a single stream and delivered to students via a custom web application (figure 3). This application provides automated chapter indexing and collaborative note taking support for students, enabling them to review, comment on, and create printable documents of the lecture content. At current no content is publically available, and students are informed via email when new lectures are posted to the web.

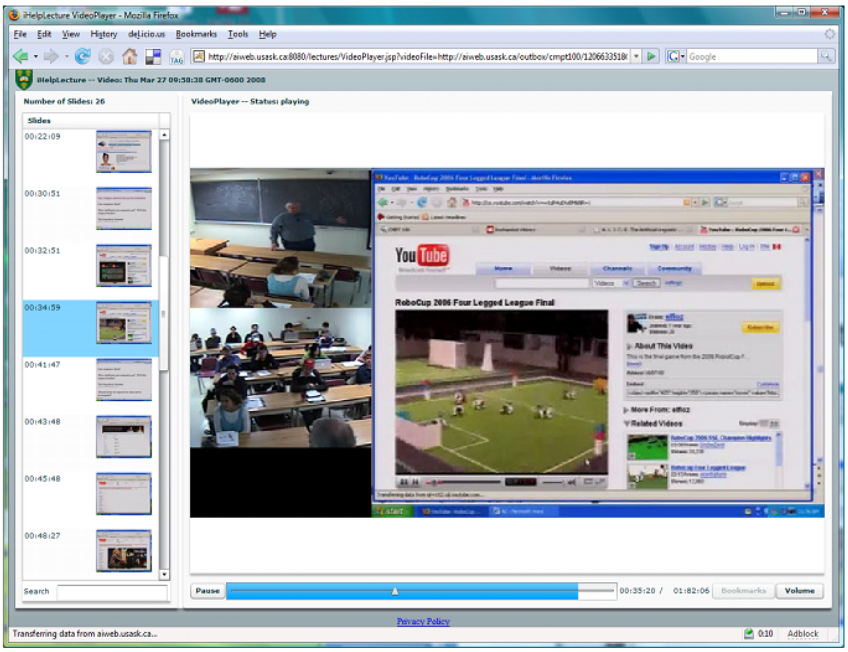

Figure 3: The Recollect lecture capture system showing two NTSC feeds and one full motion VGA feed. Chapter markers on the left are automatically created using image recognition techniques.

Study Results

Various studies by members of the three institutions above were carried out throughout 2008-2010 using both qualitative and quantitative methods. Principle goals were to characterize student perceptions, expectations, and behaviors with respect to lecture capture. Only a few results have been selected for this presentation in order to address important aspects. Controlled studies across the institutions were not carried out because of the different institutional policies, cohorts of students, and technologies used, though we address our steps to remedy this in our conclusions below.

Fully online learning

The *Introduction to Surgery Clerkship* course at Tel Aviv was studied, with 76 students where 50 of them consented to their involvement in the study ($n=50$). A single week in which the students had no other classes was allocated for taking the online course, and no face-to-face support was provided. Upon completion of the online studies (which required the viewing of 10 lectures), students were certified to work at a hospital and filled in the survey form.

The majority of students surveyed spent more than 10 hours viewing online content (figure 4a), which they typically viewed in the late afternoon to evening (figure 4b). Demand for video learning resources was quite high (figure 4d), and only eclipsed by the demand for interactive learning quizzes. While there were a number of people who ranked traditional face-to-face methods of instruction as a higher preference, the overwhelming majority of students indicated that fully online courses were of higher preference. Selection bias in this study likely exists because the cohort was a set of online students, but it was interesting to note that a number of the students were explicitly interested in the videos as a learning technology (figure 4c).

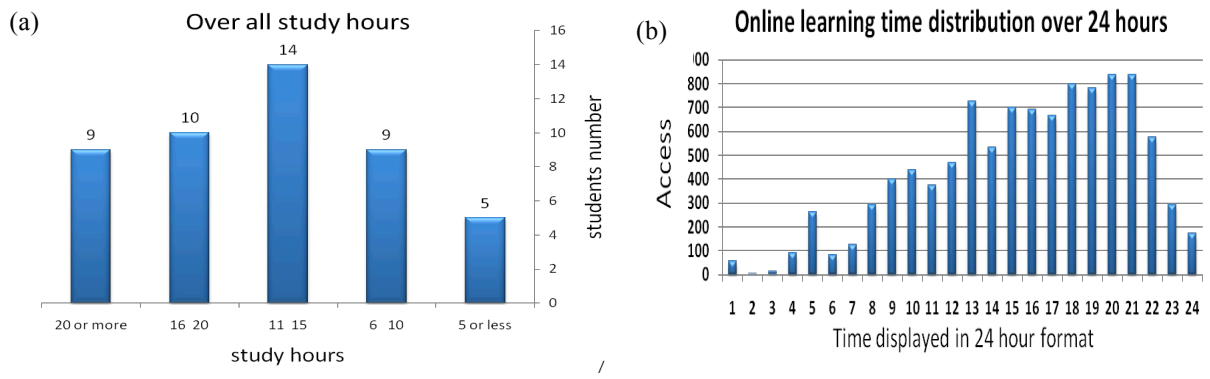

Figure 4: (a) Time spend on online learning – Over 75% of the students spent more than 10 hours on learning online (they requested to study 10 recorded lectures to be certified to start the work at the hospitals 45 minutes each recording)**. (b) preferred hour to learn –** The LMS logs verify students reports learning very few in late night and morning hours (The chart is referring to complete semester logs of 130 medicine students learning 12 fully online courses)

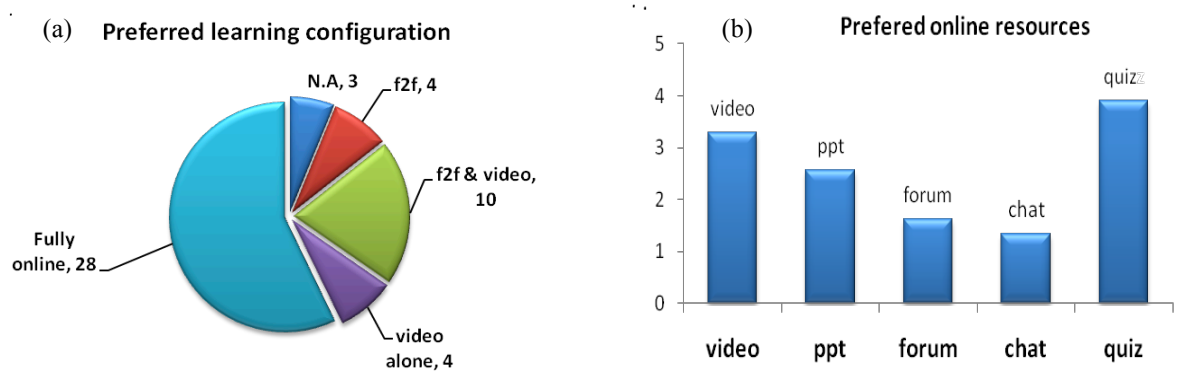

Figure 5: (a) Students survey results on preferred learning configuration – Most of the students (60%) reported that they prefer learning fully online. **(b) Resources which helped students the most while learning online –** Quizzes were reported to be the most helpful online resource, while the video recordings and PPT followed respectively.

Students were also asked if they reviewed some parts of the video recordings multiple times to better understand them, and responded with slight disagreement (μ=*1.6* on a three point increasing likert scale), and over 90% of students indicated the home was a preferred learning environment.

Traditional face-to-face learning

Data taken from a first semester computer science class at the University of Osnabrueck where 200 students had access to lecture recordings as well as in-person access to the instructor while the class was being taught showed some similarities. As with the case of online students, recorded lectures were a popular learning resource (figure 6a), second only to the lecture transcription. Surprisingly, students own notes about the lecture were of less interest when understanding the content than the lecture recordings. The inspection of student lecture recording usage behavior (figure 6b) was somewhat contradictory to survey feedback in figure 4a. Students do not usually watch complete recorded episodes, they are looking for certain parts in the recordings, repeat them or they skip sections. In a previous study done in 2007 (Schulze et al. 2007) mainly extern learners (interested learners from outside the university) reported that they watch the recorded lectures completely.

The fear of having an empty lecture hall if recorded material is available is an oft-cited issue by instructors of lecture recording technologies. Student feedback on this issue is interesting, as they tend to indicate that recorded lectures are sufficient but not ideal for learning (figure 7).

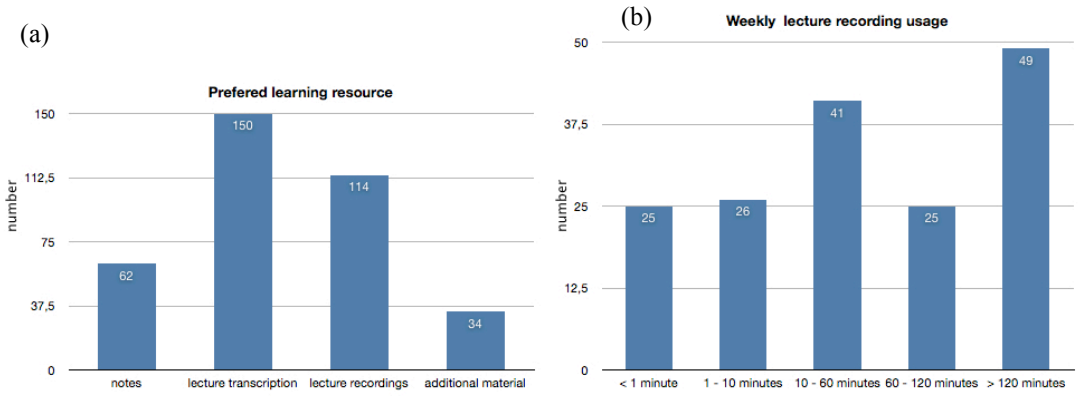

Figure 6: (a) Students preferred learning resources – (b) Weekly recording usage (180 minutes available)

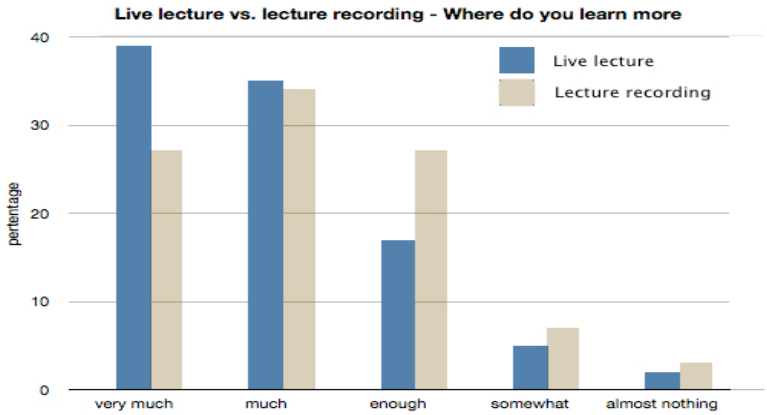

Figure 7: Live lecture or recording – preferred learning configuration

Recording of face-to-face lectures brings up the issue of privacy and, in the experience of the authors, is one of the most significant barriers in gaining instructor acceptance of these technologies. The classroom as a semi-private learning space where students and instructors can share misconceptions, theories, and challenges is of constant concern; especially of audience cameras (shown in figure 8) are being used. Two studies using the Recollect system at the University of Saskatchewan examined this, asking students if they were hesitant to ask questions because they were being recorded. The first was of a set of students in an introductory Computer Science course where half of the students were in the view of the camera, while the second was of an introductory Mathematics course where only the instructor was in the view of the camera. While the mean values and standard deviations in both cases were quite low ($\mu=2.01$, $\sigma=0.89$, $n=34$ in case of the former, and $\mu=2.11$, $\sigma=0.35$, $n=46$ in the latter), response breakdowns demonstrate clearly that privacy is a significant issue for a minority of students.

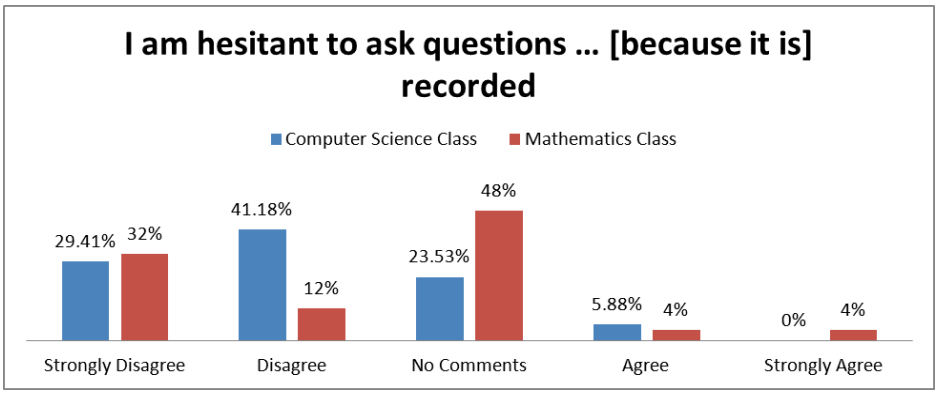

Figure 8: How important is privacy in lecture recordings

Conclusions and future work

The affordability of lecture capture has increased the demand for lecture video services in higher education. The increased importance of this domain for academic institutions has lead to a more critical analysis with respect to the way the content is being produced, managed, re-used and distributed in multiple ways. This paper presented usage and survey results taken from three different institutions using electures in different scenarios. Therefore three independently developed systems have been used that similarly emphasize functionality and features students expect from lecture recordings. The overall aim for this study was to showcase common important aspects for universities trying to establish lecture capture services for students. In order to summarize and interpret these results adequately one might say that this study lacks a common evaluation questionnaire. This might be the case, but on the other hand data from different usage scenarios was presented overall giving proof of how useful electures can be if used in the right context.

Home grown solutions are expensive, and features often come at the cost of stability or scalability. Different institutions prioritize and implement features in different ways, which is why cross-institutional validity of studies is problematic. Proprietary or commercial solutions tend to lack more innovative features, and are cost-prohibitive in the long term. Further, they often have restricted datasets reducing the potential impact of studies.

The Opencast Project (http://opencastproject.org) is an international partnership of universities, academic institutions and individuals exploring the issue of audiovisual objects in higher education. With 12 institutions participating in building an open source software solution (*Matterhorn*), and over 200 other institutions involved in the broader community, the impact of this project on the lecture recording area is already high. The authors and institutions presenting this paper are also involved in Opencast.

A single reference implementation is pivotal in increasing the validity of our investigations. In this paper we have outlined some high level observations from our institutions, but inter-institutional studies cannot be accomplished with different software systems. With multiple instances of Matterhorn running at different organizations, we will increase our ability to gather meaningful interdisciplinary and internationalized results. Once this has been assured, we will begin outlining a research agenda specifically with the aim of replicating and deepening our investigation of the results presented here. Being an open source project, we encourage the broader technology enhanced learning community to join in in this new form of content delivery.

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