# Improving Speaker Training with Interactive Lectures

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**Abstract:** Feedback has always been a cornerstone of the learning process. Advances in mobile devices and wireless connectivity promise closer and better feedback between speakers and audiences. In this paper we discuss a system allowing both real-time and reflective feedback for speakers. By means of online video annotations the audience can augment a lecture with personal notes and give the speaker valuable feedback both instantaneously and retrospectively. The strengths and weaknesses of the system based on lecture hall experiments are presented and discussed.

## Introduction

The technology is in place to record lectures and seminars in computer readable format, to unify audiences from different physical locations into one virtual lecture hall, and to give the audience tools that can be used to interact with a lecture. The advantages that these developments bring with it have not been explored to their full extent. The Collaborative Technologies Laboratory (CTL) [5] project at the University of California at Santa Barbara investigates how the learning and teaching experience may be enhanced with these technological advances.

This brief paper discusses a system built to be used in the CTL to provide real-time and reflective feedback for speakers as well as annotations of video-recorded lectures for personal review. We also present preliminary lessons learned from a pilot study and reason about design choices for a larger-scale experiment.

We conclude that while new technologies can enhance the learning process, they can have an even more significant impact through unprecedented and effective didactical means. However, much fine tuning has to be done to seamlessly integrate these into the educational process. Finding a balance between the amount of information gathering and the degree of distraction of concentration is regarded as a crucial aspect.

In the following sections, we first motivate our research and present related work. Next, we provide a detailed description of the system and its capabilities. We then discuss preliminary data collected and user impressions from the pilot study of the system. Finally we present our conclusions and plans for future work.

## Background and Related Work

The described pilot study and system deployment was staged during a graduate student seminar at UC Santa Barbara's Computer Science Department. In seminars, students present recent research papers in hour-long talks. Aside from learning about the latest research, this also serves as presentation practice for the speaker. Unfortunately, the huge potential for speaker training can not be exploited with traditional means: time constraints do not allow each member of the audience to interact with the speaker as they could in a private conversation. Instead, feedback and interaction must be limited to a small number of questions. Furthermore, these questions are usually content related. Few if any comments concern the presentation style.

Taking handwritten notes combined with video-recording has other drawbacks. First, during lecture review, the comments have to be time-correlated with the video. This requires note taking overhead and may not be done consistently. Second, polling and integrating many peers' impressions continuously over time is difficult. Third and most importantly, feedback is largely constrained to after the lecture.

Our goal was to overcome these limitations and to permit a new dimension of participation and interaction of the audience with the speaker. The tools we used to accomplish this were time-synchronized video annotations and live speaker feedback with handheld computers.

Digital classrooms have caught researchers' attention for quite some time now, for example projects at AT&T [6], UC Berkeley [8], Georgia Tech [1], and on our campus [5]. Recent lecture-storing projects give access to recorded seminars and classes in an on-demand, from-anywhere fashion, but no interaction or feedback tools are integrated (see for example the Online Classroom [7]). There also have been many research projects [2,3,4] demonstrating how interactive computing can assist in lectures. Our system records frequent and fine-grained information about the clarity of the talk and the degree of listeners' interest in the subject. In contrast to previous systems, we do not require explicit integration of feedback solicitation into the lecture or presentation. We value this platform as an unprecedented means of feedback to the speaker.

## The Interactive Seminar System

In this section we first describe the user interface for the audience, then the system architecture, and finally a use scenario including lecture creation and review.

## Feedback Panel

The audience gives feedback through a "feedback panel", accessible through any web browser (see Figure 1). It has three components. Input in the topmost area composes *personal notes*, similar to sticky-notes that are "attached" to the video stream. Whenever this listener reviews the video at a later time, her notes pop up at the time they were composed. Second, a text area for *comments to the speaker* also annotates the video stream, but these notes can be seen only by the speaker, or alternatively by anyone who plays the video (if "public" is checked).


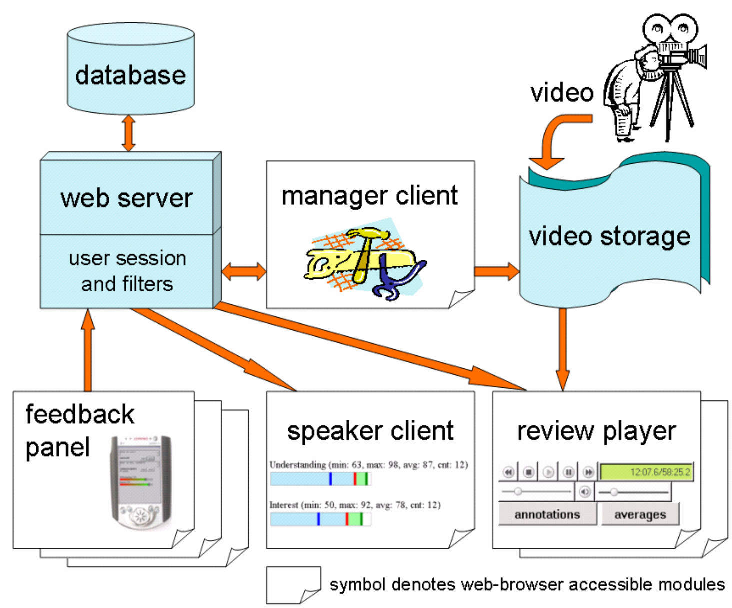


**Figure 1: Feedback Panel:** Controls for the audience. **Figure 2: Architecture Overview.**

Third, two slide bars at the bottom of the display are placed according to the listener's *level of understanding* of lecture contents and the *level of interest* in the matter being presented. As future work, many other slide bars are conceivable. For example, we have considered commenting per slide on its legibility. Slide bar events are recorded anonymously, as opposed to comments. Listeners can opt to comment non-anonymously to allow for further inquiries from the speaker.

## System Architecture

Our web-based architecture (Figure 2) is centered around a web server with an SQL database backend. All interaction with the system is facilitated through thin clients, allowing access and control from any web browser. Video is recorded on a digital video capture system which encodes the video stream in real time and stores it in a web-accessible location for replay on demand. A "manager client" is the authoring tool used to create and edit lectures. This client also implements the synchronization between web server and video storage.

In our pilot study, every member of the audience used a personal digital assistant (Compaq iPaq) with wireless network access to connect to the server and to display the feedback panel. Feedback events - comments, notes, level adjustments - are sent to the web server which timestamps the messages and stores them in the database. To circumvent synchronization problems, the video stream is also time-stamped in the database through the web server.

A special browser-based "speaker" client polls the server in fixed intervals (10 seconds) for the audience's combined levels of understanding and interest and graphically displays corrected min, median, and max values. This client is projected onto a location visible to both the audience and the speaker. Gauging the overall levels of understanding and interest is possible with a glance.

Reviewing the annotated lecture videos at a later time is facilitated through a "review player", shown in Figure 3. The video player software forwards video timestamps to the web server which correlates them with timestamps in the database and plays back synchronized notes and comments. A feature to filter messages during playback according to different categories allows private notes, speaker-only comments, public comments, and/or overall understanding and interest levels to be displayed. Using this setup we provide both real-time and reflective interactivity.

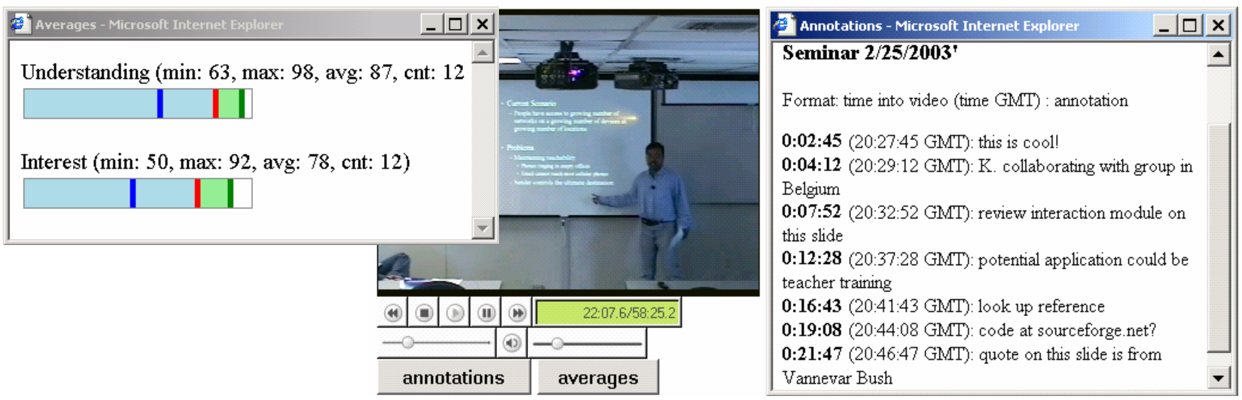


**Figure 3: Screenshot of the review player interface.**

The pilot seminar used to test our system was held in two, electronically linked lecture rooms with separate audiences permitting virtual presence of one within the other [5]. Our system implementation permitted seamless integration of the two locations. This enabled us to evaluate differences between students in the actual lecture room and the remote location. This paper however concerns only the interactive and reflective portions of our system.

## Operation

The speaker or an administrator creates a new lecture and starts the video recording through the manager client. Audience members can then create a lecture-specific user account and log in to their personal feedback panel. All notes, comments, and level adjustments are logged on the server. The current levels of understanding and interest are displayed through the speaker client in real-time.

After the lecture, speakers and audience members can watch the recorded video through the review player, linked from a web site in the department. Notes and comments pop up at the time in the video when they were created. Similar to the speaker client, the audience's levels at video time are displayed as well. It is also possible to obtain and print out all notes with timestamps.

A straight-forward extension of our system could allow for question moderation during large conference talks. All public comments to the speaker would be accessible as a collection from a special client, and a moderator would pick the most interesting ones to ask publicly during a question and answer session.

## Discussion

Both the speakers and audience members appreciated the experience. Speakers reported that the system provided valuable feedback, especially when the lecture was reviewed. Video combined with textual notes and comments from diverse audience members were reported by speakers as helpful for fine-tuning their presentation content and presentation techniques in general. Most speakers also reacted to the live feedback (levels of understanding and interest). We did not note a particular threshold, but speakers seemed to be comfortable with only a limited drop in understanding before they offered alternative explanations to the audience. Speakers reported that they attempted to counter drops in interest levels, for example by increasing eye contact with the audience.

The audience members enjoyed interacting via the handheld computers. While composition of notes and comments was observed to be rather infrequent (one event every five to ten minutes per user), the two slide bars were used extensively throughout the seminars. However, many members reported that the devices tended to distract them from the content of the talk. This was due to several reasons, the first being the novelty of the devices. All audience members were very computer literate, but many had never used handheld devices before. Even after taking this into account, our web based system invited web browsing to sites unrelated to the lecture. Others reported that formulating coherent questions using the on-screen soft keyboard was time-consuming and that they lost track of the lecture. Finally, the authors noted that when the audience was truly involved with the talk the use of the handhelds was reduced.

In addressing these points, we expect that the novelty aspect will become irrelevant over time. We have also limited the ability of the clients to browse the entire web. For a larger scale deployment of the system, we will focus on making input methods less disruptive. Emerging techniques (pen based computing etc.) will alleviate some problems, but might not resolve all the issues. More controls similar to the slide bars seem best suited for live interaction since they do not interrupt the listener's concentration on the talk. If a text-based interface is desired, the input method that the listener is most familiar with should be used; most frequently this will be a standard-size physical keyboard.

## Conclusions

Advances in computer and network technology permit new modes of interaction for users. We have explored a system to allow greater interaction and live feedback between an audience and lecturer. This interaction had both positive and negative aspects as discussed above.

We are pleased with the system's performance and its ease of use. Reception of the system was positive overall, with the main points of critique focusing on the cumbersome nature of on-screen soft keyboards. Through live feedback and enhanced review possibilities we are able to venture into new teacher training possibilities. Future work will focus on less disruptive input methods for the audience.

## References


1. G. Abowd. Classroom 2000: An experiment with the instrumentation of a living educational environment. *IBM Systems Journal*, 38(4), 1999.
2. R. J. Dufresne, W. J. Gerace, W. J. Leonard, J. P. Mestre, and L. Wenk. Classtalk: A Classroom Communication System for Active Learning. *Journal of Computing in Higher Education*, Vol. 7, pp. 3-47, 1996.
3. C. Massen, J. Poulis, E. Robens, M. Gilbert. Physics lecturing with audience paced feedback. *American Journal of Physics*, Vol. 66, May 1998.
4. G. M. Novak and E. T. Patterson. Just-In-Time Teaching: Active Learner Pedagogy with WWW. *International Conference on Computers and Advanced Technology in Education.* May 27 -30, Cancun, Mexico, 1998.
5. S. Rollins and K. Almeroth, Deploying an Infrastructure for Technologically Enhanced Learning, *ED-MEDIA*, Denver, Colorado, June 2002.
6. B. Shneiderman, M. Alavi, K. Norman, and E. Borkowski. Windows of Opportunity in the Electronic Classroom. *Communications of the ACM*, 38(11):19-24, Nov. 1995.
7. Stanford Center for Professional Development. Online Classroom. http://scpd.stanford.edu/scpd/students/onlineclass.htm.
8. D. Wu, A. Swan, and L. Rowe. An Internet MBone Broadcast Management System. In *Proceedings of Multimedia Computing and Networking*, San Jose, CA, USA, Jan. 1999.