Collateral Distance Communication Support of Traditional Classroom Learning: An Empirical Study

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Abstract

Preliminary results are reported for a field experiment in distance communication and learning. Students enrolled in traditional classroom courses are provided with asynchronous distance communication support, consisting of optional anytime/anyplace access to classroom lectures via the World Wide Web. The traditional classroom lectures are audio-recorded and the audio transcripts are digitized, compressed and provided, along with the synchronized lecture slides for viewing via the Web. Usage patterns are unobtrusively monitored and correlated to performance and attendance. Additionally, participants' subjective reactions are collected, compiled and analyzed. The results will provide a foundation for further research and application by 1) helping assess the value added for distributed communication technologies, 2) shedding light on user adoption behaviors and attitudes, and 3) identifying practical considerations in implementation.

1. Introduction

Distributed group communication technologies are widely believed to have great potential benefits in the area of distance learning. In this context, the term anyplace/anytime characterizes systems, also known as Asynchronous Learning Networks, that support time and space-dispersed learning groups. Intuitively, it seems clear that this support will not only be enabling for such groups, but can add value to the learning process. But, research effort is needed to understand how best to exploit the technological features to maximize that value.

As the enabling technologies evolve, so do the capabilities of support systems, and thus exploratory studies are needed to help illuminate the nature of their application and the most promising paths for development. This paper describes the first phase of a series of such studies, designed to help assess the ways in which people will use such technologies and the effects that are likely to obtain.

This first phase study focuses on an application of the emerging technology of media streaming. Streaming extends the distributed communication capabilities of the Web by allowing audio and/or video messages of virtually any length, to be delivered in successive incremental “chunks,” each of which can be played while the next chunk is being delivered in the background. Assuming the data delivery rate is equal to or faster than the data use rate, the chunks are integrated seamlessly by the client and the message is viewed (or heard) without interruption. Since play can begin as soon as one “chunk” is delivered there is no excessive initial delay. And since chunks can be discarded after use, there is no excessive storage requirement. Thus, it becomes feasible to distribute even the highly data-intensive media of audio and video over the web.

Media streaming technology has matured recently, increasing its attraction for a variety of applications, including education. San Francisco was recently host to Streaming Media 98, a conference and exhibition devoted to this subject. RealNetworks, Inc. is a leading corporate player in streaming technology, along with Macromedia, and MicroSoft has entered the arena with their NetShow technology. Perhaps the most obvious application of streaming technology to support distributed communication learning is in migrating traditional classroom lectures to the web, and this is the focus of this initial phase study.

2. Background

Distributed communication learning and distance learning have been a focus of much past research and many important findings have been reported[2][3][5][7]. But the body of knowledge continues to evolve in response to technological development, and the recent revolutionary impact of the World Wide Web has spawned a period of intensified interest by making the
widespread delivery of learning support easy, reliable and cheap. Indeed, there are those who suggest, quite arguably, that this revolution will alter the face of education as we know it— that our notions of the traditional classroom, teacher and student are artifacts of an obsolete paradigm and that the future will redefine their roles so as to make them unrecognizable incarnations of their former selves. Hiltz [4] foresees a future shakeout among schools competing for students, survived by prestigious institutions serving larger numbers of students through technology-bred economies of scale and web-enhanced accessibility.

While there are dissenting opinions about specific future impacts, it is clear that institutions of higher education have much at stake and, despite the confusion and uncertainty that stems from the dizzying pace of the relevant technologies, there is a rush to explore, adopt and implement. Such efforts inform and are informed by a growing body of anecdotal, experiential and empirical knowledge.

Richards, Irving, et al. [6] is an example of a pragmatic study of which students are attracted to distance learning alternatives and why. The authors compared enrollments between traditional and on-line versions of the same courses at a community college, looking at demographic data and practical considerations such as work schedule constraints etc., only the latter of which was found to have significant impact.

Alternatively, Bourne[1] presents a number of general observations based on extensive first-hand experience, and summarizes strategies and tactical considerations, including cost-benefit estimates for various levels of web-based learning support. For different advanced types of material, he approximates the cost, benefit and complexity with respect to a basic, or standard web site pegged at 1.0. For slides, ie. PowerPoint, with synchronized streaming audio, the values are 2, 1.5 and 3, respectively, suggesting that the costs outweigh the benefits and that the additional complexity is significant. He notes, however, that recent new technology improvements are making it easier and thus less costly to implement this form of content.

The study reported here is designed to explore and extend Bourne’s observations in light of the latest technology. Toward this end, the Experimental Streaming Instructional System (ExStreamIS) was created using Macromedia technology to deliver actual recordings of the classroom sessions, synchronized to the corresponding lecture slides and to record usage for later analysis.

3. Approach

The project was conceived as a preliminary, incremental step toward a technologically sophisticated web-based support site for students enrolled in a traditional classroom course. The goal of this first phase was simply to provide students with a way to view or review actual class sessions on their own time wherever they can get access to the web.

The course is, coincidentally, an introductory data communication course mostly taken by junior level undergraduates majoring in Management Information Systems in the College of Business at San Jose State University. The study involved three sections of the course, representing approximately 132 students. It should be noted that the results may be affected by the characteristics of these subjects, namely their residence in “Silicon Valley” and their predisposition to technology as MIS majors, among others. Both of these factors would be expected to tend to favor their acceptance and use of the experimental system.

The experimental system was designed to replicate the actual classroom sessions as closely as possible so that the only manipulated factor was that of distributed communication. That is, the content of the classroom version and the web version of the classroom sessions was held constant so that, from a student’s perspective, the differences between the live classroom experience and the web-based version were minimal except for the time-space flexibility factor. While the distributed system content was equivalent to that of the classroom session, the nature of the experiment itself imposed some unavoidable communication difference artifacts, the possible impact of which should addressed.

First, one might suggest that using video rather than audio transcripts would convey a more equivalent experience to the student. However, even in the classroom lectures, the slides, especially those with diagrams (which were common), were the visual focus. Indeed the front lights were dimmed for better viewing of the slides, so the lack of the video element is probably a minor difference. Furthermore, the presence of a video element was judged more likely to be a distraction when viewing the slides.

Second, there would seem to be an obvious difference in the interaction potential. However, the ExStreamIS system was designed to facilitate student-instructor interaction through email: available throughout the distributed lecture is a question mark icon that can be clicked to bring up a message window addressed to the instructor with the subject automatically set to indicate the current session and slide number. The message can be authored and sent without ever leaving the ExStreamIS environment or losing sight of the slide in question. Of course, this is not equivalent to face-to-face interaction due, in part, to the asynchronous nature of the exchange. But, this difference might be mitigated to some degree by the absence of self-consciousness that may inhibit some students from speaking up in the classroom. By analyzing the use patterns, we hope to shed light on
the extent to which this may be true.

Finally, it should be noted that, beyond the time-space flexibility factor, the pacing flexibility factor might be expected to favor the use of the system. ExStreamIS allows a student to skip over slides quickly or to review a particular slide repeatedly if desired. Indeed, some students who attend the classroom version of a session may use the system collaboratively to reinforce the material. Again, the analysis of the use records will indicate the degree to which this apparently occurs.

With these pragmatic issues in mind, the study seeks to lend empirical evidence toward answering the following primary research questions framed in the context of our experimental conditions:

Is the use of distributed communication of classroom sessions, as a collateral communication option, providing anytime/anyplace accessibility, correlated to:

- classroom performance?
- classroom attendance?
- student-instructor interaction?
- student assessment of course effectiveness?

Secondarily, we explore correlations of use to aspects of students’ learning styles, preferences and history, including conscientiousness, independence and motivation, while attempting to account for external factors such as transportation issues and work or family schedule constraints. Finally, we examine the resulting usage patterns identifying practical implications for expanded applications and future system extensions.

4. Methodology

To meet the aforementioned goals of the study, an array of data is being collected regarding the student subjects and their use of the system. In addition to unobtrusively monitoring usage patterns and maintaining classroom attendance records, pre and post questionnaires provide demographics along with satisfaction, learning style and preference data, etc. Correlations are then measured and usage patterns are assessed with respect to the stated research questions.

The ExStreamIS system was built using Macromedia’s Director 6.5 which not only supports audio streaming through its Shockwave technology, but also includes a PowerPoint slide import facility. This made it relatively easy to synchronize the slides with the corresponding compressed audio files. Director also supports transparent external calls that facilitate the invocation of the user’s email message creation function. Furthermore, Director’s scripting language, Lingo, allowed us to unobtrusively monitor a user’s actions and to log them through external calls to a PERL script. In this way, the actions could be examined at a greater level of detail than is recorded in the standard server log file. For example, it was clear when a student terminated an audio segment before the end. Thus, usage patterns could be more accurately assessed. Students were assigned login names and passwords so that their use could be tracked on an individual basis.

Performance and classroom attendance are two major factors of interest. Performance is measured simply in terms of exam and project/exercise scores. As for attendance, at the beginning of the semester, students were explicitly told that, even though their attendance would be recorded for every class session, their presence or lack thereof would not affect their grades in any way, positively or negatively. Thus, classroom attendance is completely optional (for those meetings for which a recorded version was available) and could be bypassed entirely in favor of the distributed session system.

Pre and post questionnaires were used to collect demographic data and to measure relevant attributes, attitudes and situational factors suggested by Richards, Irving, et al. [6] to be major factors in students’ proclivities toward on-line instruction. For example, pre-experimental questions were designed to assess students’ level of preferred learning independence and their proclivities for social interaction. Obviously, certain pragmatic factors, such as computer accessibility, distance from campus, work schedule and level of family obligations, would affect their usage levels and were also measured. The post experimental questions measured their level of satisfaction with the system, assessment of its value, etc. Standard course evaluations were also administered, so measures of satisfaction with the course itself were collected as well.

The ExStreamIS system was launched after the first midterm exam, approximately one third of the way through the semester. During each classroom session, the audio was taped as unobtrusively as possible, given the need for a high quality master. The instructor wore a small external microphone over his ear. The microphone was connected to a mini cassette recorder, carried in a hip sack, and powered by rechargeable alkaline batteries. This allowed the instructor to move freely about the room while ensuring that the recorder would not run out of power during the session. Given the seventy-five minute length of sessions, ninety minute (45/side) tapes were used, and an auto-reverse recorded averted the need to pause the sessions to change tapes or reverse their direction manually.

Tapes were digitized into separate files for each slide and then compressed using Macromedia’s Shockwave audio technique to make them suitable for
streaming. They were then uploaded and imported into the ExStreamIS shell, along with the PowerPoint slides to which they were synchronized. Students accessed ExStreamIS from their web browser of choice after downloading and installing the required Macromedia Shockwave plugin. Both Windows and Macintosh platforms were supported and hardware requirements were modest: a sound card, 14.4k bps modem and a minimum 256 color monitor.

Complete results will be compiled and presented at the conference, but preliminary indications are positive. Students are enthused about the system and perceive it to be of significant educational value.

5. Future Directions

The ExStreamIS system was designed to be easily extensible. The Director authoring environment supports state of the art levels of interactive animation, a technique well-suited to engaging learning experiences. As we learn about students use habits and preferences around the emerging technologies as well as the associated practical challenges and pitfalls, we hope to exploit the advancements wisely to enhance classroom-based education and go beyond anytime/anywhere accessibility toward added value.

References


