Factors Impacting Student Utilization of Streaming Media in Distance Learning

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Schools around the world have different degrees of involvement with the Internet. In some schools, professors post their syllabi and class Web pages on the Internet and use E-mail as their main teacher-student and student-student communication tool. In the more advanced settings, the use of the Internet also involves the posting of digitized pictures and video. Class-lecture videos on the Internet could be classified as the latest innovation in the field of distance learning.

At the University of North Texas in Denton, new technologies are being used and tested to deliver class instruction across the Internet. In the Department of Technology and Cognition, faculty have been posting their class syllabi on the department's Web site to give prospective students a chance to read about the classes in which they are interested before they actually register, a sort of "class sampling." Innovations in the faster delivery of video on the Internet are now allowing teachers to take "class sampling" one step further. By storing portions of videotaped class lectures on the department's server, faculty is giving students a chance not only to read about a class but also to listen to a class. Through this "class sampling," unknowingly, students are being exposed to the setting of attending classes through the Internet.

Once the semester is under way, each professor updates their class' Web site with information such as the class reading list and test and project deadlines. E-mail, as a form of communication among students and between students and teachers, has also been available for years, not only for personal communication but also for submitting class assignments and receiving feedback.

The department has developed a program for the delivery of asynchronous class-lecture videos with the use of the Internet. A course is recorded in its entirety during one of the semesters it is taught. The video is split into manageable segments. Each clip is then labeled by class sequence and by the book chapter to which the segment related. All video clips are then encoded using Real Video technology, stored on the department's server and the URL (Web site address) published in subsequent semesters in the class syllabi. Additionally this material can be pressed on a CD for students who don't have acceptable access to the Internet for viewing multimedia materials.

In subsequent semesters, the course is being presented in a modified classroom setting. If there are scheduled class meetings some may be conducted in a classroom, others are viewed on the Web through the pre-recorded video clips stored on the department's server. Each registered student is thus responsible to Web-view the clips in their own time. The Department is now examining audio conferencing techniques that could also be used for class presentations and discussions.

The class setting also supports the use of other Internet technologies including: E-mail, WebCT testing and WebCT Forum or bulletin board. Of all the technologies utilized in this setting, streaming video is the latest addition to the Internet class format. Streaming media is a

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presentation of either an audio stream, a video stream with audio, or a combination of audio, video and synchronized graphics, that is delivered across a network so that, after a 10-40 second initialization, the user will view a continuous stream of material that could be several hours in duration. The source of this media stream can either be prerecorded material or live presentation.

Delivery of streaming media requires the use of (1) a streaming media client or player, (2) a streaming media server and (3) an appropriate network protocol. The user simply enters a URL into the streaming media client or clicks on a link in a web browser to activate the desire file. After a few seconds to create a safety buffer, the client begins playing the media stream, while continuing to receive and buffer new material.

For material located on a Web server, the customary protocol HTTP across TCP/IP is used. If the material is located on a dedicated streaming media server, the appropriate protocol is RTSP across UDP/IP, with TCP/IP as a backup. The major use of the dedicated streaming media configuration is for time critical material that, if interrupted in delivery would be extremely disruptive to the end user. The dedicated system also has the advantage of maximizing band width requirements, providing the material at different frame rate video, so as to not flood the network infrastructure with packets at such a high rate as to cause a system failure.

Content creation is either live delivery or prerecorded material. Material is prepared using either Video for Windows or QuickTime video tools and GIF or JPEG. The material is collected using Hi-8 videotape, but we are migrating to using Digital-8. Images are kept as small as possible, using 160X120 pixels for analog modems. Material is converted using Real Video Producer to generate a compressed Real Video format. Materials are compressed at about 75% of the available bandwidth (i.e. 20 K/sec across a 28.8 K/sec modem connection).

Delivering live presentation across the network requires a live encoder. The Real Producer software on a 200 MHz Pentium-class machine with a video capture card and an audio capture card. Mid-priced audio capture cards are sufficient to the task. The server uses UNIX or Windows NT. Even a 486/66 with 32 MB of RAM is sufficient to deliver 24 simultaneous streams of video.

Disk space is also maximized. Using the high compression of Real Video enables a 160X120 video stream, encoded for delivery across a 28.8 modem to occupy only 64 MB of disk space. At this rate an entire 3 credit hour course (45 hours of material) would occupy only 1440 MB of space.

Evaluation of delivery methodologies was done by interviewing students. Based on their personal learning preferences and current lifestyle they were able to identify several factors and associated advantages and disadvantages. The positive factors identified by the students were: Convenience (family, focus, comfort, economy); Flexibility (archived class material, content acquisition, time, schedule, viewing); Learning Enhancement (note taking, discipline, multi-tasking, technology); Psychology (questioning, support, participation, self-esteem). The negative factors were: Isolation (body language, discussion, timely questions, interaction); Learning Environment (interruptions/distractions, lack of focus, missed material, procrastination); Technology (language, net congestion/buffering, out of synch video/audio, video quality, video segmenting)

Of these factors identified, students named convenience and flexibility of attending classes in this format as the most important positive factors. In other words, they valued the convenience of viewing at a more preferable location with the time flexibility required by their

other many commitments. Some commitments were as common as needing to be around the family to more unpredictable commitments such as having to make a sudden family relocation to a different city or a last minute business trip. In any case, knowing that whatever the circumstances in life, access to education is possible, gives students the freedom to pursue a degree without the fear of losing credit hours when forced to transfer to another institution because of a move. In addition, this access simply allows students to further their education without the fear of inflexible class schedules that compete with unpredictable family commitments and equally unpredictable job schedules.

Of the negative factors related to this class format, isolation and technological problems were considered the two major ones. Participants, who expressed extreme frustration with isolation and technical problems, also had one or more of the following characteristics: 1) extroverts (as determined by the Canfield's Learning Styles Inventory Survey), 2) visual learners and highly disturbed by the quality of the video image, 3) lived near campus, 4) had some serious technical problems with the delivery and/or their computer at home, 5) inexperienced computer users who did not understand some or any of the software used in the class.

Closer analysis of the characteristics of the population that preferred the Internet class setting over the traditional class setting, reveals that some of these students were introverts, and a few were mid introvert/extrovert; most were auditory learners, who had other commitments outside of school for which the format was ideal. The majority was married; some had children, full-time jobs, and lived over 30 minutes away from campus. For this group viewing the classes at their chosen time was vital given the constraints of other commitments in their lives. For students with these circumstances, who had a computer fully equipped for using the technologies at home, who had some computer expertise (at least 3 to 5 years) and who were comfortable using such basic technologies as email, bulletin boards, and the Internet, the CD/Internet class format proved the most adequate and beneficial.

CONCLUSIONS

Overall the results of this research look promising for the future of Web based courses, certain target populations, identified in this study, do seem to benefit, want, enjoy, and look forward to more courses offered over the Web. Students with a highly demanding lifestyle of unpredictable job schedules, with a family, who live far from the university campus, who are auditory-introverts, disciplined, highly detailed, and organized in their classroom preference do better with Web based courses, than students with opposite characteristics. Lifestyle seems to be the determining factor for wanting to enroll in a Web based course, for even though the student's learning style does not accommodate well with the Web based class format, students with major outside commitments are willing to compromise their learning preference in favor of furthering their education. Further, the Web based instructional tools could meet the learning needs of the last type of students and assist them with adjusting to the Web based course setting.