A Digital Language Resource Center

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Introduction

"The new language lab is wonderful! I love that our profs can now put videos, etc. on the server. It makes life much easier. The center is conveniently located, comfortable and there's always a workstation available." This was one of the first student comments we received after opening Harvard University's new Language Resource Center. While many others repeated the student's comments, the facility is still changing and responding to suggestions.

Planning Stage

The Preparation

After five or more years of discussion, Harvard opened its new Language Resource Center (LRC) in the penthouse of Lamont Library in January 1998 and introduced full-motion video streaming. The LRC replaced a thirty-nine year old facility in Boylston Hall where much of the equipment was outdated, numerous faculty requests for the latest technology were unfulfilled, and students complained about waiting in lines and the insufficient number of video copies. Moreover, the faculty sought a new facility that provided more space for small class projects and group viewing, new computers, flexible carrels, and a solution to long-standing circulation problems.

To prepare for the change from twenty year-old cassette units to the digital world, several years ago we installed a small server that provided computer exercises and allowed students to access some lab materials from their dormitory rooms. Although we anticipated a slight decrease in lab attendance (due to the ease of retrieving materials in dormitories), lab attendance actually grew by a small margin. Several of my freshman advisees explained that the dormitories were too noisy for study, so they preferred the quiet environment of libraries and labs. In addition, they also wondered if many of their classmates own computers with sufficient capacity to handle the server materials with sufficient speed. Computers owned by students in 2000 are capable of handling these streams, but in 1993, many were not.

An additional reason for students' continued presence in the lab was the "mumbling" factor. That is, students studying

a new language often mumble through their exercises so the lab offered a place safe for mumbling far from roommates who might giggle at the mispronunciations.

The next step in our planning began with the construction of a small area in the language lab, where we removed ten tape carrels and constructed six "group area" multimedia carrels. Our goal was to study student preferences for various carrel styles and to provide an area that could be used for faculty multimedia training and small group instruction, such as small course sections.

Five Macintoshes, one IBM-PC, videodisk players, VCRs, and monitors were installed in large carrels with adjustable sides and counters designed to accommodate individual use or groups of four. Initially, students used the computers to read their e-mail messages and word processing. After a few mandatory course assignments were installed, the students began to use the computers for their intended purpose.

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Faculty members appeared to enjoy regular use of the group areas for small course sections, but students provided a range of praise and criticism. Some liked the carrels' flexible configurations and the convenience of easily including classmates in group projects, while others preferred the privacy provided by the old individual carrels for most course assignments.

Following several IALL language lab development suggestions, we then toured facilities at sister schools and those using video servers. We consulted with directors of recent projects, operated the equipment proposed by all vendors under consideration, and prepared some preliminary budget estimates.

The next step was the preparation of a task list, a development team, and assignments. We surveyed faculty and student users to discover preferences, problems, environment comfort, desired technology, and suggestions. We consulted with experts in each technology area; for example, we spoke with audio experts about audio products and computer experts about computers. We kept the administration regularly informed, and Associate Dean Jeff Wolcowitz chaired our faculty committee, which included both technology users and non-users. We met almost monthly, and invited the architect to each meeting and special guests to discuss specific topics.

IALL members provided input about several of the vendors under consideration. Financial reports were available through brokerage houses for many of the larger firms, so we reviewed them to determine financial health. Many vendors were quite competitive during the selection process and made numerous negative comments about their competitors; this was distracting and added to the confusion.

Although we developed many steps and followed careful plans, the process hit speed bumps and U-turns. The most interesting bumps included the loss of our computer staff to attractive positions with outside firms, construction delays, discontinued equipment models, the late arrival of numerous items, and the lack of Macintosh streaming.

Nine months before construction, we surveyed students to determine user preferences and usage patterns. We discovered that students averaged about three visits per week and stayed between thirty and forty-five minutes. Forty percent of attendees were freshmen, which is not surprising due to our first-year language requirement, and twenty percent were sophomores. The remaining forty percent of users included juniors, seniors, and graduate students. Students in introductory music courses, core curriculum courses, and a few humanities courses also used the lab. While some faculty members used the larger carrels in the new group area for small class sections, most students chose individual carrels to complete assignments.

Surveying the Students

By a margin of 57% to 37%, students preferred watching assigned videotapes in single carrels rather than in small groups. They also preferred single carrels for audiotape exercises by a margin of eighty-eight percent to twelve percent. Forty-six percent of the students used audio tape players, twenty-two percent used computers, and nineteen percent viewed videotapes.

In the questionnaire's comments section, students complained about the old and often broken tape recorders, large headphones, the insufficient supply of VCRs and computers, and restrictions on tape duplication placed by copyright law. The lack of multiple videotape copies made it difficult for students to view course-assigned programs, as they had to compete with their classmates to checkout the only copy. We used this survey data to aid our development and construction plans.

Although the Language Resource Center could provide new equipment and furniture, we knew that we must also solve many circulation difficulties. No location in Harvard Yard could provide enough shelf space to store sufficient analog copies of all course materials, and copyright laws did not allow us to duplicate our videotapes. Although publishers often allowed us to make a small number of copies of the audiotapes that accompanied the course-assigned books purchased by Harvard students, our inventory was often insufficient for busy periods.

Implementation
Selecting a Video Server

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Our attention then turned to servers and the question of streaming video and audio to multiple stations simultaneously, with the possibility of streaming at different points in the same tape at the same time. Media servers function as a depository for digitized video and audio files, and they provide the contents of the files on demand to client workstations. Servers use three components to achieve this: computer hardware, disk storage, and software. While many may argue that server purchases should be delayed because prices are decreasing, the potential savings gained by waiting would not have compensated for the costs of buying new analog equipment which would be removed when a server was installed. In addition, our old location was closed for renovations and new construction was necessary.

To select video server companies for our review, we chose firms providing MPEG-1 full-motion video to 100 or more workstations, RAID arrays (data is striped across multiple drives), full fault tolerance (all components are redundant to ensure high reliability), a turnkey system (prior to delivery, system components were prepared by the vendor to "talk" to each other), and nearby service. Fault tolerance is very important to language labs that must provide high reliability and remain open seven days a week. To ensure a swift response to service calls, we chose "reasonable driving distance" as one of our criteria. We eventually reviewed systems from Silicon Graphics, Panasonic, Mercury, TNCi, and Siemens-Nixdorf. Of the five, one system serving small collections was functioning well in several schools at the time of our review, while the other systems were operating successfully in numerous corporations.

After months of discussions and product reviews, we determined that four of the five firms could provide reasonable solutions. We began our final selection by eliminating the firm that did not have a large system in operation. We eliminated the next firm because it did not provide front-end or back-end software and we had neither the staff to develop it nor the time to test various alpha and beta editions created by outside programmers. From the final two, we chose the firm that provided all of the features we required, offered the lowest price, and was the original equipment manufacturer (OEM) for most of the system's components; therefore, negotiations with numerous firms were unnecessary. This firm provides a "single point of service" solution, and it performs all warranty service, including replacement parts. The system provides full fault tolerance, hot-swappable drives (which means they can be replaced without turning off the system or disrupting users), high throughput, extensive scalability, HTML-based administrative and front-end software, and MPEG-1 video encoding compression with

multi-level adjustability for each recording. Moreover, the firm has an office within forty minutes of Cambridge, so quick service can be provided.

Our system streams over 400 hours of video to almost forty stations and is capable of streaming to over one hundred stations via 10base T Fast Ethernet connectivity. Although we are using the Optibase Mpeg Forge encoder (which is housed inside a Windows NT dual processor workstation) to digitize 1.5 Mb/sec, MPEG-1 full-motion video and 128Kb/sec audio, the system can provide MPEG-2 and H.263 images and use Optivision, Sony, or Minerva encoders. The system uses a RAID array of 9GB disk drives and back-up storage on DLT. Our client stations have 2 GB hard drives and 32-64 GB RAM and our server modules provide 5.12GB/sec I/O bandwidth.

With our current number of drives, the server handles over 50% of our videotapes; this system not only solves the issue of insufficient copies to meet demand (by allowing any number of students to simultaneously view the same program at different points), it also provides easier access. Students may view the first half of a tape on Tuesday and return on Thursday to view the second half without winding the tape. A mouse-operated slider advances or reverses between any two points in a tape in less than three seconds.

After two years of use, the server is streaming to PCs almost without flaw. Although a few drives have malfunctioned, there was no interruption for the users as the redundant system worked as designed. Our computer specialist merely removed the drives and installed new ones; this is a very fast process, and the system remains powered.

Our disappointment was the initial lack of Macintosh streaming. The firm's original software programmers were not granted a license, and we opened the LRC without this capability. Recently, this situation has improved, and the system can stream at an acceptable level to newer Macintosh computers. We do, however, prefer the stability of the PC and the configuration of this system to others that we reviewed.

Testing the Video Server

Although our streaming server provides some "replay" features, most of our audio materials are stored as regular QuickTime files, which can be downloaded and easily controlled by the student on local client stations.

The Language Resource Center is located in Lamont Library, an undergraduate library surrounded by several freshman dormitories and the new Barker Center [for humanities]. Many students find this arrangement convenient, as they can study for classes and conduct research on the lower floors of Lamont and

then use the LRC to complete foreign language course exercises. Students enrolled in foreign language courses served by the LRC are members of one hundred and four undergraduate foreign language courses

The Facility

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The LRC has eighty stations, a music listening room (to serve introductory music courses in our Core Curriculum), two offices, a circulation area, a faculty workroom, a server room, and two group video viewing rooms. The carrels include twenty-eight single units (38" wide), twenty-three large units (47" wide), and two adaptive technology units for students with disabilities (76" wide). There are two group areas of six carrels with space for small section meetings, nine carrels (34" wide) and four stuffed chairs in the music listening room, and two large monitors with wireless headphones in the reception area for viewing SCOLA and other foreign language satellite programs. All stations, excluding the music area, have tilt-and height-adjustable metal keyboard trays and height-adjustable chairs. Two of the stations in the group areas have height adjustable work platforms and wide trays to accommodate wheelchair users. Two other stations have large LCD monitors to provide text enlargement for visually impaired students.

Twenty stations are equipped with Macintosh 7300/200 computers and twenty-eight stations are equipped with Dell Pentium II computers. All Dell stations receive video streams from the SGI server, and software for streaming to the Macintosh computers is being developed for release this spring. Twenty carrels are equipped with Sony language tape player/recorders connected to a Sony LLC-8000 faculty console. Twenty-eight stations are equipped with stand-alone ETI recorder/players. The ETI units are portable, so they can be transferred to other carrels when necessary. A small inventory of these units is held for circulation by faculty members, as well as for students in special circumstances. Sixteen stations are equipped with VHS-VCRs that play on the computer monitor (to avoid having two monitors in a carrel) and five of these stations include videodisk players.

"Das Fernsehzimmer" (television/family room) is a group viewing room that seats twelve and is equipped with a video/data projector. "Camera Con Vista" (room with a view) seats sixteen students and is equipped with a large screen monitor and video recording equipment for student skits; it also has beautiful views of Cambridge. The faculty workroom is equipped with basic editing equipment, computers, and a scanner. It is next to the office of our multimedia specialist.

Features for Students with Disabilities

In designing the LRC, we considered the needs of students with disabilities. The aisles were made wide enough for wheelchairs, but we also included additional features.

Two carrels are twice the width of standard carrels, so that adaptive equipment could be installed, and extra workspace is available for future expansion. Voice recognition systems, track balls, and other features are included in these carrels. To assist students with visual impairments, we acquired 21" multi-sync flat screens. These LCD monitors offer two advantages over the CRT units: they provide a large image in a small space (twenty-one inch CRTs are too large for the space) and the flat screen is easier to view (CRT flicker is bothersome to many individuals with visual disabilities).

While all stations provide adjustable chairs and keyboard trays, two additional carrels offer adjustable workstations. One lever raises or lowers the entire workstation to accommodate various wheelchair sizes; it also offers the additional benefit of great flexibility to the tallest and shortest students. The keyboard tray is as wide as the workstation and it can be adjusted—tilt and height—independently of the workstation.

Student Reactions

Student responses have been very positive. Typical initial reactions were, "The lab is very impressive"; "The new language lab is wonderful"; and "This is great, but can I get it from my dorm room?" However, when we asked some of the numerous students who made similar comments if they would prefer to use the system from their rooms, most said that they prefer the LRC, but they wanted the option to occasionally study from their rooms during midnight study sessions or horrific weather. A freshman explained, "The first time I went to the new 'Language Resource Center' I was very impressed. There were so many computers, cassette players, VCR's, and laser disc machines and they were all modern! This semester, I'm in both French and Urdu-Hindi, so I find myself in the new language lab a lot, listening to Urdu conversations and Hindi songs and watching French movies and news programs. Now I don't have to struggle to find working machines; I just have to struggle to find a booth among the many students trying to increase their lingual knowledge. I actually enjoy my trips to the language lab and feel that I learn a lot by going. C'est beaucoup mieux."

Some students were confused during their early sessions in the LRC. For example, one student commented, "It's especially annoying when I come up here and everybody is watching movies and I can't get onto a computer to do my computer exercises for a class." This student was relieved to learn that the films were on PCs and his exercises were on Macs. "It's nearly

impossible to rewind the audio files to make sure a dictation is correct as you go," was another student's legitimate complaint regarding the difficulty of rewinding just a few seconds of a program. This function is now being improved. Occasionally, a PC freezes while displaying a videotape, but restarting it usually solves the problem.

We had some concern that students would use too many of the machines to read and send their e-mail messages. Our computer department supplied the equipment for a kiosk but we knew that only some novelty would attract students to use it. We took a 1959 wooden telephone booth from our old language lab and sent it to a woodworker who converted it into an e-mail booth for us.

Faculty Reactions

Professor Judith Frommer, Director of Language Programs in Romance Languages, describes the advantages of the new system in this way: "...not only will students' learning be more efficient, it will also be more agreeable. Since recent research has demonstrated the importance of the affective component of language learning, the 'agreeableness' of the learning situation actually adds to its efficiency and effectiveness also.

"Another aspect of the "Portes ouvertes" [a first year video-based program that also includes 2 CD-ROMs produced by Haggstromm, Frommer, Jones, Bunting, and Patenotte] is that students can record their own voices using the CD-ROM, in the context of real conversations. These recordings are then saved in sound files, which the students can put in folders to be picked up by their instructors over the network or on diskettes that they can hand in.

"In both of the examples given here, students are in direct contact with the real language. They are hearing natural spoken French and they are speaking French themselves. This experience, which is what we want our students to be able to do, would not be possible without the technological sophistication of the new Language Resource Center."

Staff Reactions

LRC staff reaction ranged from student-employees, who love the new, hi-tech, and sun drenched facility to full-time staff who found the LRC challenging, exciting, overwhelming, and perfect but imperfect. Ivan Audouin, our multimedia specialist stated, "I think the benefit to the students is tremendous in terms of how much time they are saving, but the potential of this new technology has not been fully realized, because nearly all the existing material was designed for analog, linear use. Educators need to adopt the new digital tools to enhance the learning process instead of merely transferring the analog archive."

After eighteen years in the "garden-level" Language Lab of

Boylston Hall, LRC Coordinator Connie Christo, appreciated the move to the penthouse of Lamont Library where "light, space, and technology" meet. "Video streaming from a server to computers is one of our biggest assets. It has helped to eliminate lines of students waiting for videotapes. Language acquisition has become more interesting because students now have access to CD-ROMS, web sites, and other resources which provide a broader experience than merely listening to audiocassettes. Even though some course material may be accessed from other places on campus, it's still a good idea to have a specific, quiet place for language learning."

Copyright

After discussing copyright with other schools using a video server and our Office of the General Counsel, we developed policies. Under the face-to-face teaching clause, we can stream video to stations in the LRC, an instructional space. We hold only one copy on the server and we do not circulate the original videotape. We do not send video files to any other locations.

For now, new materials for which we have copyright permission to duplicate and non-copyright materials are held on a small but separate server accessible from all dormitories and buildings on campus.

Problems

Although we initially feared the occurrence of some catastrophic events, most of the issues we have faced since opening the LRC were small. For example, the compact VHS-VCRs lacked timers, the inexpensive stereo headphones were not durable, and the small tables in the music listening room were too large for the allocated space. The server, however, continues to perform as anticipated and the fail-safe system works as designed.

Future Plans

Each semester, we add additional drives to our server and encode more materials. The new drives store more information and they are less expensive than our original drives.

After fulfilling LRC internal requirements, addressing copyright issues, and expanding campus bandwidth, we hope to expand the system to serve students from their dormitories, faculty members from their offices, and professors from their classrooms.◆

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