Technological Advances in Distance Education Mitigate Short-Term Instructor Absence from the Classroom

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Abstract

Recent advances in communications technology such as FAX, videocameras and accessories, and videoconference give an instructor freedom to teach class from remote sites effectively. Common low-tech methods such as canceling, postponing, or substituting are briefly discussed. Three possible alternatives employing different sorts of communications technology are presented: videoconferencing, combining videotape with interactive audioconference, and combining FAX with audioconference. Discussion includes advantages, difficulties, costs, and surveyed student reaction. This investigation does not explicitly consider Internet adaptation of its methods.

Introduction

For professional reasons, an instructor may be absent from class. The occasion may be a conference, to present a paper or to attend professional meetings. Short courses during the semester present opportunities to meet with colleagues in industry and to maintain proficiency in the latest methods. Fundraising time often seems to occur in mid-semester. Even such necessary obligations as military reserve duty and jury duty seriously disrupt continuity in the classroom. Classroom attendance becomes even more of a problem when an instructor is the only one available for advanced courses in certain disciplines.

Face-to-face interaction has an important place in education not yet effectively supplanted. If lectures or books were adequate alone, then there would be no need for a resident campus. A good library would put the faculty out of business. Interaction with instructors and peers in discussions, formal and informal, lectures, seminars, demonstrations, and a host of other opportunities enhance the effectiveness of learning. The interaction and opportunity to ask questions, to encounter new opinions, and to gain wisdom are of great importance. The value of human interaction is a reason that distance education by Internet is more complex and difficult a problem than some of its proponents would lead educators to believe.[1]

To mitigate their own occasional absence, instructors have employed several low-tech methods. Among the more popular are canceling the class, postponing the class, or hiring a substitute instructor. With the recent advances in communication technology, a wider range of options opens. A creative instructor may now take advantage of a greater range of professional opportunities outside the classroom while disrupting the classroom schedule less than was the case in the past. This paper presents field-tested options to combine technologies to maintain the personal touch, not replace it.

Low Tech Methods

Traditional low-tech methods for addressing short-term instructor absence include canceling the class, postponing the class, and employing a substitute instructor. Canceling the

class works well if an instructor absence occurs on short notice, for example, due to illness. Unfortunately, repetition degrades this method's usefulness quickly.

Postponing the class is one step better than canceling it and can work for both short notice absences and for those planned somewhat in advance. Postponing a class at least preserves the quantity of contact time. Finding a time to reschedule a postponed class may be difficult, particularly with engineering undergraduates, who often carry heavy courseloads. In creating academic schedules, the best times are already filled with other classes, perhaps for no more reason that than they are indeed the best times. The unpopular and inconvenient times remain, which makes postponing classes an inconvenient idea. Finding an acceptable time for a makeup class can degrade into an exercise in trying to please everyone. A notable exception to these observations occurs when the course syllabus, distributed the first day of class, schedules the makeup classes: two weeks of makeup classes produced not a single complaint when scheduled as part of the initial course syllabus and highlighted the first day of class[7], but failing to do so produced over 80% complaints on summative reviews.[8,9,10]

When a department chair was recently asked how he addresses his teaching obligations while out of town, he explained, "That's why we have post-docs!" In this anecdote, he was referring to the substitute instructor, a popular low-tech idea. There is a perception, not without merit, among administrators and faculty that they must occupy students' attention for the assigned time interval. A human interaction is desirable, hence the substitute instructor. The lower the level of instruction, the more this perception becomes practice. Unfortunately, the substitute instructor finds it difficult in the short time allotted to establish the necessary relationships and to identify appropriate interactions for learning to take place. Neither substitute instructor nor student feels a need to build a long-term learning relationship. The perceptive instructor asks whether a disjoint interaction is preferable to no interaction at all; the answer is not always the same. Consequently, the author of this paper avoids being a substitute instructor unless given the opportunity to attend at least the two immediately preceding class sessions.

The most effective low-tech method to mitigate instructor absence may be a full-length in-class written examination. Unfortunately, this method has rather strict limits in both frequency and timing.

Each of the methods reviewed above may be best under certain circumstances, but each has significant difficulties. Advances in technology now make these methods merely one of several options, as explained in the following sections of this paper.

Videoconference Technology

Videoconference technology now exists in most cities and many college towns in the US. Institutional and commercial sources provide fully interactive two-way communication between sites. Because many professional reasons for absence from the classroom (conferences, professional development, fundraising, etc.) are in major cities and most classes are in college towns, this is a possible way to mitigate a classroom absence. The hardware required for this method makes it the most expensive of the methods discussed in this paper. For that reason, its practical availability is likely to be low.

At a minimum, each site in a videoconference system contains a main video camera, monitors showing video from both locations, and audio from the distant end. A control panel at each site allows an instructor with little training to control camera settings (for example, camera position, zoom, and audio volume) from either end. Associated software has become fairly user-

friendly, though not always entirely compatible, among the major distributors, reducing the learning curve to a few short minutes. Common options include the following:

- several video camera presets (position and zoom with autofocus)
- videotape playing
- videotape recording
- computer port to enable display of a computer screen
- document camera, including options to display the main video camera, document camera, or both
- high quality, full-duplex audio

These options enable a full range of classroom hardware and teaching methods, of which some follow:

- chalkboard or whiteboard--shows up nicely and camera locations can be preset
- transparencies and documents
- handwriting, particularly useful during interactive problem-solving sessions
- computer simulations--anything a computer can simulate and display
- computer-based instrumentation displays from experiments, even remote experiments
- prerecorded videotaped presentations
- computer-based presentations from standard (or non-standard) software
- computer-based multimedia

Anything that can be presented on a computer monitor can be shown in the same form on the videoconference monitor. Usually, the videoconference monitor is more effective for a group audience because videoconference monitors are larger than most computer monitors. Showing and explaining small items to an audience is a strength of videoconference technology, just as it is for videotape.[4]

Videoconference technology has obvious advantages in mitigating instructor absence. With a little practice, an instructor and students can interact nearly as if in the same room. Frame rates and compression technology make the video image remarkably sharp and interactive, following motion well with minimal choppiness. Experience shows that an instructor may require a slightly more aggressive initial approach to establish a personal presence the class. Students seem to be, at least initially, less attentive to an instructor's image on a monitor. It is also more difficult to attach names to faces and voices on a monitor than it is to do so in person. This is particularly true if the instructor is remote from all the students or if it is too early in the semester to know students well.

At the University of Idaho, videoconferencing has mitigated instructor absence from time to time for the past two years. Student opinion was recently obtained by survey on the effectiveness of videoconferencing.[6,7,8,9,10] For the same class, several instructor absences were mitigated in each of the several ways discussed in this paper. Students unanimously preferred videoconferencing to all other options presented in this paper, decisively perceiving it as superior to substitute instructors or to postponing a class session or other methods discussed in this paper.[6,7,8,9,10]

This can be an expensive option, however. A dedicated system with the above capabilities costs approximately $50,000 per site. A dedicated T1 line is about $2,000 per month; it contains enough bandwidth to run four videoconference systems simultaneously. To

rent facilities can quickly run into tens or hundreds of dollars and requires advance coordination of facilities, switch routing, and payment. If mitigating instructor absence is the only reason for having it, videoconferencing probably does not justify its expense. For example, when this author requested such rental access to mitigate a two-week absence in New York, connection and line charges led to disapproval. Without other reasons backed by sufficient funds to justify the expense, the availability of videoconferencing is unlikely.

Mitigating instructor absence at the University of Idaho with videoconferencing is a nice auxiliary benefit. Other uses justify its existence: administration, outreach, and research. Though administrators exhibited a normal initial apprehension about such a large expense, they justified it on a proposal to improve outreach in graduate and low-enrollment technical classes. However, once installed, administrators immediately developed an unexpected fondness for the system and became its heaviest users. Meetings on video became legion as videoconferencing allowed administration and faculty to spend more time with government and industry sponsors while maintaining contact with the campus on compressed video. Employers' recruiters conducted remote "on-campus" interviews on it. Even the Board of Regents employed it for committee meetings, publicly endorsing videoconferencing's ability to effectively link people who have already developed working relationships, but were now located hundreds of kilometers apart.[11] Videoconferencing provided the face-to-face interaction necessary to unify a department, and later a college, having a substantial portion of its faculty in two different locations.[2]

The videoconference system also enhances the university's outreach. The University of Idaho operates a compressed videoconference system 24 hours a day between its operations in each of the state's three population centers. Students meet instructors remotely, not only for occasional classes, but also for office hours. Whole courses have appeared with an instructor at one end and the majority or even all of the students at the other end.

Research also profits from videoconferencing. Idaho, like a number of states, has its industry base in one population center and its land grant university elsewhere. Design projects with industry support explored the medium, with the industry supervisors at one site and students at another. Regular research meetings on videoconference enhanced a number of research projects, including the following in just the first year: a Federal Rail Administration project with MK Rail, a large generator modeling project with Idaho Power Company, several microelectronics projects with Hewlett-Packard, Santa Clara Plastics, Preco, and Micron Technologies, and a "smart irrigation" project with J.R. Simplot. Engineering pioneered the installation, but Business, Psychology, Agriculture, Education, and Law soon discovered some of the research-enhancing potential. The university rents a T1 line and divides it as follows: two videoconferencing systems require one quarter of a T1 line each and extending its computer network fills the remaining half. A rural university campus has become interactively available to support research with distant urban industry.

Making Videotape Interactive

Videotape is becoming an easy and relatively inexpensive option to mitigate instructor absence. Camcorders and desktop camera technology now are quite common, having come a long way in quality and price. With some imagination and effort, making a decent quality videotape is within the capability of an individual faculty member having neither camera operator nor video studio.

Unfortunately, videotape alone can be rather sterile. The student watching a tape has but two options: slowing down the presentation by hitting the "pause" button whenever the instructor moves along too quickly or hitting the fast forward through the dry spots. There is no immediate opportunity to ask questions or interact with the instructor or other students. As Willis and Gottschalk have observed and as video outreach students have often mentioned, videotaped presentations require some imagination to avoid becoming an expensive lecture from a "talking head."[3, 4]

Though videotape alone can be sterile, combined with advances in speakerphone technology, a videotape can become remarkably interactive. In other words, showing a videotape to students while the instructor is available on a good quality speakerphone strongly enhances a videotape presentation. To do this, the instructor first pretapes the lesson. Then, after arranging for a teaching assistant or mature student to show the tape to the class at the appropriate time, the instructor contacts the class by telephone and makes comments and answers questions while the tape is being shown.

Pretaping the lesson is the instructor's first step. A camcorder, a sturdy tripod mount for it, and a good quality videotape are all the hardware necessary. With a little practice, a nice presentation can be generated.

There are a few simple techniques that make the presentation easier to generate and more effective. For example, a videotaped presentation using a whiteboard is more legible than the same presentation using a blackboard. Moreover, using the camera in an overhead , pointing straight down, fashion and writing on a piece of paper beneath it is even more legible on videotape than using a whiteboard. It is easier to see videotaped graphics generated on paper under an overhead camera than it is to see transparancies projected onto a screen and subsequently captured by a camera. Another advantage to the overhead camera position or presentation software is the ease with which copies of all written materials can be reproduced, distributed, and saved.

An effective slide presentation technique employed at the University of Wisconsin is to position the instructor with a computer screen behind one shoulder. Using slide presentation software, with a mouse for pointing and for progressing, is quite convenient.[5] Some camcorders will accept computer input directly, making the "over the shoulder" technique unnecessary, but such camcorders are still rather rare and expensive. However, if a computer can become involved, then a whole array of even more sophisticated presentation software and ideas become available.

The videotape must be shorter in length than the class period in which it is to be shown. Experience shows that at most 40 minutes of videotape serves a 55-minute lecture format, though optimum tape length is a strong function of the level of class discussion and interaction. Students are quite shy the first time through this, so the instructor must initially make more than the usual effort to stimulate interaction. The flexibility of this method is apparent: it is possible to interrupt the lecture occasionally for student or instructor questions. On the other hand, it is also possible to show a short demonstration or experiment and then engage class discussion. An optimum mix is somewhere between and varies from class to class. In any case, questions and discussions make this method better than simply watching a videotape. Regardless of the presentation medium, instructional techniques, or length chosen, the instructor avoids trouble by previewing the tape in its entirety before presentation.

This method is dependent on efficiently showing the videotape. Initial setup and pausing appear to be the weak links. To avoid wasting time in setup, a good teaching assistant or a trustworthy, mature class member is essential, as is designating the same person to control the "pause" button. Even so, further shortening the videotape to compensate for a few minutes for classroom setup is wise. Providing the students with advance copies of everything written during the pretape session, for example the whiteboard notes or presentation software slides, enhances the discussion dramatically.

Student reaction to this method was mixed when approximately 70 students were surveyed in five courses.[7,8,9,10] They strongly preferred it to a substitute instructor, but it was not as popular as videoconferencing or the FAX method of the next section. They liked demonstrations followed by discussion, but they were not enthusiastic about a presentation dominated by lecture. Whenever students responded with their own optional comments at the end of each survey, at least one of them always expressed gratitude for providing copies of whiteboard notes and other written and graphic materials or included a request for the same.

In contrast to the greater cost and lack of convenience of videoconferencing, the telephone is readily available wherever an absentee instructor may be. The speakerphone can be an expensive hardware item, but Polycom makes a good quality speakerphone for about $800.[12] It has none of the noticeable delay in switching that was the bane of early speakerphones. It also has echo cancellation and can pick up and amplify conversations throughout a conference room or classroom of a typical size. Camcorders with appropriate capability are about $700 in most consumer electronics stores and, on many campuses, may be available for rent or request from a central location. An alternative to the overhead camera setup is a document camera, though these may be more difficult to find and rent.

Problem Solving Session with a FAX Machine

Another interesting option is a problem-solving session by telephone and FAX machine in the following manner. The instructor assigns advance problems and designates students to recite on these advance problems. Each reciting student prepares an appropriate solution and give a copy of the same to a clerk or secretary before the class session starts. The clerk or secretary then sends the problems by FAX to the instructor and makes transparencies and copies for the students. If the secretary serves several instructors, the time necessary to send the FAX solutions this may dictate a significant advance submission of this material. Upon assembling for class, each reciting student gives an oral presentation, using transparencies of the solution, while the instructor follows remotely and asks questions by speakerphone.

The strengths of this method, identified by surveys of the students,[7,8,9,10] are threefold: First, the presentations identify the points that the presenter finds difficult. Because most students taking a given course struggle with roughly the same set of difficulties, having one student publicly identify the hard parts efficiently benefits the rest. Second, students enhance their oral presentation skills in a peer group environment. Third, without an instructor physically present, students developed a greater responsibility for their own education and some even noted this on their surveys. Unfortunately, the opportunity for instructor feedback on their presentations is quite limited.

On summative reviews,[7,8,9,10] students requested the following enhancements to this method. Each presenter should prepare an advance copy all slides and graphics. This makes note-taking more efficient. There should be a formal requirement that every student attempt

every problem, under threat of collection and grading if necessary. This focuses the questions efficiently. A formal published solution should be made available after the class session. Without a published solution, the presentations went too fast for them to capture the concepts on paper. The instructor, who could not see what was happening, failed to identify these problems, but the students recognized the difficulties, suggested improvements, and gave the reasons for doing so.

In sophomore and junior-level mandatory courses, 3-5 problems of a typical homework length were sufficient for an hour. Seniors in technical electives normally ran out of time before completing two presentations. As with the videotape method, this method also requires a teaching assistant or mature student to set up the speakerphone.

Hardware and cost are fairly minimal for this method. Most academic and corporate offices have FAX machines, as do guest services at most major hotels. The cost is too often twofold, however: the ordinary charge at the sending end plus a receiving service charge of about $1 per page at a typical conference hotel. With careful planning, aggregate presentations rarely exceed eight pages, even for a fairly ambitious problem set. Telephone charges are about $15 for an hour class session. Time zone differences can affect the cost and convenience, but this is true of any real-time method. At the University of Idaho, using the university's 800 number avoids wasting time accounting for small telephone charges. An alternative to the FAX machine is to attach the presentation materials to an email file. Access to email is becoming fairly common in hotel, academic, or industry environments and is quite convenient for sending presentation documents.

Future Work

None of the above methods use the Internet. This does not mean that the Internet is an inappropriate vehicle for these methods. Rather, they may need some more thought and adaptation or they may need more time for technology to develop to support them better. For example, attaching presentation materials to email efficiently replaces the FAX machine in the immediately previous section of this paper. FAX software for scanned documents even exists, giving an instructor the ability to bring up such documents on a laptop computer at a remote location rather finding a FAX machine on which to receive documents. Sending a presentation for which appropriate software exists on each end, is fairly easy. Real time audio software also exists, but can become choppy, for example, under heavy Internet traffic conditions. This includes text, spreadsheets, data, graphics, math package results, as well as files for "presentation software."

Videoconferencing is in its infancy on the Internet. A camera, interface card, and software costs about $600 per station. Software that gives a refresh rate of 1-8 frames per second under good conditions is currently available for 28.8kbps modems. It is choppy and a bit grainy, but it can be argued that such quality is better than no video at all. Projecting such images for an entire class to see may be more of a problem than sending and receiving them given current technology and prices.

Eliminating the requirement for a teaching assistant, a mature student, or a secretary will need to be addressed. The FAX method can be modified by requiring students to send their advance presentations attached to email, thus eliminating the need for secretarial support. How to eliminate the "operator" for other methods is not readily apparent, even for videoconferencing

on a personal computer. Investigating these Internet adaptations is the subject of ongoing research.

Conclusions

In this paper, applying certain advances in communications technology mitigates instructor absence from the classroom. Low-tech methods, such as canceling or postponing a class or hiring a substitute instructor, have been employed for many years. Now, videoconferencing is becoming available in many places and near many campuses, though it is the most expensive and probably the least available of the methods considered. Combining interactive audio with videotape enhances the effectiveness of both. The expense may be within reason, but advance preparation and reliance upon an "operator" degrade this method. An innovative use of FAX and telephone to do a problem-solving recitation is the least expensive method proposed. Students recommended supporting it by distributing copies of written presentation material. All of the methods using communications technology are real time techniques that provide a measure of personal interaction so essential to effective learning.

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