

Extending the Classroom Walls Electronically¹

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Tom Creed enjoys being at the cutting edge of information technology. Years ago he began accepting assignments via email; he noticed that his students' handwriting no longer affected his grading of their work. When he realized that electronic communication erase the limitations of time and place, he began to incorporate them into his courses. He is Professor of Psychology at St. John's University and the College of St. Benedict, Collegetown, Minnesota. He founded the Learning Enhancement Service there and serves as its director. He writes about and gives workshops on active learning strategies, classroom assessment, and collaborative learning, and has consulted with several colleges on programs to promote enhanced student learning. Most recently, he wrote and produced the User's Guide for Opening Doors: Two Cases of Formative Assessment, a videotape distributed by The Collaboration for the Advancement of College Teaching and Learning. His E-mail address is <TCREED@CSBSJU.EDU>.

We are bombarded daily with hype about the coming technological revolution in higher education. Technology is touted as the most recent panacea; the cure for what ails us. Certainly, technology is transforming our lives, and will continue to do so. But will it impact our teaching?

¹Chapter 8. *New Paradigms for College Teaching*. 1997. Wm. E. Campbell & Karl A. Smith, Eds. Interaction Book Company.

And if so, how? The question that we need to ask is, "What do we want to accomplish in our courses, and can technology advance our teaching goals?" rather than "What can we do with technology?"

This chapter isn't about increased productivity, or the fears that we will all be replaced by machines, or any of the *Really Big Issues*, but about how electronic communication has the potential to help us extend and enhance the conversation that goes on within the classroom. The technology is available now, does not require great sophistication to use, and is generally available to faculty and students. But electronic communication involves compromises and trade-offs; I'll discuss the downside as well.

This chapter assumes the faculty member still meets students in a normal classroom and is hoping to extend, rather than remove, the classroom walls. No matter what the medium, we communicate with our students in different ways at different times for different purposes. Some of the information that we exchange in a course should be private. Much of a student's graded work should be private: it should be privately communicated to the instructor and the instructor's assessment of it should be privately communicated to the student. Also, the concerns of individual students about aspects of the course (e.g., expressing some dissatisfaction with an assignment, asking for clarification of the grading system, elaboration of a point raised in class, etc.) are probably best handled privately. Other types of information, such as discussions about the controversial issues of the class, should be public and dynamic (interactive)--we can all gain from sharing ideas and hearing the informed opinions of others. Still other forms of information, such as course syllabi, handouts, and other resources, should be publicly available but static (noninteractive).

Briefly, I see my use of electronic communication as falling into three distinct categories:

- **Private Discourse.** My use of private discourse falls into two subcategories: my students submit their writing assignments through E-mail and we carry on personal conversations, such as setting up appointments and holding brief discussions of routine questions about the course through E-mail.
- **Public forum.** Through an electronic conference set up specifically for my class, we discuss topics of general interest in the course. Issues raised during class discussions and discussions of questions raised by individual class members are the main subjects discussed.
- **Repository of information.** The major course materials--the syllabus, writing and reading assignments, and some of the textual content of the course (handouts, explanations, etc.)—are available through the World Wide Web on the Internet. Those interested can see how I use the web in my classes by visiting my web site at:

<http://bingen.cs.csbsju.edu/~tcreed>

Each of these three broad categories uses a specific computer program. In the table below, I've summarized several parameters of communication and how these three categories compare, as well as typical uses and programs for each. This table should help you think about how you want to communicate with your students, and then pick the most appropriate technology. For example, if you want to communicate with an individual, E-mail would be preferable. It's private, quick, and easily created. But if you have a large amount of relatively unchanging information that you want available to many others, a World Wide Web site would be the way to go. It's public, it's organized, and while it's more difficult to construct (you need to

use a special programming language, Hypertext Markup Language, or HTML), it is permanent. As with traditional communication, we need to be cognizant of how best to communicate with each other when we communicate electronically.

Three Categories of Electronic Communication

	Repositories	Public Forums	Private Discourse
Description	Information stored by a (usually) large entity (schools, museums, government agencies) and retrieved by individuals.	Information from others is available and can be retrieved; the information is a collective knowledge base.	Two-way communication between individuals. The communicators control what information is available to each other.
Use	Efficient gathering and storage of collected knowledge that an individual or small group would be unable to compile and maintain on their own.	Small groups of individuals with a common purpose come together to share information, create a body of knowledge on a limited topic.	Two (or more) people share information that is of importance to themselves but of little value to others, or needs to be confidential.
Organization of information	Hierarchical ----- Non-hierarchical		
Persistence	Permanent ----- Ephemeral		
User input of information	Little ----- Considerable		
Modifiability by user	Unmodifiable by user ----- Highly modifiable by user		
Audience	Large, Public ----- Small, Private		
Amount of information	Mass quantities ----- Small amounts		
Ease of creating information	Fairly difficult ----- Easy		
Intrusiveness	Not intrusive ----- Very intrusive		
Conventional examples	Libraries	Roundtable Discussions, Town Hall meetings	Letters, conversation
Educational examples	Lecture	Cooperative Learning	Tutorial
Electronic forms	World Wide Web	Electronic Conferencing	E-Mail
Specific examples	Lynx	VAX Notes	VAX Mail

A classroom example

My class, *Principles Of Learning And Behavior*, an upper-division (junior and senior) course within the psychology major, is typical of how courses can use electronic communication. The structure of my course is driven by my goals for my students. I want them to:

- learn the basic principles of conditioning,
- come to appreciate that these principles can be used to explain, predict, and control human actions,
- "automatically" use these principles in analyzing situations they encounter,
- use these principles to improve their own lives, and
- have this ability five years from now.

The kind of learning that is important to me requires active rehearsal, and one of the best forms of active rehearsal is to talk to someone else about what you know. While learning is based on what we have individually acquired, the consolidation comes about best when we discuss our ideas with others--I think learning is primarily a communal event. I rely heavily on cooperative learning in my courses to meet this communal sharing of knowledge (Johnson, Johnson and Smith, 1991). I view my role in the course, then, as setting up the environment so that my students will most likely learn the material as well as possible, but I do spend some time playing expert and transmitting information.

Principles of Learning and Behavior meets twice a week for 70 minutes. I structure my courses in functional units (e.g., Pavlovian conditioning). Class periods are a combination of some lecture and class discussion, and a lot of small group cooperative learning. The way I

assure that students have a solid knowledge base at the beginning of the unit is by having them write out answers to unit guide questions prior to starting the unit. So, every third or fourth class meeting my students are required to do some reading in the textbook and answer some questions that are designed to help personalize the material and to get them to think about the more complex aspects of the topic.

The unit on Pavlovian Conditioning is an example. Before we begin our classroom discussion of Pavlovian conditioning, students read a chapter from the text, plus some short ancillary readings, then complete a writing assignment, consisting of three parts:

- the first part asks them to describe three examples in which they have been Pavlovianly conditioned. I ask them to come up with fairly unique and significant examples and to label the components of their example (e.g., CR, UCS) and to explain why they think their examples are Pavlovian conditioning.
- the second part asks them to write the one page text of a speech they would give to a seventh grade class explaining what Pavlovian Conditioning is all about.
- the third part asks them to make up their own question about the chapter and explain why this question is important to them.

The first part of the writing assignment helps them to personalize the material, while the second helps them to structure an overall picture of the phenomenon, determine what's important, and put it in their own words. The third part gives them some ownership of the material, in that we are likely to address their question in class or on our electronic conference.

Their written responses essentially drive what happens during the next three class periods. When we first meet to discuss Pavlovian conditioning, I'll give a short demonstration, make sure

we are all using the same terminology, and provide a little clarifying information that I think was either missed, poorly explained or glossed over in the text. Next comes the most important part of the first class meeting--my students get into cooperative learning groups of three or four students, and talk about their examples. As a group, they write up their most intriguing examples and any questions they have. Each group submits what they have written to me at the end of class. Their write-ups tell me what I need to address during the next couple of class periods, either through mini-lectures, more small group discussion, demonstrations, or whatever classroom procedure that seems most suitable.

The Limitations of My Course without Electronic Communication

I think it's important to stress that I first structured my courses in this manner several years ago, before I used electronic communication with my students. While I've found this structure successful in producing good student learning, there were four distinct areas of my class with which I was concerned: 1) the quality of my students' writing on their assignments, 2) whether I was getting adequate feedback about the class, 3) my management of the volume of material for the class, and 4) several issues related to the temporal and spatial limitations imposed by the traditional class structure. More specifically—

1. Did they write it on the bus coming to class? My students' writing was not always as thoughtful and reflective as I would have wished. Students were reluctant to do multiple drafts of a pre-class writing assignment, and their work often looked like it was dashed off minutes (or seconds!) before class. Also, if they wrote it right before class, they didn't have the opportunity to reflect on what they wrote. And if they got to use their written homework in class, which I

think is a good idea, how could I know they were not writing it during class rather than before? Finally, their pre-class writing assignments were often so messy that I had a difficult time deciphering what they had written.

A related concern was how, when, or even if, they were engaging the material outside of class. Since I didn't know what they were doing when they weren't in class, it was difficult to know how they were structuring their time with the course material.

2. What are they really thinking about the class? I use quite a few Classroom Assessment Techniques (Angelo and Cross, 1993), and these are invaluable for getting a sense of what students know and how they feel about the class. But a student might be reluctant to tell me something that she is really angry about, for fear that I'd be able to tell from her handwriting who wrote it. So, was I getting the honest feedback I needed?

3. When did they give it to me, and where did I put it? Frankly, I'm not the most organized guy in the world, and I had a problem keeping track of everything that was submitted and when it was submitted. Like many professors, I have deadlines for when work is due. Students often claim that they put their assignment under the office door in time, it's just that I wasn't there, or they gave it to another student who put it under the wrong door, etc. And when papers were handed in at times other than class time, I had a tendency to misplace them. The kiss of death for a paper was when a student handed it to me in the hallway when I was on my way somewhere else. They must be some place in an alternate universe where all of those papers have accumulated, along with all of my pens and Phillips screwdrivers.

4. And several problems resulting from time and place constraints--

- **Sorry, time's up!** Many times, we had to stop a class discussion before we had come to some resolution. Other times, there were people who wanted to speak and didn't get the chance. Too bad the discussion had to end at 12:30--we could have gone on productively for another 20 minutes.
- **Pack it in--you don't have much time, and you won't see them again for a while.**
Class time may not be the best time, nor should it be the only time, for the transmission of information. Handouts help, but the transmission of information seems like a poor use of that most precious of commodities, our time with our students. Class time shouldn't be the only time to convey important information, such as a new assignment. A corollary of this for me was the "Oh, one more thing..." phenomenon--about 30 seconds after class, I would think of something *really important* that I wanted them to think about, some important housekeeping information, etc. The opportunity was lost if I didn't remember it while I had them in my grasp. This was a big problem in my evening class that met once a week.
- **Why doesn't Betty talk more in class? She writes great papers.** Class discussions tend to favor the verbally adept, extroverted student. But what about those quiet ones sitting over there? They seem attentive. Don't they have something to contribute to the conversation? A small group cooperative learning structure certainly helps get around this problem, but the groups and reports from the groups can be dominated by the same people.
- **Sorry, I work then. How about midnight after I get off work?** There is no reason why the classroom should be the only place where the interchange goes on, but, as most

people who use cooperative learning know, arranging face-to-face interactions outside of class is difficult. Students have busy schedules, and often live quite a distance from each other. Even on my campus, which is primarily residential, students have a difficult time arranging meeting times.

- **Sometimes grandmothers really do die.** Students frequently have legitimate reasons for missing a class. A student who misses a class has clearly missed something important, but in addition to missing the conversation that went on that day, they have usually missed announcements, assignments, etc. that will prepare them for the next class meeting. There's a double jeopardy to missing class--you've missed what went on that day, and you may be ill prepared for the next class meeting. How many of our students drop a class because they aren't sure how to catch up and are embarrassed to go find out?

Electronic communication has helped me address (with greater to lesser degrees of success) each of these problems.

The Advantages of Electronic Communication

Most of the communication on the typical campus between teacher and student, or even between student and student, takes place during the prescribed classroom meeting times. We gather in the same place at the same time, information is transmitted almost entirely orally, and in real time. This puts severe constraints and extreme pressure on the communication--what is communicated has to "fit" within the allotted time period, and since that time period is fixed and inflexible, you can't waste valuable time ("we have to cover the material").

Two characteristics of electronic communication give it promise: The first is that the communication is not restricted to a specific time and place (i.e.--it is *asynchronous*, not occurring at the same time, and *asyntopic*, not occurring in the same place). Second, it is primarily visual and textual rather than oral. This is all pretty obvious, but these differences have enormous implications for student learning. These two characteristics provide benefits in several distinct areas in that they:

- allow for increased accessibility to the information relevant to the course and the ongoing dialogue about this information,
- provide for a more pedagogically sound interaction with the information by students,
- encourage more thoughtful discussion by students about the information in the class,
- provide more equal participation in the ongoing discussion (level the playing field) in several important ways,
- enhance student interaction outside of class,
- enhance my ability to archive and retrieve my students' work, and provide increased structure of information,
- provide a unique classroom assessment technique,
- and provide access to diverse sources of information.

Increased accessibility

Clearly the major advantage of electronic communication is that it is asynchronous and asyntopic. My students can be anywhere and ask me a question when it is of concern to them; they can comment on each other's views on our electronic conference when they have the time

and inclination; and, through the World Wide Web, my students can get the important, static documentation for the class from a wide variety of locations and on demand. Their dog can't eat this syllabus. The web is always there and waiting for them--their electronic servant. Like the Wobblies, it never sleeps, it never forgets. If they miss a class, they know where to go to get the missing material.

In turn, these same advantages hold for me. I can address students' concerns from any place and when I have the time to devote to them, which is often while I'm at home after I've gotten my son to sleep. If I've forgotten to mention something important in class, I can contact them through a distribution list E-mailing, or post it on our electronic conference or our web site if I know they will be accessing either in the near future. I use the distribution list if it is something imperative, since it is more intrusive--it signals my students that it has arrived, so students are notified that I have sent them something. The electronic conference is more efficient (in terms of disk storage), but since it does not notify conference members that there is a new posting, they may not get the message before the next class meeting.

I'm off campus quite a bit, and I can log in from anywhere, access my account, and respond to my students requests, monitor the discussion on our electronic conference. I can easily update the material on my web site when I want (or need) to, from wherever I happen to be. And my most recent update is the version the students have--I can update the syllabus after it's in their notebooks. I can create and modify courselinks whenever I want. (A courselink is some information relevant to the class that I create and store locally in my account, such as a definition or description of a phenomenon. Examples of courselinks are definitions of terms, chapter outlines, diagrams, etc., the things that I would normally hand out on paper.)

Courselinked material can be any size; the 8 1/2 x 11 size restriction paper handouts impose upon us is gone. A courselink can be as short as a sentence or two, or as long as it needs to be. How many of us feel like we have to use the whole page if we hand something out, or, if it is longer, feel like we have to trim it to fit on as few pages as possible? With courselinks, it's easy to embellish an on-line syllabus, and it's easy to create links to new material that you've discovered after class starts.

The asynchronous and asyntopic nature of electronic communication provides the true extension of the classroom walls.

Pedagogically Sound Interaction with the Information

Electronic communication allows me to structure a more pedagogically sound way for students to complete outside writing assignments. For example, I ask my students to submit their written homework two hours before class begins. Since their E-mailings are time and date stamped, I know whether they've done it or not. There are a couple of pedagogical advantages to this. First, they can't do their work on their way to class. Since they must do their work at a terminal, they are doing their work in a setting conducive to intellectual work. A computer terminal is a setting that has become associated with intellectual work for most students. Consequently, their work will be more thoughtful and they should be more efficient since the setting evokes scholarly work fairly immediately.

Second, they must do the assignment far enough in advance that they will be engaging the material twice--when they wrote it, and then again when they talk about it in class. The break of two or more hours between writing and discussing allows *incubation* to occur. Incubation occurs

when we work on a problem, then leave it alone for a while. Even when we do not actively engage the material during the break, our thinking on the topic improves (Ellis, 1978).

One of the major concerns I've always had about my students is how they are spending their out-of-class time with respect to my class. Are they starting their reading with enough time to do a thorough job? How often are they engaging the material? This is even a bigger concern for me with my class that meets once a week. I don't want them to start thinking about it a couple of hours before class, with a week intervening since they last thought about it. Most of what was learned last week will be gone. I want them to reflect periodically on what happened last time, and prepare for next time. Our electronic conference was made for this purpose. For example, in my weekly class, I can ask them to post a response a day or two after the class meeting, either addressing a specific question that I post after class, or something more open-ended, such as "What did you find most interesting in class last night, and what interested you about it?" I might give them a day or two to respond, then ask them to re-join the conference, read each others' postings, and respond to what others had to say. A couple of days later, I might post a new question that will get them thinking about the next class meeting, following the same format. The point is I've structured their interaction with the material so that they must think about the material, and in a thoughtful manner. They can do this when they have time, yet not too much time has gone by without their thinking about the class. Research conducted since the 1920's shows clearly that spaced practice--breaking the task into smaller, more frequent interaction with the material—produces stronger long-term learning than does the same amount of exposure to the material in one longer sitting (massed practice). In short,

electronic communication allows me to structure their out-of-class interaction so they're not cramming.

The World Wide Web allows for some degree of hierarchical organization. The web author is like an architect. You structure the page, but students select their own path, very much like the relationship between the designer of a museum and one of its visitors. The better the designer has done her job, the less intrusive her presence is and the better the visitor gets to profit from the experience. The same is true for the design of the web page. Your organization of the information is evident, and student notes will be better organized than the chaos we frequently see.

On my web page, I can structure how my students get their writing assignments. I used to give them the option of first reading a short description of their reading assignment—what I wanted them to look for, etc.—or going straight to the questions. It became clear that they were not reading the introductory material, so I rearranged the site so that they must first click on the description; from there they can get to the questions. This method doesn't assure that they will read the description first (you can lead a horse to water . . .), but does make it more likely since it is right there in front of them. Also, I opted against direct submission of answers through the web. They must download the questions into their personal accounts, then edit the file with the questions, then submit the file. I chose this route since my goal is reflective answers. Editing a file, with the possibility of redrafting, leads to more reflective work than the one-pass submission that occurs when people respond directly to a web site.

Perhaps more importantly, the native structure of the web is hypertext. Hypertext has the potential to be a pedagogically superior format. The student is in control of what information

comes her way, and at what pace. Such a technology has always been the goal of designers of teaching machines (Skinner, 1957) and the web provides it. For example, my assignments on the web may have links to further explanations, definitions of terms, etc. If the student is familiar with a term, she can pass by the link, but if she is uncertain about what a particular term means, she can click on that link and find out more. That next link may lead to some small course link I've created or may open up a vast array of new information through additional links. It may take the student in unexpected directions, very much like a good open-ended conversation. By selecting her own path through the web, the student creates her own unique learning. And she has some control over how she structures the web for her own use--once she finds a web site that is of value to her, she can mark it and always get back easily. The web is particularly suited to the independent, motivated learner, which is what most of us want our students to become.

However, hypertext's potential as a pedagogically superior format can only be realized if course pages are designed with effective pedagogy in mind. Anyone who has surfed the web quickly realizes that the typical homepage is a jumble of independent links interspersed with some personal opinion. Setting up a course page that is pedagogically sound is time consuming, and needs to be driven by the goals one has for the course. For example, one of the writing assignments for my Principles Of Learning And Behavior class (UGLI 5, for those clicking along as you're reading) asks my students to give examples from their own lives of the four basic forms of operant conditioning. The assignment includes a course link to a table I created, showing the four types. There are some terms in the table that may be unfamiliar to my students, so each of these includes another link that explains the term and gives a brief example. For the student who is quite familiar with the basic concepts, all she has to do is download the assignment and start

in. For those who are less familiar with the concepts, however, the information is there to help them. The student is in control of how much or how little information she accesses, based on her own assessment of what she needs.

More thoughtful discussion

Since the construction of our electronic correspondence is not limited by time, we can both compose what we have to say and take as much time as we need. This breaking of real-time constraints allows for a more thoughtful conversation, since we can ponder what we have to say and use the full editing power of a word processor. When I get a request from a student, say for an exemption from a class assignment, I have the opportunity to reflect on how to handle it. I have a tendency to feel rushed to judgment in face-to-face requests, and my response is often more moderated by my current mood than by the merits of the request. By having the opportunity to reflect (and edit!), my response is more likely to be well reasoned. I've been so pleased with the effects of this procedure that I ask students to submit requests by E-mail. My sense is that student requests are better reasoned and less frequent because they've had to think it through in order to put it in writing. The availability of E-mail doesn't preclude a student coming to see me. She may have some very personal matter to discuss, and would be uncomfortable committing it to text, or simply be uncomfortable with the fairly sterile medium of electronic communication.

Students' written assignments are more thoughtful for the same reasons. They work on them when they are ready, they can take as much time as they want, and I encourage multiple drafts, which computers were made for. In a similar vein, their electronic discussions can be as

thoughtful as they wish. In fact, the medium commands thoughtfulness—what can be tossed off verbally comes off badly textually. But by using E-mail, students can quickly clean up the conversation. I find the general tenor of postings on our electronic conference getting more thoughtful as the semester goes along. And since there's a persistence to students' writings (they can *see* what they and other students wrote, and make comparisons), the flippant ones show the most marked improvement. I've had more than one flippant student come and tell me they felt embarrassed by what they had said when they saw what the other students had written.

Leveling the playing field

Since students' electronic work is formatted identically (80 characters to the line, 25 lines per screen), the electronic submission of assignments levels the playing field--the vagaries of handwriting and penmanship are eliminated. When I first asked students to submit their homework through E-mail, it was mid-semester, so I already knew a fair amount about their writing. I was amazed to discover that I read the work of several of them differently--the volume of those with BIG handwriting shrunk, those with tiny handwriting grew, and the bias of good vs. bad penmanship disappeared. It was immediately obvious to me that I was reading their work in a less biased fashion--I could much more easily see how well students knew the material. I could much more easily give them feedback on the mechanics of their writing as well, since the similar format allowed me to focus on what they said, not the clarity of their handwriting.

A further, and more important, leveling of the playing field derives from the fact that asynchronous communication is not bound by the "real-time" constraints that exist in the classroom, allowing the quieter, more reflective student the opportunity to participate in the

discussion at his or her own pace. I have several students every semester who are quiet during entire class discussions who are "E-mail bloomers"--they come alive when they have the time to reflect on what they want to say and have the opportunity to edit and make sure that it is right. Another way of looking at this is to say that the electronic component of the course allows for the student with a different "learning style" to come forth--the reflective, contemplative student.

Breaking through the power differential. Electronic communication can be customized to level the playing field between students and the professor. For example, our system manager has set up a virtual member of my class--IPAVLOV. IPAVLOV has a single role in life--to provide me with anonymous feedback from my students, a task that is somewhat difficult electronically since everything we send is tagged with our names. IPAVLOV is set up so that, if a student types IPAVLOV at the 'USERNAME:' prompt, no password is needed and they are automatically thrown into the text editor for MAIL. After they have finished writing what they have to say, they close the file, it is automatically sent to me, and the account is closed. This assures anonymity (anyone can log on as IPAVLOV and there is no way to trace who has done so), yet protects against abuse (e.g., sending someone, other than me, a threatening note) since IPAVLOV can do only one thing-- send me a message.

The web also levels the playing field since any site can be accessed by anyone. This essentially means that the web is, in some respects, uncontrollable—despite the wishes of the US Congress. While there is some level of control, the control that exists tends to be mutual. This semester, for example, I'm teaching a Senior Seminar, *Popular Delusions*, that explores the widespread belief in unsupported phenomena such as ESP and Creationism. One of my students, who is a real web surfer, has set up a page with lots and lots of links to various paranormal belief

sites. As we were discussing his site, he wanted artistic control over it. Well, it's his page, I can't control what he puts on it. On the other hand, if I don't like what he's doing, I can always remove the link from my class's page to his page. Since we can not control what each other does, we had to negotiate an understanding.

This is the true power of the web--everyone becomes a master of their own material, and no one is compelled to visit a site if they don't like it. It is the true example of a democracy voting with its feet.

Enhanced student interaction outside of class

One way that I extend the classroom walls electronically is by having my students respond to questions generated by other members of the class and posted on the electronic conference. The next class meeting, I have those who responded to particular questions discuss them in cooperative learning groups. They arrive at a group response to the question, then present it to the rest of the class.

Also, groups are assigned topics to research. They quickly learn to divide up the topic and E-mail each other the part they've done. (In cooperative learningese, this is known as a jigsaw technique-- each student has part of the puzzle, and the solution only becomes apparent when each fits their part with that of the other students. This technique loads heavily on the "Positive Interdependence" component of cooperative learning, cf. Johnson, Johnson and Smith, 1991.) When the members of the group get together in class, they've already shared their knowledge and are ready to hit the ground running.

Many of my students have adapted the pedagogy and technology of the class to meet their own needs. For example, when they are preparing for the final exam, many groups break the task up into components, then each works on a part and E-mails their answers to the others in their group (another example of the jigsaw procedure). I find their spontaneous adaptation of both techniques to their own needs very exciting, in that a tool I taught them, E-mail, and a pedagogical technique, cooperative learning, have quickly become adapted to their own uses. Part of my goal for the course is to have students learn skills that will be of value when they leave college. Learning to work cooperatively and to communicate electronically are two skills they are likely to need to be successful in the future.

Enhanced ability to archive and retrieve my students' work, and provide increased structure of information

Electronic submission of assignments has considerable organizational advantages for me. I know when the student's papers were submitted, and I know where I can find them. They submit their assignments to BFSKINNER, the other virtual member of our class, rather than directly to me. The advantage is that their assignments don't get mixed in with all the rest of the virtual clutter in my account. The only mail BFSKINNER gets is my students' assignments, so I know where they are, and since there's nothing else in his account, it's easy to find my students' work. Further, I can file their assignments with a uniform notation-- their initials, the assignment, and as an extension, the semester, which allows me to find easily any particular student's assignment, from any semester. Another advantage of this separate account is my

Teaching Assistants can have access to it, do an initial read-through of the class's submissions, yet my personal account remains secure.

Not to be overlooked is the fact that electronic communication also allows students to keep systematic records of their own work as well. I encourage them to keep copies of anything they send me, just in case mine happens to get deleted (it has happened).

A Unique classroom assessment technique

As mentioned earlier, my students E-mail me their written homework assignments two hours before class. Not only does this allow for incubation for them, but it provides a unique and invaluable classroom assessment technique for me. I can read my students' submissions before class, which allows me to assess what they know BEFORE class begins--I go to class having a good idea what they know and where the problems with their understanding are. This allows me to skip material that they seem to know well already and concentrate on the areas where there are widespread weaknesses. My homework assignments usually include a *Make Up Your Own Questions* section; by reading these in advance, I can address in class the topics that they have already identified as being of interest to them. Similarly, the ongoing discussion on our electronic conference gives me vast insight into how they are viewing the more controversial areas of the course. Our discussions are enhanced since we all have an enlarged shared cognitive set--we all know what the others are thinking about the topic.

An unexpected benefit that E-mail and electronic conferencing provide is that I have a much more accurate assessment of my students' work habits. Since postings are time and date stamped, I've been amazed at how many of them do their work very late at night (a good

percentage of the postings are after midnight). I know they are in fact more organized than I had thought (most of them start their work in a timely manner, usually a day or two before it is due). Consistent patterns show up, and I've been able to point out to some students whose work is poor (and usually comes in right at the deadline) how they might do better work if they started earlier.

Provides access to diverse sources of information

I can't keep up with everything in my field, but there are repositories of information out there that can be of great value to my students. For example, several schools have established large electronic repositories of information on conditioning--on-line abstracts of journals, compilations of annotated references, databases on active researchers in the field, etc—which have been of great value to students taking *Principles Of Learning And Behavior*. The World Wide Web is a democratically distributed network of resources that is constantly changing and being updated. For a class like *Popular Delusions*, where we look at current beliefs, the web is a bonanza--it seems like every possible world view (including craziness not available in the library) is available on the web.

Our electronic conference provides more restricted access to diverse opinions -- the diverse opinions of the members of the class. I think students generally are not aware of the diversity of opinion in a typical class, and our electronic conference brings that diversity to the fore.

A Summary of the Advantages of Electronic Communication

The table below briefly summarizes which forms of electronic communication provide what sort of benefits:

Advantages of Electronic Communication

Advantage	Repository	Public Forum	Private Discourse
Increases Accessibility	very high	very high	very high
A pedagogically better technique	-	high	high
More thoughtful communication	-	high	high
Levels the playing field	-	high	high
Enhances student interaction	-	high	high
A unique classroom assessment technique	-	very high	very high
Enhances record keeping and structure	very high	high	very high
Access to diverse sources of information	high	moderate	-

Not all forms of electronic communication are both asynchronous and asynoptic. For example, one can "talk" electronically with another person in a different location via computer--each types what they want to say, in real time, and it immediately appears on the screen of the other person. Such a program is asynoptic but not asynchronous. While it is more interactive than E-mail, anyone who has been in a talk session knows right away that it's of limited utility. People make lots of typos and take time to go back to correct them, etc., while the other person waits.

Generally speaking, the most advantageous forms of electronic communication are those which take advantage of both asynchronicity and asynopticality. We all know how difficult it is to get a group of people together, and once we have, the time constraints we have in getting anything accomplished. How nice not to have to go out on a frigid Minnesota February morning

(which it is as I write these words), but E-mail my chapter outline to a colleague for critique. On the other hand, we still put a lot of effort into arranging to come together to meet, so there may be something about the face to face interaction that is important, and important parts of the communication process may be lost with electronic communication.

Some Cautions and a Few Suggestions

In short, electronic communication has several advantages, offering the potential for enhanced learning for students and organizational advantages for us. So, sign me up, Doc, right? Not so fast. Several factors need to be addressed if electronic communication is to be worth the effort. The first is that there are some cautions to be kept in mind about using electronic communication. Electronic communication will only live up to its potential in our courses if it is employed in a rational, well thought-out manner. Ignoring these cautions can lead to electronic communication being a frustrating and counterproductive experience for everyone. Second, there are things we can do to make it serve us better. Third, there are costs associated with electronic communication. I want to turn my attention to these, and discuss ways that many of these costs can at least be minimized, if not eliminated, with some planning. Before employing electronic communication, you should address the following issues.

Have a rational plan in mind

Electronic communication should meet a need. A little confession at this point may be in order. I like technology, and much of my early use of it in my classes was driven by my desire to use it because I liked it. Much of my early frustration resulted from many of my students not

being nearly so enamored with it. When I started thinking first of what needs I had in my class and whether technology could meet that need, rather than how I could use these wonderful toys, I had fewer problems. From that point, technology started meeting my students' learning needs as well as satisfying my own interests.

Electronic communication should be driven by effective pedagogy. Roger Johnson, one of the gurus of cooperative learning, frequently says that cooperative learning without a well thought out structure is just another seating plan. Electronic communication without student learning in mind can be just one more technological hoop for students to jump through. The reason that I have not used multimedia in my classes is because it doesn't meet a particular need I have, and I am concerned that a multi-media presentation won't actively engage the students. If my subject matter were more visual, such as Anatomy and Physiology, it would probably be more useful. But even then, I would want to put the control of the mouse in the hands of the students--it's too easy for the instructor to get wrapped up in the presentation, in which case the "high-tech classroom of the future" becomes just another chalk-and-talk, minus the chalk dust on the back of the professor's coat at the end of class.

One of the forces working against effective pedagogy is the fact that campus electronic communication systems have not been designed with effective pedagogy in mind. Most computing staff are not trained in effective pedagogy and tend to encourage a usage of the system that is not pedagogically sound. Structuring a pedagogically effective use of electronic communication may require extra steps, but the extra effort is worth it. For example, electronic communication is designed to encourage simple, immediate communication. Creating, editing and finally sending a file is more cumbersome than dashing off a quick E-mail, which is what the

system promotes. I gave an earlier draft of this chapter to a friend who teaches on another campus who uses many of the same programs as I do. One of her comments was, "Is my VAX system idiosyncratic, or do you think others also have the problem of not being able to save a message and go back later to edit it? We have to send it right away, so we don't get the reflective time." The fact is, I use the system she does quite often, and more reflective practice is possible, it's just that most faculty aren't aware of it because it is not promoted by computing staff.

Start with what you already use and know well. Even seemingly simple techniques have subtle nuances; mastering them can mean the difference between success and failure. So the best insurance for successfully using electronic communication is to start small, with a technique that you are already fairly comfortable with. Master it, then add other components when they seem to meet a need. A brief description of my use of electronic communication as a case study may be instructive. I've been using electronic communication with my students for six years. Each year, I've modified what I'm doing or added a little more that's done electronically, so that at this point in my class, much of the course—essentially, that part of it that is best conducted outside of the classroom—is conducted electronically. My use of electronic communication has changed over the years as I've thought about when it's worked well and when it hasn't.

Like many of my colleagues, my introduction to electronic communication was through E-mail. I loved it, and quickly adopted it to my classes. Some of my uses of E-mail worked fine, and others not so well. Like most things I do, I jumped into it with both feet and was sending out lots and lots of E-mail to my students. I was kind of like a little kid who first discovers hammers--I used it for everything, even when it wasn't the most appropriate tool. We liked the

opportunity to communicate individually over this new medium, but my students quickly became overwhelmed by all of the E-mail I was sending them, and the system manager wasn't thrilled with my clogging his precious hard drives, either.

Add a new electronic communication technology when it better serves your needs.

Discovering the electronic conference solved some of my problems and first got me to thinking about different types of electronic communication. Why did the conference work better than E-mail for some things but not others? It was clear to me from the outset that since it was more public, was organized hierarchically, and had more permanence, it was advantageous for material like syllabi and handouts. The electronic conference also allowed my students to carry on public discourse on issues raised in the course, which I thought was really neat. It turns out, this is the only part of the conference that I've retained.

If the conference was an advantage for syllabi and handouts, why did I abandon it for this use? The start of the next semester presented me with a problem--should I start a new conference, or keep the old one? Starting a new one meant copying all of the permanent stuff to the new one, keeping the old one meant I had lots of conversations that I either needed to delete or have an unwieldy huge conference. Worse, electronic conferences are designed to keep an historical record of the discussion, which means that it's difficult to replace an old syllabus with a new one. But if I wanted to make even slight modifications, that's what I had to do. Quite the dilemma.

Then I discovered the World Wide Web. The web provided me with the last piece of the puzzle I needed for efficient communication with my students, since it had all of the advantages of the conference for my more permanent material, but without the disadvantages. Material

placed on the web is permanent, but unlike an electronic conference, it is easily modifiable. So by using the technology I first knew, then adding new techniques as I became familiar with them, I was able to use each technique most effectively by using each for what it was best designed to do.

Choose the electronic communication technology that best meets your needs. What you need should drive which mode of electronic communication you choose. Many of the problems we have with electronic communication result from the inappropriate use of an electronic tool when a different one would be more appropriate. I ran into trouble when I used a technique inappropriately--trying to use E-mail, which is designed for small quantities of private communication, for a repository.

There are lots of inappropriate uses of electronic communication. A listserv is a derivative of distributed E-mail², but is being used primarily for public discourse--an inappropriate use of the technology. Anyone who is on a listserv will recognize that much of what gets posted should never have been--not all 4,000 people on the listserv need to know that Fred wants to know if Bob is ready for lunch yet, or that Mary thinks Mike is a jerk. Since listserves mimic E-mail, they are intrusive--they notify you that a new posting has arrived. Some people like listserves for this reason, but it's also a prime reason that they can be so irritating. In comparison, electronic conferences must be intentionally accessed, and people have a tendency to forget to do so, so the postings may fall on deaf ears.

² An E-mail can be arranged to reach many people simultaneously by sending it to a *distribution list* -- a listing of many people who share something in common (e.g.-all members of a professional organization.)

Electronic communication has a steep learning curve, and can be frustrating for students. Technology does not come easily to all. Many of your students are going to experience the deer-in-the-headlights effect when they first try to learn a program with which they are unfamiliar. Computers just spook some people, and you need to be prepared to be patient with them. It's easy to see where their lack of confidence comes from. Both you and your students need to understand that you have to play strictly by the machine's rules. Electronic communication technology is like an idiot savant--it is very fast and very good at doing one thing. But if you try to get it to do something other than what it wants to do, or if you do not do things precisely as it wants them done, it will simply refuse to work and become uncommunicative. And the task of the user is to figure out what they did wrong, and not do that again. For the neophyte, this can be both frightening and frustrating (every semester someone says, during our first training session, "I think I broke it!"). Electronic Communication may be a real transition in how your students approach their work. They not only need to learn how to use the technology, but they need to make a cognitive switch in terms of how they see their roles.

To cope with this potential problem, it is important to make sure your students have lots of instruction, that you be patient with their initial attempts to use it, and provide lots of support and encouragement. Our task is to get everyone up to speed as quickly as possible so that those who are technologically challenged are not put at a disadvantage by using this form of communication. I have some real technophobes in my classes, but they all get there eventually, and most all of them like it after a while.

Some Costs of Electronic Communication

Asynchronous and asyntopic does not mean anytime, anyplace. One of the positive points of electronic submission of assignments is that the students' work is done in a setting that is conducive to academic work--in front of a terminal rather than on the bus right before class. But what if it's a nice day, and the student wants to be inspired by the great outdoors as they write? She could always haul her subnotebook out with her--if she owns one. Another potential unlevelling of the playing field. Students who do not live on campus or go home for the weekend, if they don't have access from home, can also be excluded.

The medium requires that participants in the communication access the system; people have to log on to find out if there's anything there. Anyone who has become a somewhat frequent user knows how frustrating it is to send an E-mail message to someone who isn't hooked on the technology. And some of our students simply are not. They log on when they have to, but if they are not frequently reminded, they just don't participate in the conversation.

Electronic communication can be a time sink. It takes a lot of time and effort to learn electronic communication technology well enough to use it effectively. And to be most effective, students need to learn how to use it effectively, also. Where does the time come from for both you and your students? Can we reasonably expect students in our courses (especially if this is the only course they have that uses the technology) to put in the extra hours that it takes to learn it?

The time commitment with technology doesn't end with learning it and thinking through how best to use it. Electronic conferences, and especially web pages, require maintenance and vigilance to remain effective. If you have your class schedule as part of your course page, it needs to be updated as changes are made, or at least every semester. Other material can get out

of date even faster. Not only do you need to be vigilant about your own material, but hyperlinks sometimes disappear or go stale quickly.

One way of minimizing the problem of the increased time commitment is to use what you already know, or want to learn anyway. E-mail in particular is so ubiquitous at this point, and useful in so many ways, I highly recommend its use with students. Electronic conferences, since they have a look and feel similar to E-mail, are learned easily. If you are interested in encouraging your students to discuss course issues outside of class, conferences are the way to go.

Learning how to set up a course page on the World Wide Web, however, is a different issue. Frankly, at this point, I would only recommend it if it is something you really want to learn how to do. It has a steep learning curve, and in all likelihood is going to be very different from anything you've learned before. It has its own programming language, Hypertext Markup Language (HTML), and getting hooked into the Internet requires assistance (at least it did for me). In other words, if you don't find the technology inherently interesting, I don't think that it's worth the time and trouble at this point. If you are interested in learning the technology, though, it has considerable benefits. If you do decide to take the plunge, find someone who already uses it to hold your hand through the first few steps. Also, look at the source code of sites that you like--you can learn a lot from them. Like much else with computers, once you get past those first few bewildering steps, you will quickly get the hang of HTML and be off and running.

Electronic communication can be a time sink for students, also. One of the joys of the web is that the student is in control of how she navigates it. But that sense of control (and the intoxicating variety of places one can get to) can become addicting. A recent article in the

Chronicle of Higher Education reported that many campus counseling centers have begun offering programs for students "addicted" to the web, and many students' grades are falling due to the amount of time they spend on the Internet, surfing web sites and on "chat lines."

Using electronic communication may also require some shifts in how we view our task as well. Since our students are writing more, does it mean we need to read more? Yes. But does it mean we need to correct more? Not necessarily. I have come to view my students' writing on our electronic conference as primarily for their benefit, so even though I read it and comment upon it in class, I don't spend time writing comments on their discussions. And I've also come to spend less time "correcting" their pre-class writing assignments. I do give them feedback, but since their writing primarily sets up their classroom discussions, I've found that they simply need less written comment from me. I save my commenting for complimenting the really good points made, and redirecting the submissions that are really off the mark.

Is it true, or is it bogus? Publishing books and magazines is an expensive process, so it makes sense for them to be well edited and well thought out. Because of this, we have a tendency in our society to equate professional-looking with accurate. But publishing on the web is virtually free, so almost anyone or any group can become an electronic publisher. This clearly allows for greater access to publishing--another leveling of the playing field. But with the decrease in the cost of admission to the playing field, the web becomes the place where any demented but HTML-sophisticated crackpot can have his electronic soapbox look as good as anyone else's. It's tough to separate the wheat from the chaff. For example, there are many more sites extolling the reality of UFOs than there are for serious skeptical inquiry of the existence of extraterrestrial life forms. Students can easily be confused by all of the misinformation.

On the positive side, developing a set of criteria for determining what's of value and what isn't is a valuable skill, and helping students to decipher what is of value on the web helps them build that skill in a fairly benign venue.

Much of the context is lost. For all of the advantages that electronic communication brings in terms of the transmission of ideas, much of the content of personal communication is expressed through tone, body language, etc., which is missing with electronic communication. One doesn't have to look far to find out where the loss is. Ideas are expressed well with electronic communication--in fact, probably better than in face-to-face exchanges. But the interchange, the personal relationship that is a part of communication is missing with electronic communication. Much of the context of a conversation is lost. And when the non-verbal component of the communication can't be detected because body language and voice inflections are absent, people can be hurt by a "playful" comment that is taken seriously. Users of E-mail have tried to replace the "non-verbal" element of communication by using emoticons; all of those irritating little smiley faces that pop up in messages. How do you tell irony? Is it :-), or is it ;-)? Since this is a relatively new medium of communication, people are still trying to work out the rules—netiquette, if you will. Learning at least some of the basics of netiquette can save embarrassment and extra work.

Not everything is communicated well textually. Electronic communication works fine for students discussing ideas that are easily expressed alphanumerically, but some disciplines rely on symbols not contained on the typical QWERTY keyboard. For example, those in mathematics have difficulty with their students doing mathematical computations on the computer, although theory, discussion, hints, and explanations are still possible and useful.

Foreign languages that have different character sets also pose a special problem, especially with the text-based programs that are most widely accessible. Again, another trade-off.

A Few tips

The better you and your students understand the technology, the more useful it will be for you. The system you use no doubt has several subtle features; the better you know them, the more useful the system will be. I have several examples.

- Posting files rather than immediate mode postings (or what many E-mail programs call 'replies') make for more reflective practice. Learning how to use a mail directory efficiently makes the mail system a much more valuable filing system. Informative (and relevant) subject lines on E-mailings let you and the recipient find the right posting more easily. (This is especially important on a large electronic conference. A title for the posting such as "Posting #1" doesn't tell much, whereas "Why gambling is addictive" is not only more precise, but will entice more readers to read the posting carefully.)
Knowing how to transfer, extract and modify files gives power to the word processing capacities of electronic communication.
- The immediate mode response that most systems encourage discourages reflective writing, as is evidenced by the large number of intemperate postings common with E-mail. It is so ubiquitous that the phenomenon even has a name--flaming.
- Most systems can give you feedback on what you've sent. A frequent question I get at the beginning of the semester, especially from students who are nervous about using the

system, is "Did you get my homework?" I now show them how to make a simple modification so that they get copies of all of the E-mail they send.

- When replying, including the relevant text of what you're responding to helps the recipient--they may have been involved in lots of things since they sent you their posting, and a response that simply says, "OK" without a proper reference may be meaningless (or misleading!).

Know how to get help. Murphy's Law applies to electronic communication as well as to everything else. When using electronic communication, if things can possibly go wrong, they will, and at the worst time. Even fairly simple technology is pretty complicated and all kinds of things can easily go wrong. It's often very difficult to figure out why it's not working, even to those with some expertise. There must be some corollary of Murphy's Law to cover the use of electronic communication on the first day of class when you're all together in the new high tech computer public access area on campus. Everything that can go wrong will.

Anyone who has given a workshop on computer use, either to their students or to a group of faculty (worse yet!) has horror stories to tell. I gave a week-long workshop on cooperative learning last summer, and I wanted us to use an electronic conference to keep in touch with each other. We got over to the public access area, everyone sat down in front of the computer, we went through joining the conference step by step, and everyone was told the conference didn't exist. This is one of those points in your career where you really find out what you're made of. The error message was useless. So, we turned it into a cooperative learning exercise! One group finally asked me to look at the list of conferences in my directory and we figured out that I had named it slightly differently from what I had asked them to join. We tried the correct name and

things worked. Another time, my class had just arrived at the public access area when the mainframe went down. We used the time to brainstorm about how we could use electronic communication, and it was a productive use of our time until the mainframe came back up.

Official support can be very helpful--our system manager has been of great help in customizing the system to meet my needs (such as setting up IPAVLOV). But it may not be everything you need, when you need it. I've gotten a lot of valuable assistance from my colleagues. They often best understand what I'm trying to do, and may have already worked out a solution to the problem I'm experiencing. This is even more important when I've started moving into the cutting-edge technologies, such as using the web in my classes. A couple of my colleagues in Physics and Computer Science have helped me set up my web site and make it do what I want it to do.

Choose the most widely accessible technology. Electronic communication has the potential for leveling the playing field for many students, but lack of access to the technology can shut some students out of the conversation. Assuring access is a considerable problem. Simply put, some of your students will have greater access than others. Those on campus will likely have greater access, as will those with computers at home. A case in point--I've been working with the Weekend College program at another college for the past three years, helping to develop a pedagogy that can make a program in which students attend classes every other weekend an effective learning experience. The research is pretty clear. Students need to interact with the material with some regularity, and electronic communication is ideal for that. So we've been working to "electronicize" the classes, but we keep running up against the problem of access. Since the students' learning is primarily an "off-campus" activity, what do you do about the

students who do not have computers at home or at work? Can you require those students to make frequent trips to campus, especially if campus is a long drive? If you do, isn't that defeating the purpose of the program? And just those students whom you wish to serve are the ones who will be excluded. But if you don't require use of the electronic communication technology, aren't you missing one of the best tools you have at your disposal? The university could supply computers to everyone who needs one, but that may not be cost effective. This is precisely the sort of Hobson's choice into which technology can force us.

Access problems are exacerbated when you use the newest technology. There are some nice electronic communication programs that only run under a Local Area Network (LAN). The problem, though, is it excludes those not on the LAN. For example, if someone sends me an E-mail with a WordPerfect attachment, that's fine if I'm at school. I can't read it, though, if I'm at home using my old clunker 386 connected to the mainframe by a modem. Using a technology that is widely accessible, such as VAX Notes, is more inclusive, but the program doesn't have as many options, and is fairly idiosyncratic. Again, another trade-off. (I'm not sure that it's that much of a trade-off, though--not as many bells and whistles means simpler to learn and use.)

And there's another access issue that is becoming increasingly problematic--what happens when everyone discovers E-mail and the system can't keep up? I'm finding it harder and harder to access our mainframe from home; everyone wants to use it now. For me, one of the advantages of electronic communication was that I could do it from home. Every time I get shut out at home, I kick myself for all of those workshops we put on touting the marvels of electronic communication.

Towards the Brave New World

I'm an "early adopter" of electronic communication. I've used it in my classes for six years and my use has settled into a fairly stable pattern. I'm quite happy with how my students get their assignments off of the web, how they submit their assignments to me through E-mail, and how the electronic conference is getting my students to interact with each other outside of class. I do see some fine tuning needed with these, however. One trend I've noticed as I've thought about this chapter is that, over time, I've asked my students to take more control over their use of the electronic conference. I'll probably push them to take even more control in the future, especially as they become more sophisticated users of the system. Their spontaneous use is encouraging, but I can do more to get them to use electronic communication more and earlier, even for their own uses. For example, in my *Popular Delusions* course, students have a take-home final consisting of a single question that I give them the first day of class: "What do popular delusions tell us about human nature?" It strikes me that this is a question that they could be answering throughout the semester, publicly, with each of them working on their answer as a separate topic on the conference, and responding to each others' musings. Just a thought--I haven't worked out the details. It's just that this technology does open up other ways of doing business.

There are, however, some significant changes in my class down the road as a result of electronic communication. I want to address two of these:

I will lecture even less in the future. Currently, I spend less than half of my time in class "lecturing," but when I do, it is primarily to fill in what is missing, inaccurate, or confusing in the text. I believe more and more that transmission of information is not a good use of

classroom time. Class time is such a precious commodity, I want us to use it talking to each other, students in their groups, me listening and responding to what they are saying, etc. I don't want to waste time in class simply conveying information. Transmitting information on the web is not only a better use of time, it may be better pedagogically, too. The web may be superior to class presentations, which are almost completely oral, since the information on the web can be any combination of textual, visual and aural, and the web allows me to present the information in hypertext as courselinks.

I probably won't have a text in the future. I've never been completely satisfied with any text I used in my classes. So if I'm not happy with my text, why didn't I just write my own? Like many professors, I have thought about it--for 25 years! But it has always seemed like such a massive undertaking and I'm never satisfied with what I have to say (this chapter will be much better six months from now!). A textbook is such a static thing; you have to get all of that stuff together, and once it's printed, you can't change it. The major advantage that the web provides for someone like me is that my site is a work in progress. I can put up what I have, add to it when I can, and modify it when I'm no longer satisfied with something I've said. Plus, the book-of-the-web is an endless set of links to other things that I don't have expertise in. In short, the web as a publishing vehicle meets my style. I can start where I am now, and tomorrow's homepage is better than today's. My web site, as a compendium of the things I want my class to know, as well as links to other sites that I can create, will (hopefully) become my text in the future.

Is it Worth it?

For me, the answer, clearly, is "Yes." The flexibility electronic communications give me to interact with my students when I want, the opportunity to structure my students' interaction with the course material and each other better than I could before, the reflective interaction my students have with the material, and the opportunity to assess their learning better are all significant advantages to me. But these advantages come at some cost. I've had to put in the effort to learn how to use the technology effectively, devise an effective plan for its use, and be vigilant that I continue to use it to my students' advantage. I recommend its use to other faculty, but with the following caution.

Technology amplifies bad pedagogy. There's the old saying--to err is human, but it takes a computer to really screw up. Both the instructor and students need to have a solid understanding of how to use the technology, or electronic communication will be largely ineffective. Learning the technology well enough to use it effectively takes time, but simply learning the technology well is not enough. If its use is not grounded in a thorough understanding of cognitive development and a pedagogy that is driven by this understanding, the use of the technology will be frustrating to both instructor and students, will impede rather than enhance student learning, and will distance us from each other.

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Resources

I've included a few resources that might help you get started (or further advanced) in effectively using technology in the classroom. I've listed them in order of what I consider to be of most value.

- **The American Association for Higher Education**. AAHE (Suite 360, One Dupont Circle, NW, Washington, DC 20036) is probably the best single source for resources related to the effective use of technology in higher education. Among these resources are the AAHESGIT listserv, moderated by Steve Gilbert, Director of Technology Projects for AAHE, addresses issues of technology in higher education. Postings come at irregular intervals, but because it is a moderated listserv, they are of higher quality than is true of most listserves. It is probably the place to begin. It's free, and the discussions are insightful and current. Pre-prints of future *Change* articles on technology appear here first. To subscribe to the AAHESGIT listserv, send an E-mail message (with subject line left blank) to:

<LISTPROC@LIST.CREN.NET>

Then, send the following one line message

<SUBSCRIBE AAHESGIT yourfirstname yourlastname>

- ***Change, The Magazine of Higher Learning*** (1319 18th St., NS, Washington, DC, 20036-1802). In addition to frequent articles on the role of technology in higher education, the March/April, 1996, issue is devoted exclusively to technological issues.
- **Teaching and Learning Technology Roundtable.** This program is designed to help colleges design a coherent strategy for using technology on their campuses. It's probably not of great value to the individual faculty member, but if you are part of a campus effort on technology, it's a valuable resource. For further information, contact Ellen Shortill at AAHE via E-mail at this address:

<shortill@clark.net>
- ***T. H. E. Journal*** (Technological Horizons in Education, 150 El Camino Real, Suite 112, Tustin, CA 92680-3670) *T.H.E. Journal*, published monthly, focuses on issues of technology at all educational levels, but most of the articles are of relevance to higher education. Subscription is free to those who have some role in technology on their campus.

- ***Syllabus*** (Syllabus Press, 1307 S. Mary Ave., Suite 211, Sunnyvale, CA 94787-3018). *Syllabus*, published 10 times a year, features articles about the uses of technology in higher education. Subscription is \$24/yr, but free to those who have some role in technology on their campus. Syllabus also sponsors an annual conference on technology/higher education each year.
- ***Educom Review*** (1112 16th St. NW, Suite 600, Washington, DC 20036). *Educom Review*, published bi-monthly, also addresses issues about the uses of technology in higher education. Subscription is \$18/yr, but free to those who have some role in technology on their campus. Educom sponsors a large annual conference on technology/higher education each year.