How do you provide a legitimate educational experience outside the space and time constraints of the traditonal classroom? The book is one obvious answer. So is a traditional correspondence course. More recently interactive television has become a mainstay for many campuses attempting to deliver distance learning. Now we have the Internet.

This article will explore how this latest medium is the same as — and differs from — past methods. It will draw on the experiences of the author and colleagues in developing and teaching in UMass Dartmouth's unique "CyberEd" program which has used the Internet — primarily the World Wide Web and email — to deliver a wide range of course materials in an interactive format that encourages student/student and student/faculty exchanges both asynchronously and synchronously. This article briefly delineates the philosophical foundations of this program; the attempts to implement those foundation principles within the constraints of current Internet technology; anecdotal examples gleaned from the preparation and presentation of course materials and some conclusions that can be inferred from these experiences.

Abstract

Exploring the Special Communications Experiences of Online Education

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Introduction

CyberEd began at the University of Massachusetts Dartmouth because Robert Waxler, the Dean of Continuing Education, asked if we could use the Internet to deliver a course. The most critical point in answering that question came right at the outset when Professor Richard Upchurch changed our focus from technology use to educational goals.

Our basic goal boils down to providing access to a viable educational experience for persons whose professional and personal lives make it impossible — or highly inconvenient — to pursue a university education that follows a traditional classroom schedule.

The initial focus on this and a related subset of pedagogical goals set the base that we repeatedly return to as we continue to explore the delivery of classes over the Internet to students all over the world. It helped us avoid the pitfall of being dazzled by the new technology and trying to bend our needs to fit its limitations. Obviously you must do this to some degree, but it's a matter of focus and emphasis, and for us the focus has been on the education/communications goals.

We now have three semesters of experience behind us and have offered twenty-three classes in subjects as diverse as writing, music, design, personal finance, history, statistics, political science and astronomy.

While the subjects have been diverse, the philosophical base has remained constant and the communications problems are all the same, at least in their gross features. From these experiences we have learned to identify and cope with the communication challenge of this new medium. What we've learned is broadly applicable to a wide spectrum of instructional modes ranging from supplementing the traditional class with asynchronous communications or Internet resource exploration, to hybrid models combining CyberEd with other instructional modalities. In this article I explore what those

problems are, how we have attempted to solve them using existing Internet technology and what we have learned in that experience.

Let me say at the outset that these are primarily communication problems and most of them focus on using the written word in place of the spoken word. But the written word takes on a different form on the computer screen than on the familiar printed page, and instructional issues take on new dimensions in a medium that now more closely resembles a global brain than it does Marshall McLuhan's famous "global village."

Our educational goals are hardly unique. They are the same ones you will find in many traditional classrooms today. We want to encourage:

1 active (as opposed to passive) learning
2 student/faculty interaction on an apprentice/master footing
3 student exploration of diverse resources and viewpoints
4 student/student interaction to enhance explorative learning

Nearly all our courses are credit courses at either the undergraduate or graduate level, and nearly all are taught by the same faculty who teach the same course in the traditional on-campus classoom. Since this is an operational program with students who are paying for these courses just as they would any other, the first goal has been to deliver the instructional material effectively — not to prove that everything can (or should) be done over the Internet. So in some courses conventional media, such as textbooks, have been employed.

Developing CyberEd has been a collaborative experience. The pedagogical and technical foundations were established during 1994-95 by Professor Upchurch in using the Web in his on-campus computer classes. Other faculty involved have contributed their ideas as the system evolved. Al Deluca, a professsional writing graduate student, has helped greatly, assisting faculty and bridging the gap between educational goals and the new technology. John Brayton, an undergraduate student in computer science, has had the responsibility of keeping all the required software and hardware running.

For the purpose of this article, however, I believe it would be best to focus on the "Web Craft" course I developed and teach. Although it is a non-credit course, it has served as a testbed for developing a standard template and methodology that is now being applied to new courses for the

fall '96 semester. It works well as a testbed because the body of information to be conveyed ranges from objective coding of documents, to more subjective design issues, to a broadly subjective view of the long-range impact of this new medium.

The course grew out of a credit course on Web design offered in the fall semester of 1995 and team taught with Professor Upchurch (Computer and Information Sciences) and Professor Dietmar Winkler (Design). I brought to this team the skills and perspective of a professional writer. While the non-credit course focuses first on the learning of HTML, the mark-up language used to create documents for distribution and viewing on the World Wide Web, Web Craft incorporates many of the broader features of the earlier full credit course. Since this body of knowledge is compacted into seven weeks, students who complete the course successfully report that they spend at least ten to twelve hours a week on it.

The short course length and its obvious appeal to an Internet-based audience has meant there have always been plenty of students, and so I was able to offer the course four times over the past six months, revising both content and methodology each time. Class size has been larger than what we consider ideal for a CyberEd course, but because I was able (in fact, eager) to devote extra time to the course, I don't believe the large class size was a handicap. I put in time commensurate with teaching two smaller classes, although for what I believe are sound instructional reasons I left the actual class large. Enrollments have been in the twenty-five to fifty range and there have been some unexpected benefits to these larger numbers that suggest some strategies that might be applied to other classes. From a faculty-load standpoint, however, I would expect the average CyberEd class to be between ten and twenty students if meaningful faculty/student interaction is to take place.

This last point is important. Many people assume — and some institutions are going this route — that classes taught over the Internet can involve hundreds of students and one faculty member. This is not the basic thrust of CyberEd. We believe faculty/student interaction needs to remain high for effective education and that means class sizes need to remain low.

The communications challenge

One of the most difficult things about this new medium is to come up with genuinely new ways of applying its unique strengths. Some people may be able to do this with intuitive leaps. My own approach has been to start with the familiar, identify the key communications/education goals associated with it, then look for a way to accomplish those goals while solving our two basic problems relating to access:

1 How do we communicate with students who may be on the other side of the planet?
2 How do we create a shared class experience when students are all "going to class" at different times?

Once we have examined an element of the traditional learning experience we try to stay focused on the fundamental goals advanced by that particular activity. At the same time we try to avoid making the CyberEd experience slavishly mirror the familiar medium. That type of an approach is common when one technology replaces another, but it can lead to grotesque, almost comical situations, akin to using a horse to pull an automobile. The CyberEd experience is not the same as the experience of the traditional classroom. It cannot be, nor need it be. It can be equal to or better than the traditional methods in terms of delivering a valid learning experience.

That said, let's look at the Internet tools employed in the Web Craft course and see how they relate to traditional media, keeping in mind the underlying educational goals.

The lecture

The lecture is the most pervasive medium employed in academe today and in many cases it hasn't changed despite all the advances in communications technology during the past one hundred and fifty years. The face-to-face lecture allows the instructor to deliver timely core information content to the class providing emphasis and perspective. The communications dynamics in delivering the content this way include voice tone and volume, facial expression, the instructor's appearance and body language. More important is a bond that the instructor can develop with the class while interacting with individuals and the group. Feedback in the face-to-face environment is instantaneous (assuming the instructor is alert and sensitive to it) and so the lecture is a flexible tool which can be adapted on-the-fly to meet the needs of the moment.

Can you duplicate this experience in cyberspace? Absolutely not. Some would argue that with two-way, interactive television you could. I don't think that's true at all. Such televised lectures are only a crude approximation of the communications that takes place in the face-to-face environment. But more importantly, they are not one of the choices we have in CyberEd because they do not solve either of our major problems of space and time. This is because the two-way, televised lecture depends upon students all being in class at the same time. While it can span great distances, it really is only financially practical for linking two or more classrooms. Each classroom must be properly equipped at a cost of about $60,000 with dedicated transmission lines adding a significant usage cost. Students must be in attendance all at the same time for this delivery system to be effective.

CyberEd, on the other hand, is designed to increase access by going directly into an individual's home or office and using the same equipment (a personal computer and modem) and the same access (an ordinary telephone line connected to the Internet) that are being used by these individuals to solve an incredible number of increasingly diverse communications problems. Among other things, this means CyberEd students are usually physically alone when they "attend class." Part of our challenge is to take that essentially singular experience and turn it into a virtual experience where they share with others in the class.

So what is the CyberEd counterpart of a lecture? To lecture in CyberEd means to place a prepared body of information on the Web for students to access at their convenience. Although the technology will support limited multimedia use, this CyberEd lecture is nearly always just text and still images. I found that preparing such information for Web Craft was very similar to writing a small book. However, there were several significant differences that moved the activity for both the instructor and students in the direction of feeling more like a lecture than a book. Advantages of the traditional lecture that can be captured completely in this medium are that it too allows the instructor to deliver timely core information content to the class providing emphasis and perspective. The traditional lecture allows the instructor, most likely working from notes that have been used for years, to adjust the content at the last moment to bring in the latest

knowledge in a field. The CyberEd lecture is just as flexible.

I printed a copy of Bush's article which enabled me to sit in the Lazy-Boy recliner to read it as well as take it with me to read when I encountered down-time between meetings. Highlighting is a personal favorite way of taking notes as I like color and vividness. I also paraphrase in the margins.
I live at home — my computer lives at work. So I usually print (I fax and that stuff is expensive!) out small stuff and take it home but the big stuff I read on-screen.

While my Web Craft lectures used in the fourth class are fundamentally the same ones used in the first, I update them continuously. Publishing on the Web is not like publishing a book where it is usually only practical to make updates on an annual basis. The nearly instant revision possibilities, interlaced with the ability of students to ask questions, are what make this activity resemble the live lecture. It works like this.

My "lectures" are posted for students viewing each Tuesday morning at 8 am and students are given a week to interact with this material. They may do that in the same hour the material is posted, or any time during the course of the week, or for that matter, during the rest of the class. I review and revise the material the weekend before it is posted and sometimes these revisions take place just minutes before my 8 am "start of class" deadline.

But the process doesn't end there. The instructor delivering a traditional lecture may notice that the students are puzzled by the material. Observing this, the instructor may, on the spur of the moment, revise the lecture explaining the puzzling material from a different perspective using different examples. In CyberEd you have a similar opportunity over the course of the week. At the top and bottom of every Web "lecture" page is a hypertext link labeled "questions." When students click on this link, they are presented with a form that allows them to identify themselves and write their question. They simply click on the word "send" and the question is sent by email to the instructor.

This can take place in the space of minutes, but of course the instructor is not monitoring his or her computer twenty-four hours a day waiting for such questions. I do check my email daily and usually more frequently. I try to reply to such questions within two days at most. When I reply, I usually send the question and my answer to the entire class. This is done through an email list where a single message addressed to a single entity (in this case the address is simply "wc" for Web Craft) goes to everyone enrolled.

Since the original material is on the Web, why not reply on the Web and post your answer there? The reason

is simple. If you do so the students would never know about the question and answer unless they took the step of visiting the website every day and reviewing a page that held these questions and answers. Email is more direct. It is closer to "snail mail" or the telephone, in that it arrives at your home or office. All you have to do is go to the mailbox and pick it up. While this is an overt action, most systems alert a user to new mail messages as soon as they connect to the Internet. Even if the system didn't do this, Internet users are likely to check their email routinely, several times a day for it may contain a wide variety of communications, not simply information specific to the class.

Eudora, the email program I use, is one of the most popular on the Internet and its way of handling mail is typical of modern email programs. I have it set to check for new mail every six minutes. It does this in the background, so I don't know it is happening and can thus use my computer for other tasks. Eudora quietly alerts me if something new comes in. This has the convenience of a telephone, but is less intrusive because I can ignore the alert and look at the mail later. But I am put on notice that there's something new waiting for me.

The disadvantage to email is it tends not to be formatted as nicely as a web page and the message containing the Q&A about the class is likely to be mixed in with several other unrelated messages. This may make it difficult to find if students want to revisit it later, so we are now developing a system — and will implement it soon — where such messages are automatically sent to the entire class and with the same single action of the instructor, are also archived on the class website. Such an archive should be useful for current and future students reviewing the lectures and related class material.

One advantage to this process that should be obvious is that both the lecture and the Q&A are available at any time for the students to review. Students are not dependent upon their memory or note taking. While the material is always available online, it is also a very simple process for the students to save all this material to their own computer for printing or for reviewing at a later time. This means that they can review the "lectures" and Q&A without connecting to the Internet.

Is answering questions this way the same as a lecturer reacting to puzzled expressions and student body language during a class to adjust the content and style of their delivery? Of course not. There are distinct advantages to the classroom environment that can't be duplicated here, most obvious being all the silent (and sometimes unintended) visual and audio cues that are such an important part of face-to-face communications. But all those visual and audio cues have their downside. They can be noise that instead of enhancing the communications, interferes with it. Tone of voice, body language, dress and the obvious issues of race, gender and age prejudice are all either non-existent, or significantly less visible in the Internet exchange.

One of my favorite students in an early Web Craft class was Kerry Redshaw from Australia. Based on his writing style and other cues (I'm not sure what) I had developed an image of Kerry as a sort-of Crocodile Dundee at the keyboard. He was aggressive, bright and funny. I learned six months later in an email exchange that "he" was really a "she." I have to wonder if through some subtle combination of prejudices I would have viewed Kerry's words differently had I thought they were the words of a woman? Would that have colored my view of what was being said? We hope not, but I believe if we are completely honest with ourselves we will find that as much as we try not to prejudge people based on stereotypes ranging from sex, race and age to dress, profession and attitude as expressed in body language, these prejudgments are really a constant part of the communications process.

The Internet doesn't eliminate them. In a funny way, they may still be there in a sort of reverse engineering where, based on the scantiest of clues in a written communication, we form an image of an individual that incorporates assumptions about sex, age, race, profession or whatever. So I'm not sure that I agree with the popular saying that "on the Internet no one knows you're a dog." They may not "know" it, but they sure can imagine it! Of course, I still haven't met Kerry face-to-face. Kerry could still be a male who has decided it would be interesting to present a female persona on the Internet! Despite all this, I enjoy the highly focused nature of written communications on the Internet which I do believe gets rid of a significant portion of the "noise" present in face-to-face communications and is richer in "signal."

But there is more involved with this approach to communications. The written word, of course, has a long history. But in that history the written word is frequently a one-way street, as in the book; or a long-delayed, two-way street, as in the paper letter. Here the lecture starts out feeling like a book during the creation process, but unlike the book, it changes from being a product, to being a process where it takes on a new life as the readers interact with the author.

Writing is simply not the same as speaking. In the case of the "computer" writing involves the tactile interaction with the keyboard and the "written-in-sand" feeling of placing words on a screen where they can be changed instantly. (And disappear in a somewhat disconcerting manner when you close the software, or turn off the computer.) More importantly, writing tends to be more analytical — and less spontaneous — than speech. Writing on the computer, however, because of the easy editing capability and the ready availability of related tools, such as a dictionary, can be both more analytical and more spontaneous than the same words placed on paper.

On the computer we have a chance to repeatedly review and revise — something that is more difficult to do on paper and is nearly impossible to do well in spoken communications. For example, as I enter these words in my computer I frequently pause, select a word, copy it and paste it into another window on my screen that holds a dictionary. (This cut-and-paste procedure is quick, avoids the typing errors to which I'm prone, and serves as a check for typographical or spelling errors.) Before I had this capability I rarely consulted a dictionary. Such consultations were cumbersome and interrupted the flow of writing. In this medium they are a momentary diversion and while I seldom change a word as a result of this, reading the dictionary meaning of the word frequently helps me sharpen my focus and keep my next few sentences on track. (There's also a comfort in knowing the word I just used is the precise word I intended to use.)

Although this article is being written for print, the basic process is the same even when I am answering a written question for the student. But the written Q&A process does differ from the face-to-face one. When a specific question is asked of me in the course of a face-to-face lecture, I tend to answer it with less precision and certainty. That is

because I am not a walking textbook. I know my subject, but I also know what I don't carry in my head. In the face-to-face environment I usually feel compelled to give some sort of answer to move the process along. To answer: "I'm not sure. I'll look that up and get back to you in the next class," sort of defeats the purpose of synchronous communications. It's acceptable, but frequently not desirable. There's also an embarrassment factor — standing at the head of the class some instructors may feel they have to appear to know everything.

The asynchronous mode of communications used in CyberEd means that students never see me receive their questions and they don't expect instant answers. The embarrassment factor goes down because they don't see me go to an online resource, or reach for a book on the shelf above my computer, in order to answer their questions. The quality of my answer goes up (I hope) because I do have several choices. I can answer: from my memory, from other re sources, such as books or online documents or in the case of HTML coding, from first having tested my answer in the computer to make sure that it works! In the face-to-face environment some of the best questions may be asked by the shy student after class. It might be important for the class to hear both the question and the answer, but they don't. In the CyberEd environment, they do.

Paper is so handy and familiar; you can take it anywhere, it doesn't crash, you can scribble notes on it easily, you can read it in bed. . . Soon as I can, I'll get a printer! (Though it may be beneficial to be *forced* to become accustomed to working in multiple windows and so forth.)

Finally, sometimes questions in class can be distracting. They don't help the class. Quite the contrary, they divert the class, perhaps focusing on a side issue of interest to only one student. In CyberEd, when I receive a question that I feel will divert the class, perhaps containing erroneous statements that will cause confusion, then I have two choices — I can answer the student alone, not sending the Q&A to the entire class, or I can edit the diversionary information from the question and send only what I think is relevant to the class. This also is a great way to keep control of the rare student who appears to enjoy being disruptive. This process also encourages the timid student. When a Q&A goes to the entire class it does not include the name of the individual asking the question. I believe this anonymity encourages the shy person, or the students who think their questions are "dumb."

While this process is timely (within the week-long time frame of a CyberEd class) it also has an obvious permanence that is lacking in a face-to-face lecture. In a face-to-face class the question and answer may only become important to a given student long after the class is over and the exchange is at best a hazy memory. When that happens with CyberEd students, they can reference their email. If they are using a good email program, they can nearly instantly sort their mail by subject, sender, or date. They can also do a complete word search of it. But even these powerful tools aren't necessarily as convenient as being presented with a searchable archive on the Web where the archived questions can be closely linked to the "lecture."

Sometimes I will post a "lecture" to the Web on Tuesday morning and before noon a student will ask a question that makes me feel I have worded the "lecture" poorly, made a mistake or left some important information out. At that juncture only a small percentage of the class may have looked at the lecture, so there is a real advantage to immediately rewriting the problem portion, as well as answering the student's question.

Even when such questions come later in the process, they are easy to use to improve the lecture for the next class. Again, the archive is a rich resource for the instructor to review while revising a lecture. If a question calls for a revision in the lecture, you can make it. If, on the other hand, the question really provides an alternative way of looking at the information, you may want to create a hypertext link to the Q&A with a pointer that says something like: "if this isn't clear to you, read this." In this way, the information does not bog down the lecture for the student who is doing fine, but does provide some relief for the puzzled student.

This is the sort of thing experienced instructors do intuitively, reaching into their gray matter every time they repeat a face-to-face lecture. The difference here is that the Q&A carried over from one class to the next don't have to reside in the instructor's mind for intuitive inclusion in the process. (The older I get the more dubious I am that my memory retains anything close to all the relevant information.) It is a simple thing to associate the questions asked earlier with the revised lecture through hypertext so students can make the decision of whether they wish to explore them or not.

All of this obviously puts a premium on the ability of both the student and instructor to express themselves in writing. Is that bad? I don't think so. To begin with, we want students to learn how to write well and what better way to learn, than to regularly write and get feedback? (When students express themselves poorly in a question they will get notes back from me asking for clarification.) But beyond this, the obvious answer is that the face-to-face environment places a premium on the ability of both the instructor and the student to express themselves with the spoken word. I don't think you can say one is a better situation than the other. What we have to do to make either situation an effective learning tool is understand the strengths and weaknesses of the medium we are using.

While my focus here has been on the written word, it is quite easy for the lecture or Q&A to convey images, elaborate examples or even computer simulations. Images can be transferred either as email attachments or placed on the website where both instructor and student can see them. While the technical procedures for transferring computer files containing images and other computer files are within the grasp of the typical CyberEd student, the compatibility problems caused by students using different hardware and software are great, so this is done sparingly. What does happen frequently is the transfer of a simple text file, either attached to, or part of an email message.

For example, when students have problems with something they are writing I ask them to transfer either the entire piece, or at least the relevant portion, to me for review. (You can do this in a face-to-face exchange, of course, but it is difficult to do over a typical distance communication tool, such as the telephone.) When students write that they can't do something, I frequently write back and ask to see their attempt. They send it to me and I diagnose the problem and sometimes turn it into a learning experience for the entire class by circulating it on the email list. This could be done in a face-to-face class with paper copies of the student work and circulating it, but it is far easier to accomplish in this medium.

From the student's perspective

What's this all look like from the student's perspective? I've developed a small poll which I give at the start

of the fifth week of class to see how students are reacting to this new learning environment. The poll keeps changing, but it does give me some insight.

One key issue that is unresolved is whether it is more efficient and useful to read materials on screen rather than in print. The screen environment — besides saving trees — presents students with a searchable body of information that they can easily take notes from by selecting portions and copying them onto an electronic notepad or word processor. This is simple for students comfortable with a multi-window computer environment.

More important, in the Web the screen environment allows for the placement of hypertext links which encourages associative thinking. Done correctly, a Web lecture is much more than it appears to be on the surface for it can include relevant hypertext links that take students to resources created by the instructor, or created by others throughout the world. For example, in my lectures I include links to my own definitions of key Web terms used in the lecture. No one has to go to the library or dictionary to look up these words — they just click on the word to get the definition.

But I do this only in a few instances. For more general reference I include a link to an online dictionary of computer terms and abbreviations. This searchable dictionary is only a click away. In fact, with the new Java script technology you can embed a search form right in your own Web lecture page. This would mean that the top of the page, for example, might have a search form where the student can type in a word or phrase related to the lesson and right from the lecture page the data base search will be initiated. The student would then be presented with the results of the search on a separate Web page. This speeds up the process, eliminating a step or two. But even without it, the world of associated resources is incredible and rapidly expanding.

So the student's primary resource (the lecture), his or her notebook, and a host of secondary resources are all wrapped up in a single, on-screen environment. The placing of such secondary resources where the student is able to easily access them during the "lecture" speaks to one of our primary educational goals — to move in the direction of the apprentice/master relationship and away from the concept of the instructor as the font of all relevant knowledge.

These advantages of the on-screen environment are compelling, but CyberEd students are still likely to print out lectures and other materials, rather than read them on screen. Most CyberEd students tend to be in their mid-thirties or older and thus were raised and educated using print media. Here my Web Craft class is not the ideal sample because the course content tends to attract more sophisticated computer users than the other classes. Still, it is interesting to see how these students handle this problem. My unscientific sampling shows that the class is pretty evenly split between those who read everything on screen (and take notes by copying and pasting) and those who print out all the lectures and other relevant material. The anecdotal comments reveal that this is not a cut-and-dry issue. While the most common reason for wanting to print things is the convenience and portability of print media, there are many other reasons, including simply force of habit. On the other hand, one student who reads on screen does so because his computer budget just didn't include a printer!

I try to prepare my lectures for on-screen reading. What this means is that what might otherwise be an hour-long lecture gets divided into four to six subunits. I try to make each unit fit into roughly three to six screens of information. This is a compromise between "chunky" text that requires the loading over the Internet of a new file at the end of every screen of information, and presenting everything in a single, long file that requires extensive scrolling. The chunky text is more or less irritating depending on the download time involved in accessing the next screen. This varies with time of day, location and equipment, but lengthy text passages requiring much scrolling are arguably disorienting to the reader.

I printed out a copy and then read it over a blueberry muffin and a fresh cup of hazelnut coffee — I did not highlight or take notes — my food was enough to slow me down to "pay attention speed."
I read this article on screen, I am slowly trying to wean myself off of printing and then reading. The notes I took were divided between cutting and pasting into a word document and actually writing them onto paper. I try to save the paper to write down the things I want to think about when I am away from my computer, such as the questions to reflect on.

When presenting original information on-screen it's not difficult to adapt it to the screen environment. When merely porting over a print article that was written for print, breaking it up into even relatively large chunks can be more disorienting than presenting it as a single long file.

One serious distraction that many Web users complain about is not having an intuitive (or explicit) understanding of the length of a lecture or article when they see the first screen. We know the face-to-face lecture is going to go for

a certain time span established by convention. If we pick up an article or book the heft, thickness and number of pages is readily apparent. When we arrive at a Web screen that begins a lecture we don't know whether that lecture or article is 500 words, 5,000, 50,000 or 500,000. A single screen of information can be the "front cover" for a pamphlet or an encyclopedia and carries few or no clues as to which it is.

I try to attack this problem in my lectures by calling each subunit of a lecture a "page" (although the term is only roughly meaningful in the screen environment) and indicate that for this lecture this is "page 1 of 5" — or whatever. That's of some help, but we need better solutions and they are difficult to arrive at because traditional lengths, such as pages, mean little in an environment where the reader controls screen size, window size within the screen and the type font and size.

It is tempting to surrender to the printed page and to use the Web as a transport medium. If we do that, however, we lose those advantages of the on-screen environment. Of course, the good news is the students can have their cake and eat it too — and several of them do. That is, they skim material on screen, and if they feel it needs more careful scrutiny, they print it out. By doing so they haven't lost the advantages of the screen — it's still there for them to reference, copy and paste from, and pursue hyperlinks.

But the dual approach of on-screen and print use should be seen as a third alternative that creates yet another environment. Part of the power of the hypertext link is its immediacy. It encourages the kind of "associative thinking" that Vanevar Bush recognized in "As We May Think." This seminal article in the June 1945 *Atlantic Monthly* in many ways anticipated hypertext and the Web.

Hypertext, of course, has its downside as well. A few weeks into our first CyberEd class I realized that students did not know where a lesson ended. If the instructor simply makes a lot of links to related material, what do they intend? Are these links here as "FYI." Or are they an essential part of the lesson? If part of the lesson, how far should the student pursue them? If you send a student to another document on the Web, that document almost always contains other links to other related material. Your hypertext link has just moved the student from your lecture to the middle of the world's largest, most rapidly changing and most eclectic library. This can be

very exciting, for your students frequently go places you have never been and occasionally return with a real gem! But it is also unfair to send them on wild goose chases, so you have to be very specific about why you are including a link in your lecture and what use you expect the student to make of the linked material.

The major complaint I've heard about hypertext in the context of online education is that it encourages students to bounce around, never completing a thought. Done correctly, I feel it can do just the opposite — that is, encourage students to bounce around indeed and in so doing, complete a thought. But we have a lot to learn about how to use hypertext and the vast resources of the Web to good advantage.

For example, hypertext links inserted in the middle of a paragraph or sentence are a common practice on the Web. However, I feel they are almost always a distraction and are a perfect example of letting the technology lure us away from a more sensible approach. We seem to be fascinated by the prospect of linking to other resources and so, if it is doable, we do it. But I feel I have structured my lectures with complete thoughts. I don't want linked words in the middle of a sentence suddenly sending students careening off into cyberspace. I want them to stick with my thoughts as presented, then go off when I feel it is appropriate. This frequently leads me to include relevant links either in a margin paralleling the text, or at the end of the text. In so doing I am trying to say that this material is relevant, but supplementary. Where the material is genuinely meant as a part of the lecture, I will be quite explicit and write an instruction that says something such as "stop reading now, go visit this other page, then come back here."

This is part of my love/hate relationship with a medium that turns over unprecedented control to the reader/user. I think that the undisciplined use of hypertext links can be a distraction and that in employing them incorrectly we are abandoning our responsibility as educators/writers. There's a logical middle ground here, but I think it is going to be awhile before we determine exactly where it is.

My other problem with the embedded link is simpler. Such links usually appear on a reader's system in a different color, such as a bright blue or red. The words chosen to be highlighted thus are chosen because of their relationship to the linked material, not because they are of any other significance.

So this colored highlighting frequently puts an undue emphasis on these words and thus distorts the writer's message. But this is a small point. Taken in all its parts, I think the online "lecture" environment we pursue in CyberEd conveys current information in a flexible format. In using it we can quickly respond to student needs, just as in the typical classroom lecture. It has the advantages of hypertext, the readily available resources of the Web, and the written word to recommend it. I think these more than make up for what it lacks in terms of a real-time, face-to-face environment. Again, the two environments are not the same, but when you weigh the strengths and weaknesses of both there is a balance in terms of educational effectiveness.

Beyond lectures

Of course lectures are not the only thing that happens in a class — we've already mentioned spontaneous questions and answers, but what about class discussion?

Here I think a similar case can be made for the online course. Class discussions, as with the lecture and Q&A modes, depend upon the written word and the strengths and weaknesses of the written word already discussed apply to the discussion mode. But the discussion format heightens both the strengths and weaknesses already mentioned, since discussions tend to be more subjective and emotional.

Because of this, class discussions — especially those focused on opinions — can frequently be unfairly influenced by both positive and negative physical characteristics of the speakers. Here tone of voice, aggressiveness and a host of other factors are perhaps under more control than other aspects of the face-to-face class, may take on a new prominence. On the other hand, a CyberEd discussion takes place in writing. Again, something is lost in terms of spontaneity and there is a premium placed on writing skill, but something is gained in terms of the careful, more analytical structuring of an argument. It is easy enough to establish technical means — through email and/or Web forms — to provide a discussion forum.

In the Web Craft class I find our forum very interesting, but students are only encouraged to go one round — a round being a single posting in response to a question without a follow-up reply. That is, I give an outside reading assignment, then ask students to write an answer to one or more questions

relating to the reading. These are subjective and sometimes provocative questions and the answers are quite interesting.

Every student's answer is posted to the Web for every other student to see. Frequently this results in useful insights on material that had not occurred to me, and I'm sure hadn't occurred to all students. While at least half the students actively participate in these "discussions," (they're optional in my class) most students say they read what others have written. One of the reasons I like the large class is that it increases the possibility of getting some really valuable answers in this forum. I review forum answers and sometimes point out especially pertinent ones to the rest of the class.

Most of the people who write something for the forum do so during the week of any given assignment. However, the writings remain an open resource. Anyone can consult them at any time, I may reference some students' responses in a later lesson (with a hyperlink), and anyone can add to them at any time over the course of the class. Such written discussions can take place in email and they can go several rounds deep, but they really seem to lose punch and cohesiveness after a couple of rounds. In Web Craft there is only the initial posting. If students want to comment on what someone has said they are encouraged by an email link attached to the posting, to comment directly to the other student. I do not know how frequently this happens, but I suspect it is very infrequent.

I feel that the trade offs of the written discussion balance nicely against the pluses and minuses of the in-class discussion to make the CyberEd experience a different, but educationally sound one.

But if we believe students learn from students we should be able to do more. In Web Craft there is already too much happening and too little time. In other classes, however, we have done more. In Professor Raymond Dumont's professional writing course students regularly participate in peer editing. That is, students swap the initial drafts of their writing assignments and critique one another's efforts. The professor reviews both the final draft and the peer editing comments.

In the original Web design course we attempted to have students work as teams on real Web projects. This was a challenge for the students involved and we saw the usual indications that the workload for a team project was not equally shared by all students. Again, the students were limited to

written exchanges, but with a twist. With the team project some of these exchanges took place in real time — or at least in terms of the Internet, they were real time. To do this, one of the Internet tools we use is called "chat." In its most popular form (Internet Relay Chat) this is a "real time" exchange between two or more people carried out through typing words and displaying them simultaneously on the screens of all connected users. Superficially, this feels like its name implies — a chat. Because you know someone else is waiting to read your words, you tend to keep your writing informal and brief.

But a "chat" meeting is not a face-to-face meeting and should not be viewed as such. It should be seen as its own special form of exchange. It differs in several important ways, but let's just consider one of them. In a face-to-face chat the conversation does take place in real time and you don't get an opportunity to review what you want to say before the words are out and said. In an Internet "chat" you type your words and before the other participant(s) see them you may review and edit them. So while real chatting tends to be a two-step process — think, then speak. An Internet "chat" is three or more steps — think, type your words, review your words, edit what you have said, and then "speak" by hitting the key that sends your words to the other participants.

This process, of course, takes longer than a spoken conversation — even if you don't consider the delays caused by the technology itself. The resulting communications tend to be more analytical and less spontaneous. Some students are extremely irritated by the slowness of the process. My personal approach to a "chat" is to multitask — that is, I keep one eye on the chat window while using another window on the computer screen to do other things. What we seem to be learning is that "chat" is a good tool for informal communications among students in the early stages of team building and is also good for brainstorming. But when teams settle down to actually carry out a project they rely heavily on email and on posting drafts on the Web for all team members to review.

The good news here is that the technology which in the Fall of 1995 we treated as individual modes requiring separate pieces of software — the Web, email, chat, and FTP (file transfer protocol) are now integrated into a single piece of software. Even when a user chooses to use four separate pieces of software for these functions, the software itself is providing

integration between the modes. For example the Eudora email program update that was released in July of 1996 turns a Web address into a hypertext link. This means that an email message can reference something on the Web and all the reader of the message has to do is click on that link to review the reference in his or her Web software.

We started using an independent chat server, then switched to a chat mode that used the Web. This has its disadvantages. However, software being released as this is written combines the original chat software with Netscape to make it far easier to use "chat" to carry on an interactive discussion while using Netscape to view and reference material on the Web. FTP, a technical stumbling block for many students who have to use it to place files on our server, is now being incorporated into the Netscape Web browser with the same easy point-and-click interface.

As this technology continues to evolve I expect we will soon have a seamless, easy-to-use environment for several different modes of exchanging text and images. This will make distance collaboration in particular, and the CyberEd environment in general, even more powerful. We can use these varying modes now, but they require the student to be either a sophisticated computer user, or to spend too much time fussing with the technology rather than course content, so we do not always get the full benefit from them.

Multimedia

One thing we are not doing much of in CyberEd is taking advantage of the multimedia aspects of the Internet/Web environment. But we have not ignored other media entirely. The music course makes extensive use of sound files containing music created by the students and a chemistry course now under development will make use of video images of experiments. But these are the exceptions. It is practical to make such exceptions only if the exceptional medium being used is essential for conveying fundamental course information. Obviously sound is essential to a music course and much practical information can be conveyed if you show certain chemistry experiments. But sound and video are not practical at this time to simply enhance a written "lecture."

There are two basic reasons for this. First, the demands to create good video, sound or computer simulations are

far greater than the demands to create text and still images. The latter are easily within the grasp of any computer literate faculty member comfortable with a word processor and a simple graphics program. The second reason there is little use of these more advanced communications media is that today's Internet — and personal computers — can't handle them well. Video and most sound files (the MIDI files used in the music course are an exception), even when highly compressed, are transferred at an excruciatingly slow rate. Most personal computers cannot display these files without special software, and even then the motion in the video is jerky at best, and the image itself is usually presented in a window the size of a playing card.

But these technical problems are rapidly being overcome. Programs such as CUSeeMe, developed at Cornell University and enhanced by a private software company, now provide a way to inexpensively connect users at up to eight different sites with real-time audio, video, text and still images using this program and inexpensive video cameras.

However, over the typical 28.8 baud Internet connection the video transfers are at only a few frames per second (a simple flip book does a far better job at simulating motion), and the audio is distorted. An associated written "chat" program does provide effective "chat" communications and a "whiteboard" does allow persons not only to share text and graphics, but be able to simultaneously edit something displayed using the "whiteboard." This process is akin to standing at a traditional blackboard with one or more students and having everyone able to jump in, erase a portion of what's on the board and make changes.

Conclusion

We are still studying the results of the first year of CyberEd and our evidence of success remains largely anecdotal as reported by enthusiastic faculty and students in formal and informal comments. Indeed, the excitement of using a new medium is in itself a self-selective force that perhaps bring us students who are above average in ability and initiative. While this assumed high quality of students may tend to dampen the value of early conclusions, the quality of the work of students participating in CyberEd classes certainly appears to indicate that they are learning through this process.

For years we have talked about an ideal of life-long learning. This new technology may not only make that ideal a reality, but also make it more educationally effective. "CyberEd" in its objective of providing access to students whose personal and professional commitments makes attending traditional classes difficult, at the same time is tapping the vast potential of the Internet for sharing information. We usually think of Internet resources in terms of traditional library resources, but in truth it means we can draw on experts of many types whose thoughts and experiences were largely out of reach, or for various reasons have not been recorded anywhere. For example, in a course on the history of the Holocaust, the students were in email touch with survivors. Opportunities for cross-cultural exchange are significant.

I do not find the current practical restrictions of the new technology to the transmission of still images and text a serious constraint. Quite the contrary, I look with some trepidation on what we will do once our bag of technological tricks is increased to practically include sound and video. My guess is that in ten years multimedia communications from home to home will be inexpensive and commonplace. That worries me because I am afraid that when we have all this communication power we will then use the medium that is the easiest to use, and not necessarily the one that is best. We tend to assume that more input is better. We assume that a spoken word is better than a written one and that a spoken word along with a video image of the speaker is better than either.

But more data is not always better or more informative. It creates a different communications environment. When we really have all these tools to draw upon, I hope that we also will have learned to reverse Marshall McLuhan's axiom that the "medium is the message," and instead of letting the medium drive content we will first determine our content, then choose the medium which conveys it best. To do this we need a fuller understanding of the strengths and weaknesses of each medium and how different media influence the message.

On an even more fundamental level, we should all heed science fiction writer Arthur C. Clarke's warning: "Before you become too entranced with gorgeous gadgets and mesmerizing video displays, let me remind you that information is not knowledge, knowledge is not wisdom, and wisdom is not foresight. Each grows out of the other."

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