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ABSTRACT

This paper discusses issues and factors involved in making decisions on whether to use World Wide Web-based instruction. Five levels of Web-based instruction (no Web use, informational, supplemental, essential, communal, or immersive Web use) are discussed, and the following factors are identified to consider before making the decision to put classes online: (1) distance, i.e., the geographical proximity of the instructor and students; (2) stability of material; (3) need for multimedia; (4) need for student tracking, i.e., the desirability and degree of accounting for student interaction with and progress through the course; (5) number of students; (6) amount of interaction needed; (7) social pressures; (8) need for online references; (9) infrastructure and technical support; (10) comfort levels; and (11) access to the Internet and equipment. (MES)

Planning and Implementing Web-Based Instruction: Tools for Decision Analysis

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PLANNING AND IMPLEMENTING WEB-BASED INSTRUCTION: TOOLS FOR DECISION ANALYSIS

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This paper discusses issues and factors involved in making decisions on whether to use web-based instruction. Five levels of web-based instruction are discussed, and eleven factors are identified to consider before making a decision to put your classes on-line.

We were talking with some colleagues the other day when one made a comment about what free thinkers academics were. After all, the whole purpose of tenure was to protect academic free speech. But on closer examination, it seems that the free thinking associated with the academy does not carry over into considerations of technology for learning and instruction. In this arena, a herd mentality seems a better descriptor. Take for example the current rush in academia toward implementing Web-Based Instruction (WBI). How many of your institutions are scurrying as fast as they can to get courses and content on the Web? How many times in the last year have you engaged in a discussion of educational technology with a colleague where the topic of the Web has not come up? How many times have you engaged in that same discussion with an administrator where the topic has not come up? If your organization is like ours then the answer to the first question is very few, and the answer to the second is almost none. We in academia are not alone in this rush to judgment, schools and corporations are equally engaged in a frenzied drive to the Web-based cliff.

Granted, the Web is, or at least appears to be, the most significant development in educational technology, and for that matter communications technology in general, in our lifetimes. Bran Ferren (1996), executive vice-president of Disney's Creative Technology and Imagineering division notes that significant increases in communications bandwidth throughout history have been accompanied by significant changes in civilization. The most familiar of these is the tie between the development of the printing press and the renaissance in Europe. Ferren holds that the Web, or more generally the Internet, is the most recent significant increase in communications bandwidth. He suggests that society as we know it will soon become society as we have only begun to imagine it. So let us stipulate that we believe the Web is the future not of educational technology, but of education.

Still, that future is not yet here. The current rush to conduct education and training on the Web is at best ill-advised and at worst could create a backlash of the disillusioned masses when the Web in its current state fails to deliver the magic educational bullet everyone expects. We argue that the Web will be incredibly valuable for education in the near and distant future, and can be incredibly valuable for education today if used appropriately. Part of this depends on the technical future of the web, and part of it depends on how we implement the technology in education. While we may not participate directly in the Web's technical future, we do have a respectable say in its implementation in education. So among the questions we need to be asking is how can we use the existing tools effectively?

The Web is not appropriate for all things in all situations. Instead educators should examine their own needs and resources, and determine individually whether to employ Web-based instruction. This paper presents a tool for determining whether, and more importantly, to what level use of the Web is advised in a given situation. We present five levels of Web use and a variety of factors that should be considered to determine which level is appropriate. We hope that educators and administrators will pause in their headlong rush to the Web and consider these factors before adopting it as a learning medium. To paraphrase Aristotle "the unexamined course is not worth giving."

Contrary to the belief of the general populace, the Web is not a neat, orderly, well-designed place. Because of the way in which the internet was originally designed, it is out of necessity amorphous, messy, and chaotic. Thus, dividing it into categories can be a frustrating, counterproductive, and often impossible task. Fortunately, if we consider only aspects of the Web intended to be used for education, or perhaps more accurately uses of the Web intended to the educational, the task becomes more manageable. We suggest five levels of use of the Web common in schools, colleges, and corporations. These levels represent a continuum from basic occasional use to advanced continual use. They are: informational, supplemental, essential, communal, and immersive.

Level 0: No Web Use

To begin though, we offer a definitional Level 0. By default, this level implies no use of the Web at all. We believe that this level of Web use, though standard now, will eventually become as uncommon as level five. This transition will occur if for no other reason than to save paper.

Level 1: Informational Web Use

The informational level of Web use is the most common and easiest to manage. Informational web use consists solely of providing relatively stable information to the student. Typically this information is administrative in nature and may not convey course content directly. Students may access this information from time to time during the course for reference purposes, but would not be expected to review it on a frequent basis. Level one Web use typically consists of the instructor placing items such as the syllabus, course schedules, and contact information on the Web for student review. This sort of information is easily created by the instructor or an assistant, requires little or no daily maintenance, and takes up minimal space and bandwidth.

Level 2: Supplemental Web Use

The supplemental level of Web use is becoming more common, is more useful than the informational level, and is only slightly more difficult to manage than the informational level. The key difference between level two and level one is that the supplemental level actually provides course content information for the learner. As the name suggests however, this information is not critical to course; it is intended as an addendum to the core content. In this level the main part of the educational experience is provided in a classroom setting. Students may access this information frequently if not on a daily basis. Level two consists of the instructor placing course notes and other handouts on the Web. A typical example would be a PowerPoint presentation saved as an HTML document and placed on the Web for students to review later. Level two use requires a bit more technical know-how by the instructor, daily or weekly maintenance, and low to moderate space and bandwidth depending upon the nature of the material placed on-line. For example, a textual outline of course notes would require very little bandwidth compared to a 30-slide, graphic-rich PowerPoint presentation. One point to consider in using supplemental web use is the timing of placing the information on-line. One colleague found that if they placed lecture notes on the web before class that course attendance dropped significantly.

Level 3: Essential Web Use

Essential refers to the fact that the student cannot be a productive member of the class without regular web access to the course. The essential level of Web use is still fairly uncommon today. At this level the student obtains most, if not all of the course content information from the Web. At this level one might think, for lack of a better example, of the Web replacing the textbook in of course. (We suggest that this thinking, while convenient, is ultimately counterproductive to the effective use of the Web and education. It is indicative of a traditional, direct instruction approach to education and may limit more effective and creative uses of the technology. It also suggests that simply changing the media makes a significant impact on the course content.) Course content may be created by the instructor or compiled by the instructor, but is likely a combination of both. It requires the instructor to have good HTML skills, good instructional design skills, good graphic design skills, good information literacy skills, and ample course development time. If the instructor does not have these skills, the instructor needs access to somebody who does have these skills. Classes still meet face-to-face, but students are expected to use the web-based course materials extensively. Essential course material made available on-line requires that the students take a more proactive approach to insuring their own learning.

Level 4: Communal Web Use

The communal level of Web-based instruction is only just beginning to receive a widespread use. At this level classes meet both face-to-face and on-line. Course content may be provided in an on-line environment or in a traditional classroom environment. Ideally, students generate much of the course content themselves. This level goes beyond basic HTML used and requires the use of other on-line tools such as internet chat, bulletin boards, and one and two-way desktop video. This level requires both the instructor and the students to have good HTML skills as well as good technology skills in general. At this writing, on-line group collaboration tools are generally not as user-friendly and bug free as one might hope. Novice technology users might not be able to get past the frustrations of imperfect tools to get to meaningful interaction about the course content.

Level 5: Immersive Web Use

The immersive level is still quite uncommon today. While several excellent examples of it do exist, most organizations do not have the infrastructure needed to support it, nor do most instructors have the skills needed to implement it. At this level classes do not meet face-to-face. All of the course content and course interactions occur on-line. Note that we're not referring to the more traditional idea of distance learning. Instead, this level should be seen as a sophisticated, constructivistic virtual learning community. While it may include some degree of the traditional content presentation, student practice, feedback, and assessment practices found in traditional distance instruction, it is more generally comprised of learner-centered constructivistic pedagogies such as cognitive

apprenticeship (Brown, Collins et al., 1989), and anchored instruction (Bransford, Sherwood et al., 1990). At this level both instructor and students need a high level of technological expertise and sophisticated learning strategies.

In addition to a continuum of levels of web use, we've currently identified 11 factors that influence the desirability of WBI. While other factors exist, this set seems to play the largest role in determining whether and which level of WBI to use. Table 1 below identifies the factors. The remainder of this paper discusses each factor.

Table 1: Eleven Factors Influencing Decisions to Use WBI

1.	Distance
2.	Stability Of Material
3.	Need For Multimedia
4.	Need For Student Tracking
5.	Number Of Students
6.	Amount Of Interaction Needed
7.	Social Pressure
8.	Need For Offline Reference
9.	Infrastructure
10.	Comfort Levels
11.	Access

Factor 1: Distance

Distance refers to the geographical proximity of the instructor and students. We represent distance as a continuum ranging from a group of people close proximity to a population that is disbursed over great geographical distances. Obviously if the instructor and students are scattered over a wide geographical area, and it is difficult if not impossible for them to meet face-to-face, then on-line instruction is likely a good way to connect the instructors and students. If the students and the instructor can easily meet face-to-face then the Web will be of less value. This is primarily because of the amount of information that can be exchanged, and the interactions that can occur in face-to-face settings, dwarfs that which is possible over the Web. However, distance should not be the overriding factor. There are situations and circumstances in which even those instructors and students in close proximity can benefit from on-line learning.

Factor 2: Stability Of Material

Stability of material ranges from highly stable content to completely variable. For example, course content on anatomy is fairly stable: a patella is always going to be a patella. However, course information on web programming is incredibly dynamic, and can change literally overnight. If the course material is highly stable, then the Web is probably not the best candidate for the delivery mechanism. Most students would still rather have the portability and readability of a textbook over network-dependent, low-resolution screen text. In addition, highly variable material requires frequent and consistent updates by the instructor or students in the learning community. An advantage of using the web is that distribution of content, or updates to content, is the responsibility of the user. This can save both time in distribution, and money in printing, binding, and shipping.

Factor 3: Need for Multimedia

Need for multimedia ranges from low to high. Granted at this point the ability to provide multi-media at acceptable speeds depends on bandwidth, and the type of media being used, the Web can be an excellent tool for presenting multimedia content. It combines pictures, text, graphics, sound, and motion video seamlessly. In addition, it allows students to access this material whenever and as often as they need. Therefore, if the course requires or can benefit from multimedia, then the Web is a good solution.

Factor 4: Need For Student Tracking

The need for student tracking refers to the desirability and degree of accounting for student interaction with, and progress through the course. WBI like all computer-based training is well-suited for collecting data about students as they interact with a course. In addition to such features as on-line testing, it is also possible to track things such as amount of time spent, content examined, content created, and student paths through the content. Depending on how student tracking is done, one can examine paths through not only your web materials, but to external web materials as well. Examining this type of data, together with an analysis of students' mental states (i.e. using verbal reports as data, (Ericsson and Simon, 1984)) allows instructors to create a rich model of the learners.

Factor 5: Number Of Students

Though it may seem counter intuitive, the more students a course has, the lower the level of WBI that is appropriate. A fully immersive WBI environment as described in level 5 requires significantly more preparation time and classroom management time for the instructor than a traditional course. In our experience, a large part of this time comes from interacting with individual students. We believe that a single instructor cannot manage more than 10 to 20 students in this type of environment. For every additional 10 to 20 students the instructor should have some sort of teaching assistance. On the other hand, for courses with hundreds of students it makes more sense to distribute as much information as possible on-line. Therefore, for large numbers of students levels 1,2, and 3 are indicated. But levels four and five, in which more interaction is required, should be reserved for smaller classes. This is often times a struggle as you begin to think about implementing web-based instruction. Administrators who are pressed for classroom space and the need to generate more tuition related dollars often encourage faculty to take more students in on-line environments.

Factor 6: Amount Of Interaction Needed

By the same token, traditional didactic courses can benefit from levels 1,2, and 3 of WBI. But courses in which a more Socratic method is employed require the interactivity found in levels four and five. Email, chat rooms, bulletin board systems, and desktop video can be great facilitators of interaction. Interestingly, the skills which allow some students to participate more in face-to-face discussions may not be as valuable in on-line discussions. For the type of synchronous interaction available in chat rooms, we found that typing ability and speed has a monumental influence on participation The faster a participant can type the more likely that person is to make contributions to the chat. The more accurately a person can type influences the perceived credibility of the chat contributions.

Factor 7: Social Pressure

Although we feel it is the least pedagogically valid of the factors influencing the desirability of WBI, social pressure is the one that drives most decisions about using WBI currently. While social pressure has little impact on the educational outcomes of WBI, its role in the operation of larger educational systems is too significant to be ignored. Institutions and organizations that offer no opportunity for Web based instruction may find themselves viewed as old-fashioned and out of date. This finding could lead to a lack of credibility and loss of resources however undeserved it might be. It is important to balance the pressure to use Web based instruction with economically and pedagogically sound reasons for doing so. But it must be a balance of sound reasons, and social pressure should not be ignored merely because it is educationally insignificant.

Many argue that instructors should put their classes on-line regardless. It is an interesting problem, that we think can be explained in the form of an analogy. Imagine that you are a professor of molecular biology, and your department chair comes to you and says, "I want you to write a self paced textbook to take the place of your introduction to molecular biology. Now, I will pay you for a summer course to do this, but here is what you will need to do. You will need to research and write all of the text. You will need to proof read it, typeset it, print it, bind it, and take care of distributing it to your students. Oh, and by the way, it is possible that none of your students would have ever seen a book before." Most of us would politely pass on this opportunity to someone else, but more and more this is what is being asked of faculty members. The social pressure of putting classes on-line needs to be tempered with the reality of the resources available to put the course on-line.

Factor 8: Need For On-line Reference

More and more content is available on the web with each passing day. From real estate listings to meteorological information, good, sound, and reliable content is available on the web. In certain disciplines, it may be impossible to not use web based resources. For example in the study meteorology, one can imagine that instructors would want their students to access weather related sites on a daily basis. In an environment such as this, much of the content exists without the instructor creating it. This is a compelling reason for students to be on-line. For other types of content where on-line resources may not exist, it may not be the wisest idea to put the course on-line.

Factor 9: Infrastructure

The infrastructure of any organization cannot be overlooked when making a decision to use WBI. Consider for a moment that in levels 4 and 5 nearly all of the course is delivered via the web. If your web server is not robust enough to handle heavy traffic, or if your Information Systems department finds it difficult to resolve server problems quickly, WBI may not be a viable option.

There also needs to be a support infrastructure for faculty to help them get materials on-line in the first place. While HTML at its most basic level is mastered fairly easily, more complicated interactions and media presentations may require external support. Students and faculty both may enjoy working from home rather than on campus. The organization needs to provide appropriate technical support to make sure that technology failures play as little role as possible in the success of the class. Faculty need appropriate hardware and software support to work with the on-line environment.

Factor 10: Comfort Levels

Obviously faculty who have never seen the web have no business trying to conduct web-based classes without significant training before they begin. Students who do not understand either how the web works, or how to manage information on the web will become frustrated in web-based environments. The level of comfort one has in the environment will dictate how much one can get out of the environment. Students struggling to understand the nature of menus and submenus on a web page will likely spend more time learning how to be a student in the environment that the content contained in the environment. It is a matter of time, and time cuts both ways here. We need to move quickly to respond to pressure to have a web presence, and we need to give ourselves time to make sure it is done well, and that we are comfortable in doing it.

Factor 11: Access

Related closely to infrastructure and comfort levels, access refers to whether or not we can get to the materials. Instructors need to be able to work from the office and at home. If they travel a lot, they need to be able to work from the road as well. There needs to be access to both hardware to run the environment and software to develop and work within the environment. Access refers not only to internet access, but to equipment access as well. Every time we offer an on-line class, there will be students who enroll in the class with some type of access problems. Usually it is a problem with a web-browser version, or in modem speed. In some cases it is as dramatic as the student needing to invest in a new computer. Students need to be prepared to accept responsibility for access, surely. But additionally, instructors need to be prepared to address access problems, and the institution needs to be prepared to help resolve them.

Conclusions

We aren't sure if there are any real conclusions yet: what we have to say is based on experience, research, and analysis. It is also based on the state of web technology as of the writing of this paper. At this juncture in history, we can foresee the five levels remaining fairly consistent. While level 0 may cease to exist, institutions take on the responsibility of reaching level 1, and faculty for reaching level 2, the higher levels require more of a conceptual shift among faculty and student. This requirement may make widespread use of these levels of WBI a longer time coming.. The factors, however, are quite malleable. As technology changes, so will the factors. Keeping up with the factors will be difficult in traditional outlets. While this report was prepared in February of 1999, it may not make it to print until July of 1999. Four months in web-time may be an eternity. We need to be prepared to not only reap the rewards of web-based learning, but to manage the responsibilities as well.

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