Technology Support for the Classroom: Technology Alternatives to the Traditional Classroom

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ABSTRACT

As technology continues to advance, instructors in higher education are able to enhance course instruction. Course support tools can be customized to meet the needs of the instructor, including file sharing, grade tracking, communicating, and making announcements. Blended learning advances course enhancements to include integrated solutions such as links to electronic textbooks and assignments. The most advanced use of technology for educational purposes is found in the distance learning format. This paper describes various uses of technology to support classroom instruction. Examples are provided.

INTRODUCTION

Technology provides the means to extend the classroom, as well as establish alternatives to the classroom. Numerous types of technology aid faculty in directly communicating with students, providing material exchanges with them, and providing partial and full alternatives to classroom interactions. Personal and professional Web pages provide vehicles for faculty/student exchanges. Electronic mail provides a communication link that extends faculty/student exchanges to 24/7. Technology provides a means for blended learning capabilities consisting of classroom and cyber-space faculty/student exchanges (Gribbons, Hadidi, Urbaczewski & Vician, 2007). As an example, Blackboard provides professionally available links supporting faculty/student exchanges. Online courses and course supporting capabilities provide even more complete alternatives to traditional classroom experiences for students and faculty. The next section discusses the use of blended learning in educational environments. We provide an example that was used by one of the researchers for a recent class. Relevant aspects of electronic communication and file sharing are then explained, focusing on applications available at many universities. The discussion then ventures from technology supported traditional courses to on-line classes and distance learning. The paper concludes with an explanation of on-line testing and summary.

Blended Learning Classes

A recent development in our curriculum is the use of what has become known as Blended Learning (BL) classes. BL classes combine traditional lecture/lab classes with online access to courseware and online documents such as online books (Bersin, 2004; Garrison & Vaughan, 2007; Gribbons, et al., 2007). Another term for Blended Learning is Hybrid, used interchangeably at the University of Wisconsin, Milwaukee. Figure 1 illustrates the web page that one of the authors uses for a graduate class entitled, Project Management for Technology Professionals, URL http://tech.uh.edu/faculty/gibson/TEPM_Courses/TEMP_6301/TEPM_6301_Main_Web-page.htm.

The TEPM 6301 class provides a blended learning experience for the students. In addition to lecture periods and periodic review sessions regarding student activities, students enrolled in the class review documentation on various subjects and complete exercises on those subjects using courseware provided through a contract with a company called Skill Soft. The Skillport Files link on the web page on Figure 1 directs students to that support site. Figure 2 illustrates the University of Houston Skillport site on which they land after entering their logon ID and password. Note that the categories of electronic learning consist of online books (Books 24/7) Courses, Simulations, Express
Guides, Test Prep Exams, Mentoring, Skillbriefs, and JobAids. Thus, students receive a true blended learning experience through traditional classroom activities and electronic learning activities and capabilities.

![Figure 1: TEPM 6301 Class Web Page.](image1)

![Figure 2: University of Houston Skillport Web Site.](image2)

Figures 3 and 4 illustrate a page from the syllabus that assigns a particular course (unit) that students complete outside of class; note the course IDs assigned for a particular week in Figure 3 and entered for retrieval in Figure 4.
**Figure 3:** Skillport Weekly Assignments in the TEMP 6301 Syllabus.

**Figure 4:** Skillport PROJ0001 Course ID Retrieved Courseware.
Through the use of the Books 24/7 category at the Skillport site, students can be assigned individual chapters out of online books to bolster assigned textbooks with topics deemed important to a course, but excluded or insufficiently discussed in that textbook. In fact, the class textbook may also be one of the books offered to the students online at the Skillport site. Figures 5 and 6 illustrate how a particular online book designated as the textbook for a class can be retrieved for viewing.
Additionally, a course may not have a single textbook, but be comprised of certain chapters out of a number of books offered at the Skillport site. Figure 7 illustrates the first page of the syllabus for a course that one of the authors recently developed that consists of textbook material from a number of books offered at Books 24/7.

Figure 7: TEPM 6305 Syllabus First Page – Note Books Assigned.

The topics designated for a particular week in the TEPM 6305 class are covered in particular chapters assigned for reading in a particular book required for the course. The syllabus designates what chapters to read out of particular books for a particular week, as well as courseware or simulations that students also complete during the week. Figure 8 illustrates how weekly assignments on the syllabus for the TEPM 6305 class direct students to specific reading material for topics assigned for the week.
<table>
<thead>
<tr>
<th>Date</th>
<th>Agenda/References</th>
<th>Deliverables/Outputs</th>
</tr>
</thead>
</table>
| mm/dd/yyyy | **Class Meeting**  
 Individual Methodology/Technology Exercises  
 - Course Overview & Requirements  
 - Resources/References  
 - MS Project Overview  
 - Stillport Online Course and Resources  
 - Technology/Technology Workshop Exercise Overview  
 - Class Study Overview  
 - Read Chapter Introduction and Chapters 1-2  
 - Read Goodpasture Chapter 1-2  
 - Review PPT slides on Chapter Intro/Chapter 1-2  
 - Review PPT slides on Goodpasture Chapter 1-2  | Start of Class  
 Introduction of class members  
 Deliverables & Expectations of Class  
 Schedule MS Project Workshop Day/Time  
 Complete Methodology Exercises  
 Complete Tools Exercises |
| mm/dd/yyyy | **PM Methodology/Technology Field Trip**  
 Project Planning/Tracking Technology  
 Individual online coursework  
 - Read Chapter 3-4  
 - Read Goodpasture Chapters 3-4  
 - Review PPT slides on Chapter 3  
 - Review PPT slides on Goodpasture Chapter 3  | MS Project e-learning Workshop  
 MS Project e-learning  
 - Creating a Project (112009_10)  
 - Specifying & Assigning Resources (112010_11)  
 - Organizing and Managing Project Information (112011_10)  
 - Tracking and Reporting Progress (112012_10)  
 - Enterprise Project Management (112013_10)  
 Schedule MS Visio Workshop Day/Time |
| mm/dd/yyyy | **Class Meeting**  
 Individual online coursework  
 Individual Project Planning/Scheduling Exercies  
 - The Benfield Column Repair Project Case Study -  
 Chapter 1  
 - Read Chapter 5-6  
 - Read Goodpasture Chapters 5-6  
 - Review PPT slides on Chapter 5-6  
 - Review PPT slides on Cappello Chapters 5-9  | MS Visio e-learning Workshop  
 MS Visio online coursework  
 - Creating Diagrams with Visio 2003 (112014_10)  
 - Developing Diagrams with Visio 2003 (112015_10)  
 Complete Project Planning/Scheduling Exercises  
 MS Project Task Completion Report |
| mm/dd/yyyy | **Project Graphical Modeling Technology**  
 Individual online coursework  
 Individual Graphical Modeling Exercises  
 - Case Study Project Work  
 - Read Chapter 7-8  
 - Read Goodpasture Chapter 4  
 - Review PPT slides on Chapter 7-8  
 - Review PPT slides on Goodpasture Chapter 4  | Complete Project Graphical Modeling Exercises  
 MS Project Task Completion Report  
 Schedule Financial Estimating Workshop Day/Time |
| mm/dd/yyyy | **Class Meeting**  
 Individual online coursework  
 Individual Financial Exercises  
 - Benfield Case Study Project Due  
 - The Strategic Project Control Initiative Case Study -  
 Chapter 2  
 - Read Cappello Chapter 12  
 - Review PPT slides on Cappello Chapter 12  | Completed Benfield Column Repair Project  
 Case Study Due  
 Introduction to Finance (FIN0144)  
 Making Budgets Work (FIN0842)  
 Financial Risk Management (FIN0216)  
 Financial Estimating Workshop  
 Complete Financial Management Exercises  
 MS Project Task Completion Report |

Figure 8: TEPM 6305 Weekly Reading Assignments from Designated Books.

Figure 8 also illustrates how wide-spread the blended learning experience can actually become. Note that in each week, a class lecture/laboratory period can be indicated or individual or group student assignments can be designated.

**COMMUNICATING WITH STUDENTS**

Communication involves both senders and receivers. By design, electronic communication enables rapid and reliable transmission of messages. One of the most familiar examples is electronic mail (e-mail). E-mail is common in business, education, and social environments. Ease of use has contributed to the ubiquitous nature of this form of communication. But, there are many obstacles that can dilute the effectiveness of electronic communication. The characteristics that make e-mail an attractive tool also lead to an overabundance of message traffic (e.g. Hershkowitz-Coore, 2005; Burgess, Jackson & Edwards, 2005). Too many email messages lead to confusion and reduce the efficiency of the communication medium (Marchewka, Liu, & Petersen, 2003). In academia, for example, students are forced to search through their entire list of messages for a single class assignment. This is because messages pertaining to a particular course are interspersed with their personal correspondences. The usual lack of organization in directory structures contributes to the chaos. To assist the user, “Find” and “Filter” tools are included with most e-mail applications, but they are not used routinely (Roussinov & Zhao, 2003). Searches are typically performed manually, by scrolling through the index of stored messages.
Another complication is the inability to receive e-mail messages. On many campuses, students are limited to a finite level of digital storage capacity. Once the student exceeds that threshold, all incoming emails “bounce”, meaning the message does not reach its intended destination. The sender receives notification of the failed attempt, but since the mail was not delivered, the receiver is often not even aware of the lost message. An alternative mode of communication is then required to share the information.

A common complaint expressed by university students is poor communication from their instructors. This section outlines a number of solutions and alternatives to e-mail that can facilitate communication in the educational setting.

**File Sharing on a Centralized Server**

Faculty members generally adapt to the technology architecture and infrastructure available at their universities. They might provide recommendations on applications or hardware, but are often dependent on the institution for implementation. For instance, client/server architecture allows instructors to work locally on their personal computers but store files remotely on the network server. Benefits include the convenience of creating backups of stored data, sharing of information with other users, and managing security at multiple tiers of the architectural framework. Also, a centralized server provides access to files without clogging e-mail inboxes. Rather than attach a file to an e-mail message and send it to the course list, students can be granted access to course folders with privileges determined by the instructor and maintained by the system administrator. In other words, students might be given “read only” rights to a course folder in order to extract instructions, or they might be able to upload assignments to a submission folder. This is particularly useful when files are large.

The computer framework used by the university of one of the researchers is set up as follows: The common drive (Q:) is available to faculty, staff and students of the school and maintained on the network server. Students have read-only access, but faculty members have read/write privileges to course folders. The exception is a separate folder created for students' electronic submissions, providing a repository for uploading assignments. Students also have individual folders on a separate drive (H:) where they can save files on the network. This permits the sharing of files based on specific criteria related to user profiles. Some students prefer to pull information from the network whenever they desire. This framework supports autonomy of system users.

The actual directory structure within the course folder is controlled by the instructor. Logical organization of folders for the course makes the retrieval of information easier for students. Time invested planning the overall structure proves beneficial during the semester. Packaged software created to support academic instruction is also available. An example is described in the following paragraphs.

**ELECTRONIC LEARNING/EDUCATION TOOLS**

What would be the ideal electronic tool for instructors? It would have to facilitate communication between students and instructors, contain a repository for uploading assignments electronically, link to Web pages and documents, ensure a secure environment to protect privacy, incorporate a scheduling device to plan activities and meetings, provide for real-time chats, and distribute online surveys or quizzes, all over the Internet so it is available 24/7. Use of the Internet and Web services ensures platform independence for accessing course materials (Venkatraman, 2004). All of those features, and more, are present in the most popular application currently used by academic institutions in the U.S.; Blackboard.

“Our role is to improve the educational experience with Internet-enabled technology that connects students, faculty, researchers and the community in a growing network of education environments dedicated to better communication, commerce, collaboration and content. Formed with this vision in 1997, Washington D.C.-based Blackboard Inc. is a leading enterprise software company for e-Education. Blackboard offers a complete suite of enterprise software products and services that power e-Education programs in our primary markets – Higher Education, K-12, Corporate/Government and International” (Blackboard, 2008).

As noted above, reliability is a major concern. Students and instructors expect the system to be available at all times. Any disruption in service prevents information from reaching its destination, and creates an obstacle for learning to occur. Therefore the success of these application suites depends on user satisfaction and reliability. Universities
invest a significant amount of resources (e.g., financial capital and technical support) in implementing and maintaining the tools. For instance, a medium-sized Midwestern university spends approximately $28,500 annually to license the Blackboard software, not including the dedicated technical staff members and incidental costs included in the total cost of ownership. With the recent upgrade to Blackboard CE, all faculty members will be required to submit student grades using the course software. To promote use of the application, technical resources, support services, and training are provided by the university. Additionally, technical assistance is available from the vendor, when necessary.

Instructors within the same university often use different features, tailoring the application to individual needs. Many instructors use the basic functions of maintaining a calendar, updating an electronic grade book, posting the syllabus and various documents, and creating hyperlinks to other Web pages. One of the researchers uses Blackboard to enhance the learning experience in the classroom in a similar fashion as a traditional course Web page.

**Blackboard Classroom Support**

The course page on Blackboard can be modified to reflect individual style and preferences. For example, page “designers” (instructors) can choose to use default icons or insert their own. Designers can make changes or additions (Figure 9), and then switch to the Student tab (Figure 10) to see how the page will appear to students who access the page. Designers can also add a welcome message or announcements as text. The menu bar on the left side of the Designer Options (Figure 9) window permits the instructor to add links to documents, insert URLs for Web pages, edit or delete links, and modify the appearance of the course site. Individual items on the page can also be hidden from the students and revealed at a later date.

![Figure 9: Designer (Build) View of Blackboard CE Course Page.](image-url)
Other options available to the Designer relate to managing the course (Figure 11). For example, the instructor can maintain grades electronically (Figure 12) and make them available to the students. The students will only have access to their own grades when they are logged into Blackboard CE. Security is embedded in the application, protecting private information such as student identification numbers and grades.
Figure 11: Manage Course Menu.

Figure 12: Update Student Grades.
Surveys and quizzes can also be developed and administered using Blackboard CE. The instructor creates a bank of questions and assigns individual items to a particular quiz or survey. The page can be made available for a limited time period, designated in advance by the instructor. This step ensures that students complete the assignment before the deadline. The application can be used to grade the quiz and post the score on the grade sheet, automating the process.

Finally, publishers offer Blackboard course packs to supplement the use of many textbooks. These packs can be modified by the instructor, saving time and effort in developing a course page from scratch. These tools include functions that exceed the benefits of a static Web page. One of the researchers experimented with using an Internet-based course application to hold a purely electronic class session – a simulated “Snow Day.” A small subset of students was selected to “attend class virtually” on a pre-determined date. The outcome of the experience was mixed for those who participated, as explained in the next section.

Virtual Class Experiment

The procedures to be followed were communicated for two weeks leading up to the date selected. The instructions were reviewed in class and distributed over e-mail. The participants were instructed to log-in to the course site at the regular class time and enter the chat room. When directed, they were supposed to follow the link to a designated Webcast presentation on technology integration (Figure 13). After viewing the Webcast, they were told to complete an on-line survey and return to the chat room. As a precaution, the instructor directed students to return to the chat room at a preset time, regardless of whether or not they had completed the other tasks.

The experiment revealed some challenges that were not anticipated. Of the eight students that took advantage of the virtual class opportunity, two had trouble accessing the Webcast presentation. One of the students was using a dial-up connection, and was not able to figure out why the presentation would not synchronize. The other student realized that he needed to disable his pop-up blocker. He completed the assignment, but missed the chat discussion because he was still viewing the Webcast.

Other more generalized observations were sporadic student participation, unavoidable distractions, and uncontrollable constraints. First, some students who rarely responded in the traditional classroom environment provided relevant and insightful comments during the on-line chat discussion. They felt more comfortable communicating electronically from a remote location. Second, one of the students admitted exiting the discussion to answer the telephone. Another distraction was a fair amount of informal discourse and extraneous comments that were not on topic. Although this served to enliven the discussion, some participants felt it wasted time. Finally, the students and instructor agreed that typing responses in the chat discussion significantly slowed communications. The application did not provide a means of saving the log, so once a person left the chat and returned, the previous discussion thread was deleted. This proved frustrating for some participants.
Student Feedback

Following the exercise, the participants were asked to provide feedback. This student enjoyed the experience and thought the format provided instructional value. “I think I was one of the only people who's webcast actually worked but I enjoyed it. The webcast was very informative and I liked the slides on the right side to let us know the important concepts. We should have more snow days in my opinion.”

The student who provided the following response was clearly not satisfied. She was not able to access the Webcast, which caused a great deal of frustration for her. “First of all, I felt ‘off the team.’ I didn’t learn anything, but that could have to do with the video not working. Now that it’s over I feel like I have catching up to do because I missed the whole video, discussion, etc. I was frustrated almost the whole time. Also, if you try to go to another page in the WebCT you lose your chat box which was really annoying. I couldn’t do the quiz/survey thingy so I was lost on that discussion. I felt that a lot of time got wasted and it was really easy to get off topic in the chat room as well.”

The following statement sums up many “lessons learned” during this experience. “Although I had fun participating in my PJ's, I think that there are too many quirks with computers to be efficient. Maybe if we were all computer wizzes... Everything takes longer when we all have to respond and keep up.”

These last two quotes provide clear assessments of students’ observations. “Unless systems are pre-tested, the delivery will have to be limited to just online discussions. Our “Snow Day” had failures, or partial failures, for most participants attempting to view the webcast.” Although open to the concept of electronic learning, this student identified some basic considerations for any similar experience. “I think it's a good idea, IF you know how to use the tools. I had to change some preferences and stuff to watch the webcast, but I didn't mind having class online at all.”

Lessons Learned

Precision and organization are critical in presenting virtual instruction. The more details that can be worked out ahead of time, the more successful the experience will be for attendees. To add value, the instructor must evaluate potential contingencies and plan accordingly.
Pre-test the equipment and links whenever possible. Prior to this experiment, the researcher tested the Webcast hyperlink and registration process. However, since students connected to the session from a variety of locations and different computer systems, it was not possible to anticipate all problems.

Train the participants in advance. This would have been beneficial, particularly for the less technical students. Demonstrations of entering and using the chat room and accessing the Webcast link might have precluded some of the challenges.

Communicate in sufficient detail. Using multiple forms of communication proved helpful in this experience. The instructions were distributed in many ways. Students were also given instructions to follow in case they could not complete the tasks.

Have a “Plan B.” The contingency plan was actually necessary, since some of the students had trouble accessing the Webcast. Although they felt disappointed at not finishing the presentation and survey items, they were able to get some value out of the discussion. They were not totally “lost in cyberspace.”

Build in incentives for participation. Participants in this experiment had to qualify by meeting specified course performance criteria. Attending class virtually was presented as a desirable alternative to physically coming to class. However, more students might have opted to participate if the instructor had offered a stronger incentive.

Varying the activities was helpful in holding students’ attention. Simply substituting an on-line chat for in-class discussion would probably not have been as successful.

Lastly, it is important to allow enough time for transition between activities. Students need time to navigate to different Web sites, to contribute to chat discussions, to complete survey questions, and to comply with instructions. Time constraints can easily become frustrating for students as they attempt to follow all of the directions.

**ON-LINE CLASSES/DISTANCE LEARNING**

Technology has finally caught up with basic educational conceptualizations of distance learning (Stafford & Lindsey, 2007; Discenza, 2003; Vu, 2003). Providing courses to students physically removed from the campus, while maintaining high standards of performance, is an intriguing opportunity for academic institutions. Distance learning is designed to “overcome (traditional universities’) inherent problems of scarcity and exclusivity,” (Discenza, 2003: 9). But, is it for everyone? Porter (2004: 12) identifies some key traits of exceptional online educators: curiosity to discover new ways to reach students, flexibility in responding to students’ needs, and communication to share information with students at a distance. Although clearly advantageous, distance learning should not be regarded as a panacea for all challenges associated with the traditional course delivery approach.

From the institutions’ perspective, the three anticipated benefits typically touted as motivation for adoption of E-learning include: “1) to deliver instructionally sound learning programs to mass audiences at a fraction of the cost of traditional learning systems; 2) to empower learners to take more control over their learning experiences; and 3) to provide learning opportunities for wider audiences who have varied learning styles and require more flexible schedules,” (Rubenstein, 2003: 38). The costs would be reduced by dramatically increasing the student – teacher ratio and eliminating the expense of maintaining physical classrooms. For students, the attractions are 1) flexibility in scheduling their coursework; 2) opportunity to take courses from universities without the constraint of geographic location; 3) variety of course subjects that might not be offered locally; and 4) personal control over the pace of the instruction (Discenza, 2003). Unsuccessful attempts at distance learning often include electronic distribution of reading materials, unimaginative slide presentations, and multiple choice quizzes/tests. An electronic page-turning format leads to a high dropout rate (Vu, 2003). These dry formats create negative impressions with students desiring enhanced learning experiences (Porter, 2004). Students having bad experiences are less likely to try distance learning again in the future, and they will not recommend distance learning to their friends and acquaintances.

One major concern regarding distance learning is the educational outcome compared to traditional course delivery. More research needs to be performed to investigate this issue. Another challenge is that the development of course materials is very expensive (Rubenstein, 2003), particularly when they are highly customized (Vu, 2003). For the individual student, there can be dissatisfaction due to the feeling of isolation (Vu, 2003), computer anxiety and
Successful learning results primarily depend on the level of initiative shown by students. However, a common student complaint is the lack of timely response from the instructor. Clearly, the educational experience also depends on the dedication and attention paid by the instructor. If the instructor is not willing or able to devote sufficient time to address students’ needs, the transfer of knowledge will be negatively influenced. Essentially, E-learning should not be viewed as a time-saving method of instruction from the facilitator’s perspective. Instructors will find they are devoting at least as much time to their teaching as they would if they were delivering courses through the traditional classroom method.

Technologies

Depending on the actual format and content of the course, the following list of technologies can be used to deliver course materials and promote interaction: e-mail, instant messaging, teleconferencing, videoconferencing, chat rooms, Web presentation applications, etc. A typical E-learning course will be accessed over the Internet through a secured site. From the course site, students download lectures (streaming video is common), read instructions for upcoming assignments, obtain reading materials, and check the timetable/schedule for required activities. Instructors are able to communicate announcements and emphasize key points in a one-to-many delivery system (Porter, 2004). The technologies can be divided into two categories: synchronous communication and asynchronous communication. Synchronous communication occurs when individuals converse at the same time, regardless of geographic location (e.g., electronic chat rooms). By contrast, asynchronous communication occurs when individuals converse at different times (e.g. e-mail). Vu provides an excellent suggestion: “Avoid tools that isolate learners,” (Vu, 2003: 17). Essentially, a variety of technologies and educational formats are desirable in order to produce positive learning outcomes.

Internet 2, the combined project of the U.S. government, corporations and academic institutions, has contributed to the advancement of E-learning by improving the distribution channels (Internet2). Faster transmission speeds enable the adoption of a variety of educational formats, including streaming video (Templeton & Schmidt, 2005). Initial efforts at these innovations were generally unsatisfactory, with excessive buffering and broken links. The major constraints today involve dial-up networks and transfer rates for information. Downloading large digital files can still prove problematic for students using slower connections. Universities can choose to either develop their own course materials and distribution channels, or they can elect to outsource these activities to application service providers (Discenza, 2003). Some key vendors are discussed in the next section. As noted above, developing the materials in-house can be expensive. The advantage is that the instructors have more control over customizing the course materials.

Vendors and University Participants

Many colleges take advantage of the expertise of third party vendors for the development of on-line courses. A variety of specific tasks can be outsourced; technical support, development of course content, delivery channels, data storage, and marketing (Discenza, 2003).

University of Phoenix (http://www.uopxonline.com/) is the largest “virtual college”. They offer degrees in business, technology, health care, education, and social and behavioral sciences.

Peterson's website (http://www.petersons.com/distancelearning/code/search.asp) provides links to many programs from a single directory (Figure 15). This type of service allows prospective students to browse various programs, conveniently displayed and presented.
Figure 15: Screen Shot of Directory of Distance Learning Programs.

Kaplan College (http://www.kaplancollegeonline.com/) provides a number of programs in business, information technology, paralegal studies, criminal justice, and continuing education.

Global Education Network (http://www.gen.com/) is a provider of course content for American colleges like Brown, Wellesley, and Williams. This group supports professors in the liberal arts with online course development.

OnlineLearning.net is “one of the largest suppliers of online continuous learning education in the U.S.” (Discenza, 2003: 11). This site focuses on the continuing education requirements for educators.

With so many programs available, potential students have a lot to choose from. In order to select a program that fits their needs, they need to decide what discipline would best support their career goals, what tuition they can afford, and what they are looking for in an instructor/university. Interested persons should talk with current or former students to gain insight into the distance learning instruction offered and their overall experiences.

Colleges have difficulty convincing faculty to facilitate distance learning courses for a variety of reasons. First, faculty members are not willing to invest the time required to develop and facilitate online courses. Second, many instructors are not familiar with the technology needed to deliver the materials. The learning curve for facilitators can be quite extensive. Third, there might not be adequate technical assistance to run the course seamlessly. Fourth, they might not value this method of teaching, preferring to physically be in the classroom with co-located students. According to Discenza, “Teaching at a distance does require a different set of competencies,” (2003: 12). And finally, lack of institutional support is perceived to be a barrier to successful course outcomes, and must be corrected before faculty will participate. For example, release time would be a valued incentive.
Many faculty members already post lecture notes and PowerPoint slide presentations on-line and maintain course Web sites. These educational enhancements are useful precursors to delivering a course completely over the Internet. On an abstract continuum (Figure 16), basic computer tools and applications used to support the educational experience is on one side, and distance learning is on the other end of the spectrum.

Faculty members interested in facilitating distance learning should take a course in this format to experience it firsthand. Technical and pedagogical training and support are required during the development stage and while delivering the material. Special emphasis should be placed on ease of use for the faculty and students. To ensure successful results, materials should be accurate, relevant, and interesting. Although difficult to implement, the educational design should promote active learning, not passive ingestion of course materials. Many resources are available; the challenge is to adopt applications and tools that fit the needs of the participants, focusing on delivering value to students. However, successful implementation of any solution will depend on adequate project management by the information technology department (Johnston & Wierschem, 2007) and maintenance of the technology beyond the initial conversion stage.

**ON-LINE TESTING**

In addition to using technology to enhance the sharing of information and files in classroom instruction, student learning can also be assessed electronically. Corporations use electronic testing in hiring prospective employees (e.g. Beal, 2004; Mooney, 2002) and for promotion decisions (e.g. On-line Testing, 1999) in order to reduce travel expenses (Bray, 2004). Gibson, Tesone and Blackwell (2001) suggest that instructors should be creative in their use of on-line testing. They caution professors to anticipate that students will be using books and notes, along with other resources, while completing tests electronically. “Tests, therefore, must aim at the higher levels of comprehension, i.e., analysis and application,” (Gibson, et al., 2001: 33).

In selecting an application for Internet testing, it is important to determine what material will be included: “hard skills (i.e. proficiency in a particular kind of software) or basic knowledge (i.e. problem solving, communication skills, etc.)” (Mooney, 2002: 45). Security and privacy are also key concerns that must be addressed by the instructor. Only authorized students should have access to the examination. Some type of authentication procedure is generally required so that only appropriate individuals are identified and granted necessary privileges. Rapid or immediate feedback is often desirable, but must be consistent with the goals of the evaluation process. In other words, feedback often needs to be delayed until all students have completed the exam to avoid the appearance of cheating.

Some third party on-line testing options are designed to support “Authoring Software” (Mooney, 2002: 46). These services convert questions to meet the format of the application, and make the exam available by hosting the instrument on the company’s website. Fees vary based on factors such as types of services required (e.g. test development), number of people being tested, mode of distribution (e.g. Internet), etc. These types of testing solutions can be relatively expensive. A practical and convenient alternative is course support software discussed earlier. Blackboard has testing features included in the software suite. Instructors can create a bank of test questions (or use questions provided by the textbook publisher). Figure 17 shows a screenshot of the designer options for creating and administering a quiz. A variety of question types is supported including multiple choice, matching,
true/false, and short answer. Instructors set the availability dates and determine specific details regarding the distribution of test results.

![Figure 17: Example of Electronic Testing Page in Blackboard CE.](image)

A benefit of on-line testing is the flexibility it affords students. They can take a test at their convenience, freeing class time for additional instruction and active learning. Also, the automated grading function can be a time-saving benefit for instructors. Scores can be directly posted in the on-line grades spreadsheet, allowing students the opportunity to track their progress during the semester. This simple procedure transfers the notification of class performance from instructors to the students, switching from a push to a pull approach. Students are encouraged to check their scores throughout the course, thereby improving communication. However, accessibility and reliability of the system are important to the students. Instructors should monitor the testing interface to ensure availability, and students should inform the instructor of problems as they occur.

**SUMMARY**

As discussed and illustrated herein, technology can be used in various ways to enhance educational experiences. Educators can use technology to disseminate knowledge, study assorted phenomena that exist in reality, illustrate aspects of diverse practices, demonstrate various aspects of methods used to complete tasks or analyze outcomes, as well as teach students how to use assorted technologies. Technology has become as commonplace as writing instruments and writing surfaces in the quest to educate people. In fact, technology often replaces traditional writing materials as more advanced educational processes unfold. It is not far-fetched to envision a day when technology similar to the type depicted in “The Matrix” motion picture facilitates the programming of people with instant expertise in a variety of skills. It may even become commonplace in the future.
REFERENCES


TEPM 6301 Web site, [http://tech.uh.edu/faculty/gibson/TEPM_Courses/TEMP_6301/TEPM_6301_Main_Web-page.htm](http://tech.uh.edu/faculty/gibson/TEPM_Courses/TEMP_6301/TEPM_6301_Main_Web-page.htm) last accessed 4/30/08.


