ONLINE TEACHING AND LEARNING – REFLECTION AND LIMITED PERSPECTIVES FROM A CASE STUDY

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1. ON-LINE TEACHING AND LEARNING – POSITION STATEMENT

Technical education is not a stagnant or even permanent concept. It dynamically evolves to meet the needs of the clients that are served. Constituent groups, including industrial and corporate entities, accreditation bodies, professional societies, government agencies, funding agencies, and even parents, are often the impetus for curriculum change for many institutions (Siller and Johnson, 2004). In the last several years, key trends in education have included incorporating design synthesis and improving social and communication skills for graduates. Moreover, students have increasingly begun to demand consumer-oriented teaching, as well as technology-based classes. Distance education is seen as one route to simultaneously accomplish these goals (Devon and Dorricott, 1996). These inclinations are not only occurring in the US, but they are also becoming popular internationally as well (Qazi and Ishaq, 1999).

A cursory search of presentations at national ASEE conferences during the last ten years yields more than 1000 results for papers discussing "online" education; "internet" educational topics yielded more than 1000 as well. Unquestionably, online modules, tutorials, and even entire classes are becoming ubiquitous in engineering and technology education in programs throughout the nation. Upon examining the many examples in the literature, it becomes apparent that the use of online education abounds, and ranges from basic introductory classes through capstone design courses, including purely theoretical/computational classes and even laboratory courses. Online education crosses all of the fields of engineering and technology disciplinary boundaries. Thus, it is not practical to review all of these examples here, but some of the most salient issues can be discussed.

Questions still exist regarding the effectiveness of online education. Many of the pedagogical issues have been discussed by Samples (2001), including the need for student-teacher interaction, problem-oriented coursework, real-world relevance, and student motivation. Effective online education cannot exist as a one-way flow of information from the instructor. For example, instructors should not just post their lecture notes as PowerPoint presentations for the students to read by themselves. Because the instructor has a direct impact on a student's motivation, he/she has a responsibility to utilize pedagogical techniques vis-à-vis each student's ability to learn. A key to online education is to address the variety of student learning styles. Kellogg (2005)

discussed these, and suggested that the use of online components can indeed improve student learning, even for traditional lecture-based courses, if they are implemented correctly.

Another issue for online education is student academic integrity and honesty. Colwell and Jenks (2005) discussed several key concerns, including unauthorized student teams, plagiarized papers and homework problems, outside help during online quizzes and tests, and use of prohibited information during online quizzes and tests. All things considered, distance and online coursework can be an effective route to achieving student-centered, technology-driven education. But, it is the duty of the instructor to design and implement the coursework strategically (Moore et al., 1990; Verduin and Clark, 1991). A fairly thorough review of online delivery methods, technical programs offered, and virtual laboratories is provided by Ibrahim and Morsi (2005).

During the past several years, engineering and technology departments have witnessed an explosion of college courses that are taught online. An examination of recent ASEE conference proceedings reveals that the number of papers addressing online learning has also registered an exponential growth during this period. As this method of course delivery is new for both the teacher and the taught, the effectiveness of this approach is not always well understood, primarily due to sparse data and lack of comparative studies. Currently, the momentum in engineering and engineering technology disciplines clearly appears to be heading towards making more courses available online as opposed to investing in research related to its effectiveness. Table 1 provides an illustrative example of trends in on-line instruction using BlackBoard (BB) across all colleges at Northern Illinois University (Krishnamurthi, 2006).

Table 1: Selected measures of use of an online learning system at Northern Illinois University

Parameter of Interest	***Spring 2002***	***Spring 2005***
Number of individual students using BB	7,695	18,406
Number of faculty/staff using BB for instruction	238	618
Number of course sections with BB pages	344	1,272
Number of enrollments in BB (students enrolled in several courses)	10,556	45,192

It is clear from Table 1 that online tools for instruction are being fast embraced by faculty and students alike and by all accounts described in the earlier parts of this paper, this is a national trend.

The authors have experience in the use of on-line course delivery systems, BlackBoard in particular. The authors are experienced in using BlackBoard to deliver an online course or augment traditional instruction. A key purpose of this paper is to focus on our hands-on

experience with this method of instruction including the delivery of a quality control course totally online.

2. HANDS-ON EXPERIENCE WITH ON-LINE SYSTEMS

The authors have used course management software for classes such as senior design, graphics communications, engineering ethics, fluid mechanics, research methods, and project management for several years. Justifiably, the initial impetus was to provide an online repository of course information (e.g., syllabus, lecture slides, course notes, example problems and exams, reference articles, additional readings, etc.) that students could obtain at any time, from any location. This accessibility was especially important for off-campus students (who lived within town) as well as those who lived out of town. Thus, online content essentially served as insurance in case handouts or materials were lost after class, or if the student could not attend class on a particular day. Over time, online delivery was augmented and utilized to relay vital course announcements (e.g., upcoming tests, cancellations, etc.) to the students, provide a means of asynchronous communication, provide a mechanism for automated examination, and even was used occasionally for virtual lectures (i.e., some lectures were held online only). It became apparent that the instructor could, during the course of the semester, save significant administrative time in the long run, even though substantial setup time was initially required. Several interesting student perceptions were also noted. Students actually began to demand online gradebooks, posted lectures prior to class, and online course syllabi. But, some did have difficulty getting used to online testing formats and virtual (synchronous) class interactions. This initial exposure to online learning technology however, provided the impetus and confidence to embark on the much more ambitious project of delivering an entire course online.

In 2005, the Division of Outreach at Northern Illinois University received a significant grant from the State of Illinois to deliver online courses. Proposals were entertained from individual faculty for development and delivery of courses and this provided the incentive to tailor an existing TECH 391- Industrial Quality Control course for online delivery. The initial phases of the project began in Spring 2005 with much of the development being subsequently completed in the summer of that year. The course was offered in Fall 2005 and the rest of the paper describes various facets of this new mode of instruction.

Northern Illinois University (NIU) operationally defines an online offering as a course in which at least 80% of the course content is delivered through Internet access. In this particular case, the entire course was taught online except for the very first class meeting where students received an orientation to the course. Considering that this mode of course offering was a new experience for many students, this orientation was a necessity. In all, forty-two students were enrolled; this number was considered high, at least in comparison with other online courses offered by the university at the same time.

The key objectives of the course were to identify the dimensions of quality in manufactured products including a study of quality costs and apply basic statistical tools to plan, monitor and improve quality. The main pedagogical challenges were to tailor the traditional presentations to spark learner interest and provide for interaction in the absence of live meetings. Multimedia

segments representing various facets of quality as applied in industrial case studies, audio-visual commentaries on the concepts of quality juxtaposed with real world examples, and demonstrated use of software tools to execute quality control operations through computer animation were some features of lesson development. In addition, an industrial case study developed under the auspices of the Laboratory for Innovative Technology in Engineering Education (LITEE) at Auburn University was utilized to teach the applications of quality function deployment (QFD).

Student – Instructor interactions were facilitated using both synchronous and asynchronous modes provided for by BlackBoard. The class was divided into groups of eight or fewer students each and discussion forums were set up to ensure that students could interact with one another and the instructor. On a weekly basis, students were required to provide their responses to items related to that week's topic. Three hours of live chat with instructor were also provided for on a weekly basis where students could join in per their desire and engage in synchronous interaction. Homework was regularly assigned and each week's topic culminated in a quiz. Briefly, the course was structured to promote and monitor continuous learning and active student participation. Requiring the students to demonstrate learning throughout the course on a continuous basis promotes student involvement which is essential towards realizing the course objectives. Equally important is ensuring timely feedback to the learners and the facility provided by the online system towards this end was exploited. Solutions to homework and quizzes were posted immediately after the due date had lapsed.

The industry case study dealing with an engine redesign project at Briggs and Stratton was introduced into the second half of the course. The original case study is much broader in scope; here it was condensed to address the QFD aspects of the project alone. Partial results of implementing this case study and other details are provided in another potential forthcoming publication (Balamuralikrishna & Rosentrater, 2006).

A survey of enrolled students revealed that a majority of students enjoyed the new mode of learning. Students were appreciative of the flexibility provided by online teaching in terms of time and place. The multimedia depictions embedded into the PowerPoint presentations were also much appreciated by the students. The age old concepts of "varying the stimulus" and appealing to a diverse group of learners (as in "learning styles") were driving forces throughout the course planning. Although there were several instances of "failure of technology" such as server breakdown disabling access to BlackBoard for some period of time, unable to download or upload files, or computer crashed halfway into the quiz there was no hesitation or resistance on the part of students in terms of adapting to the new classroom. A small group of students commented that on line offerings were not suited for all courses; they preferred conventional delivery in case of topics that were predominantly of an analytical and /or quantitative nature.

From an instructor's perspective, the flexibility afforded by online teaching in terms of time and place is attractive. Considering that this was a first offering of the course, the most challenging part of the process was the lesson planning and development. Also, it takes considerably more time to respond to student queries which can occur at anytime. Grading homework can be a slow process when larger files need to be downloaded, evaluated and then uploaded. It is imperative that instructors remain vigilant and continuously improve their understanding on what can go

wrong with computer technology. Also, as outlined in the earlier parts of this paper, broader concerns related to ethics, fairness in evaluation and academic honesty appear to assume greater significance and higher proportion in an online course offering.

3. SUMMARY AND CONCLUSION

Faculty use of online teaching tools, such as BlackBoard and WebCT, is growing at a rapid pace. But, a majority of users tend to use these systems in a passive manner, such as posting course handouts and grades. Web teaching technologies, though, have made remarkable strides in recent years, both in terms of available features and by becoming more user-friendly. Although opportunities for training and professional development are widespread across college campuses around the country, it is always challenging to induce changes large enough to cause an educational paradigm shift. While the answer to the question "Is online delivery of instruction better than, or at least as effective as, conventional techniques?" may not be satisfactorily answered for many years, there is little doubt that engineering and technology educators will increasingly use online teaching tools in one form or another, due to peer pressure, student demand, or for purely "moral and aesthetic" reasons**.

Online courses and teaching tools such as BlackBoard have added yet another dimension to the learning process. In terms of diffusion of innovations, this approach is still in its infancy as the larger population is yet to understand the technology, leave alone tapping it to its fullest. At this point however, there is little doubt that online teaching and learning has emerged at the forefront as one of the hot button educational issues of today. The concepts of "learn anywhere, anytime, and from anyone you want" and the much touted (but sometimes perplexing) ABET criterion of "lifelong learning" have become more practical in the Internet era. It is important that any student graduating in Engineering or Technology should have some exposure to online education as this method of learning is fast becoming prevalent in modern industry due to easily justifiable reasons of greater flexibility, time savings, and reduction in total cost of receiving training. The authors hope that this paper inspires all educators to consider the use of tools such as BlackBoard and its parallels to augment engineering and technology education. Further, it is important for engineering and technology instructors to share their experiences in converting a conventional course offering to the online format so that we may all move towards being part of a more productive and resourceful learning community.

** *The late Peter Drucker (a noted management expert) once used this phrase to describe the American stock market corrections of the late 1990s*

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