THE IMPACT OF INTERNET TECHNOLOGY ON AN ENGINEERING MANAGEMENT CURRICULUM

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ABSTRACT
A desire to meet 21st century student needs prompted the creation of a three-way distance learning delivery system at the University of Dayton's Department of Engineering Management and Systems. By using Blackboard Collaborate's Elluminate Live: live in the classroom, live simultaneously to cyberspace students at their distant locations, and recorded sessions available for viewing at a later time by all, the Department of Engineering Management was better able to serve the needs of the current graduate students enrolled in the Departments two degree programs. Although a prior observation study revealed no significant difference in student performance for these three modes of delivering course material, distant learning did create a heavier administrative load for the instructor. As remote students submit their homework via email, and ask questions via instant messaging during class or via email after class, testing and observation by the instructor of student's behavior to determine if concepts have been understood can become an issue. Equally, veracity of work submitted by the student, either exam or term paper, also become a point of question. Suggestions for combatting these issues is explored and presented. As technology continues to expand, distance learning practices too must continue to evolve to meet the needs of both the student and the instructor presenting educational concepts.

DISTANCE LEARNING WITHIN THE DEPARTMENT
Technology continues to spread throughout traditional education affecting the way that colleges and universities dispense sought after knowledge, The University of Dayton's graduate program of Engineering Management and Systems offers a distance learning option for its two master programs in Engineering Management and Management Science. As the department transitioned from a traditional graduate mode of chalk on blackboard education to an exclusively distant

learning mode of education, the department initially pondered the issues raised by the impact of technology on the process. In a paper published by The American Society of Business and Behavioral Sciences in 2007, comparisons were made of the three delivery modes the department was currently using to present courses material: traditional classroom teaching, live voice over the Internet to the cyberspace students while simultaneously recording the lecture for those students unable to attend classes. The findings indicated that our students found no differences in the mode of deliverance to our course material; that the in class lectures were just as effective as the distance learning methods implemented by the department. The same instructors taught the same courses during this time frame. Student performance was analyzed by scores on exams and responses to surveys. There was no significant difference among the test scores for the three modes of delivery, and the students were overwhelmingly satisfied with the instructors. Although there was a significant increase in faculty workload associated with Web-based distant learning courses, student learning did not suffer.

Our present delivery system has resulted from a bottom up approach to distant learning from our initial chalk on blackboard sessions. The department's campus program thrived during the 1990's and early 2000's with students working at Wright-Patterson Air Force Base in Dayton, Ohio, as well as the local General Motors Delphi Corporation plant. The courses were held during traditional graduate class times in the evenings for 15 sessions of 2 hours and 45 minutes duration once each week during a semester, with an additional week for final exams. Enrollment was relatively stable and almost all of the graduate students were employed. In order to better serve our students, the department moved the class start times to the noon and 4:30 PM hours so that the students would not have to lose time away from their workplace. As the department began to investigate the advantages of online distant learning technology, several faculty members initially travelled to various workplaces in Northwestern and Southwestern Ohio to deliver our curricula. As these targets of opportunity faded, the department proceeded to adopt distant learning as an equal delivery system to reach new and existing students.

Initially, during the transition process, The Engineering Management Department offered traditional classes in the classroom at the noon hour and then offered the same classes in the evening, but via distance learning methods only. The inefficiency of offering both modes separately led the department to combine the online with the traditional classroom setting and to record each session for those who could not attend at the scheduled times, or for a review by those who did attend.

The department's current mode of delivery is the combining of traditional classroom presentations simultaneously with our cyberspace students tuned in from their different locations while also recording each session.   Students may then download course material including articles, syllabus, Power Points, whiteboard diagrams, as well as the recorded lectures as soon as they are posted on the web site. The students can further annotate their slides as the instructor presents the lessons during class. Questions from the students are answered live when asked in class via a chat option, or the instructor may reply via email after class. This technology allows more material to be covered for more students at different locations than from the traditional mode of chalk-on-blackboard lectures in a classroom.

All students are required to take instructor-proctored examinations in the classroom except for those students residing outside of the local area, or outside of the United States. These remote students are given strict time limits for completing and returning the exams by either email, or by posting the timed exams via a Blackboard type repository known as Isidore through the University of Dayton's eLearning Center. With present technology, the department is able to send

the exams to the students whenever and wherever they are located with minimum time spent by the students away from their jobs.

TECHNOLOGY IMPACT ON THE EDUCATION PROCESS
As higher education moves toward more technology enhanced application of teaching, many universities are moving to implement or improve their distance learning methods. With distance learning components, students can be taught anytime and anywhere. The Department of Engineering Management at the University of Dayton uses Blackboard Collaborate's Elluminate *Live* system to provide distance learning options for the students in the department's two graduate programs, many of whom are traditional graduate students who have full-time jobs and families and are unable to attend daytime classes. The live but simultaneously recorded courses are presented twice a week throughout any given semester and many of the Engineering Management program students opt to use the distance learning method for their entire graduate program. The course content is mainly disseminated through annotated Power Points that are available to the students from designated web sites, as well as lectures which are recorded live during the class sessions which can be played back by the students within an hour following the class via the students University of Dayton Isidore account, which is a Blackboard type repository for syllabus, recordings, and links for students to post completed coursework.

The Elluminate *Live* system provides the user with a digital whiteboard for chalk talks, the ability to load Power Points, and other helpful aids to communicate with the instructor remotely, as well as enabling students to view computer applications such as operating simulations and animated graphics modeling. An example would be that a slide may show the results of a simulation with commands from a computer application in the note section of the slide. The instructor or the student could then execute the command to see how the results were tabulated. This technique involves both the concept of training and educating while allowing the student to become proficient with current technology. Whatever can be put on the computer can be shown live to the students: Power Points, Word documents, Excel spreadsheets, IThink modeling simulation material, Arena modeling software, MapQuest examples, etc.

INSTRUCTOR AND STUDENT BEHAVIOR
For the most part the students in the classroom are a group of nameless faces while those out in cyberspace are a list of faceless names. Students in the classroom behave as normal graduate students, but the instructor can only see the list of names of those attending in cyberspace. Competing for their attention via distance learning then becomes more demanding on presenting and questioning the student as to their understanding of the course content in order to best comprehend the students aptitude toward the course material. Polling the students on line provides immediate feedback.

Students are encouraged to form study groups in cyberspace to provide for their sociability, and for each to learn from the other. Students are encouraged to ask questions during class lectures, or to email questions to the instructor after class. The email questions after class however do not benefit all the students in the class, since several students may have the same question, and the instructor must decide how best to provide one students answered questions to benefit the entire class. This at times requires the professor to answer multiple versions of the same question to several students.

Students may view the course lecture and Power Point presentation in the classroom while tuned in to the session via their laptops, and if they have a headphone with a microphone, are able to ask questions and interact with the instructor and their classmates online provided their classmates have the same type of technology.

Seeking interactive discussion by questioning the students lessens the time for class presentation. There is almost always an awkward delay in getting a response from students in cyberspace and a similar but shorter delay from a question asked by a student in the classroom as the instructor in turn interprets the question to the internet students. As technology continues to improve, this technical setback will more than likely disappear. At times, it is suspected that some cyberspace students will sign in and leave the room, as when they are queried with a question, they do not answer. It is noted that some students claim not to have microphones, that they did not hear the question, or that they stepped out briefly or were reading the notes: a gamut of excuses for probably inattention. Instructors have to gauge the waiting time for a response, not knowing whether the student is present or heard the question or is thinking of a response. Students may use the chat board to answer instructor questions or ask the instructor questions, so the instructor must be adept at staying focused on multiple fronts, including being aware of the list of student chats among themselves in the postings, as well as reacting to the questions appearing in the chat board for general comment. If there is an awkward silence, usually the instructor will ask several students to help answer the question to shorten the silence.

Usually during the first week of class, almost all of the local students attend in the classroom. However, after about two weeks, about a fourth of the students have opted for cyberspace attendance and within another two weeks about a fourth of the cyberspace students (not necessarily the same) have opted for viewing the recordings. Class attendance in the three modes-in the classroom, via cyberspace, and via recordings-tends to stabilize throughout the remaining class sessions, with more gravitating to cyberspace or the recordings or in the classroom for review sessions just before exams. It is obvious that the students prefer the traditional classroom attendance initially, but prefer the distance learning cyberspace mode or recordings thereafter, either for convenience, or possibly away from the watchful eye of the instructor.

Although instruction and experience can be provided to the students, motivation cannot. Motivation must come from within each student, and can become a struggle for the instructor to keep the students moving forward. Sustaining sufficient motivation can be challenging for distance learning students as there is no guiding force to listen to each weeks posted class sessions, and many find themselves scrambling at the last minute to listen to several lectures and complete homework requirements. The graduate students in both degree programs within the Engineering Management Department are primarily motivated by the thought of promotion following graduation, and many will take at the least one class per semester to keep the forward momentum. Degree credentials have taken priority over knowledge. As our ability and demand for hand written documents fades, students are encouraged to use the computer for solving problems and presenting solutions. Instructors can present inspiring lectures, but no instructor can fascinate all students simultaneously and continuously.

Adopting the distance learning mode of course delivery is not linear. Learning how to use the new technology creates a mild angst for both instructor and student. Instructors were normally given a reduced workload in order to prepare a distance learning option, and a reduced workload for teaching the first session. These reductions were used to encourage faculty to embrace the distance learning mode of mastered presentations. Nearly all associated with distance learning understand the increased workload, preparation, and time commitment needed on their part in order to bring a course to this format.

Students have available practice sessions and lectures which are posted on the department's Web page in order to review and work with the technology prior to the start of classes in order to become familiar with the distance learning methodology. At the beginning of each semester,

many of the new students to the technology need help in acquiring access to the class sites listed on the syllabus and received that help from the Information Technology personnel on campus, or by the administrative staff in the office.

This venture into distance learning to better assist the students is valuable many ways. The convenience of distance learning reduced missing time from work and students are now not driving to campus or paying for parking. Presently, the majority of students (over 80%), are from the local area, and many of these same students use the distance learning capability rather than driving to campus.

CHEATING

Maintaining academic integrity while conducting classes within any course, not just distance learning, is difficult. As cheating becomes more prevalent in academia, academia must develop new ways to combat the activity in class. Students in today's classrooms do not view cheating as unethical or even as something not to do. In fact, in many cultures it is viewed as a form of respect to cite ideas and whole passages from a respected authority within a student's written work. Unfortunately, even students from the States do not properly cite their work when submitting for a grade which causes a considerable amount of problems with respect to the intellectual property of others. There is another factor at work which must be discussed, that of course is culture. Holland (2010) addresses the larger picture faculty on American campuses must adapt to when teaching Asian, and to most extents Middle Eastern students; that the professors must understand that within these cultures, they as professors are revered, and that they are the "masters (who) conveys knowledge to the students, who then memorize and regurgitate the same knowledge back to the professor" (p. 39). Engaging students from these cultures to discuss concepts or opinions, or challenge the concepts that are being expressed is completely foreign to the student, and in many cases forbidden in their cultures, and to engage in this behavior is disrespectful to the professor.

As a professor of a distance based learning course, due diligence should be maintained to keep abreast of new tactics of cheating by students during exams, both on line or in the classroom, or by submitting papers not their own. Internet sources such as Turnitin can help provide instructors with the ability to verify student's citations, but these internet sources are not completely foolproof. Students are still able to use paper mills, which will allow a student to purchase a ready-made paper, or hire a professional ghostwriter who, for a price, will write a specific paper on a specific topic for a fairly hefty price.

Multiple exams with altered or reversed questions may help deter students from cheating on exams, as they will not have the exact same exam as the student sitting on either side of them. As well, on line students can be emailed or have posted on their student account, one of several composed exams which they will have to complete within a set time limit. For many instructors, knowing that a test will be sent out electronically to a student, they will allow the students to access notes, textbooks, or Power Point slides knowing that the students will access this material anyway since no one will be observing them during the timed exam. Those students who have read the material will have a better opportunity to quickly reference their notes to answer a question while those who have not opened the textbook or properly studied at all will be unable to answer a question quickly enough to finish the exam on time.

MAINTAINING PROGRAM INTEGRITY

With current technology offering smartphones, cameras, IPads, BlackBerry devices, laptops, SKYPE, electronic translators and many other affordable devices for students, it is easy for students to be tempted to communicate with each other (e-cheating) during examinations. Students have the means to e-cheat even under the watchful eye of a proctor since a camera

phone or another electronic device can be copying one page of an exam from a student's lap while the student is working on a different page of the exam. Although students are encouraged by the department to collaborate on homework and are occasionally assigned group projects, they may not collaborate on exams, and policing this can become an issue. Thus far all local exams within the Department of Engineering Management are instructor or graduate assistant proctored, but the present technology provides temptation to collaborate among the students. Technology helps instructors create multiple choice exams from a database provided by textbook publishers, with the instructors further being able to scramble questions on different copies. New exams are created each semester while prior semester exams are usually shredded.

Some instructors will mildly interrogate students in cyberspace and in the classroom during regular classroom sessions as an additional input for determining the student's knowledge of material. To maintain an equal playing field during exams, equivalent available technologies are permitted for use, such as electronic notes from class, Power Points, and electronic translators for the international students to use to interpret questions on the exam. Instructors must verify that the students enrolled in the class are submitting their own work. This has become a challenge with distance learning students since exams are either emailed to students, with the student therefore able to have someone else take the exam for them, or posted as a timed exam on a Black Board type repository which once again can be opened by the student who may then have someone else take the exam for them, submitting the completed work as their own. Since cameras are currently not installed in the classroom for monitoring during exams, camera technology could help lessen the burden on the instructor, but is not a current consideration. Current research shows that camera technology has proven useful in policing distance learning students who will show their identification to their lap top camera so that whomever is proctoring the on line exam can verify the student by their identification, but this technology has proven expensive as well as burdensome and its use on colleges has not grown in large enough numbers.

SUGGESTIONS FOR DISTANCE LEARNING PRACTICES
The Internet has become the universal instructor for all seeking knowledge. All students are able to gain access to the Internet and obtain information which is essentially at their fingertips. The requirement for a good memory to hold facts becomes less important as the ability to use this new knowledge becomes paramount. Lectures can be replaced by shorter, conceptual presentations wrapped within a problem-solving process. The sociability of the students should also be considered, since having a classmate to study with greatly encourages students to master the material while working with their colleagues. The emphasis in teaching should be on the subject material and not on how to use the technology to teach the subject. The goal of teaching is to create a passion in the student for independent lifelong learning. Therefore, a primary goal for the instructor should be to help inspire the students to take responsibility for their continued learning.

Students can be taught anywhere and anytime in a technology-based society by a multi-mode delivery system of classrooms, cyberspace, and recordings which can be synchronous or asynchronous. The collaboration of students is desirable for learning, and educators need to provide learners with the access to the curricula, and to other students as a means of collaborative work.

Technology has provided means to amplify student ability to extend their thought process for not only calculations and computations, but to function at higher orders of thinking. Emphasis must still remain on the understanding of the concepts and more time can be used to secure this understanding. A menu of subjects to benefit society can be offered via the Internet and taken by anyone who has access to a computer. Cognitive Reasoning skills should remain a top priority for educators.

The future holds promise for much of the curricula to be available to all who have access to the Internet without tuition costs or with significantly reduced tuition costs. Here again the responsibility falls on the learner (the student) to seek out the desired courses furnished by the universities in an open learning system. The student of course must be aware that they will not be able to receive a grade for the individual work they will perform; they will nonetheless have the knowledge from the free course material. As this movement, known as MOOC, or Free Massive Open Online Courseware, continues to expand and develop, students are provided the ability to study, without cost, a wide arrangement of courses from such august institutions as MIT and Stanford.

Larger class sizes can be expected to occur with lower marginal costs. The best instructors could present the main thrust of a subject to a relatively large class, while other instructors could then be available for answering student questions, or for tutoring, or for further explanation of the concepts presented in the class. Many institutions of higher education already employ this tactic, having graduate students conduct the labs, leaving the professors who are experts in their fields to conduct the actual class sessions.

Eliminating grades would of course eliminate cheating, as well as cramming and soon forgetting concepts, as well as encouraging continued corroboration in learning within all modes of delivery. This of course leaves the instructor with the larger question of being able to judge if the student has mastered the course material. Presently student performance is indicated by symbols or numbers, but portfolios of exceptionally good work could be kept for students who would be required to provide the proof of their understanding of the course concepts within completed projects which demonstrated their skills, knowledge, and application of concepts. As well, instructors could provide a tentative grade to the students for feedback purposes, which would not be used for recording or for labeling. As a consequence, cheating would cease to exist, for cheating then becomes collaborative learning with each other. Students should become motivated to learn for themselves the subjects of interest to them. Students would then not have the stigma of failure, or if so, it would be strictly due to their own lack of performance. From the very beginning, students would soon realize that they are responsible for developing their own performance of knowledge. Intrinsic motivation should therefore be something already within the students as they learn what they want to learn and from what interest them.

With the rapid technological changes in aids to learning, students could link their devices such as lap tops or I-Pads to curriculum designed devices which would enable them to access all that an instructor has available on any given topic or course. These links to cloud computing technology will allow students greater ease in accessing knowledge from their home or office space while allowing them to work around their day jobs. Any given university's curricula could therefore be maintained and updated with students accessing the material from their computers or mobile devices, with their devices serving as ever ready tutors with access to all of the latest information available on any given subject.

CONCLUSIONS
Distance learning has helped The University of Dayton's Department of Engineering Management and Systems reach out to more students while delivering a varied, well-received set of delivery modes of instruction. Currently, ranked by the U.S. News and World Report as number two in the United States in faculty credentials and training for on line graduate engineering programs for the 2011-2012 academic school year, distance learning remains popular with the students as evidenced by the number of local students enrolling for courses, even

asynchronously, if desired. Currently at the University of Dayton, only the Engineering Management Department is offering two entire graduate programs via this technology.

Students have access to the posted lectures and can view the recordings from each class to refresh concepts prior to exams, as well as to continue to access material the instructor posted on the white board during the class lecture through the end of a semester. This technology has enabled course redesigns and combining materials for higher density presentations to be more fluid and easily adaptable. Students have access to annotated slides and may use the time in the classroom exclusively for focusing and understanding the concepts, knowing that they have the opportunity to re-review should they need to throughout the remainder of the semester. Students have a better learning environment with the presentations and lectures at the ready than in traditional classroom lectures.

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