



Innovative Uses of Classroom Tools & Technologies to Foster Students' Learning

Dr. MD B. Sarder, University of Southern Mississippi

Dr. Sarder is an associate professor and program coordinator of the industrial engineering technology program at the University of Southern Mississippi (USM). He is also an assistant director of the center for logistics, trade and transportation. At the USM, he revamped his program by developing as many as fourteen new courses, implementing hands on experience in courses, and delivering online courses for distant students. Dr. Sarder is very active in engineering and technology education research. He has published a book and more than fifty articles in various areas of industrial engineering including K-12 research. He is actively involved with professional society activities including IIE and ASEE. He is the editor in chief of the International Journal of Logistics & Transportation Research and serving in the editorial board for several other journals.

Innovative Uses of Classroom Tools & Technologies to Foster Students' Learning

Abstract

According to many researchers, students learn best when they are actively engaged in the learning process. The more opportunities provided for students to participate and be involved, the better they ought to achieve from the course. In many cases, professors need to go beyond the institutional and technological barriers to deliver the best of class education. Many professors frequently use multimedia application such as PowerPoint, graphics, audio, video & animation in courses to promote student involvement in their learning. PowerPoint supports hyperlinks and sound features that can easily create an interactive presentation that provides opportunities for students to employ higher cognitive strategies. Digital video and animation are invaluable tool for demonstrating processes such as automation. This paper highlights some uses of classroom tools and technology in a particular institution which were proven effective.

Nowadays online course delivery is a popular concept, but it has some issues with engaging students. There are some very effective common tools that can be used in online classes to improve students' engagement. It is very unlikely that a single tool or technique is enough for online learning. Creative uses of a combination of tools serve better in this case. Some of these tools are: email, discussion boards, application sharing, selective release, podcasting, vodcasting, and mass texting. Email is a teacher's best friend. Students should be encouraged to use email and discussion board extensively. They need to be monitored for their discussions on course management site continually and guided constructively. Discussions generate ideas, help create a learning community in online classes, provide discussion transcripts, provide a means of online conference and collaboration, and get students thinking in writing as they write. It is shown that archived lectures with the PowerPoint slides helps student the most. Competitive group projects are common course requirements. Technology such as selective release can create work environment so that students within the group use their specific room as virtual communication platform. It makes easy for students to do brain storming and share files with their group members without revealing information to other groups.

Introduction

As students learning is widely accepted as key metric of student success, increased attention is being paid to the tools and techniques best suited to its successful adoption in classroom environment. It is very evident that technology seems to offer a natural and accessible way to advance students learning [1]. ECAR has surveyed undergraduate students annually since 2004 about technology in higher education and found that more and more students are using latest education technology in their education [2]. On an average student to computer ratio of 4:1 and a teacher and student population ready, willing and able to use technology (Figure 1). Yet despite its availability, technology is not widely integrated into the learning experience. A recent survey of ECAR shows that they wish that their professors more often use classroom technology in online or face to face teaching (Figure 2).

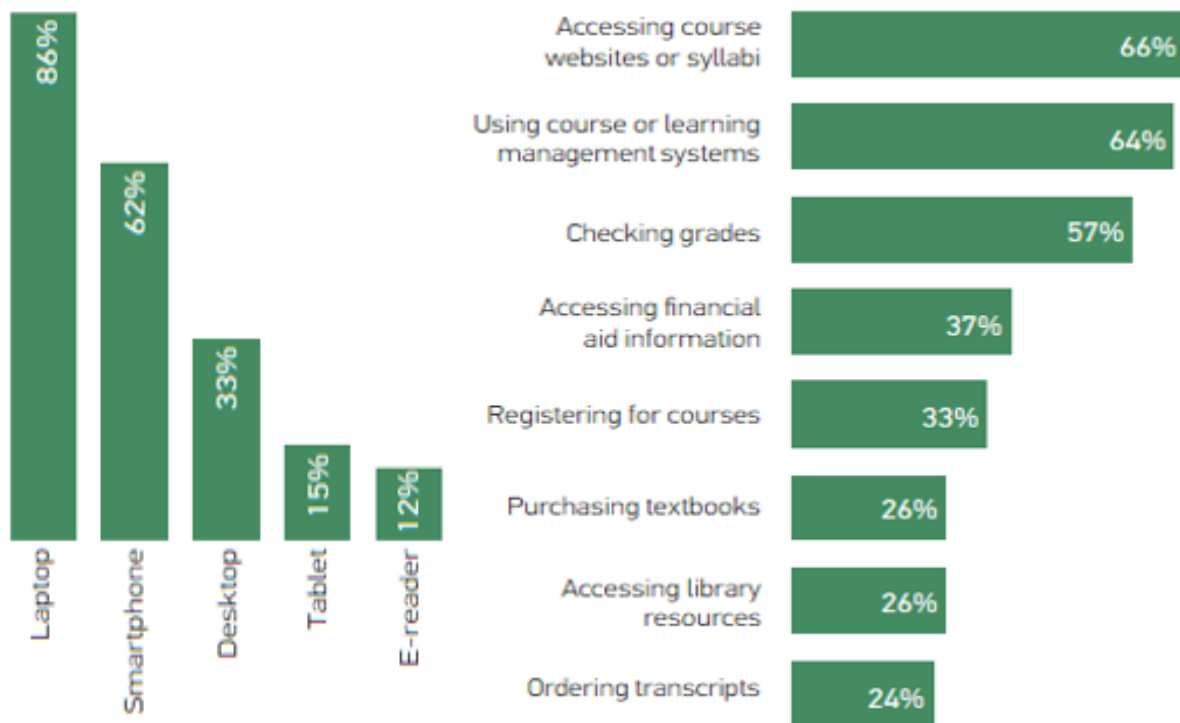


Figure 1: Students' ownership of education related tech devices (a) and their importance rank to do with mobile devices (b) [2]

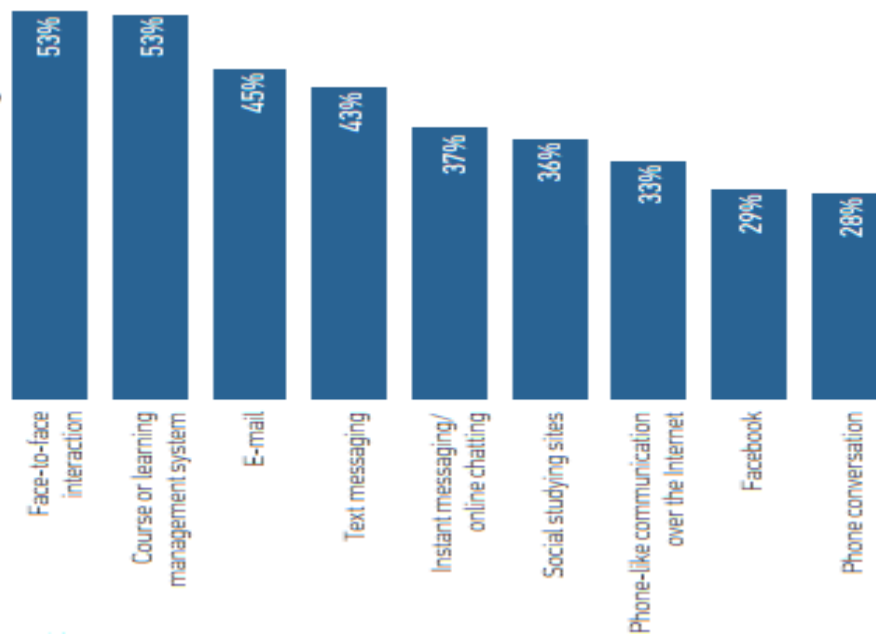


Figure 2: Student wished that their professors communicated more using these means [2]

Classroom technology is both highly customizable and intrinsically motivating to students, it is particularly well-suited to expand the learning experience [3]. Besides innovative uses of technology in classroom, organized teaching & rich course content is very important to students' learning. In addition to rich course content & organized teaching, a good teacher needs to personalize the needs and problems of the students. As a teacher, it is our goal to inspire students & enhance their learning. Our objective as a teacher is to motivate students toward a level of independence where they develop a desire to learn and think for themselves. Professors should try to maintain a very lively and interactive environment by using a variety of teaching methods. They should encourage students to voice their ideas about the subject matter and to ask questions. They also need to challenge students to broaden their minds and go beyond specific course objectives.

If instructors are not properly trained in online delivery, methodologies and effective use of e-Learning tools, the success of the online program will be compromised. An online program will be weakened if its facilitators are not adequately prepared to function in the Virtual Classroom.

To keep these in mind, professors at our institution use variety of tools & technologies in an effective way to enhance student learning outcomes. Some of these tools and techniques are Adobe, PowerPoint, Podcast, Vodcast, Live lecture, mass emails, mass texting, Microsoft office live workspace, Wiggio, WebCT, and Wimba. Professors at our institution strive very hard to keep their knowledge up to date and explore new ways of effective and efficient teaching by learning.

Technological advancement in classroom equipment provides an edge to teaching. This brings flexibility to both teachers and the students. Audio-visual aids like using power point slides, laser technology, video clips to emphasize important points, and using WebCT, Wimba are effective learning tools with proven impacts. Due to the availability of these technologies, more students are able to take courses via online. In our online courses, we made the course curriculum suitable for online students. Students were allowed to view the lectures, performed group projects, appeared quizzes and exams, joined group discussions, etc. via chat, teleconferences, video conferences and other online means. Following sections described some effective & efficient use of e-learning tools specific to our institution.

Need for improved engagement in online classes

Classroom tools and technologies are means to engage students in online classes and hence improve students' learning. In 2008, a survey conducted by the U.S. Department of Education showed that 97% of 2-year and 89% of 4-year public institutions offer distance-learning courses [4]. Also, according to new research recently released by the University of Wisconsin-Madison involving about 7,500 undergraduate and graduate students, an overwhelming 82% of students said they would prefer courses that utilize online lectures over traditional classes that do not include an online lecture component [5]. As more courses in higher education move to an online format [6, 7], a major concern is a potential loss of personal interaction between the professor and student [8]. There is evidence that a growing number of courses delivered in an online format tend to be configured and delivered in an asynchronous manner, more often associated with traditional independent study and correspondence work (i.e., students work independently to complete posted assignments at their own pace) [9]. While this format serves the purpose of meeting the needs of the non-traditional learner in regard to delimiting issues of time and

distance, and in many instances is a viable option, it leaves a "missing link" in the learning curve for students because they lack the opportunity to benefit from the experience of structured dialogue, interaction with faculty and peers, and the sense of community that can be created in a traditional on-site classroom environment. As Berge states, "...learning involves two types of interaction: interaction with content and interpersonal interaction (i.e., interaction with other people)" (p. 22[10]). Kearsley and Lynch contend that online courses must adopt a pedagogical framework more closely aligned with social learning theory for students to maximize the benefits of online instruction [6].

Design Methodology

One of the most important elements of planning and managing online courses is that there are lot of tools and techniques available, but not all of these technologies are appropriate matches to the subject taught and the teacher's pedagogical style and strategies. As such, it is very important that instructors ensure that pedagogical principles drive the use of technology rather than the other way around. Instructors must strive to achieve certain learning standards, regardless of the medium through which they are teaching [11]. Because of this, course planning should take place before instructors select the technology and course management system that will be used for the course.

It is also important to note, that although there is tremendous diversity in the educational technologies available to online instructors, the field of distance learning technology is changing quickly, and it is therefore necessary for instructors and administrators to keep a close eye on emerging trends and associated best practices [12]. The first step in the planning process involves the development of learning objectives. The importance of learning objective development and communication is highlighted throughout the literature, including Park University's guidelines for the creation of learning objectives [13].

In our effort to increase student interaction and students' learning within an online course delivery system, whether the course is entirely online or being offered face-to-face augmented by online support, we planned to incorporate various tools and techniques. We found some tools

and techniques are more effective than others. The following sections highlights some implementations. We are still evaluating the effectiveness of these tools and hence a complete assessment is not presented in this paper.

Innovations in Curriculum Design

We implemented a multi-tiered online delivery (MOD) system. The first tier consists of in-lecture activities (Lecture Recording Tier). The second is an offline modification of lectures by importing quizzes into the lecture as well as extracting events (Offline Lecture Splicing Tier). The third tier of the application is available to the students and it increases their interaction with the instructors (Student Interaction Tier). The MOD has two features. The first feature was based on a question/answer repository (database) related to material covered in specific lectures. This repository works in conjunction with the recorded lectures to serve as an interactive feedback mechanism to ensure proper viewing as well as improve understanding of the lecture material. The second feature was to extract specific events from each recorded lecture. These events correspond to interactions between students and instructor in a live lecture setting. The benefits of extracting these interactions will reflect on current and future students. Furthermore, it will positively impact the training of future teachers of the subject matter.

Educating Educators

If instructors are not properly trained in alternate delivery, methodologies and effective use of e-learning tools, the success of the online program will be compromised. An online program will be weakened if its facilitators are not adequately prepared to function in the Virtual Classroom. Keeping this in mind, we developed an “Educating Educators” program at USM for faculty members of IET and CS programs. Following are the components of the program:

i. Summer Workshops

A summer workshop was designed for online faculty development that will show faculty how to use MOD architecture and other online teaching tools in teaching alternate delivery classes. Our primary goal here is to encourage faculty in any discipline to engage students in the class

discussion. We outline the structure of our ten-day workshops (1 day per week for 10 weeks), specify the video conferencing software (Blackboard Collaborate or similar ones) the workshop participants use to connect remotely, discuss the technology to be implemented, and explain how the new methods works pedagogically. During each session we demonstrated and discuss specific online tools and their uses to improve interactivity in the class, and at the same time, we incorporated participant feedback and contributions. Our Learning Enhancement Center (LEC) was used to coordinate and organize this virtual workshop.

ii. Peer Mentoring

Peer mentoring at a university typically involves support and guidance for junior faculty or faculty who are new to alternate delivery from more experienced faculty, often within the same discipline. It is an important strategy for assisting relatively inexperienced faculty during their transition to alternate teaching. It is an effective program for faculty development and retention. Many institutions such as Florida State University, University of Iowa and Monash University have implemented peer-mentoring programs to increase faculty competencies. We formed a group of volunteer peer mentors who are experienced and effective in alternate delivery and willing to provide the mentoring service to their fellow faculty.

Innovation and Uniqueness of our Approach

i. Real Time Communication with Students

An online instructor must be able to compensate for the lack of a physical presence by creating a supportive environment in the Virtual Classroom where all students feel comfortable participating. Professors at our institution use as many interfaces as possible to provide flexibility and accommodate individual needs. They use almost all Blackboard functions such as discussions, chat, assignments, mail, assignment drop box, selective release, podcast, vodcast, e-board, web access, breakout rooms, application share, tracking, etc. along with emails, telephone calls, and meetings to manage online courses. For competitive group projects, students are given access to their specific groups where they can upload documents and share within the group. Students are allowed to present their projects and attend all quizzes and exams online.

Most professors at our institution go beyond the institutional and technological barriers to deliver interactive and on time information. For instance, WebCT linkage with Wimba does not support mass texting or captioning. On time student interaction is critical for online learning. The project will implement a “Virtual Office Hours” to connect students in real time using Wiggio. Wiggio supports mass emailing, mass texting, voice notes, polling, hosting group conference calls and others to communicate with students. Accommodating disabled students was also possible in the online environment. In some cases, online media provides a better interface to decipher information for disabled students. We create transcripts of online lectures, caption video clips, and make them available to those students.

ii. Interactive Use of Multimedia

According to many researchers [14, 15], students learn best when they are actively engaged in the learning process. The more opportunities provided for students to participate and be involved, the more likely they will benefit from the course. We use multimedia applications such as PowerPoint, graphics, audio clips, video clips & animation in online courses to promote student involvement in their learning. PowerPoint supports hyperlinks and sound features that can easily create an interactive presentation that provides opportunities for students to employ higher cognitive strategies. Audio, digital video and animation are invaluable tools for demonstrating processes such as industrial automation.

iii. Effective Uses of e-Learning Tools

As mentioned earlier that we have found some very effective common tools in our online classes. It is very unlikely that a single tool or technique is enough for online learning. Creative uses of a combination of tools serve better in this case. Some of these tools are: email, discussion boards, application sharing, selective release, podcasting, vodcasting, and mass texting. Email is a teacher's best friend. I encourage students to use email and discussion board extensively. We monitor discussion board continually, check our email several times a day and reply students' email instantly. We have found that archived lectures with the PowerPoint slides helps student the most. Most of our classes have competitive group projects. We create separate rooms using

selective release so that students within the group use their specific room as virtual communication platform. It makes easy for students to do brain storming and share files with their group members without revealing information to other groups. Discussions generate ideas, help create a learning community in online classes, provide discussion transcripts, provide a means of online conference and collaboration, and get students thinking in writing as they write. We also found mass texting and voice messaging to student's cell phones as convenient and on time communication tool to notify updates. WebCT announcements or emails are not able to do the same as texting.

Promoting Critical Thinking

Certainly, one of the greatest gifts teachers can give to students is the ability to think critically on a variety of topics. We hold our students accountable for their actions and set their expectations high. Professors need to value students' input and opinions by serving as a facilitator. In our institution, we use various techniques such as Class Assessment, Cooperative Learning, Case Study, Open Ended Questions, Conference Style Learning, and Dialogue to promote critical thinking. Class Assessment Techniques monitor and facilitate students' critical thinking. Cooperative Learning puts students in a group learning situation which is the best way to foster critical thinking. Case Study methods present a case to the class without a conclusion. Professors then lead students through a discussion, allowing students to construct a conclusion for the case. Use of Dialogue and Open Ended Questions obliges students to think critically. In a Conference Style Learning environment, professors act as facilitators to maximize the organic flow of discussion and allow students to develop their critical thinking skills.

Technology Impact on Student Learning

Through the use of online tools and technology, learning can also be qualitatively different. The process of learning in online classes can become significantly richer as students have access to new and different types of information, can manipulate it on the computer through graphic displays or controlled experiments in ways never before possible, and can communicate their results and conclusions in a variety of media to their teacher, students in the next classroom, or students around the world. Online learning has its most promising potential in the high synergy

represented by active dialog among the participants, one of the most important sources of learning in a Virtual Classroom. Online teaching provides convenience, wider student access, and efficiency in student learning.

Student Centered Learning

Student centered learning is about helping students to discover their own learning styles, to understand their motivation and to acquire effective study skills that will be valuable throughout their lives. Our online classes are much more student centered than the typical face to face classes due to uses of various online tools. The students are much freer to move in individual directions in the online environment. Online teaching drove the “center” of the classroom from professor’s podium to students’ desktop. Our courses are designed as truly a student-centered learning episode. Most of our student not only meet the specific course objectives but go beyond that. They learn interpersonal skills, better communication skills, conduct researches, and publish articles. They learned to be competent in the challenging job market.

Other techniques of engagement

1. Uses of WebCT Functions

Most of our online professors use almost all of WebCT functions such as discussions, chat, assignments, mail, assignment drop box, selective release, podcast, vodcast, e-board, web access, breakout rooms, application share, tracking, etc. along with emails, telephone calls, and meetings to manage our online courses. Those professors who teach face to face format can also use online shell as a supplement for their face to face courses. Students can access course materials or view announcement from the online shell in case they miss the class or lost their handouts.

2. Contingency Approach to Handle USM Server Downtime

In the last year our WebCT server was down for atleast four times for more than several hours. This kind of situation puts students in a difficult position to prepare their quizzes and exams and to submit their assignments ontime. We use Microsoft Office Live Workspace as a backup tool to handle that situation. Following figure shows an example of using Microsoft Office Live Workspace. Figure 3 shows the use of Microsoft Office Live Workspace in IET 409 course.

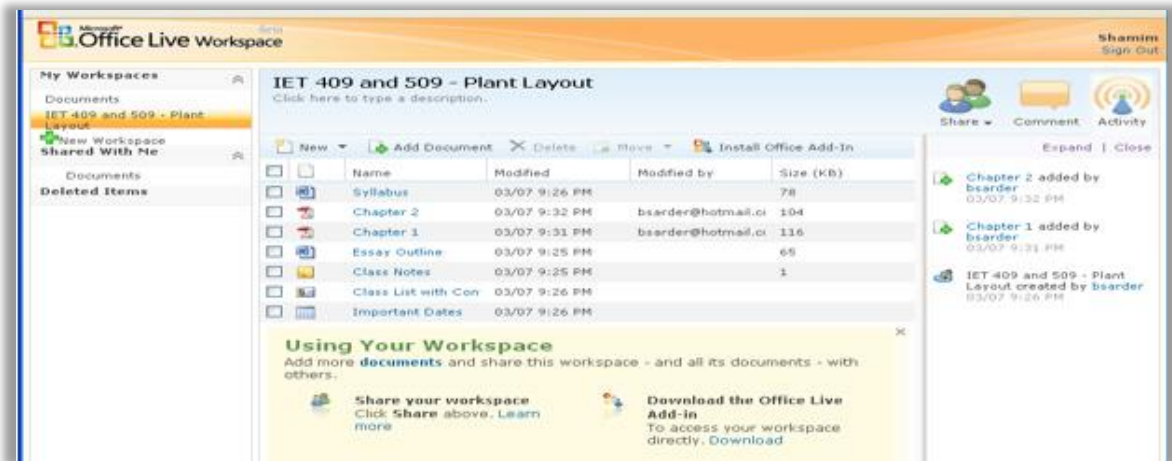


Figure 3: Use of Microsoft Office Live Workspace in IET 409 online course

3. Use of Live Classroom

Access to Live Classroom gives face to face feelings to online students. Professors discuss lecture materials and solve representative mathematical problems while student can see and listen lectures in real time. They can ask questions using VOIP or chat functions. Sessions can be recorded for students to review at a later time. We use web, e-board, and share functions to make our online lectures interactive. Following figure show some example of Live Classroom use.

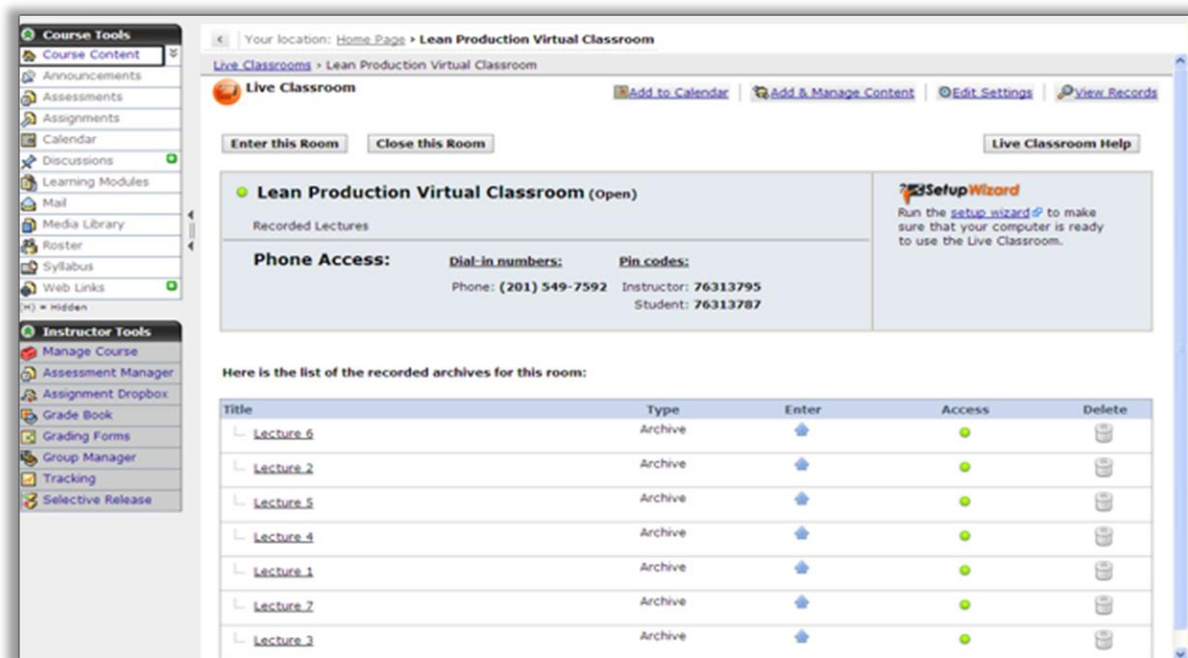


Figure 4: Use of Live Classroom in IET 513 online course

4. Administering Virtual Group Projects

Nowadays, collaboration is a necessity for graduates to work in real-world job. Most often engineers and technologists work with multi-disciplinary team and require people management skill. These students must participate in group projects and case studies, which provide vital opportunities to effectively work as a team. The virtual projects are useful learning tools where the students assimilate and implement all the concepts they have learned in the classroom and get the feedback from teacher to pinpoint their roles in the group. In our classes, online students learn how to perform a group project despite they are physically separated. They need to organize the project and to coordinate with their project partners using various communication tools. To make that easy, we created individual live classroom for each group where they can discuss their projects, share documents, and even present their project report to all students. Since it is a competitive project, only group members of each group have the access to their specific live classroom. We found this tools very effective for our students to conduct their group projects.

5. On Time Student Interaction

Many of our online professors go beyond the institutional and technological barriers to deliver interactive and on time information. For instance, WebCT linkage with Wimba does not support mass texting or captioning. On time student interaction is very critical for online learning. Many professors at our institution have implemented a “Virtual Office Hours” to connect students in real time using Wiggio. Wiggio supports mass emailing, mass texting, voice notes, polling, hosting group conference calls and others to communicate with students. Following is an example of mass texting to IET 400 students to notify an impromptu meeting.



Figure 5: Impromptu meeting notification by mass texting using Wiggio for IET 400 class

6. Accommodating Disabled Students

Accommodating disabled students is very challenging in face to face teaching format, but can be easy in online environment with the use of appropriate tools. We create transcripts of our online lectures, caption video clips, and make them available to those students.

Measuring Technology Impact

As mentioned earlier that we are still in the process of assessing the impact of various tools and techniques at our institution and hence this paper doesn't show any specific assessment results. We are using some measures and evaluating impacts while implementing various tools and techniques in online education. Table 1 summarizes the impacts and benefits.

Table 1: Summary impact and benefits of using classroom tool & technologies

<p>Facilitate adaptation at other sites</p>	<ul style="list-style-type: none"> • Will educate educators and establish engineering education partners • The methods, materials, and assessment tools have the potential for transferability and for offering effective formative and summative feedback for engineering programs nationwide.
--	---

<p>Advance discovery in teaching and learning in undergraduate engineering education</p>	<ul style="list-style-type: none"> • Will enhance student learning by increasing student interactions/engagement in course content delivery methods via innovative open-source applications. • Expose students to actively engage and experience different ways of thinking and learning that aid cognitive flexibility. • Will engage more than 75 engineering students in the proposed alternate learning environments, to enrich the limited exposure that they currently gain about these engineering topics. • To seek Type II proposal funding after successful completion of current project.
<p>Contribution to a paradigm shift in undergraduate engineering education</p>	<ul style="list-style-type: none"> • Will demonstrate the implementation of a fully developed case study for industrial engineering technology education in an alternative environment to increase student interactivity via unique applications. • Approx. 52 faculty, including women and junior faculty will participate in intensive technological and educational training experiences.

Conclusion

There are various classroom tools and techniques available for online teaching, but not all of these technologies are appropriate matches to the subject taught and the teacher’s pedagogical style and strategies. At the same time, all classroom tools and techniques are equally effective on students learning. Most of the time universities need to prioritize the uses of classroom technologies due to their budget constraints. Research on the effectiveness of various classroom tools and best practices on implementing various classroom technologies can be helpful for those universities. This paper tried to address that very issue. A better understanding of how sophisticated technology impacts teaching and learning in engineering will emerge through our assessment and evaluation efforts once completed.

The project being implemented will also effectively evaluate and assess student-learning outcomes. It encompasses methodologies that are not only sustainable and scalable, but will also standardize the instruction process of engineering courses, that can be easily adopted in any university setting. Finally, it promotes innovative uses of classroom technologies that not only help professors in alternate course delivery but improve students’ learning through better student-faculty interactions.

REFERENCES

1. Babette Moeller & Tim Reitzes (2011) Education Development Center, Inc. (EDC). Integrating Technology with Student-Centered Learning. Quincy, MA: Nellie Mae Education Foundation.
2. Dahlstrom, Eden, J.D., Walker, and Charles Dzuban (2013), "ECAR study of undergraduate students and information technology (Research Report). EDUCAUSE center for analysis and research.
3. University of Wisconsin-Madison E-Business Institute. (2008). *Insights regarding undergraduate preference for lecture capture.*
4. U.S. Department of Education, National Center for Education Statistics. (2009). *The Condition of Education 2009*
5. U.S. Department of Health & Human Services. (2009). Preparing for the Flu: A Communication Toolkit for Institutions of Higher Education
6. Kearsley, G. & Lynch, W. (1994). Educational technology: Leadership perspectives.
7. Keating, A. B. & Hargitai, J. (Eds.). (1999). The wired professor: A guide to incorporating the world wide web in college instruction. New York: New York University Press.
8. Sadowsky, G. (1999). Visions for a virtual university. In A. B. Keating & J. Hargitai (Eds.), The wired professor: A guide to incorporating the world wide web in college instruction. Chapter 6, New York, NY: New York University Press.
9. Perley, J. & Tanguay, D. M. (1999). Accrediting online institutions diminishes higher education. *Chronicle of Higher Education* 46 (10), B4.
10. Berge, Z. L. (1995). Facilitating computer conferencing: Recommendations from the field. *Educational Technology*, 35 (1), 22-30.
11. Richard Ascough. —Designing for Online Distance Education: Putting Pedagogy before Technology. | *Teaching Theology & Religion*. Volume 5, No 1. 2002. Pg. 17.
12. David Porter. —Innovations, Trends, and Creativity in Distance Learning. | *Paper presented at the 4th International Conference on Education and Technology – Inter-American University of Puerto Rico*. September 7, 2006. Pg. 2.
13. Park University. —Faculty Resources Quick Tips: Learning Objectives – Guidelines for Writing Effective Learning Objectives. | See <http://www.park.edu/cetl/quicktips/writinglearningobj.html>
14. Radwan Ali and Elke Leeds, (2009), "The Impact of Face-to-Face Orientation on Online Retention: A Pilot Study", *Online Journal of Distance Learning Administration*, Volume XII, Number IV, Winter
15. Huett, J. K., Kalinowski, K. E., Moller, L. & Huett, K. C. (2008). Improving the motivation and retention of online students through the use of ARCS-Based E-Mails. *The American Journal of Distance Education*, 22 (3), 159