Improving Student Engagement in Online Courses

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.

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Abstract

Distance education is a learning model in which students and instructors are separated by location and/or time, and in which students may complete courses or programs without attending scheduled classes in a specific location (E-learning). Distance learners are growing in numbers and universities capitalizing on this segment by expanding their course offerings. Online courses are becoming popular, but it has some drawbacks including lack of interactivity. Institutes of higher learning are still discovering that teaching methods implemented in traditional courses may not necessarily translate directing into the distance learning model. This paper will highlight a number of issues concerning distance learning and what teaching methods may be implemented by professors to facilitate student engagement in online courses.

There are a number of teaching approaches that institutions of higher learning may implement in order to engage distance learners in online courses, one of which is the Engagement Based Learning and Teaching (EBLT) approach. According to the Engagement Based Learning and Teaching (EBLT) approach there are two basic elements that provide an effective method of establishing a facilitation technique for more student engagement. These elements are pedagogy and preconditions where pedagogies are techniques that must be followed in instructions and preconditions are set of guidelines that need to be present in effective teaching. This paper discusses various methods of improving students' engagement in online course delivery with examples at the implementing university. The Industrial Engineering Technology (IET) program at our university has been converted to an online program as other programs are also following the same pursuit. As we are switching to online course delivery, we are actively researching ways to foster critical thinking and maintain adequate real time communication and interaction with students. Our task was to design online course delivery that offers students a variety of learning styles and preferences in interactive ways. We have implemented various techniques including enforced sequential viewing of lecture videos and virtual class meetings in some of our courses as part of students' engagement initiative. We have found interesting and positive correlation of improved students learning with those techniques. This paper will discuss the detail design of experiments and results of the implementations.

Introduction

Online learning, one form of alternate learning, has created a paradigm shift in education, and in particular, the way knowledge is transmitted [1]. The opportunity to access broader and previously underserved markets has been spectacular. Moreover, education can be arranged to form learning communities of geographically scattered learners throughout the world. The phenomenal growth of online education in recent years has made this teaching method a viable alternative for learners who previously may not have had access to traditional education due to geographic location, financial position or other impediments [2]. The modality is in its infancy and online education has been subject to both praise and criticism. One of the most common criticisms relates to the quality of educational outcomes due to the lack of face to face faculty-student interactions [3].

At the implementing institution, the Industrial Engineering Technology (IET) program has been converted to an online program and the Computer Science (CS) program is converting some of its courses. As the implementing institution switches to online course delivery, they are actively researching ways to foster critical thinking and maintain adequate real time communication and interaction. Our task was to design alternate course delivery that offers students a variety of learning styles and preferences in interactive ways. In this research project, we implemented at least two techniques of increasing faculty-student interactivity in alternate educational environments. It engaged students in the online class discussion by interjecting frequent questions from the covered contents and providing audio/video repository of answered questions.

Online students appear to be successful when provided ample opportunities to interact with the instructor, other students, and the course content. In this project we designed interactive course content for online students and codify them. We then use this as a basis for an "Educating Educators" program to help online faculty become more effective teachers. For example, we already know that online courses should include active learning opportunities. To support this modality cross-campus, we implemented innovative solutions such as In-Lecture Event Identification Applications, Offline Lecture Splicing, and will examine foundational tools such as Student-Interaction Enhancement Applications to help redesign undergraduate course delivery

to stimulate interactions. In online environments, students are unmonitored. Faculty lack the tools to ensure complete viewing of the lecture content. This research will enforce an interactive component in the recorded lectures that ensures thorough student engagement. We are in the process of evaluating the benefits gained from adding interactivity to online course delivery and show how it benefits students.

Two representative classes in the industrial engineering technology program, Quality Control (IET 302) and Engineering Project Management (IET 414), are being used in this study. IET and CS at the implementing institution have more than 52 faculty members including adjunct professors. Most of them have little or no experience in alternate course delivery. This study will then feed the pilot case where we will be implementing the "Educating Educators" program that will prepare our faculty members for the alternate delivery method using the in-house applications we build. We will measure the effectiveness of alternate delivery and compare it with traditional face-to-face learning using education experts' evaluation methodology as well as by documenting students' learning experiences.

Need for improved engagement in online classes

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].

Online education has been gaining popularity for the last two decades. It has expanded dramatically since the 1990s and continued growth is expected over the next several years [11]. Many factors influence student-learning outcomes in the online learning environment. These may include: (1) interactive course content, (2) varying degrees of expertise, skills and technical experience, (3) faculty and student interactions and relationships and (4) real time communication, grading feedback. One aspect of online learning that constitutes a major challenge for student learning is the lack of interaction. However, lack of interaction has produced dropout rates that are higher in online classes than those in traditional face-to-face courses [12-21]. This may result in decreased interest in the class, which leads to poor learning outcomes [22-25]. Laws, Howell and Lindsay report that many studies have found that completion rates in distance courses have historically been very low, with some estimating between 40 – 50 % at best citing lack of interaction as the major cause [26].

Student satisfaction, which leads to ultimately student learning outcomes is the key feature of any good educational program. Deden reports a 7.76% improvement in student learning outcomes after one year, by improving a number of measures including the quality of an instructor's online interaction with students [27]. This improvement was measured with the comparison of students learning outcomes in some online classes that used a set of measures such as enhanced teacher-student interaction. Beaudoin's empirical study found that increases in both the quantity and quality of faculty-student interaction and student-content interaction improve student learning in distance education [28]. A typical example is quoted by Bocchi et al. about an online MBA program in the University System of Georgia called WebMBA, which has maintained a high retention rate with an average of 30 students per course [29]. They attribute this retention rate to the team and cohort-based approach, as well as to extensive faculty

interaction (during orientation, online, and even by phone) with the students. Research studies have shown that in-class lecture, where the students are more involved, leads students to participate regularly and respond with more enthusiasm [30-34]. A pilot study at the implementing institution, conducted last summer, also supports that increased student interaction with the course content improves student performance. This study was conducted from our online class (IET 414: Engineering Project Management) where 28 students were enrolled and the instructor posted recorded lectures for the students who viewed those lectures at various capacity. Students' participation and viewing statistics were collected from Blackboard course management system. Table 1 shows that students who review the lecture thoroughly and actively participate in the discussion do well in the class.

Table 1: Student performance and student interaction with the course content

Blackboard Communication Context	Tally	Final grade of A or B
Reviewed the lecture thoroughly and participated in question & answer session at least 90% of the time	5	5 (100%)
Reviewed the lecture thoroughly at least 90% of the time	12	10 (83%)
Skimmed through the lectures at least 90% of the time	8	4 (50%)
Never reviewed or skimmed through the lectures	3	0 (0%)
Total:	28	19 (68%)

Web-based instruction has become an important part of higher education. Course management packages such as WebCT and Blackboard are being used widely in higher education by many instructors because they are easy to use and have the capability to create a flexible and better managed learning environment. But these platforms are not able to easily incorporate interactivity [35-39]. They use different lecture capture media such as Camtesia, Wimba, etc. to record class discussions, which lack interactions [36-38]. So far, most online learning is synonymous with broadcast learning [39, 40], and innovation is required to make online learning more interactive (see figure 1).

Students who do not attend class or do not listen to the lecture tend to do poorly in the course. In face-to-face lecture sessions, it is easier to engage students in discussion, but in an online environment it is hard to determine if students are engaged in listening or not. Most of the time

students review the recorded lecture instead of participating in the live discussion, and by doing so, become inattentive and miss important information.

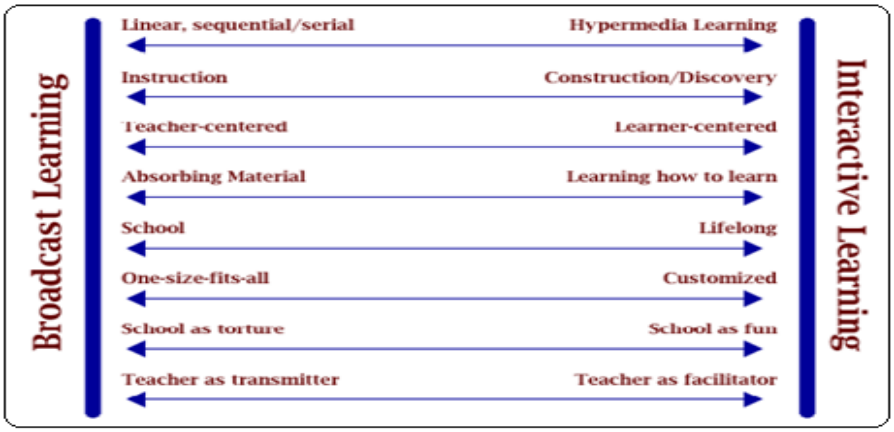

Figure 1: Shift from broadcast to interactive learning [39]

This problem is harder to track in online setting than face-to-face. In some cases, students skim through the lecture or do not listen at all. Available online course management systems such as WebCT, Blackboard, Second Life, Wimba, Moodle, etc. have failed to enforce a mechanism that ensures 100% viewing of lectures [41-43]. To increase class interaction and hence student learning outcomes, it is necessary to develop an online lecture management system (see figure 2) that can add interactivity and ensure A-Z viewing of recorded lectures.

Figure 2: Online lecture management

Design Methodology

This section covers some innovative techniques that were implemented in our institution to increase students' engagement in online classes. Some of these techniques are proved to be very effective and some are not. We are still in the process of measuring the effectiveness and hence this paper doesn't provide enough detail of assessments. In our effort to increase student interaction within an online course delivery system, whether the course is entirely online or being offered face-to-face augmented by online support, we plan to incorporate two features that we believe will advance the quality of student learning and interactivity. The first feature will be based on a question/answer repository (database) related to material covered in specific lectures. This repository will work 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 will be 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.

Innovations in Curriculum Design

In developing our applications, portability will be paramount. We aim to make our enhancements as widely available and usable as possible. As a result, we used open-source packages to develop our solutions. Specifically, we are targeting the Java platform. Java is a popular, portable programming language and it is widely supported to work with the popular web browsers. Once our code is functional, we plan to not only use it in our classes, but also to release it to the public by publishing it on the project website. To our knowledge, we do not believe that software with these capabilities has developed yet. We also plan to offer our applications to other schools and universities and invite them to use them and suggest enhancements that fit their specific needs, and enhance it further themselves as they see fit.

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 architecture of our system is depicted in figure 3.

In-Lecture Event Identification Applications:

In the first tier of our system, we will build two Java applications that will run parallel to the live recording session of the lecture to keep track of the two types of events. The first application (Segment Identification) will keep track of the start and end of lecture segments. We define a lecture segment as that in which an instructor had reached the end of a significant subject within the lecture. The instructor will simply give an input signal (mouse click) for the start and end time of each segment. The second application (Event Logging) will basically be used when a particular event takes place in-lecture. We define an event as a section of the lecture during which interaction between the student and the teacher took place (e.g. a question asked, a discussion the teacher started). The data from both of these applications will be saved for further processing in the next phase.

Offline Lecture Splicing:

In the middle tier of our architecture, we will develop another Java application that will take the output of the two applications in tier 1 as input. Based on the start and end time of each segment of the lecture, it will break down the recorded lecture into that many media files, each corresponding to one segment of the class. Moreover, this application will query a repository of questions related to each subject covered in the lecture and pull in mini-quizzes corresponding to each segment of the lecture. In addition, this application, using similar methodologies, will also extract the logged interaction events into separate media files for each student-teacher interaction event. This processing takes place offline after the lecture has been given, and before the students have viewed it.

Student-Interaction Enhancement Application:

In the third tier of our system, we will use the information obtained in the middle tier to implement a client/server application that will allow the students an “instructor-controlled/monitored” viewing of the lecture. This application will start running by showing the students the first segment of the lecture. The ability to fast forward through this segment will be

disabled; however rewinding can be done at any time. Once the student finishes a segment, a quiz will be given by the application to test the understanding of the segment. Once the student finishes the quiz (assuming he/she passes a threshold designated by the instructor), the ability to fast forward a lecture will be available for that particular segment only. Statistics on the performance of each student will also be recorded to measure student engagement.

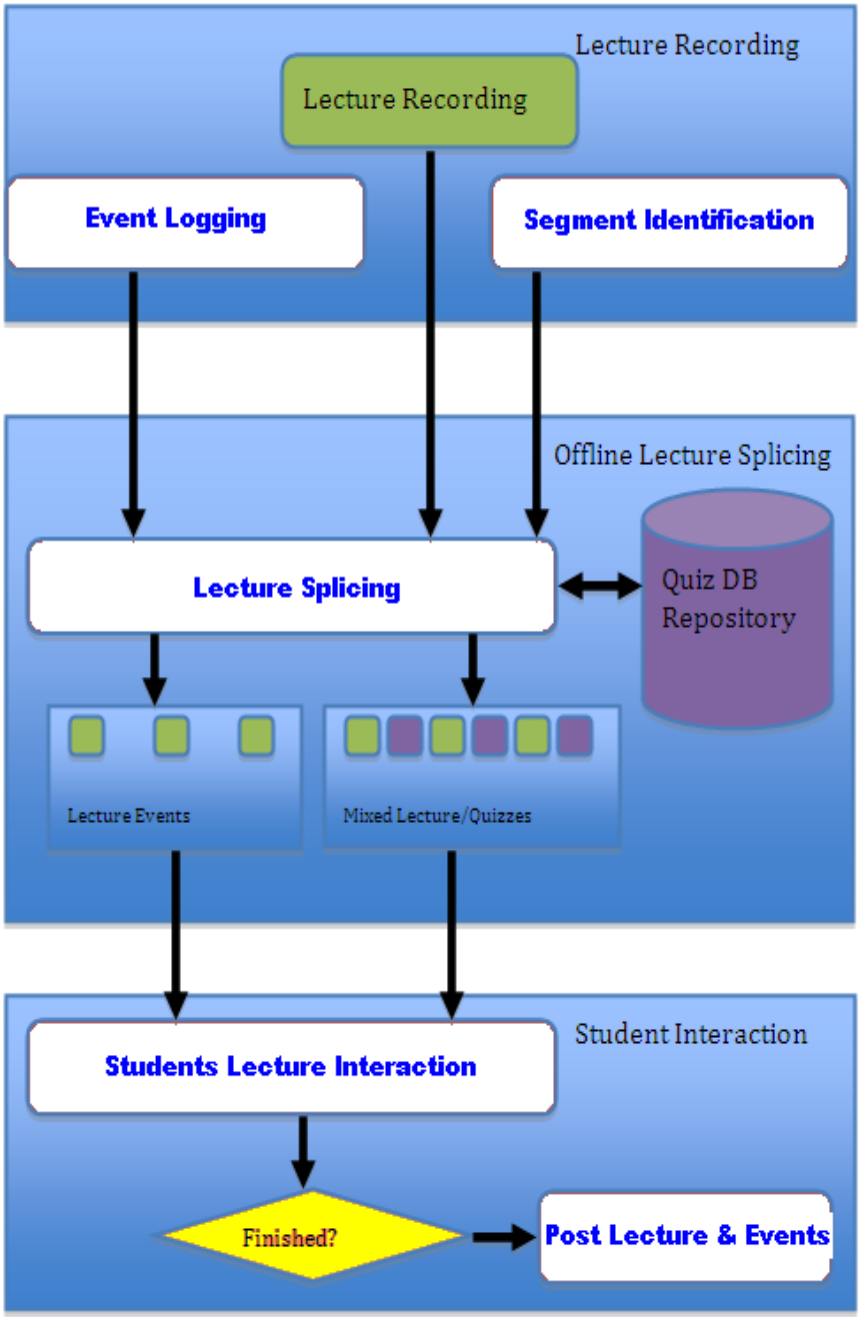

Figure 3: MOD Architecture

Once the student finishes all segments and all quizzes, the ability to view the entire lecture will be made available to the student using our application and using the online course supplement. The instructor may also make the lecture available for those students who attend the lecture during the recording. As for the logged interactions between the students and the teacher, these can be also made available to the students once they finish viewing the lecture, either using our application or via the online course supplement. Moreover, these interactions will be made available for future teachers to use as examples of past experience in teaching the course.

Other techniques of engagement

Preconditions of student engagement are assumed to be in place prior to commencement of a class. The first precondition of a classroom, in any medium, that facilitates a high level of student engagement is learning relationships. This precondition assumes that student will put forth maximum effort in classes where they feel that teachers or professors do not care or simply "go through the motions [44]." Learning relationships between student and instructors is an ideal way to facilitate a highly engaged classroom environment. The second precondition to a highly engaged classroom is a well-designed and maintained learning environment. In the physical sense, this would imply that classrooms are well maintained and organized throughout the duration of a course. If this precondition is applied to an online setting this would imply that online classrooms are we organized, easily navigable, and follow a structured timeline. This particular aspect of student engagement identifies that "good teachers pay attention to the physical learning environment and do not make changes to that environment that could become obstacles to student learning [44]." The next precondition to a highly engaged student is an established system of rewards and incentives. While incentive and rewards should be implemented carefully, instructors should use rewards and incentives to build a stronger student perspective on intrinsic motivation as an incentive for student work and learning. Another precondition for a highly engaging classroom environment is the identification and establishment of habits within the classroom. Instructors are able to improve the classroom experience and stimulate higher levels of student engagement by focusing "on appropriate procedures and having students practice those procedures until they become habit [44]." The final precondition for high levels of student engagement is the possession of the fundamental skills necessary for a

student to properly function and preferably excel in a given class. If students do not have the base knowledge to engage in a course curriculum then they are likely to withdraw.

In addition to these preconditions to an actively engaged classroom, the EBLT approach acknowledges that there are several key aspects of pedagogy that teachers and professors are able to emphasize in order to facilitate student course engagement. The first key for the successful pedagogue is course design for rigorous and relevant instruction. EBLT argues that relevance can facilitate the motivation and conditions necessary for students to investment the time and energy necessary for a rigorous curriculum or optimal learning. The bottom line is that student are willing to work more and harder if the information they are presented with is relevant to what they already know. The next aspect of pedagogy that professors should focus on in course design is personalized learning. No two students learn the same way and come from identical backgrounds. Therefore, each student, when treated as an individual, will have a unique learning requirement. Professors must acknowledge this and design this assumption into a course syllabus. Student will learn in different ways, at different speeds and respond differently to course material. "Teachers can create improved classroom environments and higher levels of student engagement if they focus on appropriate procedures and have students practice those procedures until they become habits [44]." The next aspect of pedagogy that results in an actively engaged student is active learning strategies. Teachers and professors must seek out new and different ways of stimulating interest in classroom material and discussion. A video lecture, recorded short lecture, and e-textbooks are inherently isolating for the student and result in a mind-numbing rather than mind-engaging learning experience. Professors and teachers should emphasize comprehension strategies that focus pre-reading and summarization that provide the opportunity for student to be more engaged in readings. Reading is a primary focus for student engagement because reading is a cornerstone of any education endeavor.

These preconditions to an engaging classroom must be backed by practices that facilitate actual student engagement. These strategies for engagement vary by course structure and medium. For instance, the methods used to engage students in a traditional in-class lecture based curriculum might not necessarily be the best method for engaging student is an online based course curriculum. There are a wide variety of methods traditionally used to engage students

participating in traditional in-class lecture focused learning. Experts from Illinois State University suggest that student respond positively to having more choices and a sense of control when it comes to the planning and evaluating a course in which they participate. This sense of control can include students having the opportunity to draft exam questions or pursuing topics of their interest in discussions and assignments. Following this strategy for student engagement, professors should seek constant feedback from students throughout the duration of the course. In this way students feel that they are a part of a course dialogue about effective teaching methods.

Positive feedback is another strategy for engaging students in a traditional course setting. This feedback can come in the form of assignment and participation feedback from the instructors or interaction within peer groups of students. Farmer et al suggest that fair and equitable evaluation methods are ways of keeping students engaged in a traditional course setting. This would constitute assignment and participation feedback from instructors. Students are more likely to put forth more effort if they feel that those efforts will be rewarded by an evaluation comparable to the amount of effort exerted. Professors should avoid competitive grading within courses and strive to vary the forms of grading activities (Farmer et al). Feedback from peers whether in a class setting or in small groups provide support and lend credit to the contributions of individual students. These two forms of feedback to serve positively enhance the learning experience of students in a traditional setting. If students feel validated from both instructors and their peers they are more likely to actively engage in a course.

The strategies used for engaging student in a traditional in-class setting have been developed over long period of time and their implementation does not necessarily equal successfully engaging students. The increased usage of distance learning as a means of granting students access to higher education has not enjoyed the same long term evaluative development process. It was not until recently that researchers realized that solely giving access to course digital materials does not necessarily equate to student engagement in those same materials. "There are two primary fundamental of student engagement: (a) the amount of time and effort students put into their studies and educationally purposeful activities, and (b) the way an institution uses its resources and organizes the curriculum and other learning opportunities to encourage student participation [45]." Current research has formulated a number of strategies for engaging students in this online digital format. Martin and Olsen [44] conclude that utilizing online social networking as a medium for student interaction is a promising strategy for improving student

engagement. This strategy reflects a philosophy that the most effective means of communicating with students is through their preferred means of communication. According to Madden et al [46], 61% of all internet using adults are members of social networking sites, such as Facebook, Twitter, or LinkedIn. It is logical for instructors to pursue social networking media as a teaching tool because student use technology in which they are interested. If students are interested in a particular technology then they are far more likely to show higher levels or motivation and engagement in course materials.

Research has suggested that making efforts to establish a sense of community within an online course is an effective way to engage students. "Community, in the online sense, can be defined as an environment which is enabled through the interaction and collaboration of its members using various technology and mixed media methods [47]." Interaction is the essential building block of any community. If members of a community are not able to interact in some form or fashion then it does not exist. The Education Development Centre at Carleton University suggested a number of techniques to foster a sense a sense of community in an online classroom. These techniques include:

- **Use inclusive language when lecturing.** Instructors note the importance of building community through inclusive language such as "us" and "we" as it generates a sense of unity for both face-to-face and distance students.
- **Build rapport with your students.** Consider posting a welcome video, podcast, or presentation to introduce yourself and your course. This is way for students to see and hear you so you are not perceived as a virtual instructor.
- **Have a positive attitude.** Be enthusiastic and market your course to your students as a way to promote community.
- **Use your voice and be honest.** Write all content and instructions using your own voice which comes across as more open and genuine with your students.
- **Set online office hours.** Schedule regular, online office hours or group discussions where you and the students can connect on a weekly basis.
- **Establish an online presence.** One instructor noted that by establishing a strong sense of being there and being present by creating a personal website, blog, or by tweeting can naturally improve classroom management in an online classroom.

Conclusion

The project being implemented in our institution showed success to make numerous ways of increasing student interactivity in alternate educational environments through innovative course delivery methods such as In-Lecture Event Identification Applications, Offline Lecture Splicing, and Student-Interaction Enhancement Application. Once completed, it will advance knowledge by improving the effectiveness of current alternate course delivery methods. The MOD enhances student learning by increasing student interactions/engagement through use of repository. It encourages students to actively engage and experience different ways of thinking and learning that aid cognitive flexibility. A better understanding of how sophisticated technology impacts teaching and learning in engineering will emerge through our assessment and evaluation efforts once the project is 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 "Educating Educators" by training faculty members not only in the use of various methods for alternate course delivery but improve learning from new student-faculty interactions. It will disseminate our model and findings to the engineering community and help establish engineering education partners (community colleges, primarily).

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