Pedagogical Risk Taking: Is It Worth It?

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Abstract

Traditional pedagogical techniques are teacher-centered, frequently entail lengthy lecture sessions or one-way presentations, and involve limited student engagement and participation. Research shows diminishing results of such pedagogical techniques in students' learning especially for millennials. As technological, economic, and cultural forces have fundamentally altered the very foundation of traditional educational models, educators try to figure out how to best meet the needs of students in a personalized, meaningful and timely way. As are result, several new innovative teaching methods have been developed. These methods of content delivery deviate from the traditional model of lecturing and passive learning towards a greater focus on active learning, where greater student interaction is encouraged, the boundaries of authority less defined, and a focus on learning over grades is emphasized. However, for a faculty member, identifying new and engaging ways of teaching and course reorganization can be a time consuming and research intensive process. Sometimes, it may also require a significant technology investment. Despite the faculty member's ardent effort, there is a risk of failure since not all pedagogical techniques work for all courses. However, when executed properly, these innovative techniques keep students engaged and motivated and significantly improve students' learning. In this paper, we refer such innovative teaching techniques as pedagogical risk taking techniques. The paper describes pedagogical risk taking activities of four instructors from three different institutions. It gives a critical look at the effort required to create such teaching methods and the results in terms of improvements in student learning and satisfaction. Findings show that taking pedagogical risk is an important pedagogical tool that instructors should have in order to engage and improve students' learning.

Introduction

College provides boundless opportunity to a student in his/her personal, intellectual and social development. Among different connections that a college student can make, research shows that student-faculty relationships are the most crucial connection within a collegiate community (Duberstein, 2009). A sense of connection with a faculty member helps students feel like they truly belong at the institution. When students feel connected to the campus community, they are more often retained and excel academically, creating a winning situation for everyone. Faculty members who understand the learning needs and interests of their students can appropriately tailor assignments, expectations, and conversations.

The center of this faculty-student relationship is various pedagogical techniques that a faculty member employs to connect and teach students. The traditional teacher-centered pedagogy is associated with top down, hierarchal pedagogy that reinforces passive learning, role memorization, and hinders the development of higher level cognitive skills ((Duckworth, 2009; Cristillo, 2010). On the other hand, student-centered pedagogical strategies which promote keeping students actively thinking, writing, comparing, and applying new knowledge result in deep learning and better student performance (Weimer, 2002; Wohlfarth, et al., 2008). In a meta-analysis of 119 studies, across grades K-20, Cornelius-White, found that learner-centered variables such as non-directive verbal interactions, incorporation of higher-order thinking, encouraging learning and challenge, and adapting to individual and social differences correlate significantly with cognitive and affective student outcomes (Cornelius-White, 2007).

Engineering technology courses tend to be content heavy, which students often find to be boring resulting in feeling of indifference towards learning. Student-centered pedagogical techniques which seek to actively engage students in their own learning could be a solution in such cases. However, identifying new and engaging ways of teaching and course reorganization are not only time consuming, but in many cases requires significant technology investment. Even if a faculty member takes the initiative, it does guarantee success. There is always a risk of failure and often these enhancements require multiple adjustments which can deter faculty from taking such pedagogical initiative in the first place. However, when executed properly, these innovative techniques keep students engaged and motivated and significantly improve student learning. We referred such innovative teaching techniques as pedagogical risk taking techniques. This paper presents four case studies of pedagogical risk taking activities by four faculty members from three different institutions. . Each case is unique in terms of the instructor's incentive, teaching approach selected in crafting a more engaging learning environment for their students, and results in terms of how each strategy impacted student learning and satisfaction. The authors hope that their case studies will act as catalyst in motivating other engineering technology educators to become risk takers with their own pedagogical techniques.

Pedagogical Innovation

Over the last 50 years, engineering education research (as well as STEM) has shifted toward understanding the processes through which students learn and factors that promote and hinder learning (Ambrose, Bridges, DiPietro, Lovett, & Norman, 2010). Many research based pedagogical strategies have been developed and their efficacy have been tested with respect to student learning, particularly in the disciplines of engineering, science, and mathematics. These strategies include learning in small groups (Springer, Stanne, & Donovan, 1999), active learning (Bonwell & Eison, 1991), cooperative learning (Johnson, Johnson, & Smith, 2006), service learning (Coyle, Jamieson, & Oakes, 2006; Duffy, Barry, Barrington, & Heredia, 2009; Oakes, 2009), peer led team learning (Tien, Roth, & Kampmeier, 2001), peer instruction (Crouch & Mazur, 2001), just-in-time teaching (Novak & Patterson, 1998), and inductive teaching approaches (Prince & Felder, 2006), such as problem based learning, project based learning, inquiry based learning, and challenge based learning. These and other pedagogical strategies have been advocated in recent reports from the American Society for Engineering Education (ASEE) (Jamieson & Lohmann, 2009, 2012).

Engineering and Engineering Technology faculty members have a history of implementing successful curriculum innovations. Prince, et al. (2004) identified 12 innovative research based instructional strategies among chemical engineering educators collaborative learning, active learning, problem-based learning, inquiry learning, concept tests, think-pair-share, cooperative learning, case-based teaching, peer instruction, just-in-time teaching, thinking-aloud-paired problem solving and service learning. About 87% of faculty who completed the survey for this study indicated that they currently use at least one of these strategies. However, faculty members also identified a number of barriers to adopting these pedagogical strategies. Preparation time and class time were their biggest concerns of faculty members (averages of 44% and 51% respectively). Sun (2014) incorporated active learning elements (such as a name game, muddiest point assessment, homework troubleshooting, hands-on activities) into a freshman level Graphical Communications course in which he observed that the students overall were exceptionally positive in their assessment of the active learning elements. However, the author stated that “Incorporating active learning into a traditional lecture is not easy to implement due to the additional class preparation time, fear of the uncertainty that comes with the change and a potential low course evaluation from the dissatisfaction of the students due to implementing new and untried course elements”. So, even though there are risks and challenges associated with incorporating innovative pedagogical strategies within the classroom, the rewards outweight the work required in developing the lesson materials. The following sections describe pedagory risk taking experiences of four authors from three different institutions. In each case study, the author addresses the motivation for their risk taking, how the changes were implemented, and how innovative teaching approach impacted student learning and enjoyment of the course. The first case study examines how one faculty member created hands-on learning opportunities in his project management course by incorporated a project based virtual simulation tool.

Case One – East Tennessee State University

Motivation

The author teaches a graduate course, ENTC 5630 Project Management, which focuses on different tools and techniques commonly used in project management. The instructor observed that a disconnect exists in his course between learning about the various project management tools and techniques and how these are applied in engineering technology professions under constraints such as cost, quality, safety, etc. Although the students learn how to create schedules, budgets, and risk management plans, they never learn if these management plans work because they don't get the opportunity to implement them. This type of exercise could be described as half learning. In order to close this gap, an innovative instructional module based on Project Based Virtual Simulation Tool was developed and implemented. It was anticipated that new instructional module will help students not only create management plans, but also execute them for a realistic project in a virtual environment. This approach helps students learn project management in full circle from planning to completion in all project management knowledge areas.

The Learning Module

This instructional module utilizes a project management simulation tool called SimulTrain® (http://www.simultrain.com/). This is an online simulation of project management which allows learners to acquire core project management competencies such as planning, scheduling, executing and controlling as well as teamwork and leadership skills in a realistic virtual environment. Working in teams of 3 to 4 people, learners play the role of the project managers. The teams have to plan, schedule and execute a typical mid-sized project. They immediately see the consequences of their decisions. Repeatedly, they must analyze the project performance, plan a strategy to improve it, and then execute their decisions out into the future to meet the project’s time, cost and quality objectives. They face great uncertainty both from the outside environment and from their own decisions. Incrementally, the students learn to skillfully adjust their plan and schedule as they discover the nature of real-life decisions, conflicts, tradeoffs, and potential outcomes. Each simulation runs eight hours which can be divided into several sessions for easy implementation in the course. The SimulTrain® activity forces students into a growth mindset because they are required to engage in a new and challenging activity, learn from their mistakes, and persist in the face of setbacks.

Assessment

The newly developed instructional module was deployed into the ENTC 5630 Project Management course in Fall 2018. In order to measure the newly developed module's effectiveness, a survey was administered and summative assessment of final exam scores were used. The survey revealed that 95% students reported that the game was challenging and interesting. One student commented "Managing cost, scope, and time, without compromising quality and workers motivation was most challenging". Another student mentioned "Initial planning, making multiple decisions with unknown-unknown risks was challenging". All students agreed that the game was engaging and they were most engaged during the planning and execution phases. The survey asked students about the positive aspects of the game. Listed below are a sample of some of the students' responses:

1. The game gave us a holistic view of project management enhancing decision making skills
2. It provided a real-time scenario with real life pressure.
3. It gave us the opportunity to test most of the knowledge areas we learned in the class. It encouraged teamwork
4. The game gives a practical idea of running a project, dealings with staffs and colleagues meeting management requirements
5. The aspects of effective planning for the usage of resources and also effective risk management response to be provided when the risks occur accordingly.

The students also pointed out few negative aspects of the game as described below:

1. It doesn't show exactly how decisions made affect the different performance indexes.
2. The initial stage was confusing and the demo should be improved to show the indices while playing demo. Also the number of messages and calls affect effective execution.
3. Risk Register should be open to change.
4. The time is so short to make quick decisions

Average final exam score was used for summative assessment. Figure 1below shows a side by side comparison of average final exam scores between the Summer 2017 and Fall 2018 semesters. Note that the course curriculum remained the same for both semesters, except that students played the SimulTrain game before the final exam in Fall 2018. The figure shows a 4% increase in average final exam score between semesters. Overall, student impressions about the game were overwhelmingly positive. The game helped them translate the knowledge they

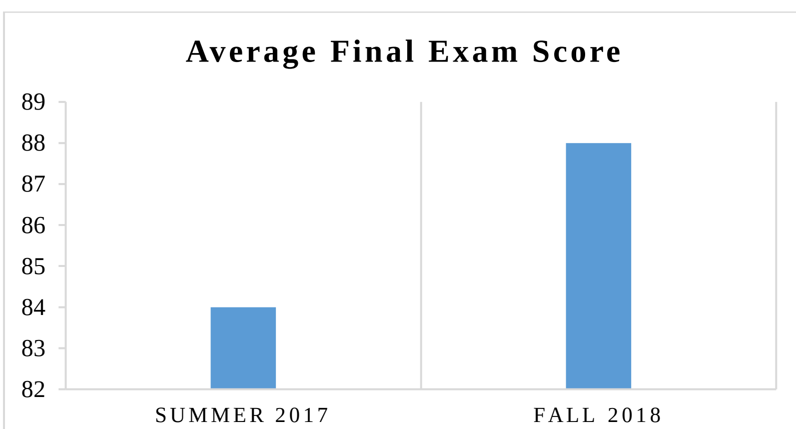

Figure 1: Comparison of Student Performance

learned in the class with a realistic portrayal of a project manager facing common issues impacting the successful completion of a project. Future plans include incorporating the game into the syllabus during the next course offering with some modifications based on students' suggestions.

In the second case study, the author shares how his risk taking pedagogical approach was applied in converting a traditionally lecture-based microprocessors course into a studio-based course with great success.

Case Two – University of New Hampshire

Background

One of the most common courses in a Electrical Engineering Technology (EET) program is a course in Microprocessors or Microcontrollers. Typically these courses focus heavily on teaching students how to program in assembly language and/or machine code. This makes the lesson material look very much like a software course. Traditional courses of this nature have 4 credit hours (3 credit hours for lecture and 1credit hour for laboratory). The intended purpose of the lecture is to introduce the concepts of programming a microprocessor to accomplish tightly constrained tasks using the peripheral features of the device. Once in the lab, the students apply the concepts covered in lecture to actual devices as they conduct a series of exercises demonstrating their ability to accomplish specific tasks. Figure 2 shows a weekly composition of a traditional microcontroller class.

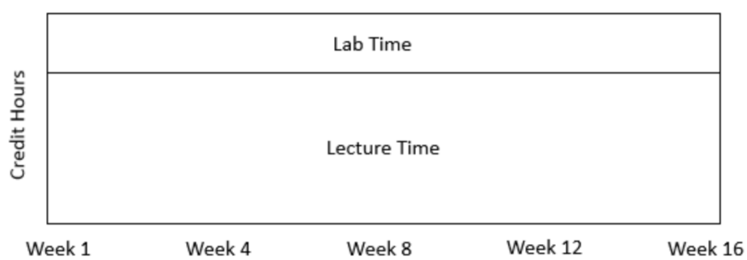

Figure 2: Traditional Microprocessor Course Timeline

The arrangement of the traditional course has several drawbacks. First it is challenging to for the instructor to teach programming in a lecture hall, it is also difficult for students to learn in this environment since programing requires hands-on (trial and error) learning that doesn't occur a lecture setting. Second, the higher level architectural features of microprocessors can be overlooked if too much effort is made to accomplish specific tasks in the laboratory setting.

Implementation

One possible approach to address the shortcomings of these classes would be to "flip" the classroom by having the lecture material presented online, allowing students to spend more time in the laboratory experimenting with microcontrollers. This approach can be too software heavy in content and the students might have a tendency to take on a "hacker" approach by looking up code on the internet and tweaking it to their purpose. This means they are not really learning programming best practices techniques or gaining a deep understating of the system level architecture. To address these concerns a new approach was developed with the idea of having a "studio" like experience where the amount of laboratory time was allotted on a sliding scale. This would allow for more effective discussions (i.e. lecture) of the high level architecture of a microcontroller and allowing time for students to explore assembly language programming through hands on experimentation.

To strike a balance between a traditional and a flipped course, the class starts the semester structured as a traditional class with weekly lecture and defined laboratory times and exercises. Two instructors taught the course; one an expert in architecture who teaches the lectures and the other an expert in assembly language coding of Microcontrollers who manages the laboratory and studio. Very limited time during the lecture was spent on teaching coding techniques that was done almost entirely in the laboratory setting through pre-defined weekly lab assignments. Initially the students were told that their grade would be based on the following breakdown:

- Homework ………………………………………….. 20%
- Hour Tests (2) ……………………….………………. 30%
- Lab Reports (tentatively 8 labs)...…………………… 30%
- Final Exam (comprehensive, no exemptions) ……..... 20%

As the course progressed, students started to demonstrate success in both the laboratory and lecture. Lecture success was evaluated through two exams and weekly homework, laboratory success was evaluated through a series of weekly graded lab exercises. After the first month of classes and the first exam were completed, students were asked to vote on doing a final project instead of a final exam.

If the students chose the final project options they were given the opportunity to propose an adequate project that needed to be approved by both the lecture and laboratory faculty. Every project needed to be unique and have a demonstrated mastery of the materials covered in the course. At this point the "sliding scale" for lecture versus laboratory time started transitioning into more of a studio style experience. After the fourth week, the lecture time was cut r to allow students to prepare for their final project. By the end of the eight week, students should have completed defining their projects and ready to start working on the final projects. By week twelve, the students were in the laboratory (studio) for the entire class session and there were no more formal lectures. The students were required to complete their project by the sixteenth week and performed a formal demonstration on the final day of class.

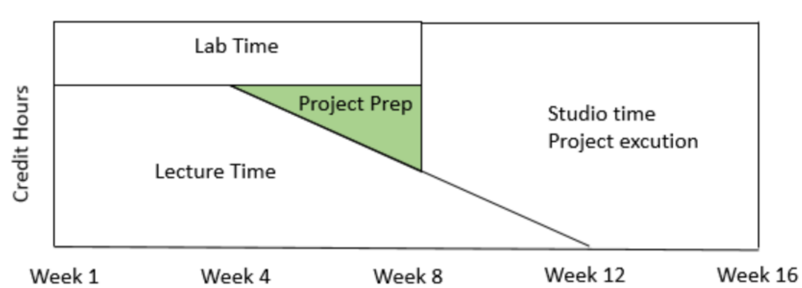

Figure 3: Sliding Scale Studio Microprocessor course timeline

The final project was graded using the following broad rubric:

50%- Project Documentation:

- Text description explaining what you are trying to accomplish
- Schematics
- Flow Charts of your code
- Code listing with the appropriate amount of comments

25% -Project Functionality:

- How well the execution was planned and thought out
- Does the project function in the way it was originally proposed?
- Where did you fall short in accomplishing what you set out to accomplish?

25%-Results:

- Summary of any data gathered or analyzed during the design
- Images of the waveform analyzed during design and debug
- Reflection, what did you learn during the design process?
- Relate your experience with what was covered in class

Results

For the past 5 years this course was taught during the fall semester. Since it is required for graduation, it is offered regardless of the number of students (explaining why in two cases there were less than five students).. Table 1 shows the number of students for each class, the average scores for labs, exams, final exams and final projects. In 2014 and 2015 the course was taught as a traditional class without a final project. The project was introduced in 2016 and the students still were required to take a final exam. Starting in the fall of 2017 the students were asked to vote if a final project could replace the requirement for a final exam.

Table 1: Students' Assessment results (2014-2018)

	#Students	Hmwk %	Labs %	Exam 1 %	Exam 2 %	Final Exam %	%Final Project
Fall 2014	4	93	100	86	80	76	No Project
Fall 2015	8	93	90	89	88	81	No Project
Fall 2016	9	81	83	89	86	69	80
Fall 2017	13	88	87	89	81	No Final	87
Fall 2018	5	90	90	87	81	No Final	84

It was clear for the classes that had a final exam the scores were significantly lower than the two semester exams (Exam 1, Exam2). In 2016 students were required to do both a final exam and a final project with the project scores higher.

The table demonstrates that students did benefit from more hands on time in the studio and they did use the extra time effectively. Students tended to struggle with defining a project that has enough depth to demonstrate mastery of the material that could be completed in the amount of time allotted even with the sliding scale of studio time. In many cases students seemed to choose projects that were too elaborate and the studio instructor worked with them to scale them down to something manageable. It is also of interest to note that the predefined weekly lab exercises tended to have higher averages than the final projects. It did come as a surprise to some of the students that doing a final project did not result in an automatic A.

Each time the students were asked to vote between a final exam or final project, they unanimously decided on a final project. It was not the case in any of the sections offered to date, but if adequate performance on the prior exams or early lab exercises was not demonstrated, the offer would not have been made. The class evaluations were generally positive with some students expressing concern that the lecture, laboratory and studio did not seem to be synchronized well. The students seemed to appreciate the democracy of "voting" to not take a final exam and the majority of them embraced the studio nature of the final project. Another interesting side effect was that students were told that, if the instructors did not receive 100% participation on the on-line course evaluation forms at the end of the semester, they would have both at final exam and project. Student participation in the on-line course evaluations was 100% the last three semesters that the course was taught. Overall, the changes were positive from both student and instructor perspectives, and with some minor adjustments the course will be taught the same way the next semester.

Employer feedback clearly indicates that self-learning (and becoming active learners) are essential skills for students to succeed in both engineering and engineering technology professions. However, traditional lecture/teacher centric pedagogical techniques do a little to train students in active and self-learning. In the third case study, the author reveals how he uses a "blended course design" to enhance active learning and improve faculty-student interaction.

Case Three – Georgia Southern University

Motivation

In the summer of 2015, one of the authors participated in a week long "blended course design" workshop offered through the University's Center for Teaching and Technology. A blended course is a course that blends the attributes of online course content (flexibility with time, place, and pace) with the benefits of a traditional classroom environment (opportunity to ask questions, availability of instructor guidance, ability to collaborate with peers, and options to explore topics in greater detail). Topics covered within the workshop included: strategies for integrating the online and face-to-face components, designing learning activities, leveraging technology for student success, and developing assessments.

At the conclusion of the workshop, the author decided to "take the plunge" and converted many of his existing courses into blended courses. Several factors were taken into consideration in making this decision:

- Blended courses seemed a viable option for maintaining the student-instructor interaction necessary for student learning in courses with ever-increasing enrollments.
- The merits of blended courses (leveraging the attributes of both online and traditional classroom components) outweigh the cost in terms of the required effort needed to convert traditional courses into blended courses.

- Blended learning is regarded as an effective approach for helping students learn how to take a more active role in their learning and develop self-directed learning skills. These skills are vital in engineering professions which require continuous learning.
- Since most millennials are tech savvy, it was anticipated that students would embrace the use of information technology and likely put more effort into each course.
- Having recently been awarded tenure, the author felt secure enough with his employment to take a chance by changing his teaching style. Privately, several of author's colleagues questioned his decision since he had a history of high instructor ratings from students (refer to Table 2) and converting his courses to a blended format would risk "rocking the boat" while also requiring substantial effort.

Implementation

Three courses were selected for blended conversion (Table 2) mainly due to their large amount of content (well-suited for online delivery) and abundance of active learning components (problem solving sessions, software applications) that require student-instructor interaction. The first course that was converted into the blended format, Fluid Mechanics, was selected based on the author's familiarity with the course (taught it for eight years). Since this was author's first experience developing a blended course, the online content was phased in over a period of two semesters. During this period, author learned which elements (often by trial and error) were best-suited for online instruction and which were better in a face-to-face classroom environment. Having gained experience with blended course development through the Fluid Mechanics course, the author then started work on developing blended courses for the Introduction to Structures (Fall 2016) and Hydrology courses (Fall 2017). Both courses also took two semesters to completely implement into blended courses.

While each of the three blended courses are different in terms of their content, contact time and meeting schedule, the basic "recipe" used for each blended course is similar. Every week students are required to review the upcoming week's lessons online and complete either an online quiz or "ticket". A ticket is a form containing various short answer and computational questions that students print out and complete. Both the quizzes and tickets are graded and used to ensure that students complete the online lessons of each course prior to the upcoming face-to-face sessions which focus on hands-on learning activities (problem solving sessions, computer-based activities and laboratory exercises). Each online lessons contains a combination of PowerPoint presentations (covering lecture style content with derivations, etc.), Lightboard and Kaltura videos showing problem solving examples, and Internet-based videos (YouTube, etc.) highlighting real-life applications.

Results

Table 2 summarizes the student responses (1 to 5 point scale) for the instructor and course satisfaction rating. Observe that, for all three courses, both the instructor and course ratings were larger for the periods in which blended courses where used than for the semesters in which the traditional classroom model was used. For the instructor rating, the increase ranged from 3.5% to 6.4%. For the course rating, the increase ranged from 3.5% to 7.7%. These results clearly illustrate that, any concern that the author (or his colleagues) had regarding the students' acceptance of blended courses was unwarranted. On the contrary, students in these courses appeared to embrace the blended course structure.

Table 2: Comparison of Student Rating of Instructor Performance and Course Satisfaction for Traditional and Blended Courses (Scale: 1-5)

Course	**Traditional Course**			**Blended Course**		
	Instructional Period	**Instructor Rating**	**Course Rating**	**Instructional Period**	**Instructor Rating**	**Course Rating**
Fluid Mechanics	Fall 2008-Spring 2015	4.60	4.31	Fall 2015-Fall 2018	4.76	4.51
Hydrology	Fall 2007-Fall 2015	4.51	4.22	Fall 2017-Spring 2018	4.83	4.60
Introduction to Structures	Spring 2016	4.63	4.36	Fall 2016-Fall 2018	4.76	4.53

While summative assessment data (exam scores, etc.) to substantiate that student learning improved through the use of blended learning was not collected (this would require having the same student sample take the same exact course using both the traditional and blended course design), feedback provided by students from end-of-semester questionnaires are overwhelmingly positive. Observations from this feedback include:

- Students like the flexibility of the online component paired with the interactive nature of the in-class sessions.
- When integrated properly, the online and classroom components can complement each other nicely. Whereas the online components are affective in providing students with needed background and application information, the classroom element provides them with an opportunity to get instructor guidance, collaborate with peers, and practice applying concepts.
- Having frequent (but low stake) activities online such as quizzes and tickets help students take a more active role in their own learning and keep them from falling behind.
- Students prefer the collaborative in-class problem solving sessions to the traditional method of using homework assignments as a student's first exposure to problem.

A commonly-overlooked element of active learning is student involvement in questioning and class discussions. In our last case study, the author how he addressed a tendency he observed in his courses in which students were not asking questions (content with leaving the classroom confused about the lesson) through pedagogical techniques aimed at stimulating class discussions.

Case Four – East Tennessee State University

In recent years more and more students have become very tech savvy and have developed a preference for digital communications over face to face communications, which often includes asking questions of faculty in the classroom. Like many faculty members, the author experienced students not wanting to ask questions openly in front of their peers (content with leaving class not knowing answers to their questions). s. When students don't ask questions in the classroom, it can be very frustrating for faculty though they can anticipate some questions and incorporate into their teaching. Numerous studies have been conducted regarding student behaviors in classroom settings and how this environment impacts class discussions and questioning. Some of the findings regarding student reasons for not engaging faculty includes, but are not limited to the following:

1. The student isn’t curious about the subject and needs inspiration.
2. The student is so utterly lost, they don't know where to start.
3. The student is an introvert who doesn’t naturally engage in dialogue.
4. Fear of asking a dumb question.
5. Fear of looking uncool or like they are kissing up.
6. Fear that everyone, teachers included, will think their time is wasted.
7. Students don't understand why asking questions is important

Though this issue seems simple to fix, it is very complex. There are social, environmental and intrinsic and extrinsic motivators that impacts students’ ability to ask questions in a classroom setting. Fixing this problem requires a cultural change. This, in essence provides faculty a unique and dynamic role of having to provide a classroom environment that is psychologically safe and non-threating for the students they teach. This includes developing positive routines from the time the students meet faculty members on the first day of classes.

Over the years, the author has tried a variety of techniques to encourage students to become more engaging in the classroom interactions and asking questions when they lack understanding and knowledge. Some techniques have increased more participation and others have shown very little positive change. One strategy that has been more effective than others s will be addressed as a best practice. However, the author has tried some of the more traditional methods including, but not limited to calling on students to ask questions in the classroom. This approach is probably the most ineffective strategy because some students develop anxiety anticipating that they will be called upon. The author also tried the “asking a friend” approach which includes one student starting to answer a question and there neighbor can chime in to answer the question. That didn’t work either. Also putting students in groups to discuss topics and ask positive open ended questions did not receive much traction. In the groups, the student (s) who feel most comfortable in that setting would dominate asking of questions, while other fail to chime in.

One strategy that the author found to be more effective than many of the others is to have students ask questions and allow them to remain anonymous. The author identifies a “critically constructive moment” (CCM) in a lecture and passes out index cards to all of the students and request that they write down one question. Students are given a short period of time to develop their question and write it on the card. Cards are then collected and shuffled in front of the class. A random card is select to further assure that students remain anonymous, before reading and answering questions. The author reads and answers several cards, continues teaching and incorporate questions from other cards throughout the remaining part of the lecture. Typically, the CCM occurs more often when covering new topics or topics that are more critical than others. Other faculty have tried similar techniques with slightly different implantation steps and have received similar results. Sometimes a card may have a question that is not relevant to the topic or previous topics, or perhaps contains a question that requires a response that would require more time than is available. In those cases, the student is asked to stay for a few minutes after the class to discuss it or perhaps meet me during my office hours.

A survey was distributed to the students in which they were ask their opinions regarding the use of the index cards as a way for them to ask questions and stimulate class discussions. . The majority of the students (20 of 23) indicated that that the use of index cards were very helpful by providing them a way to ask questions without being singled out. One students commented “If I asked a stupid question, no one knew it was mine”. When ask if the index card activity should be continued, all of the students 23 surveyed in the classed agreed that it should. A more formal assessment of the use of index card will be conducted during the Spring 2019 semester.

Conclusion

Engineering and Engineering Technology faculty face many obstacles (limited time to cover large amounts of content, highly technical content, challenges in creating hands-on learning experiences) that, if not addressed through a proactive teaching approach, can lead to limited student engagement, disinterest in course topics, and reduced student learning. This paper illustrates four cases studies from authors at three different institutions that were willing to take a proactive stance and take pedagogical risks aimed at improving student engagement and student learning. All case studies illustrate that, while developing and implementing alternative pedagogical activities requires significant investment in time, resources and effort, the benefits in terms of student learning and course satisfaction outweigh the time commitment. Engineering educators often comment that the new generation of students lack motivation and are not actively participating in their own learning and development. These case studies illustrate that perhaps the use of traditional (i.e. “same old”) pedagogical methods need to be supplemented with alternative approaches to make courses more interesting and relevant to the students’ needs and interests. The authors conclude that engineering educators should experiment and take risk with new innovative pedagogical techniques in order to facilitate meaningful student engagement.

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