Improving Communication in Industrial Engineering Courses by Implementing a "Zero Email" Policy and Optimizing the Use of a Course Management System

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Abstract

Numerous research studies have shown that college students prefer face-to-face, verbal communication for their college courses, rather than social communication (e.g., Facebook, Twitter, apps, text messages); despite the fact that college students communicate more via text messages than any other communication option (e.g., face-to-face, email, text). This paper describes a study in which the instructor did not email the students, but instead communicated information face-to-face during class and kept the learning management system up-to-date in terms of calendar deadlines, assignments, grades, and course notes. The results of this study show that students were very satisfied with the instructor-student communication methods used in the industrial engineering classroom. The results show that the majority of students accessed the learning management system 2 to 3 times a week, daily, or multiple times in a day. The students reported logging into the learning management system most commonly to check grades, print lecture notes, and check the course calendar for upcoming course assessments and topics to be covered on assessments.

Introduction

Have you ever thought about how many students in your classroom actually check their email accounts? Have you ever thought about how many students actually read every line of an email after opening an email? When an instructor sends an email to his or her students, the instructor must realize that this form of communication is probabilistic, meaning that only a percentage or fraction of the students will actually get the necessary information that was sent to them. This paper discusses the results of a study performed in an industrial engineering department at a large, public U.S. university to identify and implement the significant factors of student satisfaction and motivation within the industrial engineering undergraduate classroom.

This study builds on another study performed at Pennsylvania State University that identified three overarching factors influencing student satisfaction and motivation in the industrial engineering classroom: Instructor Interaction and Feedback, Classroom Environment, and Modes of Instruction. The instructor implemented a list of factors to improve the educational experience for both the students and the instructor. At the heart of the implementation strategy was to continue to improve communication between the instructor and the students. Throughout years of being a teaching assistant and an instructor of industrial engineering courses, it had become more and more apparent that communication through email was simply not effective.

The instructor decided to implement a "zero email" policy, meaning "zero emails" would be sent from the instructor to the students enrolled in the course. The only time this rule is broken is if an emergency occurs (e.g., instructor is ill, school is cancelled), or if an individual student emailed the professor and the professor replied to the individual student. The instructor found that by starting class each and every day by taking attendance (no matter the size of the class) and discussing the upcoming events in the learning management system calendar while taking

questions from the students, a higher percentage of students were actually receiving the necessary communication from the instructor.

The instructor also optimized the use of the learning management system at Pennsylvania State University. This paper will summarize data taken over a span of three years regarding student use of the learning management system and the effectiveness of restricting instructor to student communication to the modes described above. The instructor of this course consistently received the highest student ratings of teaching effectiveness in the industrial engineering department at this large U.S. public University. The hope is that this communication methodology and student satisfaction model will be adopted by other industrial engineering programs in an effort to improve communication, student satisfaction, and student retention in industrial engineering.

Literature Review
This paper addresses the repeated notion that students prefer face-to-face communication to other forms of communication. The management and administration of the course was completed through use of a learning management system, with communication occurring during classroom instruction time. The following literature review outlines internet usage, social media usage, email usage, media multitasking among students, and learning management system usage in higher education.

Internet Use and Internet Communication within Higher Education:
Widespread use of the internet within higher education has only occurred in the past 20 years[1]. Its usage and its impact on society has been comprehensively monitored by the Pew Internet and American Life Project[1].

In a 2002 study from Pew Internet and American Life Project[2]:
- 49% of college students (in 2002) first began using the internet in college and 47% first began using it at home (before college)
- 79% of college students agreed that their internet use has had a positive impact on their college academic experience
- 46% of college students agreed that email enables them to express ideas to professors that they would not have expressed in class
- 58% of college students have used email to discuss or find out a grade from a professor
- 65% of college students have used email to report absences

Pew Internet and American Life Project, comparing 2000 to 2015[3]:
- In 2000, about 50% of American adults used the internet, in 2015 that value was 84%
- In 2015, and steadily since 2010, internet usage of young American adults has been 96-97%
- In 2015, and steadily, internet usage by college-educated American adults has been 95%

In a 2005 study of College and University Faculty in the USA[4]:
- 98% of faculty members reported using the internet to communicate to students
- 92% of faculty indicated email was their preferred choice when contacting students via the internet (the paper did not differentiate between email and learning management systems)

- Most faculty reported positive impact of internet usage with students, although there were differences between gender and age (of the faculty).

However, in a 2015 paper, a study showed that first-year college students still prefer face-to-face communication over all other communication options[5]. Even though first-year college students communicate more via text messages than any other communication option (e.g., face-to-face, email, text). Yet, for example, first-year college students do not think it is appropriate to have a course-based Facebook page for a college course. In other words, first-year college students have a professional expectation of communication with professors and classes - rather than a social expectation. A study from 2006 showed that college students put more thought into emails to their professors (and groups of students) than they do in verbal face-to-face communication[6].

Social Media Use within Higher Education:
The Pew Internet and American Life Project has also studied the usage of social media. There work found that in 2015[7]:
- 24% of teens (aged 13-17) are online "almost constantly" via smartphones
- 92% of teens go online daily, 56% of teens multiple times a day, 12% just once per day, 6% just weekly, and 2% less often
- 34% of African-American teens report being online "almost constantly," 32% of Hispanic teens, and 19% of White teens

The preferred social media outlet is Facebook (71% of teens using the platform), followed by Instagram (52%), Snapchat (41%), Twitter (33%), Google+ (33%), Vine (24%), Tumblr (14%), and Other (11%). With a majority of teens (71%) using multiple social media platforms. It was also shown that wealthier teens were more likely to use Snapchat and Instagram, than lower income teens. Females were more likely to use visually-oriented social media platforms (e.g., Instagram, Snapchat, Pinterest, Tumblr). Whereas, males were more likely to play video games.

Yet, social media policies for higher education are lagging[8]. A paper outlined guidelines for social media usage in higher education communities. The work reported that in 2009 only 38% of medical schools (132 accredited medical schools surveyed in the USA) had social network policies, and only 13% of colleges and universities (500 surveyed in the USA) had social network policies. Even though 97% of the schools had student guidelines and policies available online. However, only 10% of these schools had social media policies that were easily found online, whereas 95% had public Facebook pages.

A recent study of undergraduate students' perceptions and practices of social media within higher education showed that Facebook was the most commonly used technology for communication and was the preferred communication for social use. However, students preferred to use email for individual communication and use a learning management system for submitting assignments. Students indicated that they did not like to use social media for academic activities[9]. This result is backed by numerous studies, that students prefer face-to-face communication for their academic activities[5,6,10].

Email Use within Higher Education and other Professional Workplaces:
Email usage has been studied in professional workplaces for some time. And email communication in contrast to face-to-face communication has been shown to be effective only when face-to-face communication was not available or when complexity and content (e.g., to share a graphic or file) dictated the need for email communication[11]. Another study of a professional workplace's email system indicated that emails were more frequent for managers than for non-managers and that the number of emails sent and received had a positive correlation with work performance ratings[12].

A study at a university evaluated whether email communication would enhance the professor-student relationship within the context of the student evaluation of teaching. The empirical results indicated that email responsiveness and email helpfulness was a significant predictor for positive student evaluation of teaching[13].

Media Multitasking among College Students:
Recently, work has been conducted to study media multitasking issues amongst college students. Empirical research showed that a majority of students attempt to media multitask (e.g., use internet or watch television while reading a textbook) and that about half of the students indicated that this hampered their academic focus[14]. Another empirical study of college students indicated that the motivation for multitasking differed by the medium. Multitasking with music was done for entertainment and efficiency needs, whereas multitasking with social media and texting was done for escaping needs. Habit was considered the primary indicator for why students decided to multitask[15].

Learning Management System Usage:
Learning management systems, at least in a primitive form, have been used since the 1970s. However, their more modern adaptations found their beginnings in the 1990s. The most widely used learning management system amongst colleges and universities in the USA is Blackboard. Blackboard, Inc. was formed in the late 1990s and its initial learning management system was based on its merger with CourseInfo, LLC's initial offerings, which merged with Blackboard in 1998[16]. Since that time numerous learning management systems have been created and continuous development has occurred to the software. However, other studies have been done to capture the educational impact of these systems, including faculty and student interaction.

One study examined email, Blackboard, and Facebook interactions among students and faculty. It found that Facebook was primarily used for social interaction, and that students initiated the connection request with faculty (some of which were reluctant to accept the request). The study also found that learning management systems were helpful for both the student and the faculty, and that group emails generated from the learning management system were sufficient in meeting the needs. The students indicated that they did not use all of the functionalities of the learning management system, perhaps because certain functions were underused by faculty members[17].

There have been studies to determine the usage of specific tools within a learning management systems. One study found that students used the learning management system to view notes,

gradebooks, and announcements; however, only about half used it for reading discussion board messages and few (less than 5%) used it for sending discussion board messages[18].

Motivation for a Zero-Email Policy and Optimizing the Use of a Course Management System
Two of the paper authors worked over a five year span to develop a model for teaching new instructors how to set up and deliver undergraduate industrial engineering courses to maximize student satisfaction. The model is dubbed "I-C-D", short for Interact, Cultivate, and Deliver. The "Interact, Cultivate, Deliver" method summarizes eleven significant factors in a short and easy way for implementation. If an instructor chooses to implement the eleven significant factors summarized by the I-C-D model in their classroom, he/she should notice an increase in student satisfaction and potentially ratings, if a survey of satisfaction is given. Communication with your students and being approachable to your students was found to be a significant contributing factor to student satisfaction when research was being carried out for the development of the I-C-D methodology[19].

As the instructor implemented significant factors from this model into the industrial engineering classroom over the course of many years, the instructor began to witness email communication being an ineffective mode of communication with the students in the industrial engineering classroom. After sending an email regarding class announcements, the instructor noticed in class during the next period that only a fraction of the students actually opened and completely read their email. Over time, the instructor began to send a smaller amount of emails. Finally, the instructor decided to stop sending emails to the class "unless there was an emergency or there was something extremely important" that needed to be communicated to the class. On class day number one each semester, the instructor makes the following known to the students of the class:

- **Beginning of Class and Lab:** Every class and lab period will begin with the instructor taking attendance. After attendance is taken, the instructor will go over the ANGEL course management system course calendar and discuss all upcoming due dates and assessments. *(Note, ANGEL is a learning management system, similar to Blackboard.)* The instructor will take questions from the students to get everyone on the same page. After all questions are answered, lecture or lab will begin for that day. The instructor likes to communicate with all students in class and lab so that everyone can hear answers to questions and everyone can be brought up to speed and be on the same page.

- **Email Policy:** If you receive an email from the instructor regarding this class, you definitely want to open it and read it because it is important. The instructor will send three or less emails all semester to the class as a whole, likely zero. You can certainly email your instructor and your instructor will respond to you promptly via email.

- **ANGEL Course Management System:** The ANGEL course management system is updated daily. Grades and attendance are always up to date and the course calendar is always updated to communicate assessments and due dates coming up in the class. The ANGEL course calendar also contains the details of exactly what will be covered on assessments. If you have a question regarding what is coming up in the class or if you missed material because of an absence, 99% of the time your question can be answered by logging into ANGEL.

Experimental Procedure

Over the course of three semesters, the same instructor of an engineering economy course (IE EE) and a manufacturing processes course (IE MFG) instituted the zero email policy and also optimized the use of a course management system. The IE EE class met three times a week (50 minutes each lecture) for 15 weeks. The IE MFG class met twice a week (50 minutes each lecture) and an additional time each week (110 minutes) for a laboratory session. The instructor answered student emails promptly but refrained from emailing students in the class as a whole. The instructor communicated with the entire class of students at the beginning of each and every class period. It was at this point in time that all questions were answered and everyone was brought up to date on upcoming events in the ANGEL calendar. Both courses were predominantly made up of junior industrial engineering students. The course management system was the place where students went to:

- Check Grades
- Check Attendance
- Check Course Calendar for Upcoming Deadlines, Quizzes, Exams
  - The ANGEL Calendar also contained the breakdown of coverage on exams and quizzes
- Print Lecture Notes (Unedited and Edited)
- Print Lab Procedures (for IE MFG course)
- Print Assignments
- Submit Assignments
- Send Emails

Data were collected in both courses regarding student satisfaction with the instructor, course, communication in the course, and the use of the course management system. Table 1 below breaks down the course semesters and enrollments for the data collection.

Table 1: Course and Enrollment Statistics for Data Collection

Course/ Semester	Enrollment	Course/ Semester	Enrollment
IE EE/Spring 2014	85	IE MFG/Spring 2014	59
IE EE/Fall 2014	116	IE MFG/Spring 2015	60
IE EE/Spring 2015	80	IE MFG/ Spring 2016	28

Results

At the conclusion of the semester the students were asked to complete an optional, anonymous questionnaire regarding satisfaction, communication, and use of the ANGEL course management system in each of the classes.

Student Satisfaction with Instructor Communication of Grades and Announcements
The students were asked to rate on a scale from 1 (not important) to 10 (very important) how important the following factors were to them when evaluating the satisfaction of the IE EE class

A. The instructor knowing student names in the Class

B. Starting Every Class with Announcements/Questions

C. Knowing all upcoming events from ANGEL Calendar

D. Knowing the Topics to Study for all Exams and Quizzes

E. Knowing Your Grades at all times on ANGEL

F. Having a 1 class Quiz or Case Study Grade Return Policy and 1 Week Exam Grade Return Policy

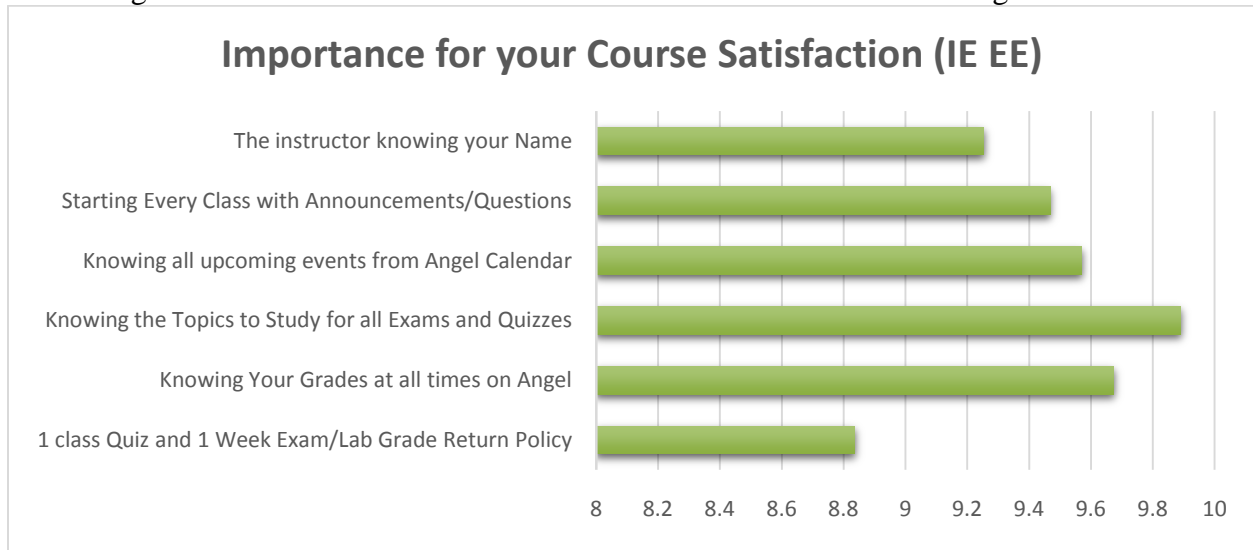The average results for the three semesters of the IE EE class are shown in Figure 1 below:

Importance for your Course Satisfaction (IE EE)

The instructor knowing your Name

Starting Every Class with Announcements/Questions

Knowing all upcoming events from Angel Calendar

Knowing the Topics to Study for all Exams and Quizzes

Knowing Your Grades at all times on Angel

1 class Quiz and 1 Week Exam/Lab Grade Return Policy

8   8.2   8.4   8.6   8.8   9   9.2   9.4   9.6   9.8   10

Figure 1: Average Results of Factors for Rating Student Satisfaction (0 to 10 scale) for IE EE.

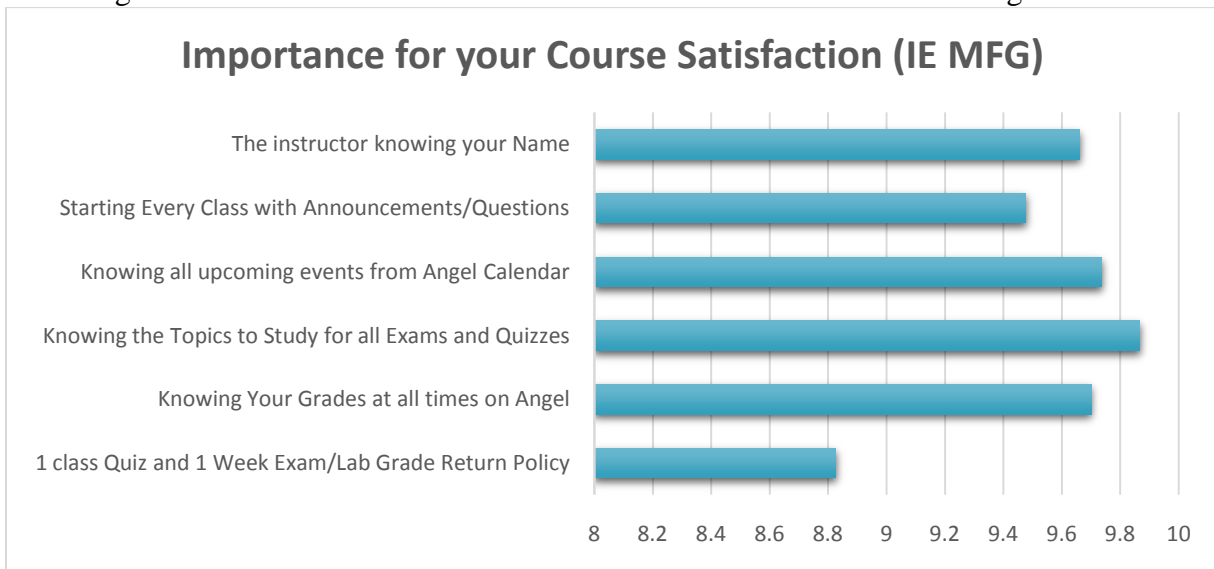The average results for the three semesters of the IE MFG class are shown in Figure 2 below:

Importance for your Course Satisfaction (IE MFG)

The instructor knowing your Name

Starting Every Class with Announcements/Questions

Knowing all upcoming events from Angel Calendar

Knowing the Topics to Study for all Exams and Quizzes

Knowing Your Grades at all times on Angel

1 class Quiz and 1 Week Exam/Lab Grade Return Policy

8   8.2   8.4   8.6   8.8   9   9.2   9.4   9.6   9.8   10

Figure 2: Average Results of Factors for Rating Student Satisfaction (0 to 10 scale) for IE MFG.

Frequency of Use of the ANGEL Course Management System
The students were asked to circle only one of the following for the frequency with which they accessed the ANGEL course management system:

1 Time Per Month   1 Time Per Week   2 to 3 Times Per Week

1 Time Per Day   Multiple Times Per Day   Never

The average results for frequency of use of the ANGEL Course Management System for the three semesters of the IE EE and IEE MFG classes are shown in Figure 3A and 3B below:

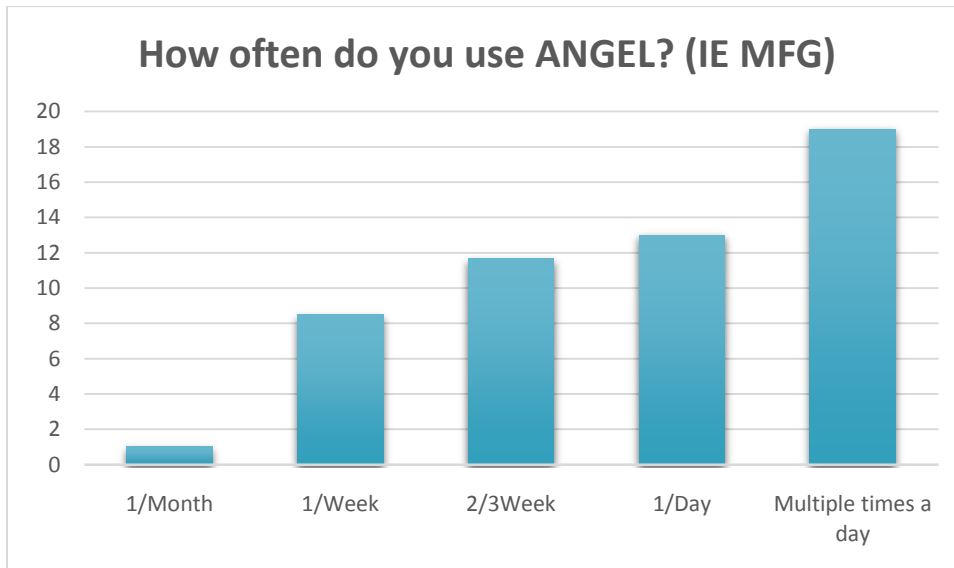**Figure 3A:** Results for Frequency of ANGEL use by IE EE students.

Figure 3B: Results for Frequency of ANGEL use by IE MFG students.

Reasons for Use of the ANGEL Course Management System
The students were asked to circle all that apply for the reasons for accessing the ANGEL course management system for their course:

1 Time Per Month	1 Time Per Week	2 to 3 Times Per Week
1 Time Per Day	Multiple Times Per Day	Never

The average results for *primary* reason for using of the ANGEL Course Management System for the three semesters of the IE EE and IEE MFG classes are shown in Figure 4A and 4B below:
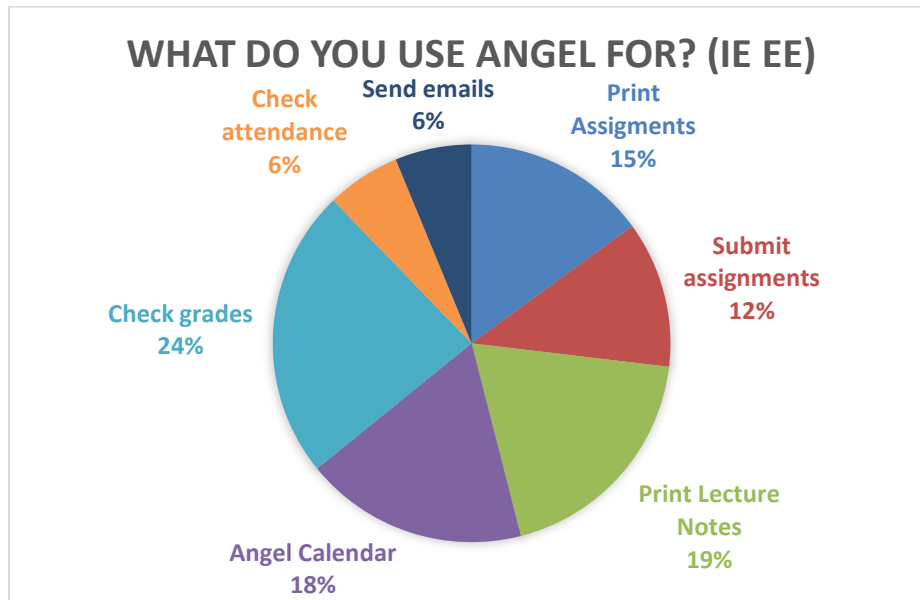

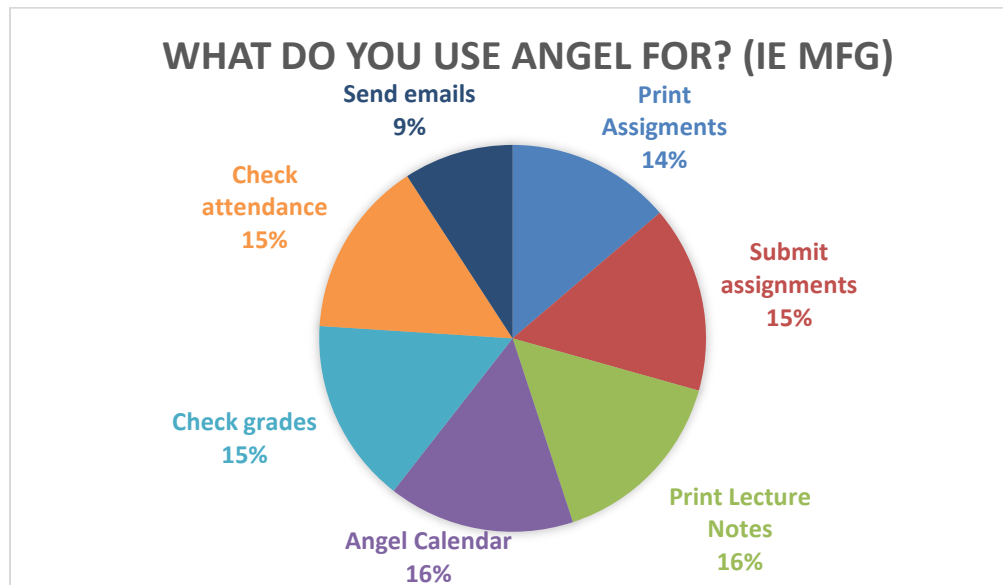**Figure 4A:** Results for Reasons for ANGEL use by IE EE students.

Figure 4B: Results for Reasons for ANGEL use by IE MFG students.

Overall Student Satisfaction with IE EE and IE MFG Courses
Looking back at Figure 1 and 2, it was apparent that students were weighting instructor communication of grades and announcements very highly when carrying out their rating of satisfaction with their IE EE and IE MFG courses. This large, public U.S. University asks students to complete an end of semester Student Rating of Teaching Effectiveness (SRTE) Questionnaire. All ratings are based on a 0 to 7 Likert scale. 0 is the lowest rating while 4 is the average rating and 7 is the highest rating. The results for the overall quality rating of the instructor and the courses are summarized in Table 2 below:

Table 2: Overall Quality of Course and Quality of Instructor Ratings (0 to 7 scale)

Course/ Semester	Avg. Course	Avg. Instructor	Course/ Semester	Avg. Course	Avg. Instructor
IE EE/Spring 2014	6.75	6.74	IE MFG/Spring 2014	6.73	6.98
IE EE/Fall 2014	6.75	6.88	IE MFG/Spring 2015	6.51	6.95
IE EE/Spring 2015	6.78	6.88	IE MFG/ Spring 2016	6.23	6.64

The instructor of the courses listed in Table 2 was awarded the Outstanding Faculty Award in the Industrial Engineering Department at this large, public U.S. University for their work in the Fall 2015 and Spring 2015 school year. After the 2014-2015 school year, the instructor moved on to another campus within the University system. Starting with Spring 2016, the SRTE questionnaire specifically asked the students in the IE MFG course to "Rate the instructor's communication skills." The average of all student responses (0 to 7) was 6.59 out of a possible 7.00. At the conclusion of the 2015-2016 school year, the instructor of the IE MFG course received multiple nominations for Outstanding Teaching Award in the School of Engineering. The instructor could not win this award because the instructor had to be at this campus for at least two years to be considered for this award.

Discussion of Results
The results of this study show that students were satisfied with the communication methods used in the industrial engineering classroom. The outside of classroom communication was supplemented using the learning management system (ANGEL), rather than email. The results show that the majority of students accessed the learning management system 2 to 3 times a week, daily, or multiple times in a day. The students reported logging into the learning management system most commonly to check grades, print lecture notes, and check the course calendar for upcoming course assessments and topics to be covered on assessments.

The results clearly indicate that students are capable of being responsible for using the learning management system to address routine course issues (i.e., calendar, assignments, notes, grades), which they would alternatively address using email. The instructor and course ratings were extremely favorable, which indicates that the students are comfortable with the zero-email policy.

The student's preferences with respect to course satisfaction (Figures 1 and 2) can all be handled via either classroom policy (i.e., handling questions during class, knowing students' names) or the instructor using the learning management system (e.g., attendance, course topics, calendar, grades, upcoming assignments/topics) to its fullest capabilities.

The results do verify some of the items mentioned in the literature review. The students did show a preference for face-to-face communication with their instructor and answering questions in class, and took advantage of the instantaneous feedback to their most common questions/needs via the learning management system. The students valued the quick feedback, both via the learning management system and for graded material being returned within a week. It is clear that the students and the faculty member responsible for this study are using the classroom time, the internet, and the learning management system's tools for both efficiency of communication and to benefit the collective educational experience.

Conclusion and Future Work

The overwhelming conclusion of this work is that industrial engineering students and faculty members can implement a zero-email policy provided classroom time is used adequately to address questions, and the learning management system is used to address real-time questions (i.e., course calendar, course grades, course notes, upcoming assignments and their topics). The results indicate that this policy still meets students' expectation for a good course and learning experience. The results of this study are aligned with what was presented in the literature review, despite the fact that the typical college student's most used communication medium is a text message.

Future work could be done in a variety of ways, including testing the zero-email policy using other learning management systems, other disciplines, with different levels of students, other universities, and other faculty members. In addition, it could be supplemented with tracking how many students actually emailed the instructor (or teaching assistant) and the frequency of those emails. Also, a correlation between some of the student's communication, attendance, and learning management system usage versus their course grades could be completed. Further, an ANOVA could be completed if demographic, ANGEL usage, email usage, and course satisfaction were known for each individual student (currently these are known only at the aggregate level).

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