The Development of the First Year Engineering Experience

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Abstract

This paper describes how the mandatory engineering course, Engineering 5: Introduction to Engineering Practice, has changed since its initiation in 2003. The course accomplishes many goals for freshman engineering students including, but not limited to an overview of the engineering disciplines available, the introduction to engineering concepts, and informs them of the attractive opportunities available at Lehigh University. The goals are accomplished through presentations from each engineering department, two projects in specific departments, and lectures from various experts. The course is lead by Professor Keith Gardiner who organizes the lecture sessions, while the projects are overseen by key faculty members from each of the seven departments in the P.C. Rossin College of Engineering & Applied Science: Chemical Engineering (CE), Civil and Environmental Engineering (CEE), Computer Science and Engineering (CSE), Electrical and Computer Engineering (ECE), Industrial and Systems Engineering (ISE), Materials Science and Engineering (MSE), and Mechanical Engineering and Mechanics (MEM).

The biggest source of change in the course has come from technological advancements that continuously affect the learning experience in the classroom. Today, Lehigh University is one among many organizations in the process of implementing the free Course Management System (CMS), Moodle (Modular Object-Oriented Dynamic Learning Environment). The goal of the software application is to allow course documentation, administration, and teaching to be simple and available for students and faculty at all times. For the past ten years, Blackboard has been the official CMS for Lehigh University. Moodle has been under pilot testing since the Spring of 2009 but is now mandatory and replaces Blackboard in the Fall of 2010. Among other technological changes, this paper will analyze how Moodle's features are utilized in the course and its effectiveness.

Technology in the Classroom

Engineering 5 provides first year students with a smooth transition into the seemingly overwhelming field of engineering. In the spring of 2010, the course consisted of 15 fifty minute lecture sessions and 23 two-hour lab sessions. The students are expected to apply the knowledge they gain from the lectures and integrate this with the "hands on" lab experience, and vice versa.

Topics such as problem solving, communication, current events, and ethics are discussed in the lecture sessions, introducing the students to the skills and responsibilities engineers will encounter throughout their professional career. The fundamentals and theory of project

management is discussed in class, which can be applied in the lab sessions and in future project work. Some lecture sessions are reserved to explain the limitless opportunities available for engineers at Lehigh University. Programs such as Integrated Product Development (IPD), supporting entrepreneurship, and working with Fortune 500 companies in the Co-Op program, are only some things that make a Lehigh engineering education unique. Many lectures focus on the programs of the engineering departments. Representatives from the seven departments provide information on topics such as curriculum, salary, and situations a student could expect if they were to join their department. Alumni accomplishments and experiences, among other facts, are highlighted in order to get students excited and more willing to join their department. Representatives also explain a project to be completed during the lab sessions that would require the student to "think" like an engineer in their field. For example, Dr. Gregory L. Tonkay, Associate Chair in the Industrial and Systems Department, captivated the students by quoting a well known commercial, stating that industrial engineers "Don't make a lot of the products you buy. We make a lot of the products you buy better." He explained, the Industrial and Systems project "Trash to Treasure", would require a student to use industrial engineering tools to find the most efficient trash collection route for Berger Sanitation, Inc., a Lehigh Valley operation.

The students gain experience in the lab sessions through the completion of two projects. The students are guaranteed one project of their choice, but may be randomly assigned to the second. They are encouraged to choose an interesting project from a department they want to learn more about. To develop teamwork and communication skills, the students are divided into groups for each project. Each student evaluates their team through a "$10,000 virtual bonus" allocation, allowing students who received a low performance rating from making the same mistakes in their second project and in the future. At the end of each project, four lecture sessions are reserved for students to share their findings and explain their projects to the rest of the class. In the spring of 2010, the students used technology to make their presentations more captivating and exciting. Videos were among the most popular presentation resources. Those presentations received the most positive feedback. The class rated the presentations based on delivery and content, again allowing the students to think about continuous self-improvement. When a person is ranked and their performance is evaluated, the person becomes more conscious. He or she will understand what makes them an asset to a team while raising awareness of their weaknesses so they can improve on them.

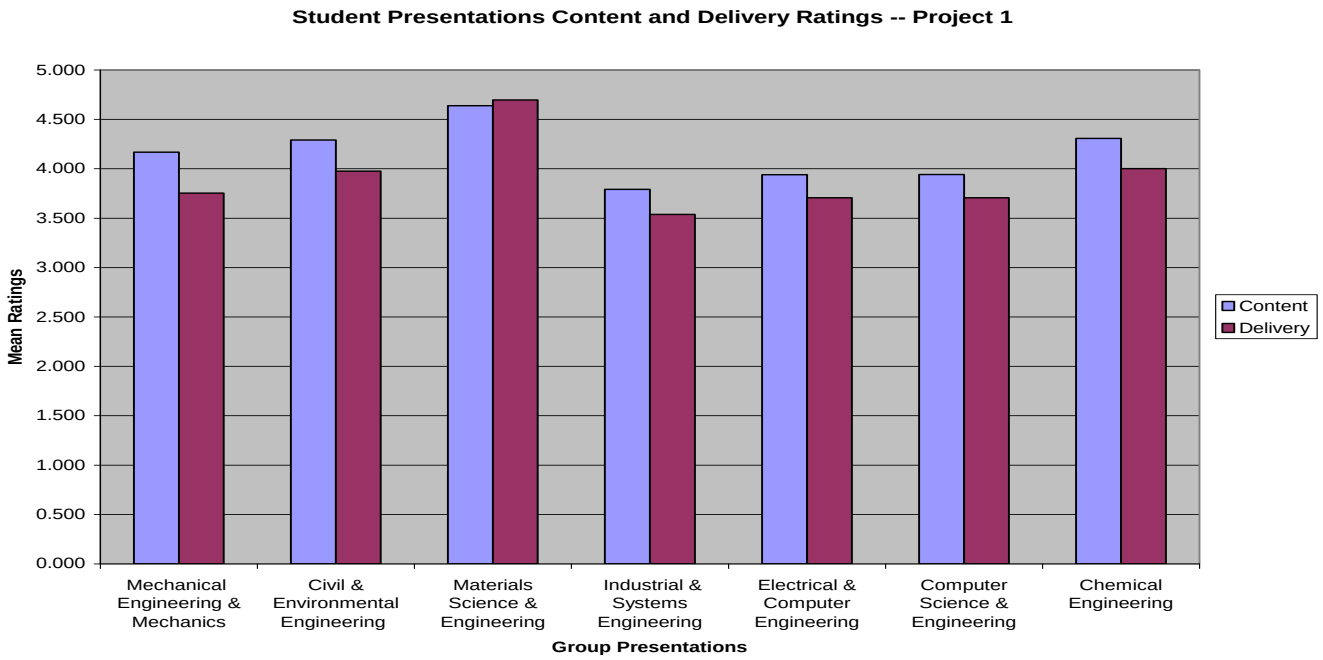
Seray Ozturk described the structure and contents of Engineering 5 in a paper at the ASEE Mid-Atlantic Section Conference during the spring of 2004.[1] Figure 2 shows the mean ratings of both projects for each of the seven departments in the spring of 2004. Interestingly, the content ratings for both projects surpassed the delivery ratings for most, but not all department presentations. Six years later, during the spring of 2010, the same pattern appears to be true although, delivery ratings appear to be higher (Figure 3). It appears like the difference between content and delivery is not as large. After analyzing the data, two questions arose:

1. Why are most presentations rated higher in content as opposed to delivery?
2. Are the delivery ratings in 2010 higher than in 2004?

Ideas discussed in a paper, by Deanna R. Cerullo and Nick Nikitas, describing the student view of Engineering 5 are cited to help answer these questions. The paper was presented at the ASEE Mid-Atlantic Section Conference during the fall of 2004.[2] In the paper, a common stereotype is stated, "Traditionally, engineers are known as being conservative, poor presenters with a lack of flair". The statistics may show that the content in an engineering presentation is more captivating than the way it is presented to an audience. Engineering is not an easy topic to discuss, especially to a person who is not knowledgeable in the specific field that is being presented. During the project presentations, students are put to the test while faculty and more than 150 students listen to their presentation. Because the students can see how the class rated their presentation, students can focus on their weakness, which seems to be the delivery portion of a presentation. An important aspect of these ratings, however, is not necessarily the ratings themselves, but the fact that the students are engaged in processes of evaluation that enhance consciousness.

The presentation ratings appear to be higher than they were six years ago, which may have been influenced by the use of technology in presentations. More specifically, the difference between mean content ratings and mean delivery ratings are not as wide. Table 1 displays the difference between the ratings for both projects during the spring semester in 2004 and 2010. A positive difference suggests that content surpassed the delivery rating, a negative difference suggests that delivery surpassed the content rating, and zero signifies a tie. In the spring of 2004, the delivery rating was higher in the first Materials Science and Engineering presentation while the ratings tied at 3.9 in the second Computer Science and Engineering presentation. In the spring of 2010, the delivery rating was higher in the first Computer Science and Engineering presentation while the ratings tied for both Materials Science and Engineering presentations and for the second Computer Science and Engineering presentation. As the table shows, the differences were wider in 2004. The ratings differed by up to 0.6 points in 2004 while the differences in 2010 did not exceed 0.3 points.

Several presentations in the spring of 2010 were explained through technology. Creative videos with special effects and music seemed to capture the attention of the class. For example, the second Computer Science and Engineering group created a comedic infomercial that spurred laughter throughout the audience. The second Materials Science and Engineering team used the video-sharing website Youtube to contrast a comedic video with ominous background music. In 2004, Deanna R. Cerullo and Nick Nikitas described the presentations as "Exciting, well-detailed PowerPoint slides…". As far as technology is concerned, PowerPoint presentations and outlines are more than likely the technological tools students used in their presentations. Presently, technology advancement is exponential while its use it much more user friendly. The use of technology in presentations could help explain the increase in presentation ratings, especially in the delivery portion.



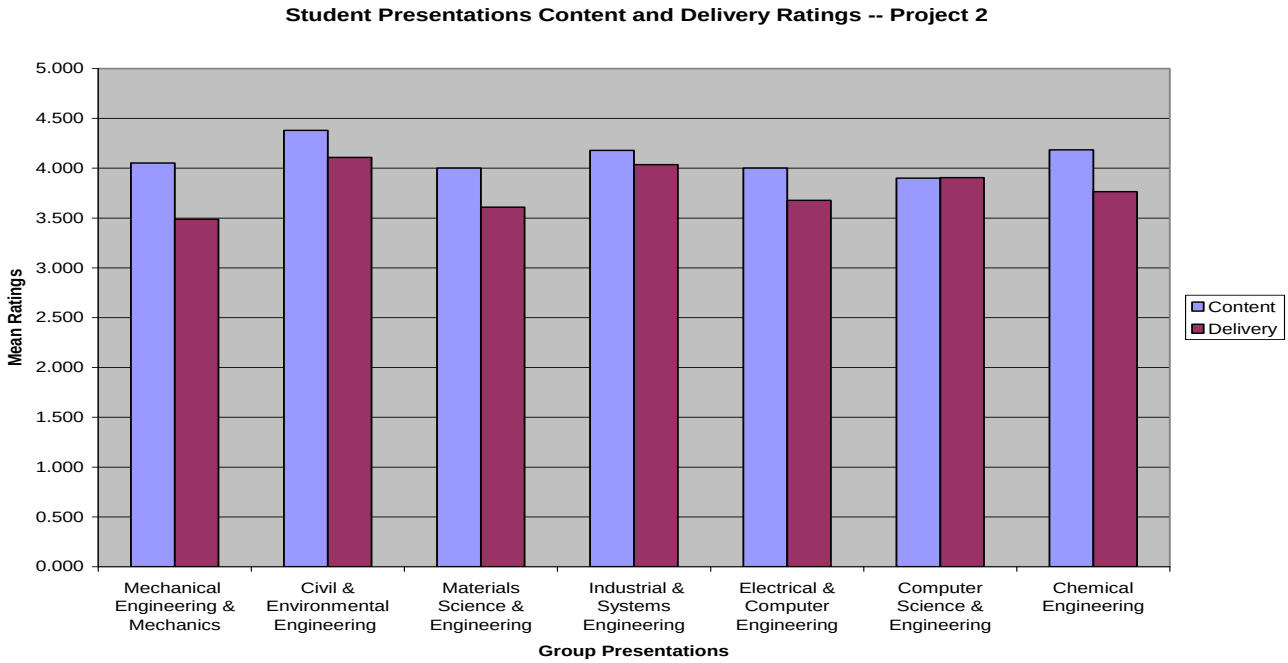
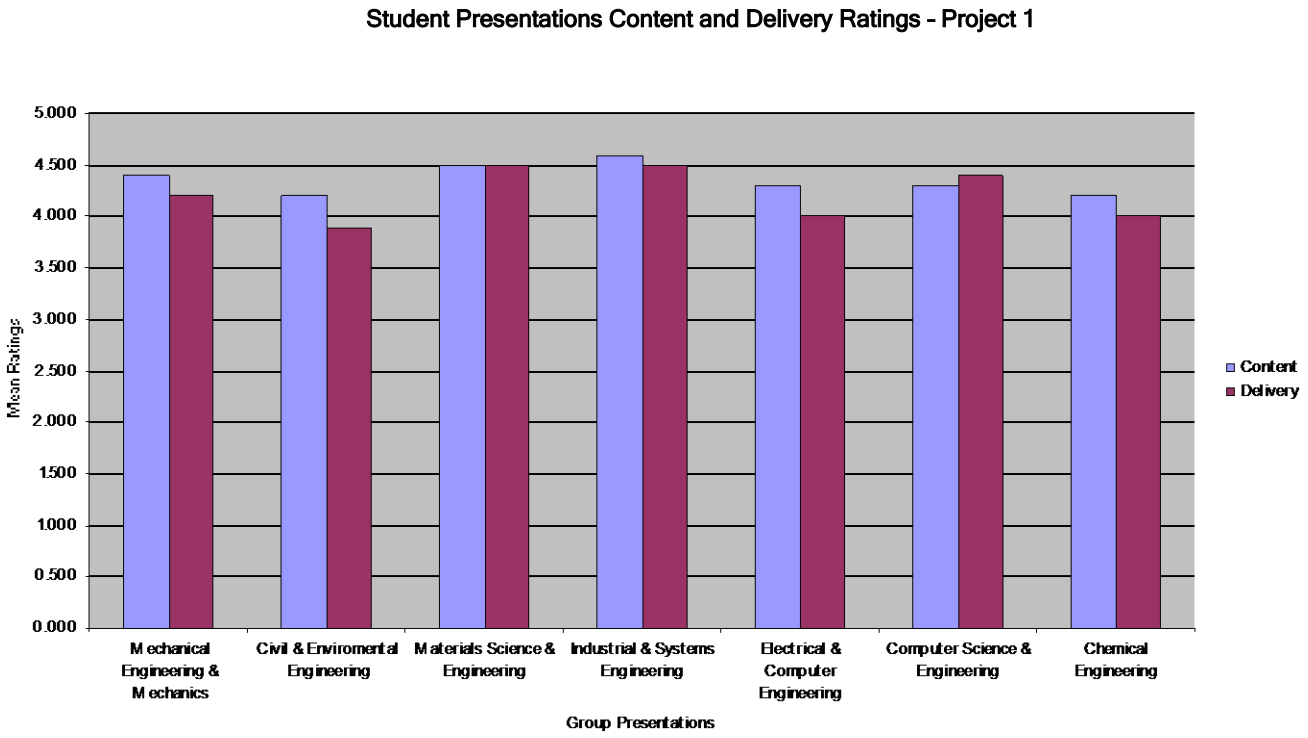


Figure 1: Spring 2004 Mean Content and Delivery Results



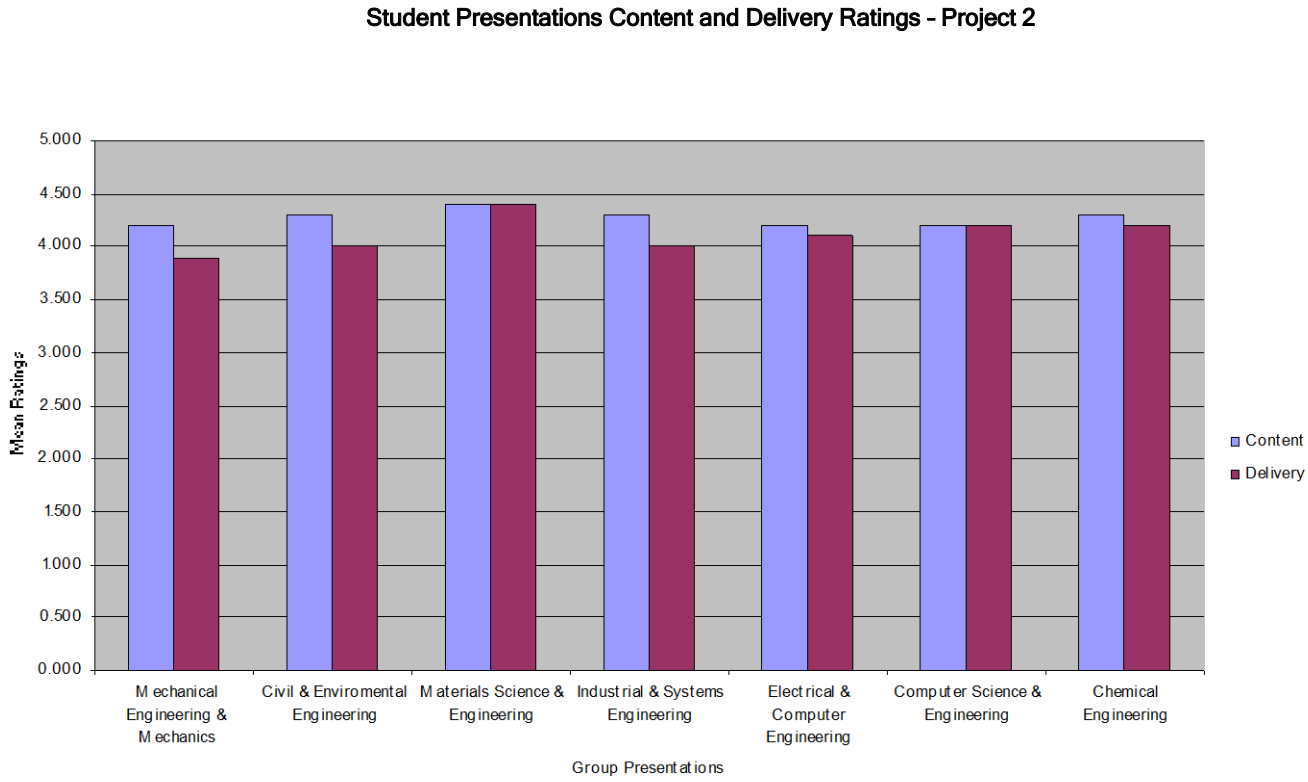


Figure 2: Spring 2010 Mean Content and Delivery Results

		Mechanical Engineering & Mechanics	Civil & Enviromental Engineering	Materials Science & Engineering	Industrial & Systems Engineering	Electrical & Computer Engineering	Computer Science & Engineering	Chemical Engineering
Spring 2004	Project 1							
	Content	*4.2*	*4.3*	*4.6*	*3.8*	*3.9*	*3.9*	*4.3*
	Delivery	*3.7*	*4*	*4.7*	*3.5*	*3.7*	*3.7*	*4*
	Difference	**0.5**	**0.3**	**-0.1**	**0.3**	**0.2**	**0.2**	**0.3**
	Project 2							
	Content	*4.1*	*4.4*	*4*	*4.2*	*4*	*3.9*	*4.2*
	Delivery	*3.5*	*4.1*	*3.5*	*4*	*3.7*	*3.9*	*3.7*
	Difference	**0.6**	**0.3**	**0.5**	**0.2**	**0.3**	**0**	**0.5**
Spring 2010	Project 1							
	Content	*4.4*	*4.2*	*4.5*	*4.6*	*4.3*	*4.3*	*4.2*
	Delivery	*4.2*	*3.9*	*4.5*	*4.5*	*4*	*4.4*	*4*
	Difference	**0.2**	**0.3**	**0**	**0.1**	**0.3**	**-0.1**	**0.2**
	Project 2							
	Content	*4.2*	*4.3*	*4.4*	*4.3*	*4.2*	*4.2*	*4.3*
	Delivery	*3.9*	*4*	*4.4*	*4*	*4.1*	*4.2*	*4.2*
	Difference	**0.3**	**0.3**	**0**	**0.3**	**0.1**	**0**	**0.1**

Table 1: Points Difference between Mean Content and Delivery

Course Site in the Classroom

Course Management Systems (CMS) are a common, and sometimes necessary, classroom tool used by many colleges and universities. The systems provide many functions including access to course documents, a grading tool, and communication tool where the professor and students can discuss classroom topics. The CMS Blackboard has always been available for the Engineering 5 course. But, was it a vital or an unnecessary element needed to meet the goals of the course? A quality CMS is almost necessary to handle the goals of a course with a roster up to 185 students in the spring of 2010, and 212 in the fall. What that sets Moodle apart from Blackboard is that it is an open source CMS. Also, Moodle does not require a software licensing fee to use but like Blackboard, it is not free to maintain. While both systems accrue server, data storage, and disaster recovery expenses, Blackboard is due for an update that would also require the time and resources from staff to train the faculty and students.[3]

The open source feature allows Moodle to be modified and customized according to what a course needs. Like the web browser Mozilla Firefox, a third party can contribute to the Hypertext Preprocessor (PHP) code. It is a volunteering effort that allows schools to change a feature and submit it to Moodle, allowing other schools to use the same programming code and feature. Currently, Lehigh is not actively involved in making these code changes, although, Greg Reihman, Director of Faculty Development, decided to change Moodle's name to Course Site

after students believed Moodle did not sound professional.[4] The first step is to introduce the students and faculty to the new software before contributing to the programming. Figure 1 shows the timeline including stages that were necessary to fully integrate Moodle. The two year transition into Moodle helped familiarize students and faculty to all the features available. Testing took place in 2009, when feedback and statistics was gathered on the new CMS. Engineering 5 was first introduced to Moodle during the third pilot session in the fall of 2009 and has been successfully implementing it ever since. Positive feedback from faculty and students assured the Library and Technological Services (LTS) staff that the transition was necessary. Courses slowly migrated to Moodle during the Spring and Summer of 2010, although, Blackboard was still an option. Blackboard ceased to be made available after August 20th, 2010 and now Moodle is mandatory.[5]

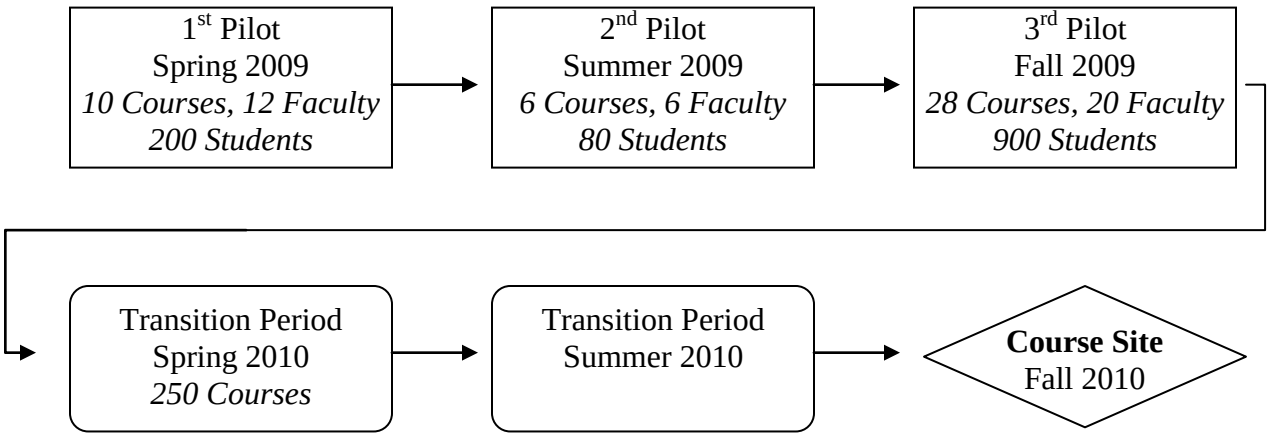


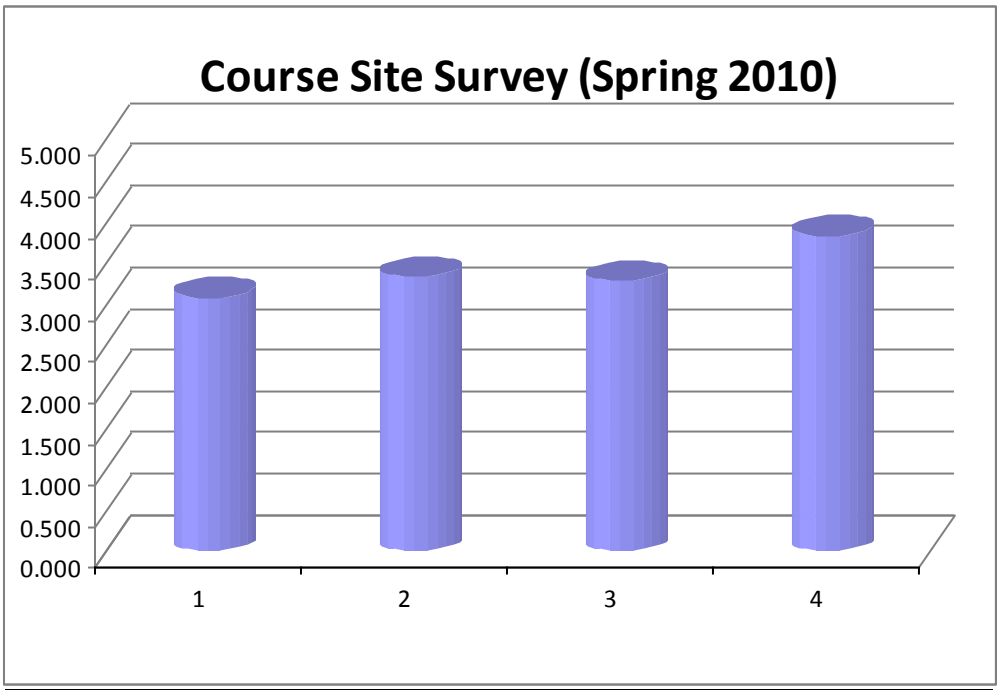
Figure 3: Two Year Transition into the Course Management System Moodle (Course Site)

Course Site plays a key role in the communication aspect of the course. It enables a large class, like Engineering 5, to run more efficiently while reducing much tedious work for the professor. In the past, for example, dividing the class into groups for the two projects required the students to write down their preferred choices on paper which were then counted, sorted, and data entered by hand. Course Site is capable of tallying the choices at a fraction of the time. The results can then be uploaded in a fraction of the time into Open Document Spreadsheet (ODS), Excel, or text format.

Because Course Site is open source, there is no limit to the features and functions that the CMS can offer. Ultimately, the content and how files are uploaded Course Site is based on the professor's discretion. Under Course Site, documentation can be organized in chronological order or divided by topic. In Engineering 5, PowerPoint presentation and current news, among other documents, were uploaded on a weekly basis. Because all courses are different, it may require a trial semester to figure out which option is most efficient. The number of students, field of study, or type of assignments can determine how the CMS will be utilized. One feature Engineering 5 students utilized was the user friendly discussion board. Students used the general

forum section to upload their thoughts on current events or other engineering topics. Mandatory blog assignments required the students to first respond to the question before he or she could see another student's response. This restriction is an example of the many options available when setting up Course Site features such as discussion boards, grading, and surveys.

Figure 4 shows the results of a survey rating Course Site by the students in Engineering 5. The survey is significant because the results are unbiased since the majority of the class is made up of first year students, many who never used a CMS and were required to learn both Blackboard and Course Site simultaneously, depending on the course. The results are high, all above 3 points on a 5 point scale. The highest score came from question number 4 rating Course Site against Blackboard.



1. The discussion forums were interesting, spurred communication, and added value to the course.
2. Material was easy to find and the layout was well organized.
3. Overall, it is successful in communicating the goals for the course.
4. (If applicable) Overall, Course Site is a preferable course management system to Blackboard.

Figure 4: Course Site Survey Results for the Spring Engineering 5 course in 2010

Another survey was administered to students that participated in the Pilot testing phase of Course Site. The students were mostly upperclassmen previously accustomed to Blackboard. Many

upperclassmen may resist change since the learning curve is high. Figure 5 shows the results of this survey rating Course Site against Blackboard. The results are all below 3 points, relatively low compared to the results from the Engineering 5 survey. How Course Site is perceived by the students may have a direct relationship with how the professor utilizes the CMS. For example, students may have a neutral opinion towards Course Site if the only role it plays in the classroom is to store the course documents. Conversely, student opinion towards will be different if functions such as discussion boards are utilized. If the settings of discussion boards make an assignment confusing, for instance, a student may develop a negative view about the system.

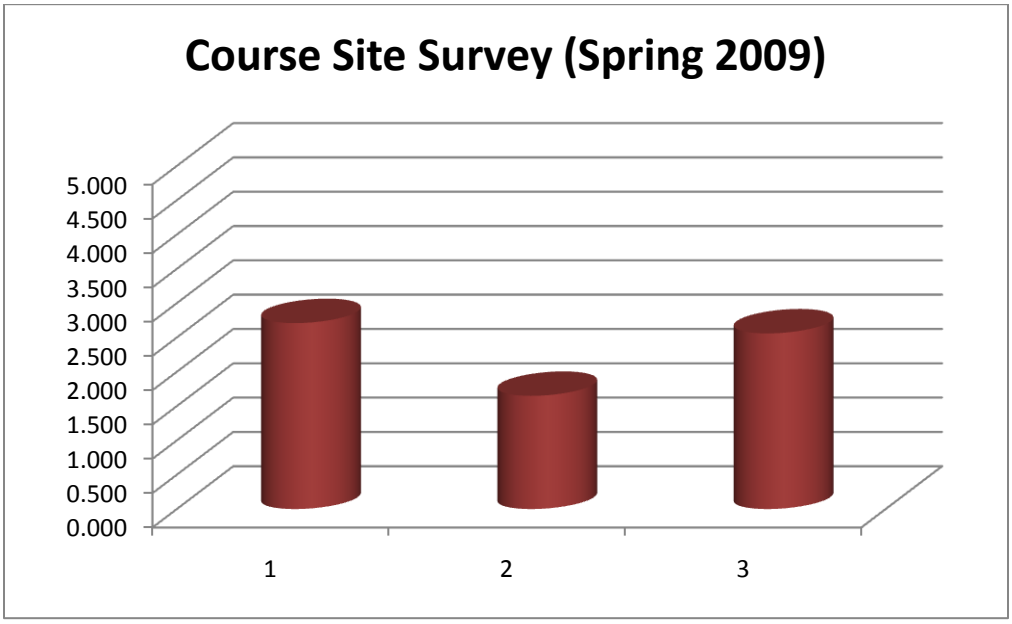


Figure 5: Course Site Survey Results for the Spring Pilot Courses in 2009

Summary

While technology becomes a more common tool for professors and students, courses such as Engineering 5 evolve accordingly. Every presentation describing the Engineering 5 projects includes a Power Point presentation, while some also include another source of technology such as a video, YouTube clips, and/or use of sound effects. While the future of technology in the classroom is uncertain, history suggest that its use will only increase.

Most colleges and universities nowadays depend on CMS technology to communicate with the students outside of the classroom. Advantages range from a decrease in printing to a place where students can access course information anytime and anywhere where there is internet access. Currently, the technology has not fully developed. Personalizing discussion boards or other functions may require a technology specialist's assistance. As the technology becomes more user friendly, more functions will be utilized that will enhance the classroom experience.

References

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