AC 2012-4028: CLASSROOM FLIP IN A SENIOR-LEVEL ENGINEERING COURSE AND COMPARISON TO PREVIOUS VERSION

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Classroom Flip in a Senior-Level Engineering Course and Comparison to Previous Version

Abstract

As students enter the final year of an engineering curriculum, an increased responsibility for self-directed learning is highly desirable. Students about to embark on a career must independently be able to meet professional development demands in a rapidly changing engineering environment. Students who arrive in class with assigned reading completed, notes reviewed, and prepared for classroom activities are developing the ability to be self-directed learners. Limited classroom contact time can be much more effectively utilized by focusing on concepts and applications identified by students as needing further review and explanation. This paper describes changes implemented to a Civil Engineering "Structural Design of Foundations" course at a Penn State University's College of Engineering. These included short pre-class assignments and quizzes that were designed to increase students' preparation for the next class meeting, as such flipping class meeting preparation to outside the classroom. A benefit of these changes is that the instructor can significantly reduce the time spent lecturing and focus on application of concepts and understanding of processes. Focusing on in-class student activities fosters student-centered learning with the student having the responsibility to prepare for each class session.

This paper describes the current study and shares previous results. Those instructors who are interested in using a classroom flip strategy to prepare students for class may benefit from this paper.

Introduction

Educating future engineers depends on an instructor's ability to develop students' knowledge and skills based on a coherent, philosophical continuum: capture interest, integrate theory with application, encourage creativity, convey professional relevance, and promote engagement. Crucial to this learning continuum are the mechanics of course management that form a framework: establish clear student goals and objectives, implement a teaching philosophy coherently, design effective assessment tools, create a diverse and welcoming learning climate, and encourage teamwork. The core of the authors' engineering teaching philosophy embraces the critical integration of theory and application into an active learning environment where students become skilled at learning. Through consistent guidance and practice with learning, students are prepared to continue the process throughout their career. Given the increasingly flat, complex, and team-oriented world in which future engineers will navigate, it is vitally important that educators awaken students to the conditions they will face during their professional lifetimes and develop life-long learning skills. Self-directed learning, creativity and innovation have been, are, and will be the critical forces that define success and the gauge by which humanity judges the engineering profession. The sustained ability to learn and master theory permits creativity and innovation in engineering application[1, 2].

Due to large enrollments, CE441 – *Structural Design of Foundations* has been delivered primarily as a lecture-based course. While successful, this approach is not entirely consistent with an engaging teaching philosophy and is a continuing concern, particularly when recognizing that students are preparing to advance to the structures capstone course, a highly group- and project-oriented experience. Fall 2011 was the fourth offering of CE441 to be taught with essentially an unchanged format and materials. The instructor worked with the Penn State College of Engineering Leonhard Center for the Enhancement of Engineering Education to design an active learning environment within CE441 that will: 1) better promote group activities and peer interaction; 2) shrink the perceived size of the course enrollment for students; 3) offer extended open-ended problems to promote development of creativity and innovation skills; and 4) include writing within coursework to stimulate a broader world view. Evaluation of this active learning plan was completed through comparison of past quiz and exam performances. Four semesters of data are now available for comparison. In addition, it is expected that lessons learned through this careful redesign and evaluation of CE441 will be directly translatable to the capstone course that all students enrolled in CE441 take each spring. This capstone experience offers two open-ended structural engineering design problems that are solved by groups of three or four students. Success and new findings from Fall 2011 CE441 will be integrated into the capstone where appropriate.

Newly graduated engineers will develop careers in an increasingly competitive, complex, and team-oriented world[3]. As educators, it should be our mission to prepare engineers so that they are ready to thrive in such an environment throughout their professional lifetimes. Engineers that embrace creativity and think innovatively will contribute most to society. This is the issue that interests and motivates this study to reevaluate how larger engineering design courses are taught.

The redesigned course adopts a strategy of gradual warm-up activities to full classroom flip[4, 5] moving lecture content to outside the classroom through the integration of student-centered activities. Online quizzes done prior to class encourage and assess reading comprehension. Individual and group efforts allow students to practice outlining or solving design examples prior to class. Consequently, students are ready to solve design problems in class in a highly participatory and engaged environment.

Course Description

The civil engineering course, CE441 - *Structural Design of Foundations*, focuses on the non-geotechnical aspects of building foundation structural design. Covered designs in the course include steel base plates, wall footings, concentrically loaded, isolated, square and rectangular footings, eccentrically loaded, isolated footings (square and rectangular) combined, isolated footings, mat or grid foundations, piles and pile caps, concrete retaining walls and abutments, flexible earth retaining structures, and caissons.

- The course meets three times per week for 50 minutes over a 15-week fall semester for a total of 44 meetings.
- The course is a senior level elective that is an alternate prerequisite for the structures focus capstone design course

Learning Objectives and Approach

A critical objective of this study is to develop self-directed learning skill techniques and a student mindset that recognizes the need for self-directed learning. While not normally explicitly understood by undergraduate engineering students, students in an engineering curriculum do not learn everything they need to know about their field as an undergraduate to perform their professional responsibilities and to embark on a successful career. It is vital for students to recognize that their professional future depends on continuous learning and just as vital that they leave their undergraduate experience with the skills to engage in that continuous, self-directed learning.

Very closely related to self-directed learning is the objective to improve student understanding of course material and to engage students in their learning process. Student expectations are much too often centered on the misunderstanding that attending lectures is equivalent to learning and that by attending, the instructor teaches them. This study is based on Simon's principle (as cited in Ambrose, 2010) that, "Learning results from what the student does and thinks and only from what the student does and thinks. The teacher can advance learning only by influencing what the student does to learn".[6] This study devised requirements such that regularly assigned tasks directly engaged students in their own learning through clearly defined study activities and assessments. Assigned tasks are completed before attending lectures so that lectures avoid the routine transmission of information and can be delivered in a much more interactive format.

An emphasis on pre-class assigned reading, pre-class example review and partial solution, and review and correction of graded assignments was included in regular tasks with the objective of preparing students for each class session. Reading assignments exposed students to detailed

factual information, alleviating the need to cover this in class. Assigned portions of class examples before they were worked in class prepared students for a robust discussion during class presentations, allowing the students to discover what they did not understand about the new material and the instructor to focus these issues, optimizing class time.

The approach used to achieve these objectives was to carefully structure the entire 15 week course and all 44 lectures for students in a detailed course schedule (see Table 1). This schedule presented clear day-by-day expectations of students for class meeting preparation, including pre-class reading, pre-class assignments, and planned in-class activities. Short online evaluations of reading comprehension were administered approximately once per week to motivate students to complete the reading and to emphasize the important points of the reading. In addition, pre-class assignments were listed for completion in advance of class examples to ensure that students reviewed the example, attempted minor steps or outlined the solution steps, and noted concepts that they did not understand. This allowed the instructor to focus classroom time on concepts that were identified by students as the most difficult and not understood through the reading. These reading and pre-class assignments were devised as a means to "warm up" students to the self-learning approach that would be fully implemented at the 10th week of the course. As students became accustomed to completing reading and reviewing examples or topics prior to attending class, they were in effect becoming self-directed learners.

Table 1: Headings for Detailed CE441 Course Schedule

Date	**Topic**	**Pre-Class Preparation Reading**	**Pre-Class Assignment**	**In Class Work**

A full classroom flip occurred at the 10th week of the semester with students entirely responsible for assigned reading and self-review of the fully worked design example provided before class. An evaluation of reading comprehension was conducted online the day before the first full classroom flip intervention. In preparation of the first full flip class, students were required to initiate the solution of the assigned, open ended design problem. This initial solution calculation was submitted for grading and returned. In order to manage the 42 students and to encourage collaboration, students worked in pairs on the design problem, both in class and outside of class. In class management of the flip required full engagement of the students, nearly in unison, as they proceeded with the design problem. The instructor guided the process by leading the discussion of each subsequent step, prompting discussion of the engineering process to some consensus, and then initiated a design period of a few to several minutes with students permitted to ask questions regarding that step. Wherever a theme developed with a significant number of students having the same questions, the instructor stopped and asked the students to work the issue out in discussion. In this way, the design problem solution proceeded over the course of 3 classroom periods through completion.

In addition, to develop a professional reference and encourage review of graded work, each student was required to complete an Engineer's Notebook. The Notebook includes all class notes, corrected design problems, corrected quizzes, and course reference material in a prescribed format: 1) two inch, three-ring binder; 2) cover page; 3) table of contents and numbered pages; and 4) professional tabs. These Notebooks were reviewed at mid-semester and

at the conclusion of the semester by the teaching assistant following the instructor's grading rubric. The Engineer's Notebook counted five percent toward the final course grade.

This project intended to design an active learning environment within the course context that: 1) better promotes group activities and peer interaction; 2) shrinks the perceived size of the course enrollment for students; 3) offers extended, open-ended problems to promote creativity and innovation; and 4) includes writing within coursework to stimulate a broader world view. Evaluation of this active learning plan was completed through comparison of past quiz and exam performances.

Assessment Strategy

Participants

The students enrolled in CE441 for the Fall 2011 semester were invited to participate in the evaluation of the course revision. All the students were fourth year civil engineering majors, 38 male and 4 female. The group was largely comprised of American students with some representation of international students from India and China. The students were recruited during a regularly scheduled class period and signed informed consents as required by the university Office of Research Protections. Students consented to the use of their course materials, performance data, survey data and focus group comments for the purpose of the study. Participation was confidential. The instructional support specialist summarized the data for the study which was not shared with the instructor until after grades were submitted.

Students' Performance

The assessment of students' performance was both formative and summative. The formative assessments were comprised of six quizzes administered during lecture periods at approximately two-week intervals, eleven extended design problems due at approximately one-week intervals except during initial three weeks of the semester, online evaluation of reading comprehension, and pre-class assignments. The summative assessment was the end of semester final grade.

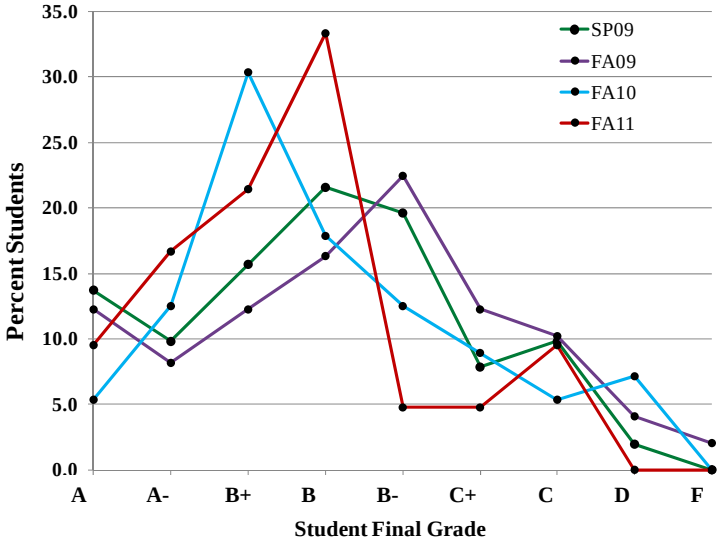

Figure 1 Percent Student Grades by Semester

The performance outcome was favorable with 34 students (81%) receiving a grade of B or higher. Figure 1 below represents the grade comparisons. The instructor was pleased with the performance because this was the first attempt at the course revision; he will use this sample as a comparison during the next iteration of the course (see Appendix A for table of grade comparisons from previous semesters). It was also observed that the normal group of "B-" and "C+" achieving students (slightly below average) was significantly diminished as a percentage during the Fall 2011 semester under study as compared to the other three previous semesters. An early observation may be that these students benefited most from the approach implemented in this study.

Students' Perceptions of Learning

Students were asked to participate in a mid-semester course evaluation, an online student perception of learning survey, and a focus group. In addition, the official university Student Rating of Teaching Effectiveness (SRTE) was used as a measurement instrument at the end of the semester.

The mid-semester course evaluation consisted of 20 questions on a 1 to 5 rating scale, with 1 being strongly disagree to 5 being strongly agree. (See Appendix B for survey items, frequency data and descriptive statistics). This survey, designed by the instructor and the instructional support specialist, was administered online and opened for a specific period of time. The purpose of this survey was to obtain formative mid-semester feedback in order to allow the instructor to become aware of any concerns students may have. Collecting feedback at mid-semester allows the instructor to adjust the course, which will make a difference for the students who took the time to give feedback[7]. The instructor used this feedback to make just in time adjustments to the course and in addition, as a snapshot for the final course evaluation survey administered online at the end of the semester. This survey instrument emulated the final course teaching effectiveness survey, which contains a scale 7-point scale. . Student's responses were favorable and direct with 37 students participating.

Overall, students at mid-semester had a positive opinion of the class thus far. Approximately 84% of the students agreed or strongly agreed that the overall rating of the course was good; with a favorable overall rating of the instructor at approximately 87%. The students agreed that the course objectives were clear with 89% responding agree to strongly disagree. More specific items that addressed the course revision were also favorable and constructive. The students indicated that the methods of presenting information in class enhanced their learning with approximately 92% replying neutral to strongly agree. Approximately 94% of the students stated that "the course material was relevant to my future work as an engineer". Regarding the pace of the class, approximately 70% of the students replied neutral to strongly agree; and approximately 30% replied disagree to strongly disagree. Regarding assessment methods as a fair representation of what we should learn from this course showed that 33% of the students said disagree to neutral with 63% selecting agree to strongly agree. The clarity of how new concepts and problem solutions are explained by the instructor at a level that the students can understand had the widest distribution. Approximately 27% said strongly disagree to neutral while 73% said agree to strongly agree. The instructor had an in class conversation with the students to discuss

the outcome of the mid-semester survey. Issues of pace were discussed with students to discover the primary concerns, which when voiced, was a concern related to time to complete in-class quizzes, therefore an additional 10 to 15 minutes was granted for the remaining three quizzes. Issues of new concept explanation were also discussed to understand concerns. Students expressed concern that, although certain fundamental concepts were covered prior to presentation of more advanced concepts, a review of fundamentals is needed as these concepts form the basis of new concepts. To remedy this, reading was assigned or handouts were provided to reinforce fundamentals before proceeding to more advanced concepts.

The Student Perceptions of Learning Survey, also administered online, was delivered two-thirds into the course. The purpose of this survey was to obtain information from the students regarding their experience with the out of class assignments and the classroom flip experience. For the first two thirds of the semester the students were given out of class reading assignments and quizzes on the average of one per week. Consequently the instructor could utilize class time to problem solving issues and questions brought forth by the students. This survey was necessary because the students had responsibilities outside the classroom that they must perform weekly.

How did the students respond to this and did they feel this method helped or hindered their learning? This is what we hoped to garner from this survey. Twenty eight of the students completed the survey. Students were asked questions about the learning process. Survey items targeted how often the students used the "lecture preparation and assignments table", 93% said they used these tools. The students were also asked to contribute to groups of items on a 1-5 scale, strongly disagree to strongly agree. The question types were yes or no, Likert scale and short answer. These two groups of items addressed two key methods, the utility and experience with the online quizzes; and the students' experience with the class examples and problems. Finally, students were asked to give suggestions as to what would help their learning in the course, (See Appendix C for survey questions and descriptive statistics). This survey proved to be a valuable resource because it enabled the instructor to gain insight on the opinions of the students. Was the teaching pedagogically appropriate for the level of the course? Were any of the students having problems with the methods? Although 28 of the 43 students responded; this was more than 50% of the class, the instructor hoped for a greater return on the survey.

Focus Group Results

A focus group was conducted at the end of the semester. The focus group method was selected because this provided a safe environment for the students to articulate in their own words their experience with the course and to give their perspective in a conversation[8]. The facilitator/researcher not only listens, but can be aware of non-verbal communication cues. The purpose of this was to obtain rich and specific feedback from the students regarding their experience in the course. How did the students see participating in the pre-class assignments as beneficial to their learning? The focus group protocol (see Appendix D) was developed to explore the reasons why the students think the way they do about the experience in the course. We hoped to garner what the participants thought and whether the course delivery was valuable to their learning. The students who volunteered to participate attended a closed door session with a facilitator. The instructor was not present. The session was captured on a digital audio

recording. All students consented according to the university policy on human subjects social science research.

To open the focus group discussion, the facilitator asked the students to reflect about the pre-class assignments and quizzes.

In general, tell me your thoughts about the pre-class assignments and quizzes.

The consensus was that the pre-class assignments and quizzes were beneficial because class time could be spent on examples. However, students thought the quantity of assignments was excessive; that turning in a paper each class was too much even though this was helpful to work on the material. Students admitted that the pre-reading would not have been done if it was not required.

The first discussion item asked the students to think about the learning effectiveness of the pre-class assignments and quizzes.

Did the students feel that the out of class assignments helped with their learning of the course material, and to be better prepared for the upcoming class meeting; were the out of class assignments a burden to you?

"Yes, It would have been better to have fewer, more concentrated ones, such as one a week instead of one every night." The students also said that it was good to look at the material beforehand. This gave the students a sense of familiarity…the students knew where the professor was going when he got to the examples. Students expressed that this was most helpful on weeks with quizzes and design problems. They felt that the quizzes/design problems should be graded on completeness instead of a letter grade. Their concern was in that regular class homework was intense and time consuming.

The second discussion segment focused on time management of the assignments.

Did the students feel they had adequate time to do the quizzes and problems?

Students shared that they had adequate time to do the quizzes as well as the problems, depending on how in-depth they wanted to go with the problems.

The third discussion segment focused on the quality of the assignments.

Do you believe that the pre-class assignments were beneficial to your learning in the course?

An overall yes, "because anytime you do anything in a course is beneficial to your learning".

What was the students' impression of doing out of class assignments as a method to prepare for the next class?

The students felt that although the professor may have had good intentions, the assignments would have been more beneficial in a less intense class. Their consensus was that this class was very time-consuming; however they all said they would take a class like this again.

Final consensus from the focus group participants:

Students liked the class and learned a lot. "The professor was a good teacher!"

Conclusions

This study allowed the authors to discover a number of learning advantages that correspond to both the classroom flip and pre-class assignments. It was observed that classroom discussions proceed much more productively when students come prepared with reading completed and examples reviewed, which was motivated by graded pre-class assignments. As the classroom instructor, student discussions during the flip segment of the course clearly revealed areas of student difficulty with design problems before the problem solutions were submitted and graded. The authors also observed that it is possible to conduct a classroom flip with 42 students provided they work at least in pairs. Learning student names is critical to managing the classroom discussion in a free flowing manner and to allow the instructor to ensure that all students, not just the vocal students, are participating and progressing. It was observed that students can be receptive to taking more responsibility for their learning, which was a welcome outcome. It became clear that the instructor needs to continuously stress the objectives and benefits of a classroom flip to students to gain trust, acceptance, and participation. It was also observed that the classroom flip may improve grades (and likely understanding) of those students who are just below average and lower. The instructor must work to manage and understand student work load with ongoing design problems, quizzes and added pre-class assignments.

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Appendix A – Performance Comparisons

Statistics of semester quizzes 1 through 6 for each of the four semesters. The FA2011 semester (shown in red) is the revised course under the presented study.

No. Students		51	49	56	42
Quiz No.	Measure	SP '09	FA '09	FA '10	**FA '11**
1	Average	77.2	81.5	79.9	**85.7**
	Standard Dev.	14.4	17.2	13.7	**11.4**
	Median	82.0	88.0	81.0	**87.0**
	High	97.0	100.0	100.0	**100.0**
	Low	30.0	20.0	47.0	**59.0**
2	Average	88.8	78.3	68.0	**75.7**
	Standard Dev.	10.4	14.4	19.6	**11.1**
	Median	92.0	83.0	75.0	**74.0**
	High	100.0	100.0	100.0	**97.0**
	Low	57.0	40.0	20.0	**50.0**
3	Average	86.3	79.7	84.0	**79.1**
	Standard Dev.	10.1	11.8	9.6	**12.1**
	Median	89.0	82.0	84.5	**82.0**
	High	97.0	98.0	99.0	**97.0**
	Low	40.0	51.0	56.0	**57.0**
4	Average	87.1	84.7	84.4	**86.2**
	Standard Dev.	13.9	14.1	12.0	**9.5**
	Median	91.0	88	87.5	**88.0**
	High	100.0	100	100.0	**98.0**
	Low	30.0	38	40.0	**63.0**
5	Average	73.5	77.0	83.9	**82.4**
	Standard Dev.	14.6	14.6	14.4	**11.4**
	Median	75.0	75.0	88.0	**80.5**
	High	100.0	100.0	100.0	**100.0**
	Low	35.0	40.0	45.0	**55.0**
6	Average	57.2	62.1	61.9	**75.0**
	Standard Dev.	10.1	16.6	12.1	**11.4**
	Median	55.0	63.0	64.0	**73.5**
	High	76.0	90.0	87.0	**97.0**
	Low	40.0	22.0	25.0	**45.0**

Outcomes and Comparisons to Previous Semesters

	Spring 2009		Fall 2009		Fall 2010		Fall 2011	
	N = 51 students		N = 49 Students		N = 56 Students		N = 42 Students	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
A	7	13.7	6	12.2	3	5.4	**4**	**9.5**
A-	5	9.8	4	8.2	7	12.5	**7**	**16.7**
B+	8	15.7	6	12.2	17	30.4	**9**	**21.4**
B	11	21.6	8	16.3	10	17.9	**14**	**33.3**
B-	10	19.6	11	22.4	7	12.5	**2**	**4.8**
C+	4	7.8	6	12.2	5	8.9	**2**	**4.8**
C	5	9.8	5	10.2	3	5.4	**4**	**9.5**
D	1	2.0	2	4.1	4	7.1	**0**	**0.0**
F	0	0.0	1	2.0	0	0.0	**0**	**0.0**
Total	51	100.0	49	100.0	56	100.0	**42**	**100.0**

Appendix B –
Student Mid-Semester Survey Response Summary

Assigned: 43
Completed: 37/86.05%

	Mean	Std. Dev.	95% Confidence
My overall rating of the course is good	4.1	0.727	3.874 - 4.342
My overall rating of this instructor is favorable	4.0	0.753	3.784 - 4.270
The course objectives are clear to me	4.4	0.672	4.162 - 4.595
The course objectives are being met	4.3	0.692	4.074 - 4.520
Material is well organized	4.3	0.827	4.004 - 4.537
The method(s)of presenting information in class enhances my learning	3.9	0.963	3.555 - 4.175
The pace of the class is appropriate for my learning	3.1	1.008	2.783 - 3.433
I am able to ask questions during class in order to clarify understanding of concepts or problems	4.2	0.750	4.002-4485
Homework assignments help me understand material	4.0	0.771	3.752 - 4.248
Assessment methods (e.g. tests, projects, assignments)are a fair representation of what we should learn from this course	3.7	0.657	3.483 - 3.906
The course resources (e.g. textbook, workbook, or lesson notes, online materials)helps me understand new material	3.6	0.845	3.376 - 3.921
The course material is relevant to my future work as an engineer	4.5	0.597	4.348 - 4.733
There is a good match between the major elements of instruction (i.e. objectives, lessons in class, and assessment)	3.9	0.818	3.655 - 4.182
The instructor is enthusiastic and interested in teaching this course	4.4	0.783	4.126 - 4.631
The instructor has a positive attitude towards students	4.0	0.550	3.795 - 4.149
New concepts and problem solutions are clearly explained by the instructor at a level students can comprehend	3.7	1.031	3.398 - 4.062
The instructor motivated me to understand concepts and problems	4.1	0.727	3.874 - 4.342
The instructor motivated me to learn how to apply new material we learned	4.0	0.753	3.730 - 4.216
The instructor was always prepared for class	4.6	0.580	4.462 - 4.835

Appendix C – Student Perceptions of Learning Survey and Descriptive Statistics

Students Perceptions of Learning Survey

Accessed: 31 **Completed: 28**

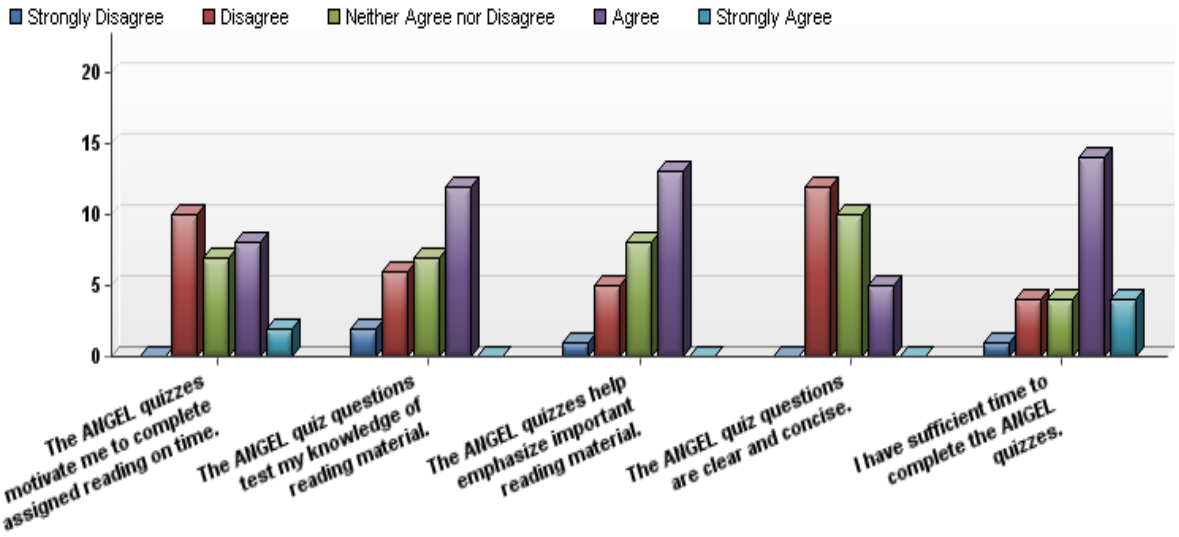
I use the "Lecture Preparation and Assignments" table regularly.

Statistic	Value
Min Value	1
Max Value	2
Mean	1.07
Variance	0.06
Standard Deviation	0.25
Total Responses	30

I have sufficient time to complete the ANGEL quizzes.

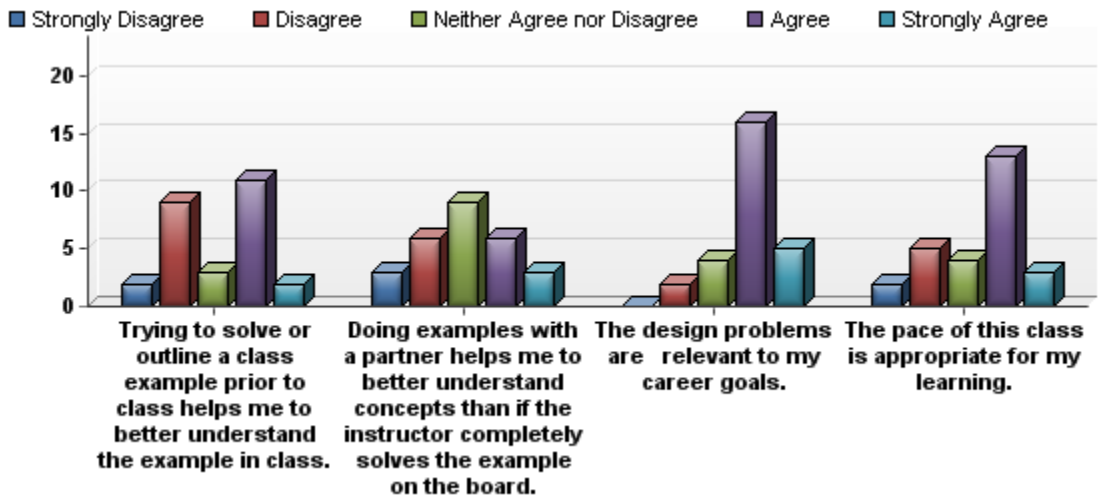
Statistic	Value
Min Value	1
Max Value	2
Mean	1.21
Variance	0.17
Standard Deviation	0.41
Total Responses	29

Regarding your experience with the ANGEL quizzes



Statistic	The ANGEL quizzes motivate me to complete assigned reading on time.	The ANGEL quiz questions test my knowledge of reading material.	The ANGEL quizzes help emphasize important reading material.	The ANGEL quiz questions are clear and concise.	I have sufficient time to complete the ANGEL quizzes.
Min Value	2	1	1	2	1
Max Value	5	4	4	4	5
Mean	3.07	3.07	3.22	2.74	3.59
Variance	0.99	0.99	0.79	0.58	1.10
Standard Deviation	1.00	1.00	0.89	0.76	1.05
Total Responses	27	27	27	27	27

Regarding your experience with class examples and design problems



Statistic	Trying to solve or outline a class example prior to class helps me to better understand the example in class.	Doing examples with a partner helps me to better understand concepts than if the instructor completely solves the example on the board.	The design problems are relevant to my career goals.	The pace of this class is appropriate for my learning.
Min Value	1	1	2	1
Max Value	5	5	5	5
Mean	3.07	3.00	3.89	3.37
Variance	1.38	1.38	0.64	1.32
Standard Deviation	1.17	1.18	0.80	1.15
Total Responses	27	27	27	27

Appendix D – Focus Group Protocol
Perceptions of Student Learning in Civil Engineering Course

Background questions:

The purpose of the focus group is to discuss how participation in the CE course pre-class assignments has been beneficial to students. In other words, how you see participating in these course assignments outside of class are beneficial to you.

1. State your name

2. In general, tell me your thoughts about the pre-class assignments and quizzes.

Regarding learning effectiveness:

1. Did you feel that the out of class assignments helped with your learning of the course material? Can you please explain your answer?

2. Did you feel that the out of class assignments helped you to be better prepared for the upcoming class meeting? Can you please explain you answer?

3. Did you feel that the out of class assignments were a burden to you? Can you please explain your answer?

Regarding time management of the assignment:

1. Did you feel that you had adequate time to do the quizzes? If not, how much time would you need and why?

2. Did you feel that you had adequate time to do the problems? If not, how much time would you need and why?

On the quality of the assignments:

1. Do you believe that the pre-class assignments were beneficial to your learning in the course? Please explain your answer
2. What is your impression of doing out of class assignments as a method to prepare for the next class?
3. What did you dislike about doing the pre-class assignments?

Other comments that you would like to share with the group? Thank you for your time.