Comparison of Traditional Face-to-Face and Online Student Ratings of Two Online Delivered Engineering Technical Electives

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Abstract

Arizona State University delivers one of only two ABET-accredited, fully online baccalaureate degree programs in electrical engineering. This paper reports on the melancholy reception by traditional face-to-face students who enrolled in the online version of the courses, whereas the online students were pleased with the course and instructor as gauged by student evaluations. In some instances, reduced course and instructor ratings appear to be due to the online course being offered in accelerated terms, while other data indicates that the decreased acceptance may be traceable to lower course grades. In the latter case, the lower course grades may be attributable to students needing to adjust to online course delivery.

Keywords

Course length, student evaluation of instruction, online course.

Introduction

At the time of writing of this paper, there are only two ABET accredited fully online electrical engineering (EE) programs in the U.S., specifically, a bachelor of science in engineering (BSE) degree is offered by Arizona State University (ASU), and a bachelor of science (BS) degree is offered by Stony Brook University.[1,2] As part of the development of two courses for the ASU online EE program, the recorded classes were initially deployed in half-semester long terms to both the online students and the traditional on-campus students. While the online students were accustomed to such accelerated terms and the Internet delivery, the traditional face-to-face students were not. This paper will report on the results of an inadvertent experiment resulting from the offerings of these two senior-level engineering technical electives. The end-of-the-course teaching evaluations completed anonymously by students are used to compare student perceptions about the course itself and the instructor.

Literature Review

There have been studies on the effect of class size, and course term length on student evaluations of instruction; however, there seems to be limited data with respect to the impact of course length.

Class Size: In 1984, Feldman presented data from 52 different studies and found a very weak inverse relationship between class size and the students' overall evaluation of the course and its instructor.[3] Bedard and Kuhn examined the impact of class size on student evaluations of instructor performance for all economics classes at the University of California, Santa Barbara

from fall 1997 to spring 2004.[4] They found that as class size increased, students gave decreasing ratings to the instructors.

Course Term Length: Rayburn and Rayburn investigated the span of classroom contact on student performance in a management accounting course.[5] They found that students in the 16-week offering performed better on exam problems than those in the 8-week class, except that no significant difference existed with respect to the points earned on multiple-choice questions. In contrast, Anastasi found that academic performance was similar in summer and full-semester length courses, with instructor ratings being comparable also.[6] Shaw et al. found no statistical difference in student achievement or engagement between six abnormal psychology online courses with half being taught in a 16-week semester while the other half were taught in an 8-week term.[7] Interestingly, Austin and Gustafson examined a database of over 45,000 observations from fall, spring and summer terms from all classes at the University of West Georgia from spring 2001 through summer 2004. They found that intensive courses result in higher grades than traditional 16-week semester length course and that these higher grades reflect a real increase in knowledge, and they observed that the improvement benefit peaks at about 4 weeks.[8]

Present Study

This study presents results from the offerings of two different senior-level engineering technical electives taught by the same instructor:

1. EEE 460 Nuclear Power Engineering, and
2. EEE 463 Electrical Power Plants.

The first fully online offerings of these two courses were made in 2015, with the second offering having already transpired for EEE 460 (the second offering of EEE 463 is presently occurring in summer 2016). The current fully online versions of the courses are produced in a recording studio using a green screen backdrop with only the instructor and producer present. Earlier Internet versions of the courses were recorded in a lecture room in front of on-campus students, and afterwards, streaming video was posted for graduate students in an online master's degree program. The present offerings overlay the instructor on top of the PowerPoint slides as shown in Figure 1. The lectures include closed captioning and are accessed via the Blackboard portal, which provides a discussion board and a platform for homework submission.

Essentially, there are four cohorts of students within each course:

1. UGF2F: on-campus hybrid (normally face-to-face) undergraduate students,
2. GRF2F: on-campus hybrid (normally face-to-face) graduate students,
3. UGON: online undergraduate students, and
4. GRON: online graduate students.

A comparison of the demographics of the online and on-campus undergraduate students is given in Table 1. A significant difference is that the online students are likely to be more mature, based on their average age and percentage of veterans in the population.

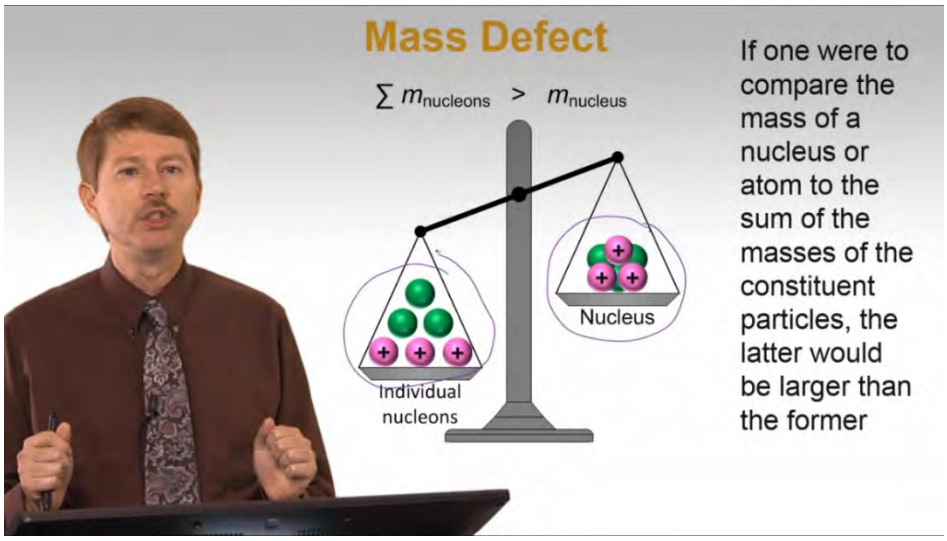

Figure 1. Screen snapshot of an online lecture from EEE 460.

Table 1. Comparison of On-campus and Online Undergraduate Students

Electrical Engineering Student Group	On-campus (Face-to-Face)	Online
Fall 2014 Undergraduate Enrollment	916 †	479 ‡
Average Age	22	32
Veterans	7%	37%
Female	11%	11%
Arizona resident	75%	15%
International	15%	0%

† https://facts.asu.edu/Pages/Enrollments/Enrollment-Trends-by-College-and-Dept.aspx
‡ https://facts.asu.edu/Pages/Enrollments/Online-Enrollment-by-College-and-Department.aspx

It is noteworthy that all students viewed the same online recordings, took identical exams, and completed the same homework assignments. The on-campus students enroll in the hybrid version of the course which simply means that the midterm and final exams are administered to the group at a preset time in an on-campus classroom setting, and they potentially have the benefit of face-to-face access to the instructor during office hours. For the online students, the university has contracted with ProctorU, which is a live remote proctoring service that monitors the students using their webcam during the exam period and while the students upload written exam solutions to Blackboard. All students have access to the instructor via email, telephone and the discussion board. In the first semester, the online students were also offered the option of online office hours with the instructor via web conferencing software (Adobe Connect), but remarkably, not a single student took advantage of the opportunity.

The initial online offerings of these courses are summarized in Table 2. Although there was a one week difference in the length of the first EEE 460 offering in 2015 and the online

undergraduate students took the course in summer rather than spring, all other aspects were identical (including the exams). The fact that the second offering of EEE 460 in spring 2016 was over the full 15 week semester was motivated by the initial findings presented in this paper (specifically, that the accelerated nature of the course was too demanding for the on-campus students).

Table 2. Initial Online Course Offerings

Course	EEE 460		EEE 463
Term	Spring/Summer 2015	Spring 2016	Fall 2015
Course length	7 or 8 weeks†	15 or 7 weeks‡	7.5 weeks
Enrollment at end of course (such that the students were sent the course survey)			
Undergrad Hybrid	50	69	68
Undergrad Online	15	9	17
Graduate Hybrid	10	11	14
Graduate Online	4	4	3
Total	79	93	102
Student withdrawals*	3	11	19

† The 8-week summer 2015 term was comprised of the undergraduate online students while the 7-week spring 2015 session included the other three cohorts.
‡ The 7-week spring 2016 session consisted of the undergraduate online students whereas the 15-week spring 2016 semester included the other three cohorts.
* The students withdrawing from the course are not included in the enrollment totals.

Student Evaluation of Course and Instructor

At the end of each course, students are asked to complete an anonymous survey about their opinions of the course itself and the instructor (the entire questionnaire is given in the Appendix). There are seven questions related to course evaluation, with the scale ranging from 2 (poor) to 5 (very good). There are nine questions probing the instructor's teaching effectiveness (scale of 1 to 5). In addition, a single question asks about the overall quality of the course and instruction, and each student is also asked to rate herself/himself as a student in the course. The surveys are completed prior to final course grades being posted to student transcripts.

For the past decade (2005-2014), the author's average teaching evaluation in these two courses was 4.78 ± 0.13 and the average rating of the two courses was 4.49 ± 0.17; however, the initial offerings of these two courses in 2015 saw a noticeable drop in these values as seen in Figure 2. This decrease motivated the present investigation. Several hypotheses for the drop are possible, including that the faculty member is just not as effective behind a camera; however, the author has been teaching with a recording camera in the classroom since 1989 (which might mean the instructor is just getting older).

EEE 463 Survey Results

The survey results from the EEE 463 course are presented first as that class was the most uniform in terms of the alignment of all the students in the same term but the data are from just a

single offering (as noted above, the second offering is presently occurring in summer 2016). In particular, from 2005 to 2014, the average instructor and course ratings were 4.74 ± 0.11 and 4.48 ± 0.21, respectively, whereas for fall 2015, those scores were 4.38 and 3.85. Thus, the instructor and course scores were about 3σ below the normal. The EEE 463 course has been taught fourteen times by the author since Fall 1993, but he did not teach the course in 2012–2014 (except for replaying lectures to online graduate students in 2012 and 2014), leading to a gap (observed in Figure 2) which might explain the drop in ratings, but a more detailed examination of the data was undertaken.

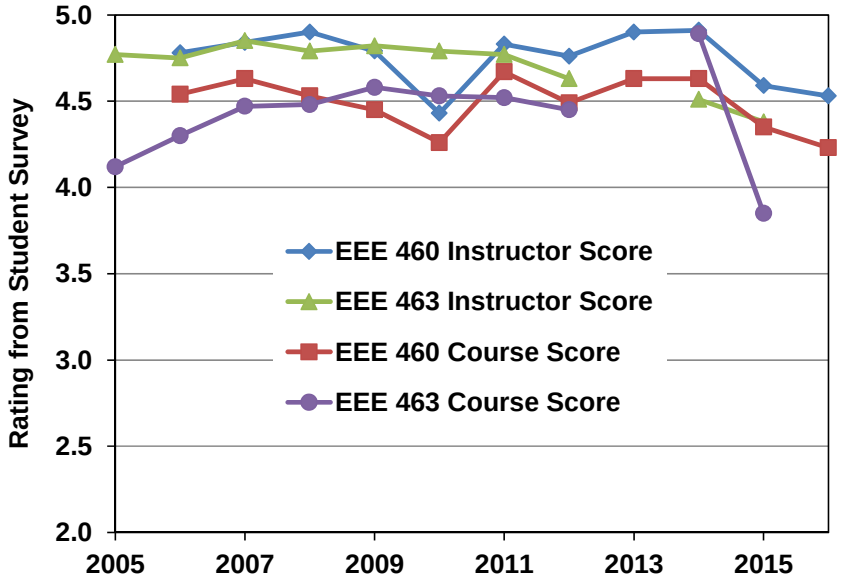

Figure 2. Composite instructor and course ratings.

Congruent with the standard deviation quoted above, Figure 3 shows that the instructor ratings are rather consistent except for the undergraduate on-campus rating in 2015. This indicates that only one—but the largest population—of the four cohorts was less satisfied with the instruction as compared to historical trends. This conclusion is further supported by Figure 4, which shows that only the on-campus cohort gave the course a reduced rating compared to the historical trends. The unhappiness of the on-campus students really reveals itself in the 2.87 overall rating of the course and instructor compared to the online student value of 4.75 (nearly a 2 point difference).

In the case of the undergraduate on-campus students, the amount of work in the accelerated terms seems to be the primary contributing factor to the student dissatisfaction with the course and to a lesser extent the instructor. The premise that the reduced ratings of both the instructor and course are strongly tied to the length of the course is further substantiated by open-ended on-campus undergraduate student comments such as “this amount of material in a half semester is crazy!!”. In fact, 7 of the 9 open-ended comments by the on-campus undergraduates complained about the doubled pace of the course; however, none of the online undergraduates made such a comment as the online undergraduate students are accustomed to 7.5-week terms and they are a

decade older than the on-campus students giving rise to other conjectures such as the online cohort being better time managers.

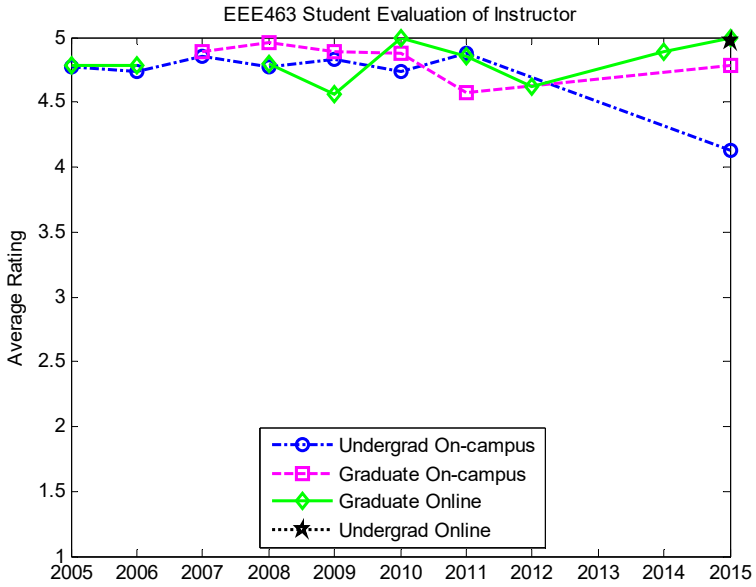

Figure 3. Student evaluations of EEE 463 instructor by cohort.

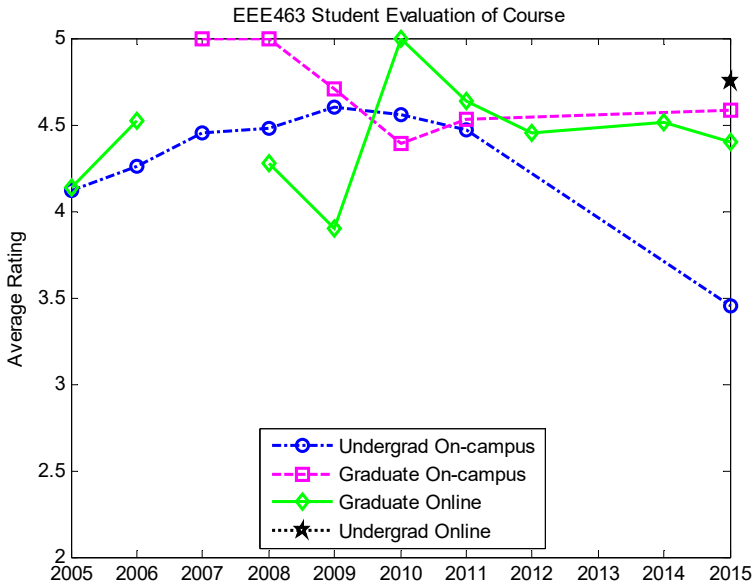

Figure 4. Student evaluations of EEE 463 course by cohort.

The challenging nature of the course is also exhibited by the number of withdrawals from the class. Of the 19 student withdrawals (see Table 2), 18 were on-campus undergraduates and the other student was an online undergraduate (i.e., 21% versus 6%, respectively). The final grade averages of the students are compared in Table 3. The correlation coefficients between the median final score and the instructor and the course ratings were 0.60 and 0.76 using the four

data of the cohorts. Focusing upon the undergraduate students, the final average of the online students was 6 points higher than the on-campus undergraduates, and the distribution spread was wider for the latter group. Other studies have found a positive correlation between grades and evaluations of courses and instructors.[9,10,11] Thus, the lower grades may explain the lower ratings by on-campus students.

Table 3. Statistics of Student Overall Final Averages in the EEE 463 Course

Cohort	Undergrad Hybrid	Undergrad Online	Graduate Hybrid	Graduate Online
Average	70.3 ± 18.3	76.3 ± 11.3	84.0 ± 8.6	77.3 ± 19.9
Median	74.1	79.3	82.4	84.8
Max / Min	92.0, 0.0	94.5 / 50.2	97.6 / 70.0	92.5 / 54.8

As many seasoned instructors would suspect, some students have a tendency to procrastinate (but rarely do we have access to quantitative evidence). Figure 5 graphs the viewings of the EEE 463 lectures during fall 2015. The plot shows peaks in the number of views corresponding to homework due dates and examinations. The bimodal peaks associated with Homeworks 4 and 7 may be explained as follows. The Thursday that Homework 4 was due was the night of a collegiate (PAC-12) football game at ASU such that some students may have been compelled to finish the assignment a day earlier in order to attend the game. The day before Homework 7 was due was a national holiday (Veteran's Day) giving them a chance to get ahead. An overall reduced number of views in the latter half of the term is expected as a result of the withdrawal of some students from the course.

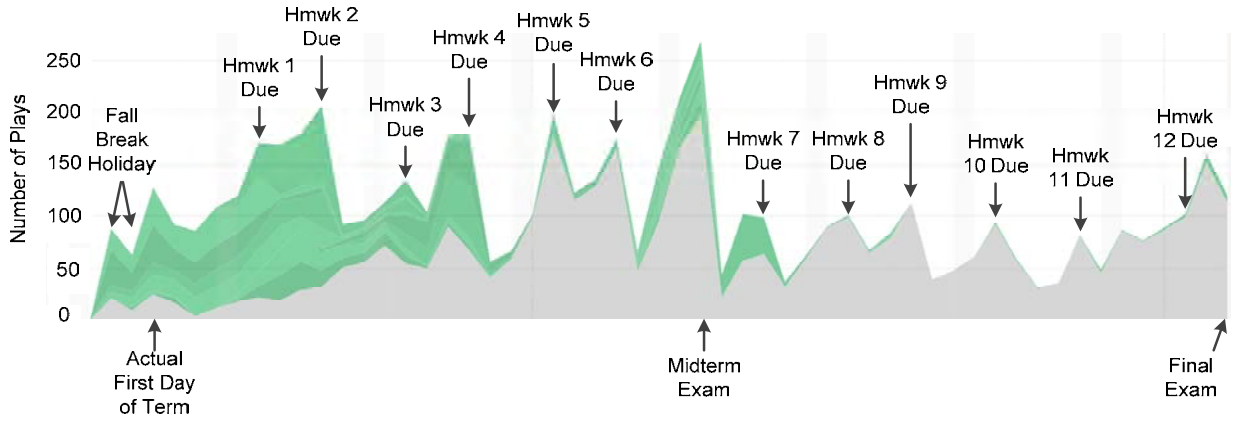

Figure 5. EEE 463 lecture plays by all cohorts during the 7.5-week fall 2015 term.

EEE 460 Survey Results

Survey data for 2006–2014 reveal that the EEE 460 instructor and course ratings were 4.79 ± 0.15 and 4.54 ± 0.13, respectively. However, the 2015 and 2016 student evaluations for EEE 460 were approximately 2σ below the historical average (which was not as bad as the EEE 463 drop). Figure 6 shows that, similar to the EEE 463 survey results, the on-campus students were

not as happy with the instructor as the online students were. Likewise, Figure 7 shows the on-campus students were less pleased with the course compared to their online counterparts.

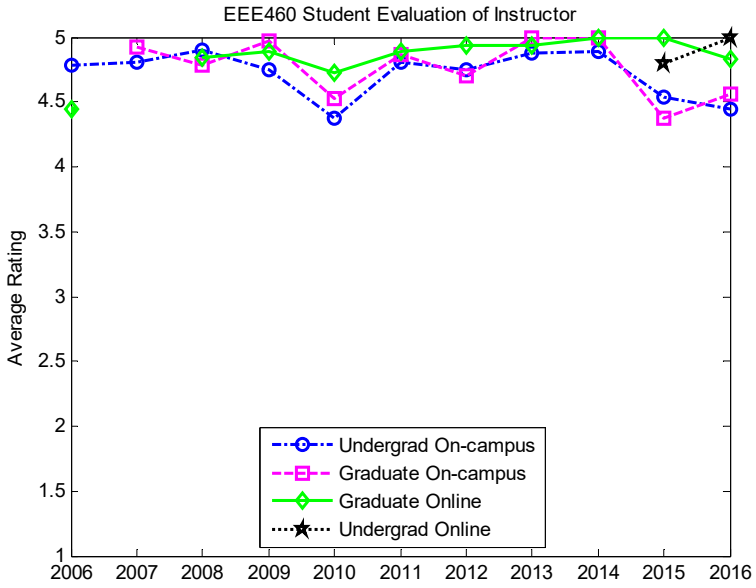

Figure 6. Student evaluations of EEE 460 instructor by cohort.

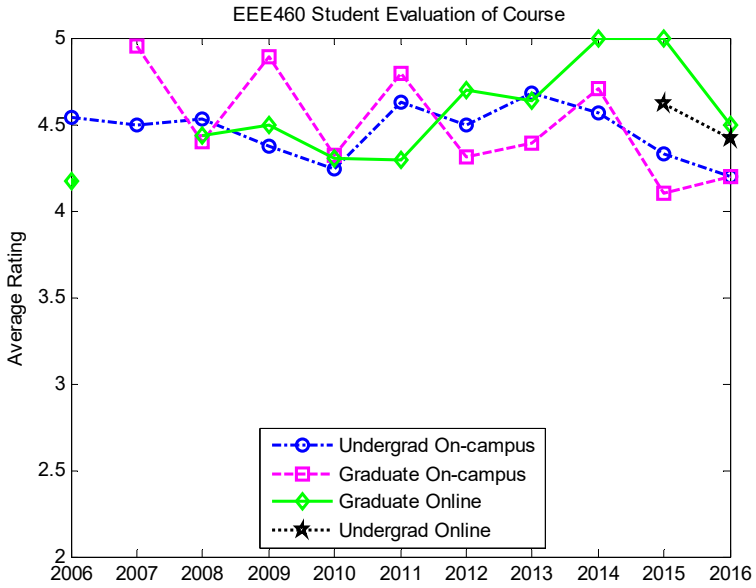

Figure 7. Student evaluations of EEE 460 course by cohort.

A significant difference in these sets of data compared to those for EEE 463 is that the 2015 offering of EEE 460 was in the half-semester term, whereas in 2016 the on-campus students took the online course over the full 15-week semester. Therefore, while the length of the course might be blamed in 2015, these survey results would tend to indicate that something else is

driving the instructor and course ratings down, at least from the on-campus student opinions. Also noteworthy is that the same lecture recordings were used in both 2015 and 2016, such that lecture content cannot explain any variability between 2015 and 2016.

With eight data points (4 cohorts and 2 years), no significant correlation was found between the students' final median course score and the instructor and course ratings (in contrast to the four data points for EEE 463); see Figure 8. The online delivery was received positively with 3 of the 4 comments from the graduate hybrid section and 2 of the 9 undergraduate hybrid students indicating in open-ended comments that aspect was what they liked about the course in spring 2015. Furthermore, one of the BSE online students wrote that what (s)he liked most was: "Enthusiasm and explanation of the material was absolutely spot on. To hear an instructor say 'stop and look at my hands' during a lecture is an absolutely refreshing idea. Really made the experience like attending an actual lecture. Pausing for input, leads to engaging the thought process rather than rambling the material in a monotone voice."

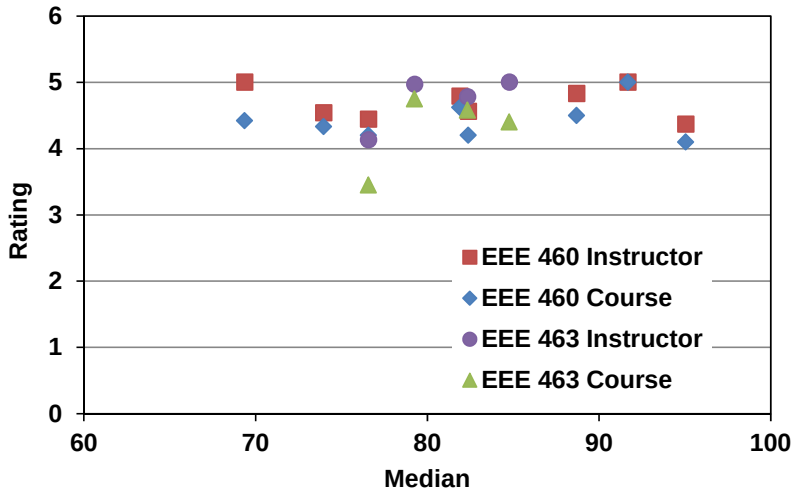

Figure 8. Course and instructor ratings compared to the median of the final student course grades.

Although not relevant to survey results, the fact that the 2015 EEE 460 lectures were viewed during two different terms provided the opportunity to compare procrastination trends. Figure 9 and Figure 10 graph the views of the EEE 460 lectures during spring and summer 2015, when in the latter case only the online BSE students were enrolled. Although the online undergraduates were described earlier as more mature (and perhaps better managers of their time), these graphs reveal that lectures were watched by them more frequently when homework is due (it must be noted that some of this peak viewing could be attributed to replays to better understand how to solve the homework).

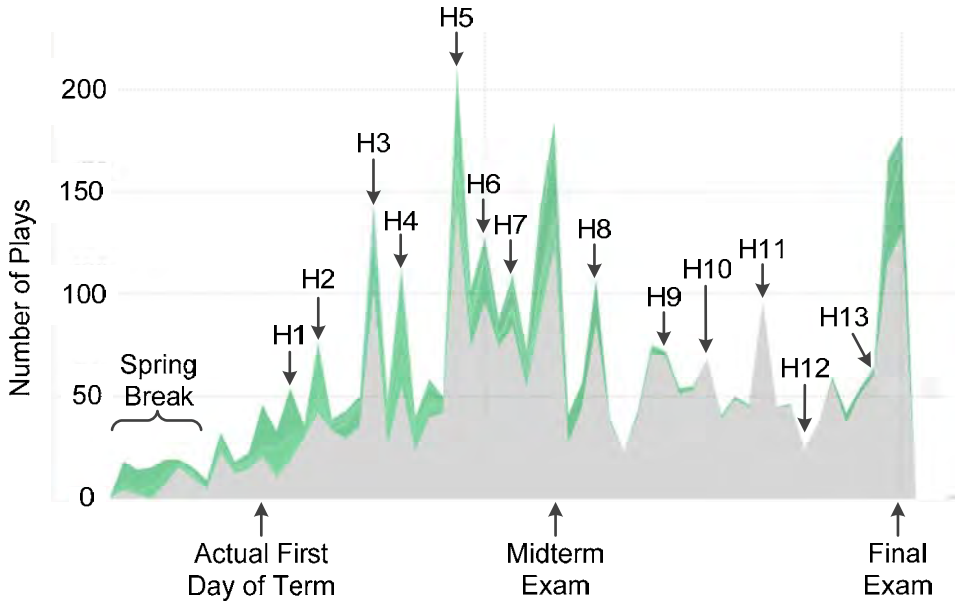

Figure 9. EEE 460 lecture plays during the spring 2015 term.

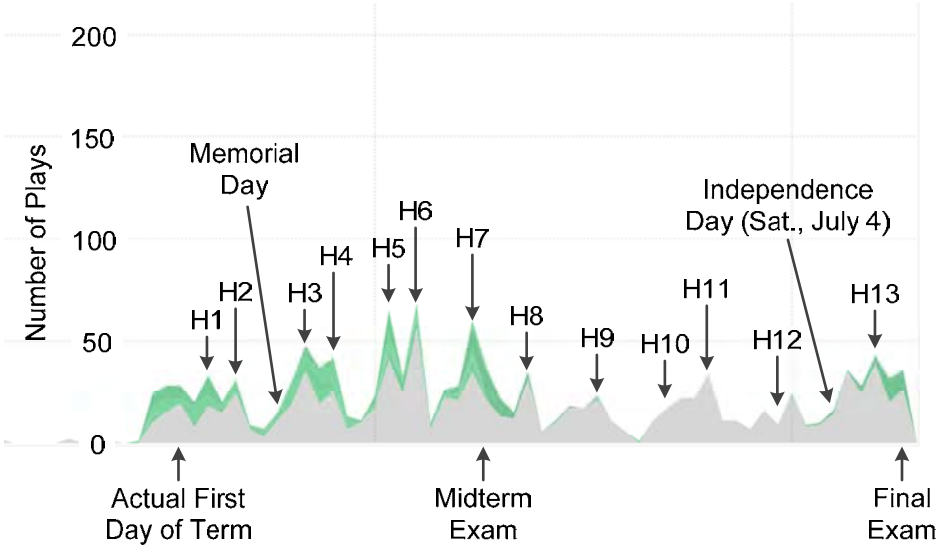

Figure 10. EEE 460 lecture plays during the summer 2015 term by the online undergraduates.

Discussion

Although this investigation is a work-in-progress some observations regarding student evaluations of the course may be possible. A conjecture is that in the case of accelerated terms, the normally face-to-face students procrastinated and may not have acclimated to the online delivery rapidly enough such that their grades suffered and this consequently led to lower course and instructor evaluations. It became clear from discussions with on-campus students that the lectures are sometimes viewed late at night when their attentiveness is not at its peak, and that

there is a difference between simply viewing the lectures (and perhaps multitasking on other items) versus sincerely watching the videos and taking notes like in a regular classroom setting. Several students mentioned that after the midterm exam, they had to make adjustments in how they were treating the online nature of the course.

The summer of 2016 is presenting a second opportunity to compare all 4 cohorts of students taking the EEE 463 course in the half-semester length version, while fall 2016 will provide the first chance to present the course in a full-semester length format for the on-campus students.

Appendix

The end-of-the course questionnaire consists of the following questions and answer options.

Part 1: Student Evaluation of the Course	Response Options
1. Textbook/supplementary material in support of the course.	5. Very good 4. Good 3. Fair 2. Poor 0. Not applicable
2. Value of assigned homework in support of course topics.	
3. Value of laboratory assignments/projects in support of the course topics.	
4. Reasonableness of exams and quizzes in covering course material.	
5. Weight given to labs or projects, relative to exams and quizzes.	
6. Weight given to homework assignments, relative to exams and quizzes.	
7. Definition and application of criteria for grading.	
Part 2: Student Evaluation of Instructor	Response Options
8. The instructor was well prepared.	5. Almost always 4. Usually 3. 50% of the time 2. Occasionally 1. Almost never
9. The instructor communicated ideas clearly.	
10. The instructor or assistants were available for outside assistance.	
11. The instructor exhibited enthusiasm for and interest in the subject.	
12. The instructor's approach stimulated student thinking.	
13. The instructor related course material to its applications.	
14. The instructor's methods of presentation supported student learning.	
15. The instructor's grading was fair, impartial, and adequate.	
16. The instructor returned graded materials within a reasonable period.	
Overall Evaluation of the Course and Instructor	Response Options
17. Overall quality of the course and instruction.	5. Excellent 4. Very good 3. Good 2. Fair 1. Poor
18. How do you rate yourself as a student in this course?	
General Information	Response Options
19. Is this a required course in your program of study?	Yes/No
20. What are the average hours/week spent studying for this course?	1; 2; 4; 8; 16
21. What is your class standing?	Grad student; Senior; Junior; Soph; Freshman
22. What % of the class meetings have you attended?	10–29; 30–49; 50–69; 70–89; 90–100
23. What did you like most about this course?	Free-format, open-ended textual essay
24. What did you like least about this course?	
25. Comments	

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