Examining Student Usage/Access Statistics from two Canvas LMS courses: Undergraduate and Graduate

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Abstract

The author has been utilizing Canvas LMS (Learning Management System) for either asynchronous undergraduate course teaching or as an online presence to communicate many aspects of an in-person graduate course. In this paper, the author reflects back on student usage or access statistics in these two courses to derive from them some interesting data or numbers. The pulled-out numbers are contrasted to the number of students in each class as well as specific events or milestones in the courses. The data is either directly pulled out from Canvas or run through simple statistical quantities such as averaging. Interesting observations are discussed herein and this provides an opportunity to reflect back on the plusses or minuses for online teaching and learning.

Introduction and Background

The move to deliver courses online is not a new thing. Indeed, for the past tens of years, this is a modality that has been developed and still continues to see development in terms of features and capabilities. The earliest attempt at online learning was in 1982[1]. With the advent of the Internet, the easy and mostly free arrival of information took hold. However, since then people started thinking about the use of the Internet in more structured formats or ways instead of the complex information delivery/gathering inherent with the world-wide "web" concept. People started focusing on how to move traditional teaching from in-person to virtual or online[1].

With that thinking or focusing, the questions of efficiency or even equivalency between in-person and online teaching modalities have emerged. Scholars or researchers engaged into contrasting plusses or minuses (advantages or disadvantages) of the two teaching modalities. According to Drexel University[2], there are four benefits for online education: "There are many advantages to virtual learning that can help you sharpen your skills and grow in your career. Courses taught online provide students the flexibility to learn on their own schedule, instead of a mandatory class time. Online courses, including those taught at Drexel cost less than traditional on-campus courses, making them more affordable. Virtual courses give students more selection in their courses. In a face-to-face setting, courses taught at the same time force students to choose between courses they like. Lastly, virtual learning gives students access to classmates all around the world, providing networking opportunities you can't get through an on-campus program."

In the last few years, online courses or classes have been more and more present and

advertised/offered by different academic institutions. The typical in-person or in-class courses are shrinking in offerings at some institutes. More and more institutions are offering courses, even whole degrees, on-line. A lot of them offer graduate courses and programs online. Some, even at the high-school level, are offering online degrees.

LaMeres and Plumb[3] found out that converting undergraduate digital circuits to online delivery is as effective as in-classroom offerings. They even found the same result for an undergraduate digital systems laboratory using a remote lab approach. Reid[4] in the Electrical and Computer Engineering Technology Department at IUPUI studied the conversion of two courses (Digital Fundamentals and C++ programming) has gradually changed two courses from a traditional lecture / laboratory format to an online format. They found that student success was comparable to success in a traditional format using a self-assessment and final exam scores. But they found serious issues with student retention and with student satisfaction with the online format of course offering. Pisupati and Mathews[5] found out that "the average quiz scores for online and face-to-face sections were identical". They also found out similar average scores for the midterm and final exams. However, they found out that the students perceived the online portion/format to be more difficult and challenging. Douglas[6] found out for an engineering statics course that "there was little to no difference in content mastery between students who completed the online and face-to-face sections of the class". This includes scores on identical proctored exam problems. However, they also found that the withdrawal and non-completion rates were higher in the online classes than the face-to-face classes. Khraishi[7], and Khraishi & Denman[8] discussed the case of offering a fully-online version of a sophomore-level class in engineering entitled "Energy, Environment and Society" and comparing it to past in-person versions of the same course. They concluded "it appears that the online classes result, in general, in lowered grade letter and course component attainment. Overall though, it appears the transition to an online course had no bearing on the two main components of the course (the midterm and final exams). The components that got affected were those involving group work, specifically homeworks and group presentation". Also in 2021, Khraishi[9,10] taught a graduate course entitled "Introduction to Continuum Mechanics" as fully online and synchronous for the first time due to the COVID pandemic. Such a course was previously offered as a hybrid course (about half the students in-person with the teacher, and about half remote or live online). It was concluded that "the modality of the course offering (virtual and fully-online in Fall 2020) did not greatly impact the eventual course grades of the students comparing to past years (especially to last year of 2019). A similar conclusion was reached regarding the required University course evaluations done at the end of the semester. For the fully online course, the evaluations of both the course and teacher were better or on par with previous years when the class was offered then by the same teacher".

The above is definitely not an exclusive list of studies or papers focused on the benefits or negatives of online courses and education, but they give a good introduction to the current work which is focused on data analytics for use of the LMS online course, something the author has been intrigued by to analyze and contrast across levels of courses (undergraduate versus graduate).

Methods and Materials

The two courses focused on in this paper are: ME217 (Energy, Environment and Society); an undergraduate course taken by all Mechanical Engineering (ME) students at UNM, and ME512 Introduction to Continuum Mechanics; a graduate course offered by the same ME department and usually taken by early career graduate students.

ME217 was offered by the author fully online and asynchronously using the Canvas LMS. It is also offered by other teachers during the academic year and garners a lot larger enrollment then. In this course, all lectures/presentations were pre-recorded with voice over PowerPoint presentations, as video with audio (or MP4), and were available to the students from day 1 of this summer offering. This course has a required textbook that its chapters are covered during the semester. ME512 was also used asynchronously online but as a medium to exchange course information and documents, e.g. syllabus and handouts or written notes or external class material not covered by the required textbook, as well as homework information. Both online presences utilized an Announcement section where weekly announcements about course happenings were posted online and automatically emailed to students as well. Both had textbook ordering info posted online. However, ME217 also had weekly multiple-choice timed quizzes and two exams (midterm and final) that students had to take during certain dates/times in the summer session. The weekly quizzes in ME217 were two of them: a pre-quiz (labelled as such) which is supposed to be taken after reading the assigned textbook chapters for the week, and a post-quiz (also labelled as such) which is supposed to be taken after not just having read the assigned textbook chapters *but also* after watching or going through the pre-recorded lectures/presentations from the course instructor. Each quiz had a few multiple-choice problems (less than ten), which require a binary answer (correct or incorrect, or scoring one point or zero). The weekly post-quiz had the *same exact* questions as the weekly pre-quiz from two days before, however with the questions shuffled around in order, i.e. randomized in order, of their presentation to the examining student. The purpose of the post-quiz is to help reinforce learning of the class material. *Both* the pre-quiz score and the post-quiz score factored into the students' final course grade (and not the lowest of the two being dropped so that the highest of the two factors in by itself). There was a total of 8 pre-quizzes and 8 post-quizzes in the 8-week summer session. The midterms and final exam (a total of 3 exams) for ME512 were done in person just like the lecturing part BUT all lectures were simultaneously recorded to the clouds via Camera/Zoom and posted online on the class Canvas site for future reference/utilization (especially if someone misses attending the class for whatever reason).

Another feature of ME217 is that students had to submit homework assignments online as a group plus one group presentation on a topic selected for the group by the teacher (i.e. the author). The group presentation was rated individually by other students who were not part of the group, and such peer evaluation was used directly as is for a group's score. There was also a total of 7 homework assignments. Both classes were offered yearly but the data presented below were only for the year 2024. The number of students enrolled in ME217 and ME512 were 15 and 9, respectively. In ME217, there were 5 groups, and each group was composed of 3 students (the choice of this group size was predicated on previously published work[11]). In ME512, there were 4 groups of two students each, with the exception of one 3-member group. In ME512 the purpose of having groups was to collaborate on homework submittal as one submission per group. There was

also one submission of homework per group in ME217 (basically weekly), see above. In both courses, any tests/exams were done (or supposed to be done) individually by each student (online again for ME217 on specific dates/times, and in-person for ME512). The online tests for ME217 were not proctored in any manner. The in-person exams for ME512 were proctored by the instructor. As for homeworks in ME512, there were only four (basically one per chapter following chapter one).

Results and Discussion

The results and discussion are split into two sections. One for the ME217 course and one for the ME512 course although towards the end any coupling or links between the two are discussed.

ME217

For this course, see first (Figure 1) a comparison between the pre-quiz scores and post-quiz scores, on average, for all 8 quizzes. As the graph clearly shows, and for all quizzes, the post-quiz score is higher than the pre-quiz. In accordance with **Methods and Materials** this was expected, or at least hoped for, as it would indicate students are better equipped, or learned hopefully, to answer the same questions albeit shuffled in their order. Another observation regarding Figure 1 is that the first two quizzes were the lowest scores in the whole semester. Starting with the second quiz or week, scores took an upward trajectory and improved till they basically plateaued with the fourth quiz or week and stayed pretty much level till the end of the semester. Such data indicates a level of comfort reached by the students in how to approach the quizzes on a weekly basis. This improved performance as students progressed through the semester, points to the importance of learning reinforcement as a method to improve performance.

In Figure 2, the *x*-axis shows the fourteen pre-recorded lectures in the course. The left *y*-axis shows the percentage of unique (or individual) students who have accessed such lectures. It is seen from this curve that in none of the weeks, a lecture was seen by 100% of the students. The best rate of access to such lectures was about 80% in the first week, meaning 20% still did not access the first week lectures! Looking beyond the first week, the picture looks dimmer as less and less number or percentage of unique students are accessing these lectures. In fact, this drop off continues until week 6 when the access percentage starts leveling off after that. The lowest access rate was about 12% for Lecture 11, i.e. a whopping 88% did not view the lecture then! One way to interpret this is to assume that students are benefiting enough from the book chapter reading, which is hard to know if it is done in the first place, and hence they don't believe that watching a lecture based on such chapters is needed.

As for the right *y*-axis in Figure 2, it shows the normalized number of lecture views by the students. Here the normalization happened by dividing the sheer number of views per lecture by the total number of students in the course. If each individual or unique student views a lecture once, then the *y*-axis would correspond to the number 1 or unity. Before Lecture 5, the curve indicates that some students viewed the lectures more than once (as high as 2.5 times per student). However, after this week, things steadied to average around 1 lecture view per student.
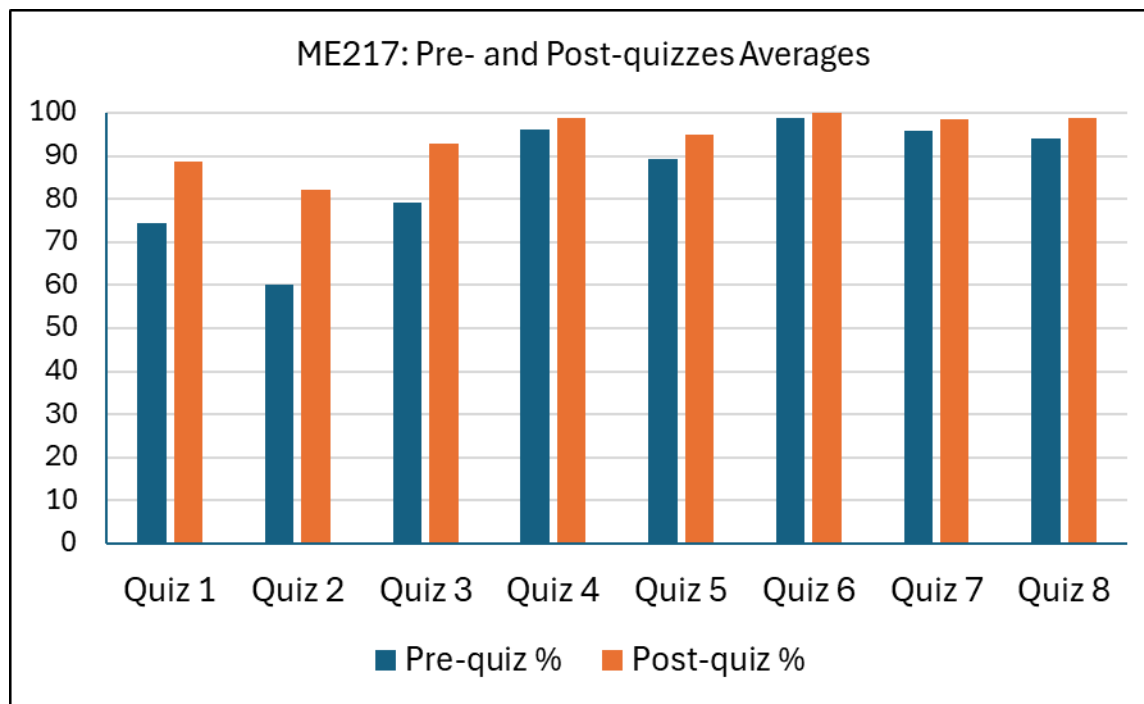
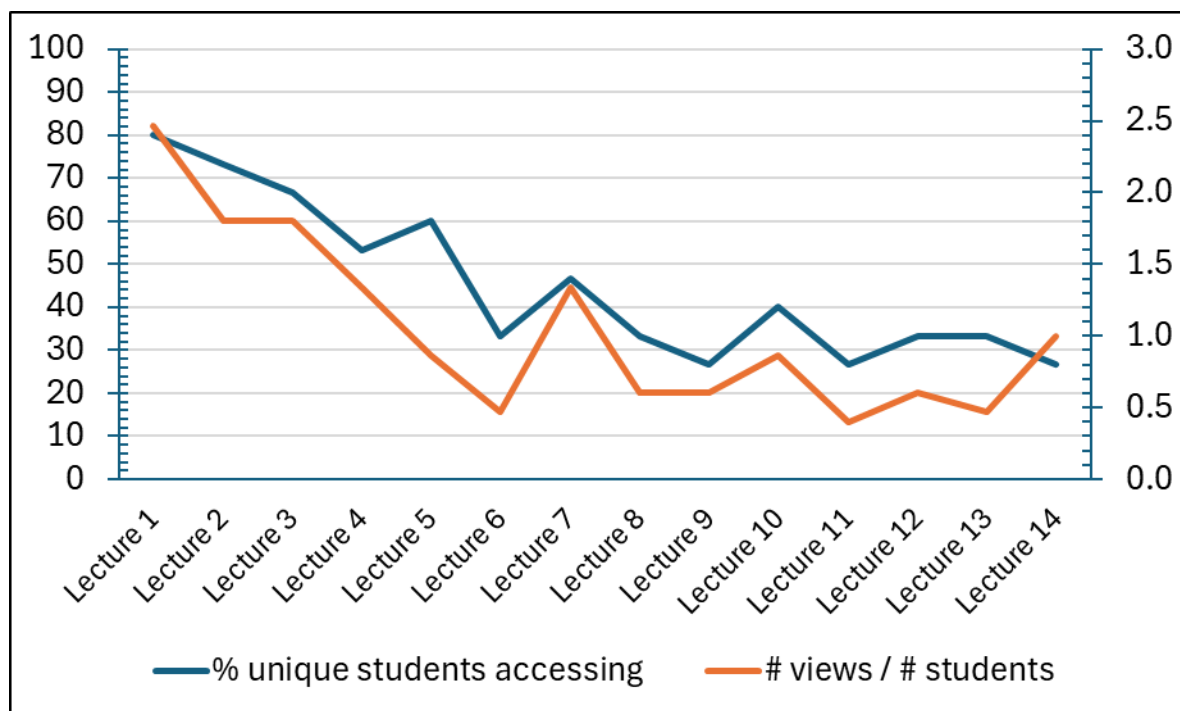Figure 1. Pre-quiz and post-quiz comparison for ME217 over 8 weeks.

Figure 2. Access to course lectures by ME217 students including the normalized view numbers for the online lectures.

As can be seen, Figure 3 shows a general downward trend for the percentage of unique students accessing the homework (HW) assignments online. Remember it is important that students access them before being able to do them as the link or page would provide details on the homework. In this figure, only HW1 achieved a 100% access rate as they all should. Other homeworks all had less than 100% access including a low of about 67% for the last homework of the semester (i.e. HW7). It is important to remember what the **Methods and Materials** section of this paper said about homeworks. These were group activities done by a group of 3 students and only one submission per group is accepted, and furthermore, one grade is given per group/submission. This setup could cause a lack of participation from some group members while relying on the more go-getter group members to check out the posted online homework and share it with others in the group, although students were advised to do the homeworks individually and then meet over their solutions to pick the best solutions for submission.

In the last figure (Figure 4) for ME217, the total number of hours spent by each student is plotted against their entire course score (in percentage). One would generally hypothesize that the more time invested or put into the course and its materials, the better the grade of the student should be. However, such a hypothesis is not completely valid as shown in the figure, although three of the lowest scoring students in the class (i.e. below 81%) were all marked by spending less than 8 hours total on the material online.

Total no. of students = 15	# unique students accessing	% unique students accessing
"Welcome" page	10	66.7
"Introduction" page	12	80.0
"Syllabus" (PDF online)	14	93.3
"Rules for Presentations" document	3	20.0

Table 1. Access to several pages or documents online on Canvas for ME217

Table 1 shows access to some online pages or documents. The second column shows the absolute number of unique students accessing them. The third column shows the percentage of students accessing them. Let's focus on the third column as it conveys the info in the second column. The ideal access percentage should be 100% or 15 students. It is observed that the actual access percentage is far from ideal, reaching only 20% for information on upcoming presentations by the student groups, or as high as 93.3% for those accessing the syllabus (which contains things such as the number of exams and the breakdown of the course grade). Even the "Welcome" and "Introduction" pages, which are the first items seen by the students on Canvas, lacked student access by 23% and 20%, respectively. From this table and previous graphs, it is clear that a percentage of students were not engaged in its content from the beginning of the course till its
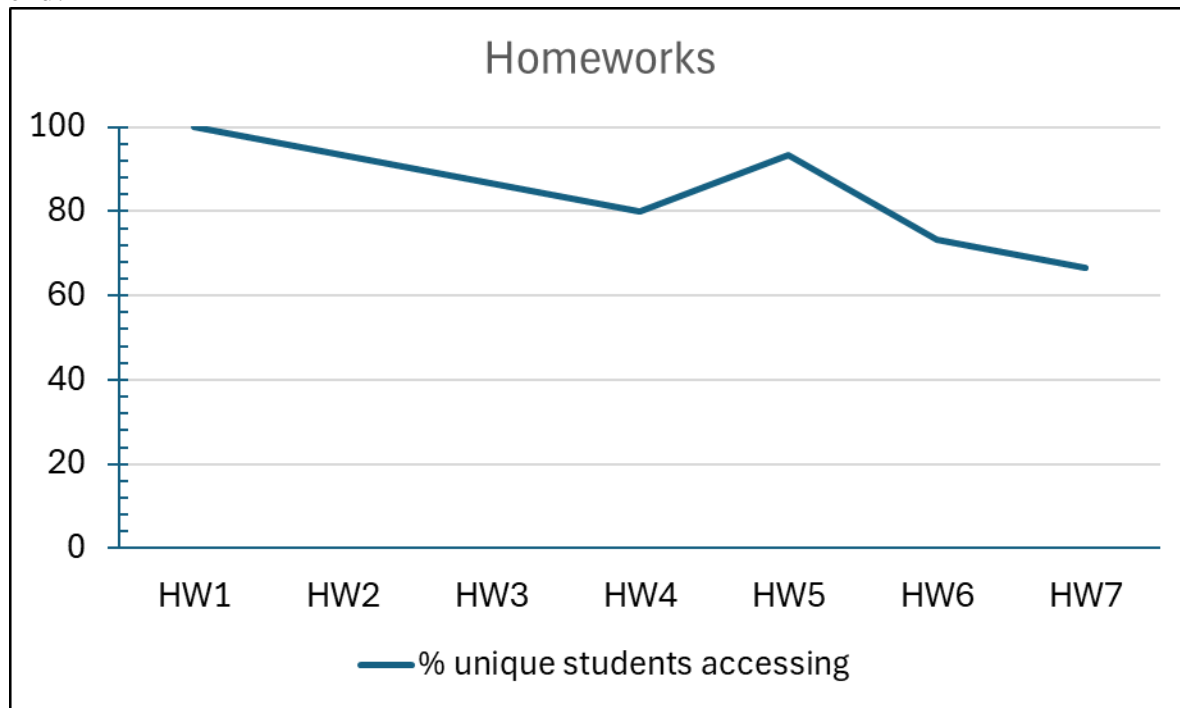
end!

Figure 3. Percentage of individual students accessing homework (HW) assignments online
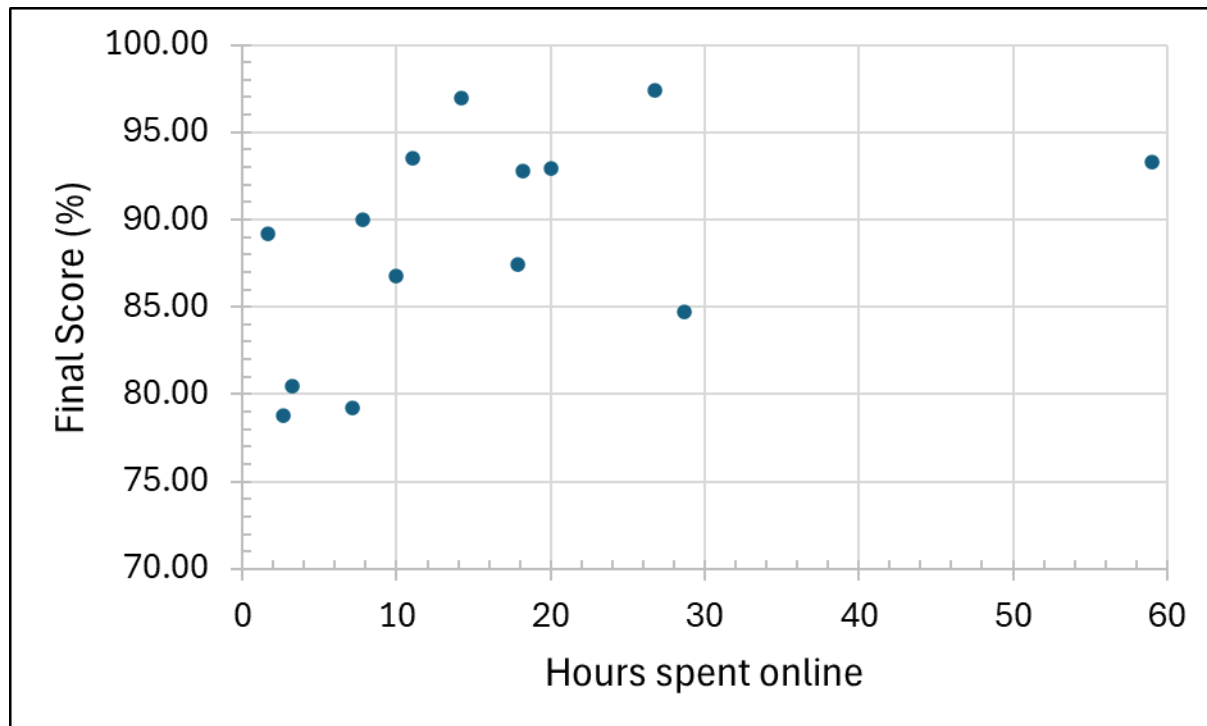

Figure 4. Final ME217 course accumulation or score in percentage versus the total number of hours each student, represented by a dot, spent on the online content of the course.

ME512

At the outset, it is important to remind about what was mentioned in the **Methods and Materials** section that for ME512, the online content was not as extensive as it was not a pure online course like ME217, and that furthermore the number of students in it is less than in ME217. However, there are still some online features that can be gleaned from it and perhaps compared to the undergraduate ME217 course.

Consider Figure 5. It is similar to Figure 2. However, the *x*-axis here is not online lectures but online word documents that have optional or extra problems to work on concerning chapter content. These problems are usually done in the classroom to ignite active learning and provide a real-time feedback mechanism with the teacher. However, the same extra chapter problems are posted online on Canvas and students can access them as much as they like as shown in Figure 5. This figure shows similar trends to Figure 2. For example, the percentage of individual student access to these resources declined throughout the semester, starting as high as 100% but not dropping lower than 56% towards the end of the semester. Contrast this with as low as 26% for ME217 in Figure 2. The general trend for the normalized number of views is also similar to that in Figure 2 for ME217. However, this normalized parameter does not drop below 1.33 in contrast to the low of 0.4 observed in Figure 2. These results might be anticipated since the ME512 students are graduate students and thus more mature and career oriented, i.e. more focused and driven to succeed, than the undergraduate students taking ME217.
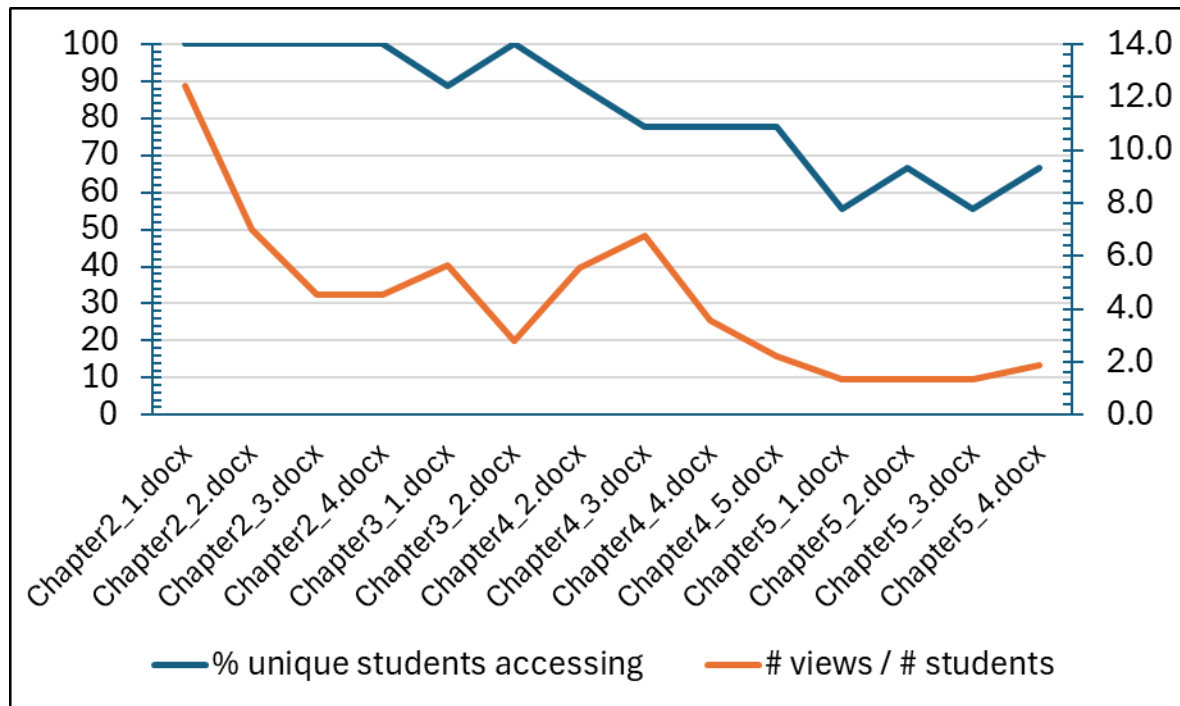

Figure 5. Access to course materials (extra chapter problems) by ME512 students including the normalized view numbers for these course materials.

Consider now Figure 6 for ME512. Contrast it to Figure 4 for ME217. Figure 6 still does not show a clear correlation between the final course score and the amount of time spent online. Most students in ME512 spent about 10 hours or less on the course online whereas in ME217 most spent 20 or less. This makes sense given the full online nature of ME217 compared to the partial online use in ME512 (most of the onlintime here going towards viewing recorded Zoom lectures which are saved/uploaded to a cloud server). Figure 6 also shows that more than half the class scored above 80% while not putting in any significant amount of time online. This again makes sense since most of the class content, i.e. lectures and in-class work, is done live in-person in class and only activities such as going through extra problems or viewing recorded in-class lectures (or the occasional homework announcements) are done online. Hence, success in the class can be greatly achieved just from strong in-person participation and attendance in this course.
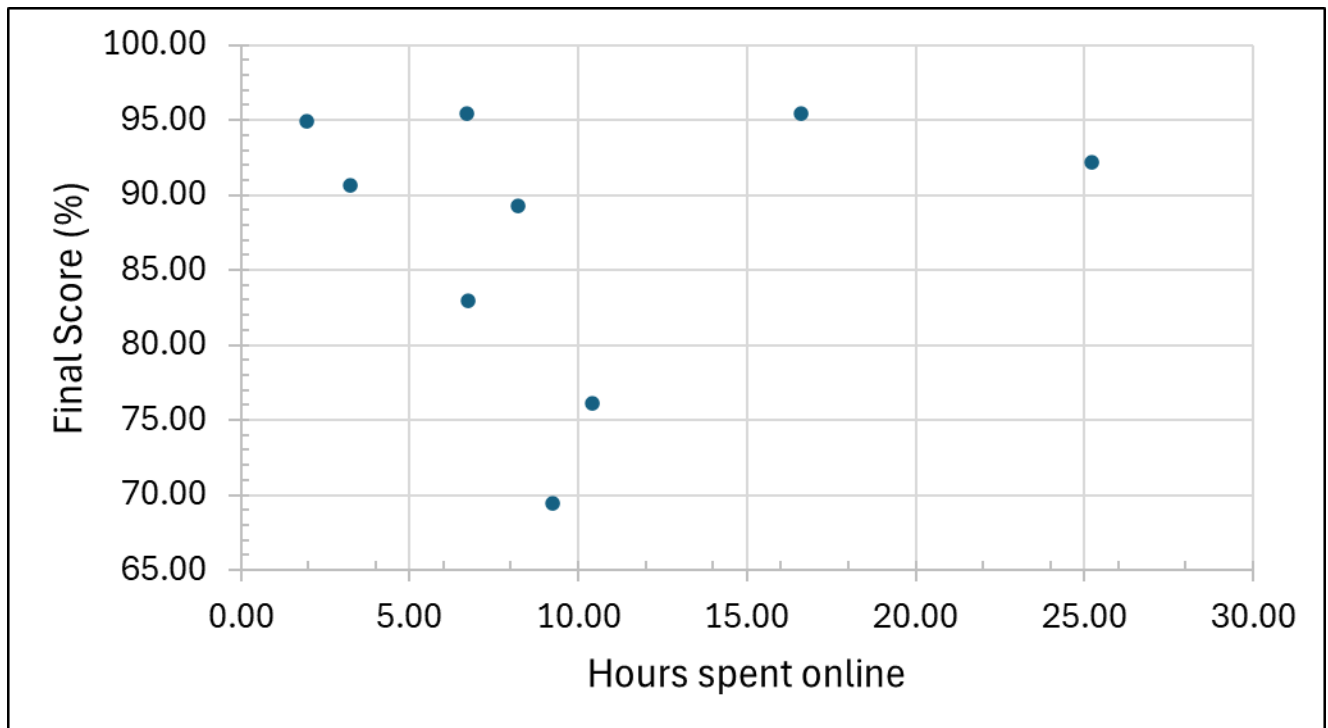

Figure 6. Final ME512 course accumulation or score in percentage versus the total number of hours each student, represented by a dot, spent on the online content of the course.

There are no more graphs to show for ME512 from online activity data. However, two more tables can be exhibited. See tables 2 and 3. Table 2 shows the percentage of access to announcements concerning homework assignments. It is essentially 100% (lower than that for the last homework). These numbers are not surprising due to the maturity of the students in this class albeit the homeworks being done in groups (see **Methods and Materials**). See the previous comments on group homeworks for ME217. Now Table 3 shows online access data for the syllabus and the textbook ordering information. Both show perfect and complete access by the

individual students. Again, such results are not too surprising and should be better than those for the undergraduate course which are shown in Table 1.

Total no. of students = 9	# unique students accessing	% unique students accessing
HW1 announcement	9	100.0
HW2 announcement	9	100.0
HW3 announcement	9	100.0
HW4 announcement	8	88.9

Table 2. The data for student accessing of homework (HW) assignments posted online on Canvas for ME512.

Total no. of students = 9	# unique students accessing	% unique students accessing
"Syllabus" (PDF online)	9	100.0
"Textbook ordering info" document	9	100.0

Table 3. Online access (absolute and relative) of two documents posted on the Canvas website for ME512

Conclusions

In conclusion, examining access or online course usage data for these two varied courses (undergraduate and graduate) can shed some interesting information on student behavior and inclinations. In both courses, student access to course materials such as lectures or extra problems has waned over time. However, the wanning happened at a higher rate for the undergraduate course. Also, both courses showed no clear correlation between time spent online versus grade or score obtained in the course. Both courses showed overuse or over-access of course materials early in the class, i.e. more than one access/view per student, with the graduate students maintaining this high ratio till the end of the course. The data also clearly shows that even important documents are not accessed or seen/read by a segment of the student population. The data also points to the effect of group work, combined with single submission, on the participation rate of the students in the group in the related online posting. Since the study involves only two courses, its applicability to other courses requires further futuristic data from other instructors.

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