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Curiosities Regarding Exam Review Sessions at LSU's College of Engineering

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Curiosities Regarding Exam Review Sessions at LSU's College of Engineering

Introduction

As enrollment increases at Louisiana State University (LSU), it becomes more challenging for students to be actively engaged with their professors and in their own learning processes. The larger class sizes and reduction in state funding contribute to a poorer learning environment [1, 2]. This struggle is compounded in sophomore level courses, where many students consider dropping out of their respective engineering programs [3]. In 2014, the authors published a paper discussing how these barriers can be somewhat alleviated by offering peer led active learning sessions through Supplemental Instruction (SI) [4]. The authors found that students in the College of Engineering who regularly attend SI sessions are benefitting tremendously from this program.

SI is a model of peer led learning where a student who has had success in a class is hired as a peer instructor in order to hold outside of class review sessions [5]. Several factors are taken into account before hiring the student including their GPA, communication skills, and ability to host a welcoming atmosphere. In addition to the review sessions, Supplemental Instructors (SIs) participate in weekly meetings and bi-yearly trainings, attend lectures, and hold office hours to benefit students.

SIs at LSU's College of Engineering will generally offer two sessions per week, where they cover course material utilizing active learning strategies. Active learning is any type of learning that gets students to actively participate compared to simply taking notes. An example of active learning would be having a student work out a problem themselves or in a small group while inactive learning may be the student watching the SI work the problem on the board [6, 7]. Experience and data indicate that success of the program may stem from the likelihood that students are much more willing to participate in active learning when a peer is leading them due to the relaxed and comfortable environment SIs offer [8].

In a previously published study, students in each class were grouped based on the number of sessions they attended, which included students who attended no sessions, students who attended 1-3 sessions (few), and students who attended 4 or more sessions (regulars). Students who regularly attended sessions were 22±3% more likely to pass the course with an A, B, or C then those who do not go to any sessions [4]. As the data were updated for another years' worth of courses, the same general conclusions were made (Figure 1). The middle group of this figure (students who attended few sessions), has remained intriguing to the coordinators and authors. Effort was placed in trying to find out why students would choose to only go to a few sessions. The assumption, published in the author's previous paper, was that this group of students only attended exam review sessions [4]. This paper will illustrate the analyses performed in order to ascertain whether students who only attend exam reviews do as well in the course as students who attend more of the normal sessions.

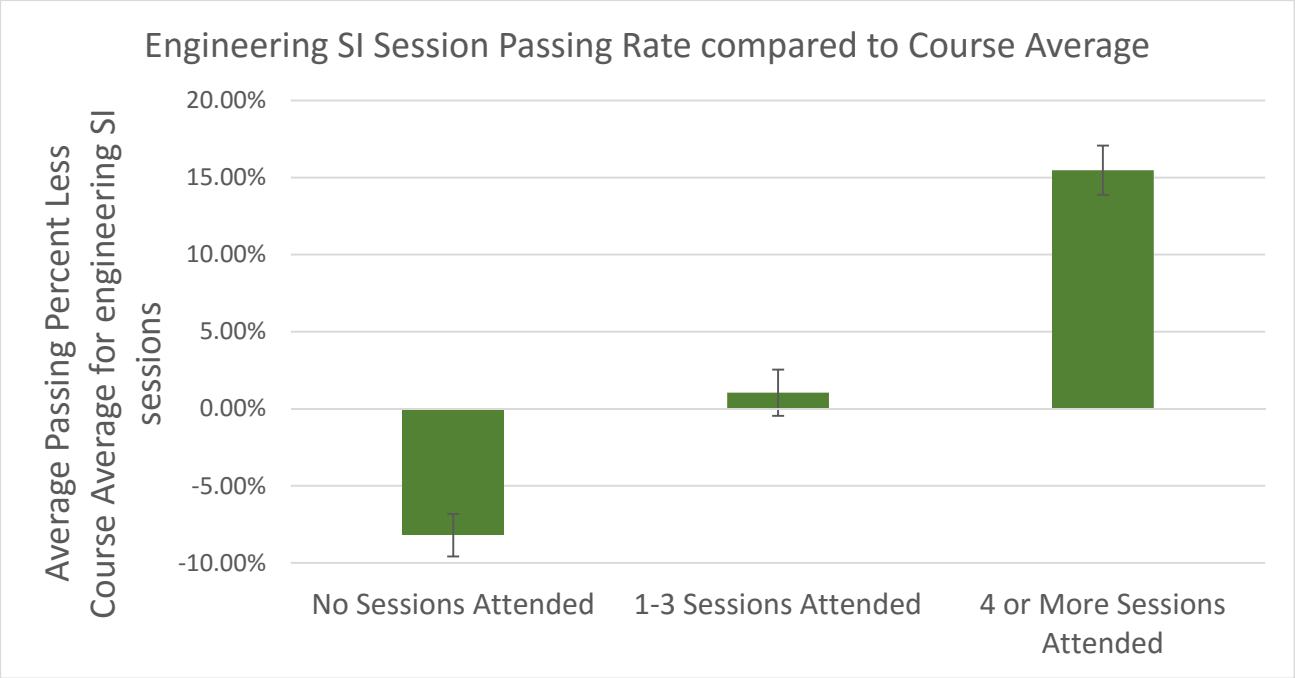

Figure 1: Passing rates compared to course averages for students who went to no sessions, few (1-3) sessions, or 4 or more sessions.

A normal session is one in which the SI is reviewing material in a similar time frame as the professor, covering problems that correlate to course work from that week. There are up to 20 normal sessions each semester, with an average of 14 for the courses analyzed in this study. An exam review session is a session that will generally happen within a few days prior to an exam. There are an equal amount of exams as there are exam review sessions, typically three, but in a few cases four. It is reasonable that exam review sessions would draw much larger crowds compared to normal sessions due to their student appeal. For example, in a statics course from the spring semester of 2015, average attendance in normal sessions was about eleven students where exam review sessions averaged seventy-four students in attendance. Upcoming quizzes and homework have a similar, but much smaller, impact on session attendance. During weekly meetings, SIs often comment on the differences between a normal session and an exam review session and difficulties the latter leads to. (For more information on the structure of this program at LSU's College of Engineering see the paper published in 2014 [(4)].)

Rationale for the study

SIs at LSU's College of Engineering were asked to write down their opinions on exam review sessions and how they compare to normal sessions. The responses had slight variations, but were generally consistent in their frustrated tone–exam review sessions are "giant masses of people expecting you to tell them what is on the test." There are "often two factions of students, those willing to work and learn and those who are just watching and not participating." "Students sometimes even get the impression that we know the problems [on the exam]." "It is often hard to do active learning [during an exam review] unless the [larger] room is designed for it..." During an exam review we usually "go over common questions/common pitfalls that we see a

lot, or questions I have seen several times on the exam and a reminder of the formulas and how to use them [and we] go over variables." "At the end of the day, it is similar to normal sessions just longer." This feedback led the authors to finally ask the question, are exam reviews less effective than normal sessions?

Similarly, when asked the difference between regular attendees and infrequent (few) attendees SIs claimed that "The people who come more often are more willing to answer questions and are often really comfortable." "Low attendees are usually the ones who just come to the exam review sessions." "Some people only come when they need help." "Regulars are usually more willing to come to office hours." "Sometimes the regulars struggle because they do not have a good foundation and good basics." "Regular attendees usually understand your [the SIs] thought process better."

The SI comments matched author's assumptions that SI exam reviews were more difficult to execute, and the group previously defined as low attendees were possibly synonymous with students who only attend exam review sessions. To verify this assumption, the need for further analysis was recognized.

Methods and results

The first step in analyzing this question was to separate session attendance between exam reviews and normal sessions. During the program's initial semesters, there was no way to differentiate between the two when compiling data. It was not until this difference between session types was observed that SIs were required to indicate the type of session on their attendance sign-in sheets. Even still, SIs sometimes forgot to mark if sessions were an exam review. This process was therefore tedious as it required session attendance data to be compared with old syllabi from previous semesters and ultimately led to some courses not being included in the final data set due to an inability to verify if a session was an exam review or not. Assumptions could have been made as attendance is very different, but the authors decided that this would be too assumptive and may cause data biases, answering instead the question of how larger attendance impacts success and not specifically how exam review sessions impact program success. Nevertheless, more than half of the early courses were able to be included in the data set, and SIs for all new courses are required to include exam reviews versus normal session indications during their data collection.

Once the data were compiled, it was decided that the previous three groupings would no longer be sufficient. If the maximum exam review sessions in a class was 4, the data would be separated awkwardly between 0, 1 to 3, and 4. Similarly a student who went to 3 out of 3 exam review sessions offered should not necessarily be categorized with one who went to 3 out of 4 exam review sessions offered. Instead, bins of percent attendance were created for both normal session attendance and exam review session attendance. For example, if a student went to 1 out of the 4 exam review sessions (25%), they would be placed in the bin of "1-34%." Alternatively, if data points were spread into equal percentages, groups may have a several hundred in one bin and less than ten students in another. The first bin was 0% attendance, and small intervals were created afterwards dependent on the count of data points (number of students) within them in an

attempt to achieve reasonably equal quantity intervals. This lead to cutoffs at 34%, 68% and 100% for exam reviews. Normal session attendance has a much larger decrease in attendance at higher percentages. This led to bin cutoffs at 0%, 12%, 24%, 36%, 60%, and 100% for regular sessions. Summary data for these bins, including number of students, are in Tables 1 and 2. Pass rates were calculated as the percentage of students who earned an A, B, or C in the course.

Exam Review Attendance Data					
% Attendance (Bin)	Count	Student Passing Rates	Average % attendance	Hours Spent in Sessions	Average Letter Grade (converted to a GPA scale)
0%	2240	55.1%	0.0%	0.0	1.67
0-33%	510	57.1%	32.1%	1.9	1.66
34-67%	591	67.3%	57.7%	3.5	2.06
68-100%	345	78.0%	95.0%	5.7	2.32

Table 1: Exam review attendance summary data.

Normal Session Attendance Data					
% Attendance (Bin)	Count	Student Passing Rate	Average % Attendance	Hours Spent in Sessions	Average Letter Grade (converted to a GPA scale)
0.00%	2531	57.6%	0.0%	0.0	1.74
0.1%-12%	377	57.6%	7.1%	1.5	1.75
12.1%-24%	305	61.3%	16.5%	3.5	1.81
24.1%-36%	180	63.3%	29.8%	6.3	1.97
36.1%-60%	187	69.5%	47.8%	10.1	2.07
60.1%-100%	103	81.6%	76.5%	16.1	2.43

Table 2: Normal session attendance summary data

When ABC passing rates were plotted against percentage of normal sessions attended and percentage of exam review sessions attended, normal session attendance had a slightly more positive impact on pass rate and GPA per percent of sessions attended (Figure 2). This difference was not statistically significant ($p>0.05$). However, it was discussed that this was not a valuable comparison as attending 33% of exam sessions would take a student about 2 hours of their time in a semester and 33% of regular sessions may be closer to 12 hours during the semester. Therefore, the plot was normalized by multiplying the percent bins by average total time (6 hours for exam reviews and 21 hours for regular sessions). For example, the average percentage of sessions attended in the range of 0.1%-10% of sessions was 7% of sessions. 7% of the average amount of time normal sessions were offered each semester is about 1.5 hours; this became the representative time for this bin. This process effectively normalizes all of the different courses with subtle differences between the numbers of sessions offered to be compared on equal basis. When passing rates were plotted against average time spent in each normal and exam review

sessions, the results differed greatly. The graph in Figure 3 shows that students who attended exam review sessions were significantly more likely to pass a course when time was factored into the analysis (p=0.0305).

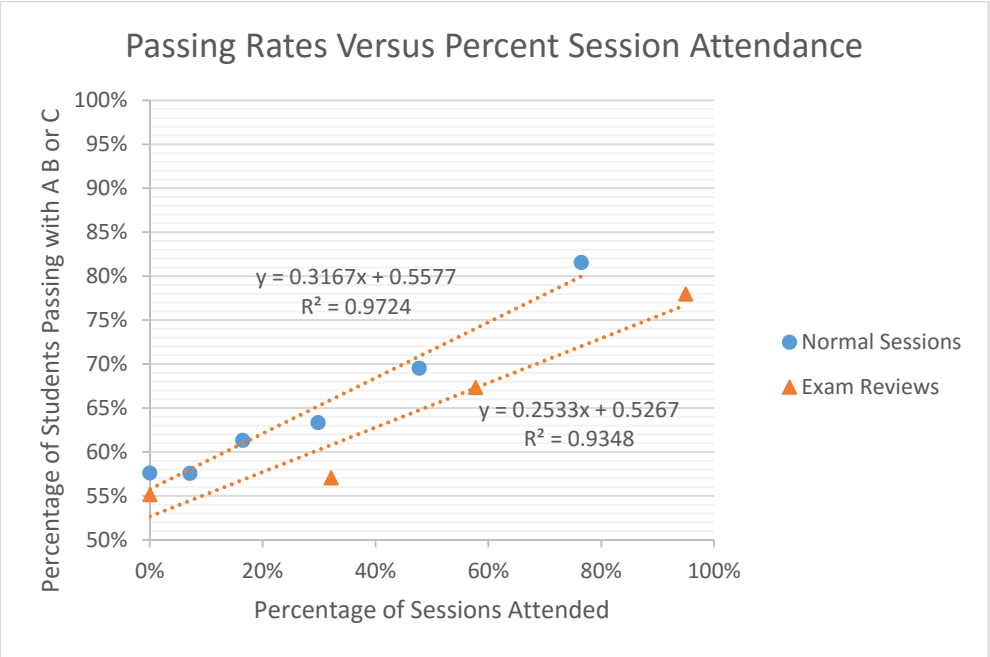

Figure 2: Percentage of students who received an A B or C in each bin of percentage session attendance for both normal and exam review sessions.

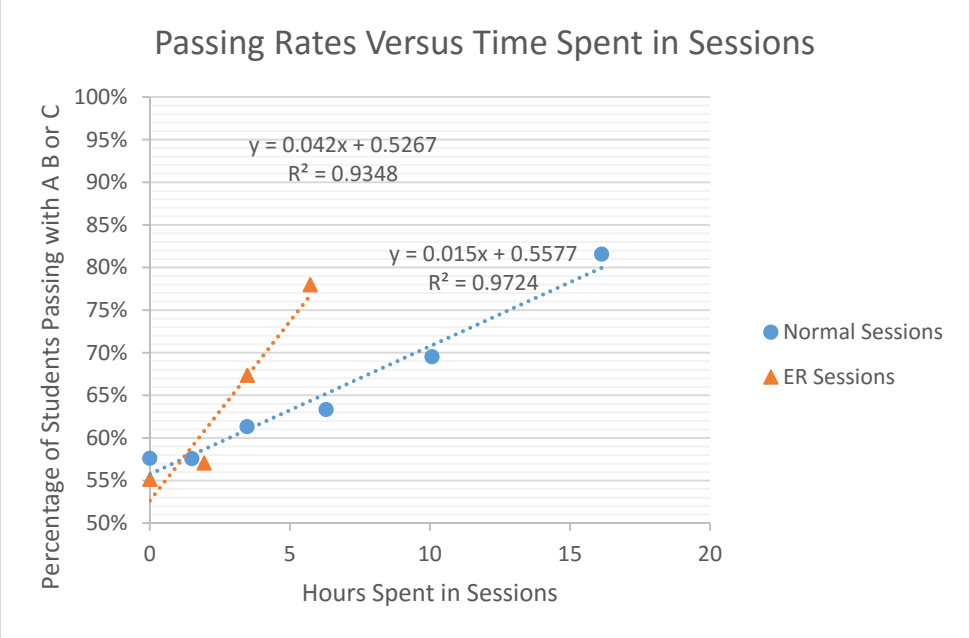

Figure 3: Percentage of students who received an A B or C in each bin of hours of session attendance for both normal and exam review sessions.

This finding was extremely surprising, as the authors expected that exam review attendance would not have as powerful of an impact on passing rates as normal sessions and that students who only attend exam review sessions would perform significantly worse than regular SI session attendees. If misinterpreted, however, these findings could also imply that students should only attend exam review sessions. Therefore a new question was asked: "Which students benefit more from exam review sessions, students who regularly attend SI sessions or students who only go to exam review sessions?"

The data were recompiled into nine different bins (Table 3). Once again, bin boundaries were set with best attempts to approach equal numbers of data points within each bin as reasonably as possible. As done in the author's previous publication, data were normalized to account for variation in course difficulty [(4)]. The normalization was accomplished by subtracting each course average passing rate from each student's passing rate within that course. For example, Student X went to 25% of the exam review sessions, attended 50% of the normal sessions, and passed the thermodynamics course in the Fall of 2014. That semester, the overall course passing rate was 29%. The student's representative value would then be calculated as 1.00 - 0.29 = 0.71. Had the student failed the class, their representative value would have been 0.00 – 0.29 = -0.29. This value is then averaged with all of the other students' values who were in the same attendance bin from all courses analyzed. In this case, the bin would include any student who met both the conditions of attending 1-33% of exam review sessions and 34% or more of the normal sessions. It was the opinion of the authors that this change would help remove the need to assume normality in attendance regardless of different course's passing rates. Without this change, courses with average passing rates of 80% would be averaged with courses with average passing rates of 20%. While randomness would imply that this would cancel out, it seemed reasonable that the harder the course, the more likely students are to attend SI sessions and therefore the normalization was deemed necessary.

	Summary Data for Normal session/Exam session combination groups							
		Normal Attendance			Counts of student in each bin			
		NS 0%	NS 1-33%	NS 34-100%		NS 0%	NS 1-33%	NS 34-100%
Exam Review Attendance	ER 0%	-6.41%	-4.50%	27.34%	ER 0%	1943	270	27
	ER 1-33%	-2.34%	-0.77%	12.60%	ER 1-33%	276	197	37
	ER 34-100%	6.39%	6.96%	17.02%	ER 34-100%	312	375	246

Table 3: Bins of student attendance to both exam review sessions and normal sessions compared to normal passing rates.

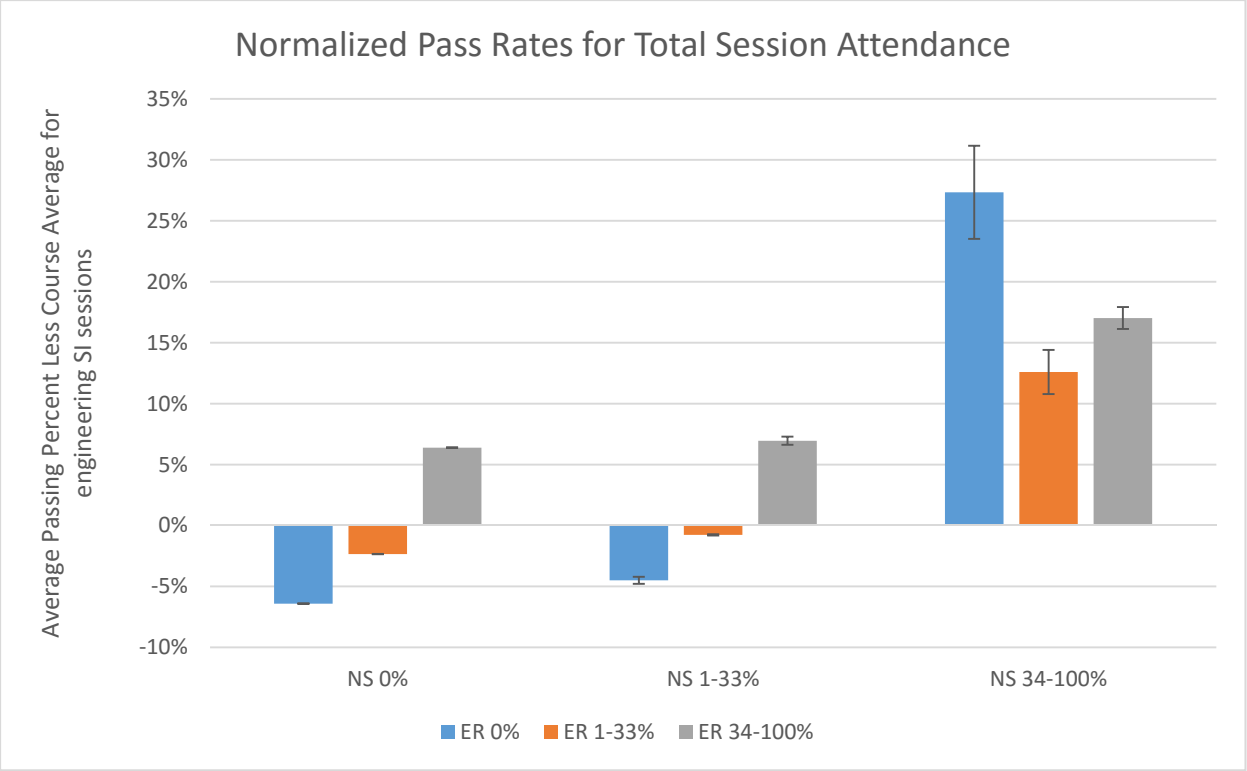

Figure 4: Student attendance to both normal sessions (NS) and exam reviews (ER) compared to their passing rates less course averages.

By organizing the data into 9 groups, it becomes evident that for students going to fewer normal sessions, exam review sessions are extremely valuable correlated to a greater than 10% increase in likelihood of passing the course with an A, B, or C. However, the largest difference from course average is the group of students who went to 34-100% of normal sessions, regardless of their attendance in exam reviews, thus indicating that regular attendance to SI sessions is benefitting students the most.

Conclusion and Discussion

Although our initial findings indicated that students who attended more normal sessions fared better than their peers, further analysis showed that exam review sessions are more strongly correlated with increases in passing rates when compared to the amount of time spent in SI sessions. However, when groups are separated based on percent normal attendance, the data suggest that this improvement is only evident for students who attend less than a third of normal sessions. Students who attend many normal sessions (34-100%) consistently pass at a higher rate than students who do not regardless of how many exam reviews they attend (Figure 4).

When these results were presented to the Supplemental Instructors, they were somewhat surprised that the exam reviews may be more valuable than normal sessions per time spent. Three reasons were postulated as possible explanations of this finding: students are often solely focused on the exam during this time period with minimal other distractions and relying on short

term memory; sessions may focus more on passing an exam compared to overall comprehension of the material (which is accomplished more appropriately in normal sessions); and professors sometimes work with SIs to cover specific material during the exam review session that is tailored towards what is on the exam. Once the final figure was discussed, the SIs agreed that it was more representative of the full story–students who rarely attend normal sessions benefit from exam review sessions, but students who are regulars get more benefit from normal sessions and get higher grades overall.

It is worth identifying that looking at the counts shown in Table 3, among the students in the high attendance of normal sessions bin (34%-100%), the numbers of students who attended 0% and 1-33% of exam review sessions were much smaller than all other groups (27 and 34, respectively). While this count was large enough to make statistical conclusions, the authors have postulated on why these bins of students are so small. Perhaps these regular attendees recognize the difficulties shared by the SIs themselves–that is harder to implement active learning in a larger group and, therefore, have decided that the exam reviews were not as helpful to them as the normal sessions. Future plans include asking students perceived values of normal compared to regular sessions during end of the semester SI evaluations.

It was originally assumed that the low attendance group in the author's previous research was likely synonymous with only going to exam reviews and that exam reviews are probably not significantly helpful. It appears that this is not the case but a question still remains, "why do some students only attend a few sessions?" As the previous assumption was incorrect, new methods are being worked on to answer this question. A prediction model is being established to try to discover if the students who attend few sessions are historically stronger students (based on overall GPA and prerequisite course grades) and do not need to attend as many sessions. Similarly, more evaluation methods are being tested utilizing online tools (Survey Monkey®) that can reach students who do not attend the final few sessions when evaluations are historically distributed. Finally, an outside evaluator will continue to meet with students in an attempt to identify additional reasons why students attend few or no sessions in hopes to encourage higher attendance in future semesters.

Contradictory to the authors and SIs original assumptions, there remains a good value for exam review sessions. This is particularly evident in students who cannot or do not attend SI sessions on a regular basis. However, incorporation of better active learnings strategies in large group settings and more training for SIs geared towards large group settings is likely necessary. This may include requesting rooms that can be tailored to breaking up large groups into smaller ones [9, 10, 11]. Similarly, further encouragement for students to attend regular sessions is vital for the program to have a larger impact.

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