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Student Perceptions and Performance with Online Instruction of Sustainability During COVID-19 Response

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Abstract

Higher education in an online learning environment has been shown to be effective and appreciated by students. However, it does have limitations and requires several weeks of preparation prior to the start of class. In the case of the COVID-19 pandemic, most institutions around the world were forced to move to an online learning environment within a week with many faculty and students having no experience with this environment. Further, while students may appreciate an online learning environment when they choose it, perceptions of learning can change drastically when forced to an online environment mid-semester. The purpose of this paper is to analyze student perceptions and performance in the online learning environment for an undergraduate engineering course in sustainability in the Spring of 2020, where the instructor had no prior experience nor training in teaching an online class. Student surveys were administered in the first week of the change from in-person to online instruction as well as in the last week of instruction. The surveys were analyzed to determine if students thought the online instruction would be as effective as the in-person instruction, and then if students thought the online instruction was as effective as the in-person instruction. Grades were also compared to determine if students performed as well during the online instruction compared to the in-person instruction. Results indicate that overall students in this class felt that learning outcomes were achieved to the same degree as with an in-person learning environment. Also, no significant difference was seen in grades between material taught in an in-person or an online learning environment for this class. The learnings from this study could help in understanding the impacts of the COVID-19 pandemic on higher education as well as gaining some insight on when in-person learning should be prioritized.

Introduction

Higher education in an online learning environment has been shown to be at least as effective as face-to-face and appreciated by students [1] - [8]. However it does have limitations [2], [9], [10], and requires several weeks of preparation prior to the start of class [6], [8]. In the case of the COVID-19 pandemic, most institutions around the world were forced to move to an online learning environment within a week [9] - [11]. Further, while students may appreciate an online learning environment when they choose it, perceptions of learning can change drastically when forced to an online environment mid-semester.

Benefits of online or blended classes include students being able to be constantly aware of their performance and able to identify areas that need more attention, instructors having a new level of control over a course, its grading and feedback, and preserving academic integrity [4]. Limitations include increased isolation and reduced student-teacher interaction [9], implementation of engineering lab activities, effective communication, and increased preparation time required for students and instructors [2]. Typically, students know upfront that they are signing up for an online class and may be predisposed to successful learning in this environment. However, in a situation such as the COVID-19 response when classes abruptly move online, successful implementation is more challenging. Typically for students to succeed in an online

learning environment they should be self-motivated and organized [2], [12], and have a good learning environment [10]. While the literature illustrating the success of online education is plentiful [1] - [8], initial research analyzing online education during the COVID-19 pandemic indicates that the majority of students preferred face-to-face learning and have negative perceptions toward online learning during the COVID-19 response [9]. Often this was not due to technical difficulties but from lack of self-discipline, suitable learning materials, or good learning environments [10].

Recommendations for successful online education include requiring synchronous online meetings [7], having weekly online discussion sessions that promote a sense of community [3], [6], [7], [10], dividing teaching content into smaller modules to help students focus [6], [10], having a back-up plan for unexpected issues, slowing down speech during lectures to allow students to capture key points, utilizing teaching assistants to share the extra requirements, using various methods to modify homework and reading to strengthen students' active learning outside of class, providing feedback to student assignments [10], making compelling lecture videos, establishing presence with a welcome message, frequent notices and feedback, and setting and reminding often of time management expectations [6]. Solutions to mitigate academic integrity issues include making sure questions are not identifiable in common web search engines, including special symbols in questions to make them untraceable by web search engines, and uploading questions as images so they cannot be readily copied and pasted [4]. These recommendations highlight that teaching in an on-line environment should be done in a different manner than teaching in-person. Therefore, instructor experience and training in on-line instruction could impact student learning and perception.

While it is difficult to directly measure teaching effectiveness and student learning, grades and student perceptions are common indicators of both. While controversial, studies have shown students to be reliable evaluators of teaching effectiveness [13], [14]. Student perceptions have been seen to correspond with student performance in many cases [15] - [17], though admittedly not in all [18]. As a minimum, student perception can provide a window into student engagement and often student perceptions differ greatly from teachers [16].

Toquero [19] recommends that the impacts of the COVID-19 pandemic on the educational system be documented, while Abdous and Yoshimura [1] recommended that future studies should work to better understand the effect of the "right fit" of a student's learning style and a specific delivery method. The purpose of this paper is to analyze student perceptions and performance in the online learning environment for an undergraduate engineering course in sustainability in the Spring of 2020, where the instructor had no prior experience nor training in teaching an online class. Student surveys were administered in the first week of the change from in-person to online instruction as well as in the last week of instruction. The surveys were analyzed to determine if students thought the online instruction would be as effective as the in-person instruction, and then if students thought the online instruction was as effective as the in-person instruction. Grades were also compared to determine if students performed as well during the online instruction compared to the in-person instruction. The learnings from this study could help in understanding the impacts of the COVID-19 pandemic on education as well as gaining insight into when in-person learning should be prioritized.

Methods

On March 11, 2020, faculty, staff and students were informed that Spring Break was extended by one week, and that classes would resume on March 23, 2020, in an online environment. The campus prides itself on its "hands-on" and personal approach to teaching, so an online learning environment was new to most instructors and students. The instructor for this class had no prior experience nor training in teaching on-line, though was comfortable with computer technology in general. A survey was administered using the Blackboard Learn Learning Management System within the first week of the switch to online instruction asking students' perceptions on if they will meet the course objectives, earn a better, worse, or the same grade, and if they feel students will adhere to academic integrity rules. A similar survey was administered to the same class in the last week of classes. Survey results were analyzed using a chi-squared test.

Grades were compared between the first half of the semester when instruction was face-to-face and the second half when instruction was online (same students, different material within the same class, same instructor), as well as between the online instruction and a previous semester when instruction was face-to-face (different students, same material, same instructor). Grades were analyzed using a t-test.

The course was previously taught in-person with traditional lecture, homework, exams, quizzes, team projects, and active learning exercises. The class previously had closed-book, closed-notes quizzes, and closed-book, closed-notes exams. In the online environment, the class used a blend of synchronous and asynchronous lectures, videos, and office hours using Zoom. Team presentations were canceled after the switch to online learning, but team project reports remained.

Students were asked 16 questions through an online survey through the Blackboard Learn Learning Management System (see Appendix for surveys). Students were first asked to create a nickname that they would use in the pre- and post-survey. They were also asked to identify their major, class (freshman, sophomore, junior, or senior) and the gender to which they identify. They were then posed a series of questions asking if they feel that they would do better, same, worse, or are undecided with regards to grade (Q5) and the following individual ABET outcomes due to the current emergency online environment compared to a traditional in-person class:

1. (Q6) Gain an ability to identify, formulate, and solve complex engineering problems;
2. (Q7) Gain an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors;
3. (Q8) Gain an ability to communicate effectively with a range of audiences;
4. (Q9) Gain an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts;
5. (Q10) Gain an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives;

6. (Q11) Gain an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions; and
7. (Q12) Gain an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

The survey also included questions asking if the student anticipates adhering to academic integrity rules, and if they feel that others may not adhere to academic integrity rules, as well as if the student feels that they are skilled enough in computer literacy to succeed in an online environment or if there will be technical problems due to the online environment.

Results

As Table 1 summarizes, the class had a total of 41 students, of which 90% were male and 95% were civil engineering majors. The majority of the class were seniors (71%), with 27% juniors and 2% sophomores. Nineteen pre-survey responses were received, and 23 post-survey responses were received. Figure 1 illustrates that survey responses followed a similar demographic as the total class, with the large majority being male civil engineering students. However, most survey respondents were juniors for both the pre-survey (63%) and post-survey (83%). It is unknown why while most of the class were seniors (71%), few chose to complete the survey (32% of the pre-survey responses and 13% of the post-survey responses). It may be that they were busy with senior design project and/or finding jobs and found this survey to be a distraction.

Table 1: Course Demographics.

	Class Total	Pre-Survey Responses	Post-Survey Responses
Class Size	41	19 (46%)	23 (56%)
Freshmen	0 (0%)	0 (0%)	0 (0%)
Sophomores	1 (2%)	1 (5%)	1 (4%)
Juniors	11 (27%)	12 (63%)	19 (83%)
Seniors	29 (71%)	6 (32%)	3 (13%)
Male	37 (90%)	17 (89%)	22 (96%)
Female	4 (10%)	2 (11%)	1 (4%)
Mechanical Eng.	2 (5%)	1 (5%)	1 (4%)
Civil Eng.	39 (95%)	18 (95%)	22 (96%)

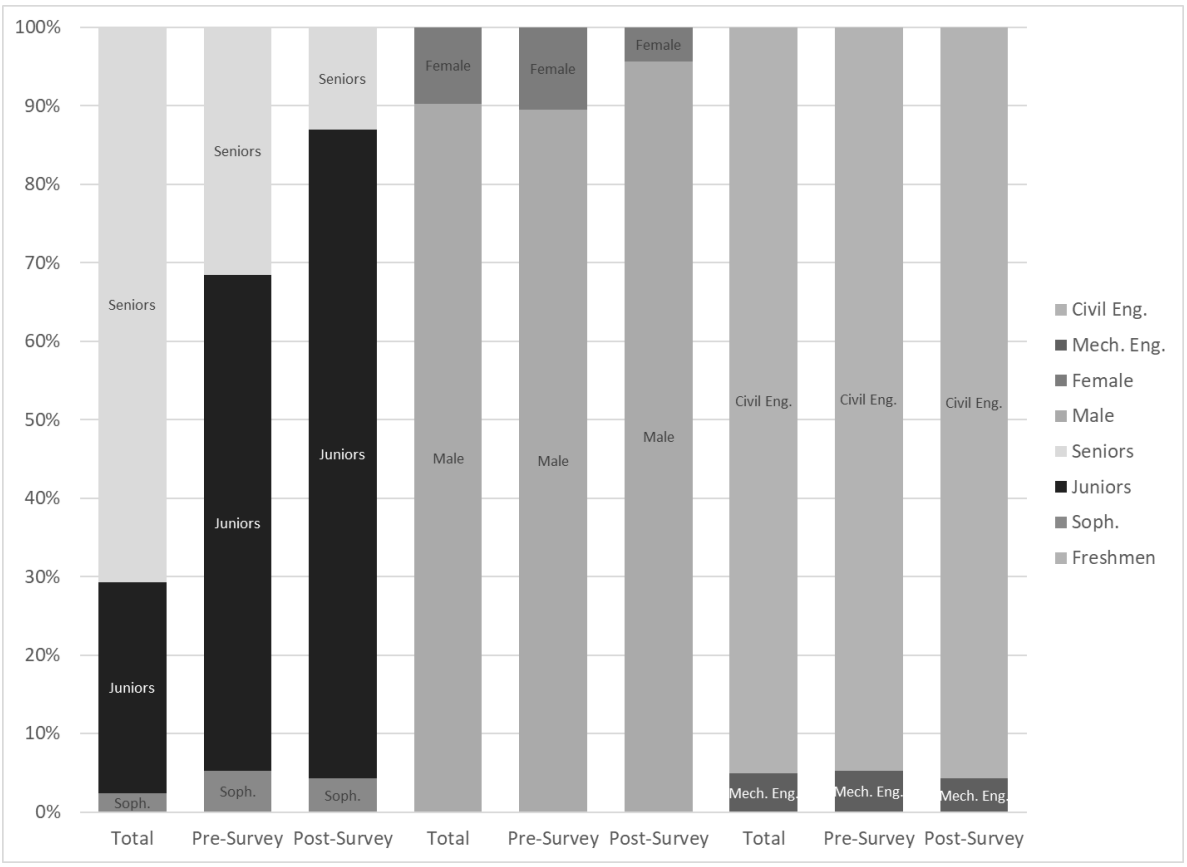

Figure 1: Class and Survey Demographics.

Chi-squared test for independence results indicate that there is a significant difference between the pre- and post-survey results (Chi-Square Statistic 1.14 > Critical Chi-Square Statistic 0.997) with a P-value of 0.000046. Responses indicating that students felt that they would meet the learning objectives in the online environment to the same degree as in the in-person learning environment increased from 43% in the pre-survey to 53% in the post-survey, as shown in Table 2. Similarly, responses indicating that students felt that they would do worse in meeting the learning objectives in the online environment compared to the in-person environment decreased from 38% in the pre-survey to 25% in the post-survey.

Table 2: Chi-Squared Test Results

	PRE	POST	(O-E)^2/E
BETTER	20 (13%)	25 (14%)	0.250000
SAME	65 (43%)	97 (53%)	0.492308
WORSE	57 (38%)	46 (25%)	-0.192980
UNDECIDED	10 (7%)	16 (9%)	0.600000
X^2			1.149325
CRIT X^2			0.997071
P-VALUE			4.6E-05

Figure 2 illustrates that question 10 (Gain an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish

goals, plan tasks, and meet objectives) received the most "worse" responses in the pre-survey, followed by question 6 (Gain an ability to identify, formulate, and solve complex engineering problems;). More students also felt that they would do "worse" in meeting the objective identified in question 8 (Gain an ability to communicate effectively with a range of audiences). The responses to the remaining questions (5, 7, 9, 11, 12) indicate students felt that they would meet the learning objectives in about the same manner with the online learning environment compared to in-person in the pre-survey.

Figure 3 illustrates that for all questions, most students felt that they did meet the learning objectives to about the same degree in the online environment compared to the in-person environment in the post-survey. Question 9 (Gain an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts) received the most responses of "same" in the post-survey and is one of the lowest counts of "worse". Questions 6, 7 (Gain an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors), and 10 received the highest counts of "worse" in the post-survey.

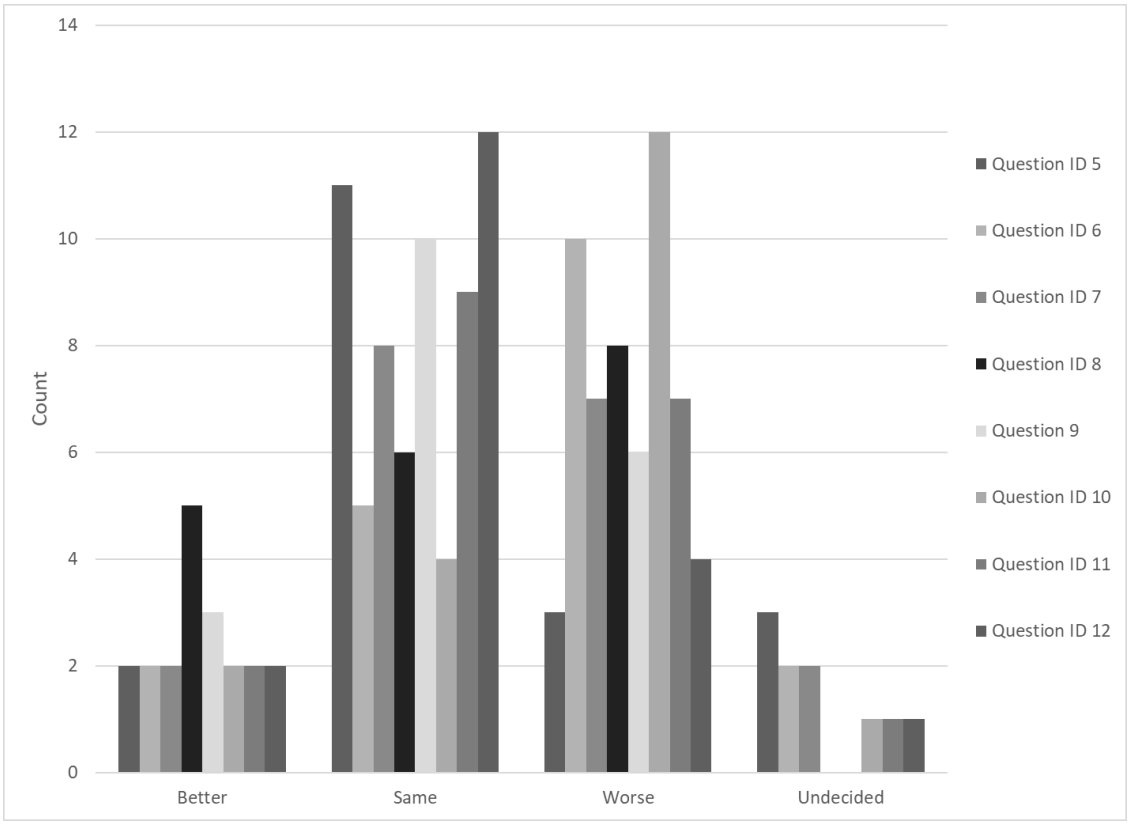

Figure 2: Pre-Scenario Survey Results Summary

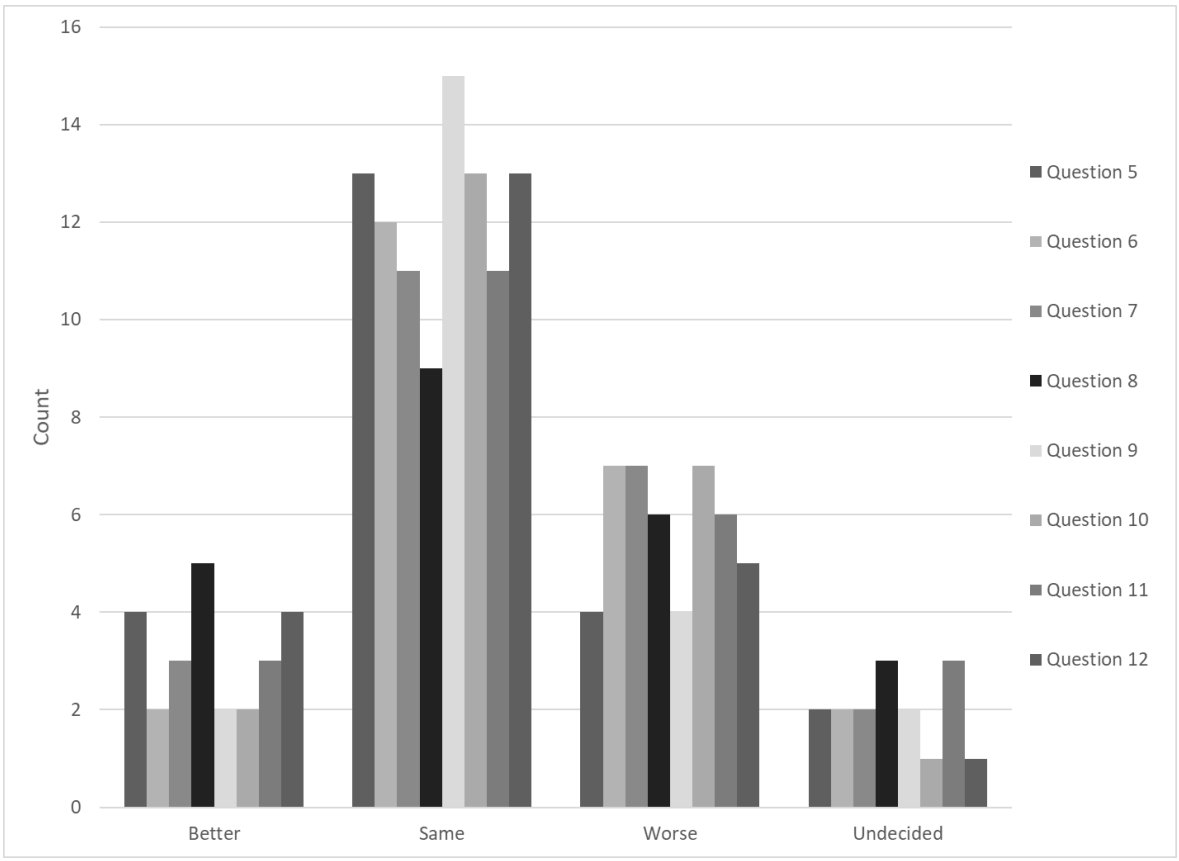

Figure 3: Post-Scenario Survey Results.

F-tests and t-tests were performed comparing exam grades between the two exams given in the class when the class was taught in 2019 vs 2020. The f-test indicated that the variances between the 2019 and 2020 in-person Exam 1 grades (0.028 vs 0.030) do not differ significantly (P-value = 0.42) and so a two-sample t-test assuming equal variances was performed on those samples. The f-test between the 2019 in-person and 2020 online Exam 2 grades indicated that the variances (0.017 vs 0.0079) do differ significantly (P-value = 0.041) and so a two-sample t-test assuming unequal variances was performed on those data. Finally, the f-test between the 2020 in-person Exam 1 and 2020 online Exam 2 indicated that the variances (0.030 vs 0.0079) do differ significantly (P-value = 0.0012) and so a two-sample t-test assuming unequal variances was performed.

Table 3 summarizes the results of the t-test when comparing the grades from Exam 1 in 2019 and in 2020. The content for this exam was the same; the teaching format was the same and was in-person, and the format of the exam was the same and was closed-book and closed-notes. The t-test results indicate that the means do not differ significantly, with a P-value = 0.79, and a t Stat of -0.26 which is greater than the negative of the t-critical two-tailed value of 1.99. The means were approximately 91% in 2019 and 90% in 2020. These results indicate that a fair comparison can be made between the two semesters despite having a different sampling of students.

Table 3: T-test (Two-Sample Assuming Equal Variances) results comparing 2019 and 2020 in-person Exam 1.

	2020 Exam 1	*2019 Exam 1*
Mean	0.903853659	0.91375
Variance	0.029690348	0.027911218
Observations	41	40
Pooled Variance	0.028812043	
Hypothesized Mean Difference	0	
df	79	
t Stat	-0.262341536	
P(T<=t) one-tail	0.396870513	
t Critical one-tail	1.664371409	
P(T<=t) two-tail	0.793741026	
t Critical two-tail	1.99045021	

Table 4 summarizes the t-test results comparing Exam 2 grades between the 2019 and 2020 Spring semesters. The mean grade was 84% in 2019 and 91% in 2020, but the analysis indicates that these means do not differ significantly with a P-value of 0.06. Again, the t Stat value (-1.94) was greater than the negative of the t-critical two-tailed value (2.03). The content for the exams was the same but the teaching format was entirely in-person in 2019 and entirely online in 2020. Also, in 2020 Exam 2 was open-book and open-notes, which most likely is the reason for the increase in the mean grade value.

To further examine the trend that the online format did not significantly affect grades, Exam 1 and Exam 2 from 2020 were compared. The content for Exam 1 was entirely in-person and the exam was closed-book, closed-notes. The content for Exam 2 in 2020 was entirely online and the exam was open-book, open-notes. Table 5 summarized the results of this analysis which again indicates that there was no significant difference in the mean grade. The mean was 90% for the 2020 Exam 1 and 91% for the 2020 Exam 2. The P-value was 0.84 and again the t Stat value (-0.20) was greater than the negative of the t-critical two-tailed value (2.00).

Table 4: T-test (Two-Sample Assuming Unequal Variances) results comparing 2019 in-person and 2020 online Exam 2.

	2019 Exam 2	*2020 Exam 2*
Mean	0.844363636	0.910476
Variance	0.017348433	0.007865
Observations	22	21
Hypothesized Mean Difference	0	
df	37	
t Stat	-1.938561525	
P(T<=t) one-tail	0.030105942	
t Critical one-tail	1.68709362	
P(T<=t) two-tail	0.060211885	
t Critical two-tail	2.026192463	

Table 5: T-Test (two-sample assuming unequal variances) comparing 2020 in-person Exam 1 and 2020 online Exam 2.

	2020 Exam 1	*2020 Exam 2*
Mean	0.903854	0.910476
Variance	0.02969	0.007865
Observations	41	21
Hypothesized Mean Difference	0	
df	60	
t Stat	-0.1998	
P(T<=t) one-tail	0.421157	
t Critical one-tail	1.670649	
P(T<=t) two-tail	0.842314	
t Critical two-tail	2.000298	

Discussion

More students felt that they would meet the learning objectives to the same degree in the online environment compared to the in-person environment after they experienced the on-line environment. This is evident from the increase in "same" (53%) and "better" (14%) post-survey responses from the "same" (43%) and "better" (13%) pre-survey responses, as well as the decrease in "worse" (25%) post-survey responses from the "worse" (38%) pre-survey responses. Most, if not all, students had no experience with an online learning environment. These results indicate that the experience was better than they initially expected.

Gaining teamwork skills appears to be the learning objective that most students felt would suffer in the online environment in the pre-survey (count of 12). Results improved in the post-survey, but this learning objective was still one of the top concerns in the post-survey (count of 7). The

course did include a semester-long team project that continued during the online learning environment. Team presentations were canceled but the final report was still required. As students were scatter geographically and still getting used to meeting virtually, working as a team remotely was a struggle for them. This continued to be evident in the fall semester.

Identifying, formulating, and solving complex engineering problems and gaining communication skills were also learning objectives where more students initially felt they would do worse in an online environment compared to an in-person learning environment. Perhaps initially students could not imagine how complex engineering problems would be solved in an online environment, without the personal, face-to-face contact with their peers and the instructor. Also, while students had the same writing assignments in the online environment, presentations were canceled. This could be a reason that students felt this learning outcome might suffer. As faculty became more accustomed to the online learning environment and available tools, presentations were required in subsequent semesters.

After students experienced the online learning environment, more students felt they would at least do the same in meeting all the objectives than worse. However, teamwork skills and solving complex engineering problems remain top concerns for this course. These results are particular to this class in sustainability that is admittedly not as quantitative or intense as many engineering courses. Instructor experience and comfort with technology is sure to play a large role as well. In this class, the instructor had no experience nor training in teaching in an online format but was fairly tech-savvy and interested in learning the required technology.

More students felt that their grade would be the same in the online environment compared to an in-person learning environment (Q5), with a count of 11 in the pre-survey and a count of 13 in the post-survey. These perceptions support grade results. Grades did not differ significantly between the in-person and online learning environments, whether comparing between semesters with the same material but different students, or between exams with different material but the same students. Grades increased in the online environment, though not significantly. The online exam was open-book and open-notes which will also influence grades and could confound these results. A comparison of grades to an on-line learning environment but with a closed-book, closed-notes exam is planned.

Conclusions

Student perceptions and grades were used to gain insight into the effectiveness of teaching environment in this study. Because the sudden switch to an on-line learning environment during the COVID-19 quarantine in the Spring of 2020 was such a unique, shared experience around the world, it deserves some study and understanding of its effects on education. The results of this study can help in this understanding for an undergraduate engineering class in sustainability, where the instructor and most if not all the students had no previous experience with the on-line learning environment. This insight could assist in prioritizing in-person classes in the future.

Student perceptions and grades were analyzed before and after the initial COVID-19 response of an online learning environment for an undergraduate engineering class in sustainability in the Spring 2020 semester. Despite the challenges of a short preparation timeframe, external

stressors, no previous experience in on-line education by the instructor, and the abrupt change in learning environment, results indicate that students overall felt that learning outcomes were achieved to the same degree as with an in-person environment and grades were not affected significantly.

Learning outcomes that appear to be more difficult to meet in an online learning environment include gaining teamwork and communication skills. These can be challenging to properly teach, integrate, and assess in any learning environment. Further study of how best to teach and integrate these skills is warranted.

Limitations of the study include that it is focused on a single class, with no lab component, and is not heavily quantitative. Also, in the comparison of grades, exam format was changed from closed-book, closed-notes with the in-person learning environment to open-book, open-notes with the online learning environment. Grades were selected as a way to measure learning but it is accepted that they are not the only nor perhaps the best method. However, the combination of grades and student perceptions strengthens the argument that in this class, learning effectiveness was not significantly different between the online and in-person format of the class. Also, the class is not very diverse with the large majority being white-male, civil-engineering upper classmen.

Future work includes comparison to future offerings of the sustainability class and other classes to analyze how student perceptions change as the online and hybrid learning environments continues. Further comparison of grades in an online environment but with closed-book, closed-notes exams is planned.

Overall, it is reassuring that student perceptions of this class were positive despite the abrupt change to an online learning environment during the initial COVID-19 response. However, the situation was still a strain on most faculty and students. Students without a strong sense of self-discipline, without an appropriate learning environment, or who struggle in an in-person learning environment are at particular risk in an online learning environment. This is particularly concerning when students do not have a choice of their learning environment.

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Appendix

Consent/Waiver

You are being invited to participate in a research study titled "Emergency On-Line Instruction" This study is a collaboration between Shannon Parks, Laura Wieserman, Amy Miller, Andrew Rose, Kurt Klavuhn, and Serdar Tumkor from The University of Pittsburgh at Johnstown.

The purpose of this study is to obtain information about your background and perceptions of learning in this emergency on-line instruction environment. We hope to use this information to improve our curriculum and response in emergency situations. In addition, we will share the aggregate results in presentations and/or publications. This questionnaire will ask about *your perception of learning in THIS class*. You may be asked to submit this survey in more than one class. You may have different answers for different classes. The survey will take you approximately *five* minutes to complete.

We believe there are no known risks associated with this research study; however, as with any research activity the risk of a breach of confidentiality is always possible. To the best of our ability your answers in this study will remain confidential. We will minimize any risks by only asking you to provide a **nickname**. This way, your responses will not be matched with your identity. Also, **your professor will not know whose answers connect to which survey or who completed the survey**. Finally, the data will be disposed of after five years per American Psychological Association regulations.

Your participation in this study is completely voluntary and you can withdraw at any time. You are free to skip any question that you choose. If you choose not to participate it does not affect your relationship with your professor or result in any other penalty or loss of benefits to which you are otherwise entitled. We greatly appreciate your assistance with this important study. Thank you!

If you have questions about this project or if you have a research-related problem, you may contact your professor for this class. By submitting this survey, I affirm that I am 18 years old or older, and I agree that the information may be used in the research project described above.

PRE-SURVEY:

Nickname: _____ (Please choose something that you can remember at the end of the semester)

Please select one to indicate your major:
□ Civil Engineering, □ Mechanical Engineering, □ Chemical Engineering
□ Computer Engineering, □ Electrical Engineering, □ Computer Science
□ Undecided/Other

Please select one to indicate your class:
□ Freshman, □ Sophomore, □ Junior, □ Senior

Gender identity (select all that apply):
__ agender
__ genderqueer/gender fluid/non-binary
__ man
__ questioning or unsure
__ trans man
__ trans woman
__ woman
__ prefer not to disclose
__ additional gender category/identity not listed

For each question, indicate with an 'X' if you feel that you will do better, same, worse or are undecided about the identified skill or measure.

	Better	Same	Worse	Undecided
1. Grade				
2. Ability to identify, formulate, and solve complex engineering problems				
3. Ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors				
4. Ability to communicate effectively with a range of audiences				
5. Ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts				
6. Ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives				

7. Ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions				
8. Ability to acquire and apply new knowledge as needed, using appropriate learning strategies				

For each question, indicate your response with an 'X'.

	Yes	No	Maybe
9. Do you anticipate adhering to academic integrity rules (e.g., not accessing Chegg, other people, or other resources) during ordinarily proctored closed-book, closed notes quizzes and exams with the emergency on-line course structure?			
10. Do you feel that others may not adhere to academic integrity rules putting you at a disadvantage with the emergency on-line course structure?			
11. Do you consider yourself skilled enough in computer literacy to succeed in an on-line environment?			
12. Do you anticipate that there will be technical problems due to the on-line environment?			

POST-SURVEY:

Nickname: _____ (Please choose the same name you used in the PRE_SURVEY)

Please select one to indicate your major:
□ Civil Engineering, □ Mechanical Engineering, □ Chemical Engineering
□ Computer Engineering, □ Electrical Engineering, □ Computer Science
□ Undecided/Other

Please select one to indicate your class:
□ Freshman, □ Sophomore, □ Junior, □ Senior

Gender identity (select all that apply):
__ agender
__ genderqueer/gender fluid/non-binary
__ man
__ questioning or unsure
__ trans man
__ trans woman
__ woman
__ prefer not to disclose
__ additional gender category/identity not listed

For each question, indicate with an 'X' if you feel that you <u>did</u> better, same, worse or are undecided about the identified skill or measure.

	Better	Same	Worse	Undecided
1. Grade				
2. Ability to identify, formulate, and solve complex engineering problems				
3. Ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors				
4. Ability to communicate effectively with a range of audiences				
5. Ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts				
6. Ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives				

7. Ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions				
8. Ability to acquire and apply new knowledge as needed, using appropriate learning strategies				

For each question, indicate your response with an 'X' .

	Yes	No	Maybe
9. Did you adhere to academic integrity rules (e.g., not accessing Chegg, other people, or other resources) during ordinarily proctored closed-book, closed notes quizzes and exams with the emergency on-line course structure?			
10. Do you feel that others did not adhere to academic integrity rules putting you at a disadvantage with the emergency on-line course structure?			
11. Do you consider yourself skilled enough in computer literacy to succeed in an on-line environment?			
12. Did you encounter technical problems due to the on-line environment?			