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Engaging Students in Synchronous, Remote, or Hybrid First-Year Engineering Courses

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Engaging students in synchronous remote or hybrid first-year engineering courses

Abstract

The emergence and rapid spread of COVID-19 changed the face of education. At Michigan Technological University (Michigan Tech) , planning for the Fall 2020 semester started well before the end of the 2019-20 academic year. For the Fall 2020 semester, faculty at our university had the option to teach in various modalities according to what fit their personal and course needs. The options included online (asynchronous materials completed with time and place flexibility), remote (synchronous, scheduled meetings that students can attend virtually), or hybrid (classes that have face-to-face meeting times, but offer students opportunities to complete most activities virtually and/or remotely). Restrictions placed on class size with physical distancing measures limited the number of students who could attend a given class session face-to-face. In the first-year program at Michigan Tech, we value an active, collaborative learning environment; an environment that would be difficult to implement asynchronously. Despite the shift to a remote or hybrid modality, we wanted our first-year students to still experience an active, collaborative learning environment. In this paper, we focus on discussing the steps we took to maintain and/or improve the connection between students and the engagement with the course materials. A comparison of responses from surveys administered in the first-semester engineering course at Michigan Technological University indicates that students were at least as satisfied or more satisfied with the remote and hybrid versions in Fall 2020 than the traditional face-to-face version in Fall 2019. Specifically, a greater percentage of students enjoyed the course, felt engaged and valued, were more prepared for lessons and saw value in the course and the skills they learned in the course.

Introduction

During their first year of study, students enrolled in engineering at Michigan Technological University (Michigan Tech) complete a common set of core classes including calculus, chemistry, physics, composition, global issues, and engineering. A student's pathway through these first-year courses, specifically the First-Year Engineering (FYE) courses (shown in Figure 1), is determined by their score on a math placement assessment. Students who place into Calculus 1 or higher are enrolled in an engineering course sequence with two classes: ENG1101: Engineering Problem Solving and Analysis and ENG1102: Engineering Modelling and Design. Students who place into pre-calculus are enrolled in a three course sequence: ENG1001: Engineering Problem Solving, ENG1100: Engineering Analysis, and ENG1102: Engineering Modelling and Design. The courses within each of these FYE pathways are designed to be discovery-based, placing emphasis on active learning and peer collaboration. For this paper, we will focus on the ENG1101/1102 pathway.

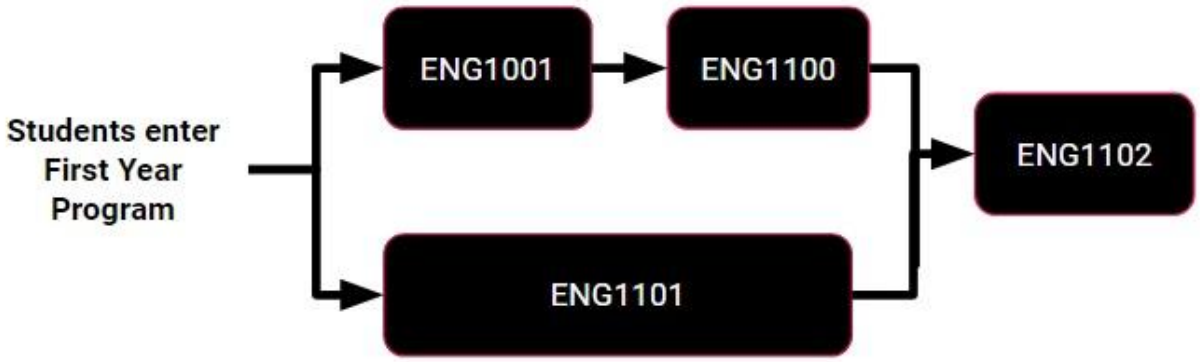

Figure 1. First Year Engineering Program

The FYE courses are structured into two main components: studio sessions and LEAP sessions. Each week, students attend two 110-minute studio sessions led by a faculty member with support from five LEarning with Academic Partners (LEAP) Leaders. The LEAP Leaders are near-peer mentors, typically undergraduates, that are assigned to individual groups of up to 24 students or 6 teams of students. During studio sessions, the LEAP Leaders monitor and guide their students through the in-class activities. The studio sessions follow a fully flipped classroom format, requiring students to complete Essential Preparation (ESP) assignments (watching videos, completing course readings, and/or submitting short assignments) before coming to class. During studio sessions, students are tasked with applying what they have learned in the ESP activities through check for understanding quizzes and in-class assignments. During this work time, students work through the activities within their semester project teams and may seek support from their peers, LEAP Leader, and instructor. In addition to the Studio Sessions, students are required to attend one 50-minute LEAP session facilitated by their LEAP leader. The LEAP sessions are active collaborative sessions designed and facilitated by their LEAP Leader. The goal of these sessions is for students to review the most difficult content covered in class that week through peer-to-peer engagement and instruction.

During spring semester 2020, the students were notified midway through their spring break that course instruction was being moved from in-person to virtual. For the FYE program, this presented some unique instructional challenges. First, we wanted to maintain an active, collaborative environment, which led us to choose a synchronous delivery model via Zoom for the Studio Sessions. Additionally, several faculty members experimented with a secondary platform such as Discord to allow students to have a method for communicating with each other both during and outside of the synchronous class time. The LEAP Sessions also moved to a synchronous delivery model via Zoom and training was quickly developed so that all 49 LEAP Leaders in the FYE program were trained in this new model by the end of spring break.

To support the faculty and students, the university held a series of Online Education Sessions to help deliver timely information to faculty as they rapidly transitioned to remote instruction. Topics included: Zoom breakout rooms and student engagement, giving remote exams, wellness, online laboratories and fieldwork, hands-on project-based learning, and feedback from students on their transition to remote learning (https://www.mtu.edu/ideahub/). Additionally, several University policies were modified in response to challenges faced by students during Spring 2020. Options were provided to extend the time for students to withdraw from classes, provided

the option to retake courses in Spring 2020 regardless of the grade they received, and included a pass/low-pass/fail grading scale option.

Planning for Fall 2020

Planning for the first-year engineering courses for Fall 2020 semester started well before the end of the 2019-20 academic year. Early in the summer, four options were presented to faculty at Michigan Tech as possible options for course delivery in Fall 2020: online, remote, hybrid, or face-to-face. These options are defined as follows:

- Online: courses designed for online asynchronous delivery.
- Remote: courses containing some synchronous component, initially designed for face-to-face instruction but moved online due to temporary external factors.
- Hybrid: classes that have face-to-face meeting times, but offer students opportunities to complete most activities virtually and/or remotely.
- Face-to-Face: courses conducted entirely in person with all students able to attend each class period.

In general, with limited classroom space available with physical distancing protocols in place, these options rapidly increased the amount of instructors teaching fully or partially online in the Fall 2020 semester. In order to ensure the quality of its online courses, our university requires any instructor or facilitator of an online course to complete training in the development, delivery, and assessment of online courses, and demonstrate proficiency in using the learning management system. Additionally, online courses are required to complete a peer review process to ensure that standards are met for online courses. Michigan Tech provided additional online training and remote specific training opportunities and all faculty were expected to complete the training for online instruction or remote instruction before Fall 2020 if they were unable to teach face-to-face. By the end of Fall 2020, 84% of our faculty instructors have been certified to teach online. The peer review process for online courses has not been required for courses which are being taught online temporarily due to external factors (COVID).

In the first-year program at Michigan Tech, we value an active, collaborative learning environment; an environment difficult to implement asynchronously. Despite the shift to a remote or hybrid modality, we wanted our first-year students to experience an active, collaborative learning environment. The rapid switch in Spring 2020 to remote learning allowed us to test several remote learning strategies and determine what aspects of the course were essential for students to not only learn the material, but feel connected to the faculty and students in the class as well as the campus community. Work continued throughout the summer months to adapt our first-year curriculum to fit the needs of our students.

To begin, the faculty in our department expanded our knowledge of online learning and teaching in this modality. All Engineering Fundamentals faculty completed the university-required classes in online teaching over the summer. Additionally, some faculty completed courses on creating accessible course content, and participated in learning opportunities through the Learning Assistant Alliance including a series of workshops to develop an online/remote pedagogy course for Learning Assistants. In addition, training materials for LEAP Leaders were updated and

enhanced to utilize hands-on active training with Zoom so that all LEAP Sessions could be run remotely.

Much of the course content and materials were unchanged from Fall 2019 to Fall 2020. However, a larger physical build and test project assigned in Fall 2019 was replaced in Fall 2020 with several smaller simulation projects that emphasized the skills learned in each unit of the course. Student success and wellness materials and activities were added to pre-lesson ESP activities. This included information note taking, creating a learning space, time management, test taking strategies, and personal organization. Additionally, these pre-lesson ESP instructional videos were captioned for accessibility and some instructors added personal videos to the preparation materials for each class.

Fall 2020 Implementation: Synchronous Studio Sessions

For Fall 2020, two of the six faculty teaching ENG1101 chose to teach their studio sessions remotely (n=165) and the other four chose to use a hybrid approach (n=513). Restrictions placed on class size with physical distancing measures limited the number of students who could attend a given class session face-to-face. For example, in our 120 seat active learning classroom, we could have a maximum of 30 students. Based on our experience in the spring with remote learning, we reduced the maximum number of students assigned to each LEAP leader from 24 to 20, which limited the number of students in the studio sessions to 100.

All sections used Zoom for their studio sessions, so students would join the Zoom meeting to attend class. Approximately one-quarter of the students in the hybrid sections were able to attend class in-person, however, all students were required to join the Zoom session so that they could communicate with their teammates. Students were not required to attend class in-person, initially the faculty teaching the hybrid sections identified which students could attend class. Once students were placed into their semester-long teams, some faculty allowed the teams to determine which of them would attend in-person, if any at all. As in-person attendance dwindled, some faculty allowed students to sign-up to attend class in-person, which allowed entire teams to attend together. Other faculty continued to assign which students could attend in-person throughout the semester, rotating through each member of the team, so that one person per team could attend.

All students were expected to complete the assigned ESP pre-lesson materials before each studio session. The ESP materials were posted in the course Learning Management System (LMS), Canvas. A typical studio session consists of an opening, collaborative work time, and a closing. The opening activities of each studio session usually included announcements, an overview of the activities for the session, and an ESP check to ensure students completed the ESP materials. The ESP checks consisted of a short quiz administered through the LMS or a collaborative activity such as a note review. Students were encouraged to take notes on the ESP materials and were allowed to use these notes on ESP checks. During the main collaborative work time, students worked with their team to complete the session activities using Zoom breakout rooms or their team Discord channel. Closing activities normally included a review of the collaborative work time activities, a discussion of ESP activities to be completed before the next session, and a review of upcoming due dates.

There were some variations in the implementation of the hybrid and remote sections, with the goal of finding an effective communication model for students to work with each other and get help from their faculty member or LEAP Leader. Table 1 summarizes the communication models for both the hybrid and remote models. For each communication pair (e.g., faculty to student) we've identified a primary communication method (e.g., what is used during the synchronous session) and a secondary communication method, which could be used within or outside the synchronous session.

Table 1. Communication Models used in the First-Year Engineering Classes (Fall 2020)

Interaction Groups	Hybrid Synchronous	Remote Synchronous
Faculty to Student	Primary ● Zoom main session ● Zoom broadcast and visits to breakout rooms ● Zoom chat Secondary ● Zoom broadcast and visits to breakout rooms ● Discord chat ● Canvas Announcements	Primary ● Zoom main session ● Zoom broadcast and visits to breakout rooms ● Zoom chat Secondary ● Canvas Announcements
Instructional Team (LEAP Leaders and Instructor)	Primary ● Discord chat ● Zoom breakout rooms for teaching personnel	Primary ● Discord chat ● Group Me
LEAP Leader to Students	Primary ● Zoom breakout rooms Secondary ● Discord chat	Primary ● Zoom breakout rooms
Student to Student	Primary ● Zoom breakout rooms Secondary ● Discord chat or voice	Primary ● Zoom breakout rooms
Student to LEAP Leader	Primary ● Discord chat ● Zoom breakout rooms Secondary ● Discord chat	Primary ● Zoom breakout rooms
Student to Faculty	Primary ● Zoom breakout rooms ● Zoom "ask for help" Secondary ● Discord chat	Primary ● Zoom breakout rooms

All sections used the main session in Zoom for their opening and closing activities during the studio sessions. Most used Zoom breakout rooms to facilitate the collaborative work time where LEAP Leaders and the instructor cycle through the breakout rooms. However, two of the

sections used a Discord server where teams would communicate during the collaborative work time so that the instructor could easily communicate with all the students to provide clarification and guidance without the hassle and disruption of opening and closing the breakout rooms. Several other sections also used Discord as a supplement to Zoom breakout rooms. It is critical to have an effective means for the instructional team (instructor and LEAP Leaders) to communicate during the studio sessions. Many of the instructional teams used a private Discord channel, while others used other applications such as GroupMe or Slack. Another created a separate breakout room where the LEAP Leaders could meet. If students had questions during their collaborative work time while in Zoom breakout rooms, they could use the Zoom "Ask for Help" feature and/or send their LEAP Leader a message using Discord. Additionally, if they had a team member in the classroom in a Hybrid section, they could ask for in-person help from their instructor.

Fall 2020 Implementation: Synchronous Remote LEAP Sessions

In the traditional face-to-face environment, LEAP leaders are responsible for developing and facilitating weekly LEAP sessions which cover the most difficult content identified by students. These sessions are designed to be active in nature, requiring students to interact with the content through discussion, problem solving, and review activities. LEAP sessions follow a structured format, beginning with an opening activity, followed by one or more main activities and a check for understanding.This structure allows students to begin the session with an evaluation of their understanding of the content, then strengthens areas of weakness with the content through practical applications. The check for understanding is used as a way for LEAP leaders and students to assess what they have learned and where further understanding of the content is still needed. While the purpose of the LEAP session is to strengthen student understanding of course content, the LEAP leader does not facilitate this session in a traditional lecture format. Instead, LEAP leaders act as a session facilitator, encouraging students to lead discussions, answer each other's questions, and ultimately, teach each other the material.

Due to the forced shift online in response to COVID-19, LEAP sessions were facilitated using the video conferencing software Zoom. To maintain an active learning environment, LEAP sessions were held in a synchronous format, allowing students to interact and collaborate with their fellow classmates and LEAP leader in real time. The structure and content of the LEAP sessions remained unchanged, allowing students to evaluate their understanding of course content and engage with difficult concepts through group discussion and practice problems. Breakout rooms were used as the mechanism to provide workspaces for student teams during these activities. While zoom was the primary software used to deliver LEAP sessions, some sections also utilized supplemental tools such as Discord or Google Meet to facilitate team interactions.

The main difference between the in-person and virtual LEAP environment, aside from the video conferencing requirement, was the types of activities and supplemental resources used. In the traditional environment, LEAP activities were not limited to resources and materials available online. Many leaders utilized resources available in the classroom such as whiteboards, worksheets, sticky notes and team workspaces to aid in their activities. Additionally, working in teams required students to merely talk across the table or share their computer if they were

working on something together. In the online environment, leaders were forced to seek out new tools to aid in facilitation of their sessions. Many leaders utilized shared documents (Google Drive, Jamboard, etc.) and the remote control feature in Zoom to complete team activities. Screen sharing also played a major role in team work activities and assisted LEAP leaders in assessing the progress of their students.

The LEAP program faced significant challenges in transitioning and facilitating sessions in the online environment. Many LEAP leaders experienced a decline in student engagement levels and a greater difficulty in encouraging student participation in planned team activities during their LEAP Sessions. In the online environment, many of the visual and verbal cues that leaders typically rely on to monitor students' progress and gauge student understanding were not available. While leaders encouraged students to turn on webcams and keep microphones on, a number of students were reluctant to do so with some students unable to due to the environment they were in or the lack of appropriate technology. As a result, many leaders cited a disconnect in communication between themselves and their students.

Methods

To determine if we were successful in maintaining the active collaborative learning environment in the remote and hybrid formats, we compared responses from end of semester surveys from Fall 2019 and Fall 2020. In Fall 2019, there were 769 students enrolled in ENG1101 in 34 LEAP sections of up to 24 students. There were six faculty members that taught the seven studio sessions. In Fall 2020, there were 678 students enrolled in 37 LEAP sections of up to 20 students and six faculty members taught eight studio sessions.

We used responses from three surveys that were administered at the end of the semester. The Use of Course Materials and Resources (UCMR) survey was administered in the last studio session of the semester as an assignment (points were given for completing the survey). This survey contains questions related to enjoyment, student lesson preparation practices, the usefulness of the course structure, activities, and resources to their learning, as well as how the course supports current and future courses and career options. The other two surveys were administered by Michigan Tech's Center for Teaching and Learning as part of the course evaluation process. The student rating of instruction is administered using an online evaluation system that is embedded in the course Learning Management System. There was one survey for the studio session and instructor, the other was for the LEAP sessions and LEAP Leader. These surveys contain questions relating to the student’s desire and preparedness for the course, standard questions regarding seven-dimensions of quality teaching, along with departmental questions related to course learning objectives. These surveys were anonymous and students were rewarded with a 1% grade bonus if 90% of the students in their section completed the surveys.

Results

In this section, we will first discuss the results of the UCMR instrument, followed by the survey results from the Center for Teaching and Learning Instructor and LEAP Session surveys.

Use of Course Materials and Resources Survey

Table 2 contains a comparison of student responses to a subset of questions from the UCMR survey. The response rates were 74.1% for Fall 2019 and 88.2% for Fall 2020. The UCMR survey was not given in one of the studio sections in Fall 2020, so while the number of responses is lower than in 2019, the response rate was higher. In the survey, students selected their level of agreement with each of the statements on a 5 point likert scale, ranging from 1 - Strongly Disagree to 5 - Strongly Agree. The percent of students that selected agree or strongly agree are included in the percent agreement shown in Table 2.

It is interesting to note that the students in Fall 2020 in the remote or hybrid course had higher rates of agreement with all the questions included in Table 2 than students in Fall 2019 in the traditional face-to-face course. With respect to overall enjoyment and engagement the students experienced, there was a 9.0 and 5.2 percent increase, respectively. Students also reported greater agreement with helping their teammates learn as well as learning from their teammates (3.8 and 17.1 percent increases over 2019). The sense that the flipped classroom environment helped students learn increased between the two years by 5.8 percent. When asked if the students felt that they developed skills that will help them learn in other future classes, agreement increased from 2019 to 2020 by almost 10 percent. And lastly, the students' agreement in their feeling that ENG 1101 was a good introduction to engineering problem solving and programming went up by 13.8 percent.

Table 2. Comparison of student responses to questions on the Use of Course Materials and Resources Survey

Question	%Agreement	
	Fall 2019 (n=570)	**Fall 2020 (n=518)**
Considering all my courses this semester, I enjoyed this engineering course.	80.0*	89.0*
I felt engaged in this engineering course.	87.0*	92.3*
My teammates helped me learn	69.6	86.7
I helped my teammates learn	79.0	82.8
The flipped teaching model helped me learn because it made me responsible for my own learning	55.4	61.2
I have developed skills that will help me learn in future classes	73.9	83.8
I got a good introduction to engineering problem solving and programming in this course	73.5	87.3

* These two questions were on a 6-point Likert scale. Agreement included slightly agree, agree, and strongly agree.

More students in the remote and hybrid version of the course also reported that they did more to prepare for studio sessions. A comparison of the number of students reporting that they almost always completed each component of the pre-lesson activities is shown in Table 3. Students were asked how often they completed various components of the Essential Session Preparation (ESP). Typically, students had one or more videos to watch, a reading assignment, and a short comprehension quiz to complete. Students could choose from the following responses: Never (0%), Rarely (< 25%), Sometimes (25 - 50%), Frequently (50 - 75%), or Almost Always (75 - 100%). The percent of students who reported they almost always watched the assigned videos, completed the assigned reading, and completed the ESP assignment increased by 14.9%, 6.3%, and 9.7% respectively. We compared these student-reported results to the course analytics from Canvas for five sections of ENG1101 (n = 75). For these sections, 92.0% of students completed all the ESP assignments before class and 85.3% of the students accessed the ESP instructional pages which gave the information for the assigned videos and reading for the ESP assignments. This suggests that the self-reported values are reasonable, since the percentages in the sample are higher than the self-reported values in Table 3.

Table 3. Comparison of student responses to questions on the Use of Course Materials and Resources Survey: Pre-Class Preparation

Question **How often did you:**	**% Answered "Almost Always"**	
	Fall 2019 (n=570)	**Fall 2020 (n=518)**
Watch the assigned videos before class	52.3	67.2
Read the assigned reading before Class	31.2	37.5
Complete the assignment before class	79.1	88.8

Course Evaluations - Studio Sessions and Faculty

Student response rates on the Course Evaluations administered by Michigan Tech's Center for Teaching and Learning, were 93.9% and 85.7% for Fall 2019 and Fall 2020, respectively. On most questions, students were asked to report their level of agreement on a five point likert scale from 1 - Strongly Disagree to 5 - Strongly Agree. The percent agreement for the questions shown in Table 4 consists of responses from students that either agreed or strongly agreed with the statement.

Table 4. Comparison of student responses on Course Evaluations for Studio Sessions

Question	% Agreement	
	Fall 2019 (n = 722)	**Fall 2020** (n = 581)
I came prepared for each class session.	81.0%	86.2%
The instructor communicated the course material clearly.	67.8%	69.7%
The instructor engaged students by encouraging participation during class	75.9%	73.7%
The instructor engaged students by encouraging course preparation, reflection or other activities outside of class.	86.2%	88.8%
The instructor displayed a personal interest in students and their learning.	78.8%	81.2%
The instructor used technology appropriately	86.1%	85.4%
Taking everything into account, I consider this course to be a valuable course.	71.2%	83.1%
After taking this course, I feel more informed about engineering majors and career options.	67.9%	66.1%
This course helped prepare me for work in the engineering field.	63.9%	70.2%
I can create a MATLAB program to accomplish an engineering task.	75.8%	87.6%
I can perform engineering calculations using a spreadsheet (Excel).	95.7%	97.1%
I can create an effective graph using Excel.	95.6%	97.6%
I can function effectively in a professional, collaborative, team environment.	93.9%	95.0%
All students are valued members of this class.	86.6%	92.3%
Mutual respect is encouraged in this course.	91.8%	94.3%
From this course, I gained knowledge and skills that are useful to me.	76.5%	88.3%
Programming skills are valuable to engineers in my field.	71.3%	79.2%
Technical communication skills (written and verbal) are valuable to engineers in my field.	93.4%	96.7%

It is encouraging to see that there were a number of items that had a larger percentage of agreement in Fall 2020 than in Fall 2019. The items with the largest increases include:

- I consider this course to be a valuable course (11.9% increase)
- I can create a MATLAB program to accomplish an engineering task (11.8% increase)
- From this course I gained knowledge and skills that are useful to me (11.8% increase)

Slight gains that were also encouraging to see, related to students' sense of value:

- My instructor displayed on interest in students and their learning
- All students are valued members of this class
- Mutual respect is encouraged in this course

It is interesting to note that while more students reported feeling engaged on the UCMR Survey in Fall 2020, there was a slight decrease (2.3% decrease) in the percent of students who felt the instructor engaged students by encouraging participation during class.

Another important item to note from the Studio Session/Faculty Course Evaluations is that there was a shift in the time students reported spending on course work outside of class. Table 5 contains a comparison of the time students reported. This is consistent with the increase in the number of students reporting that they prepared for each lesson.

Table 5. Comparison of time students spent outside of class on course work

	0-2 hours	**2-4 hours**	**4-6 hours**	**6-8 hours**	**More than 8 hours**
Fall 2019	13.9%	36.1%	34.6%	10.9%	4.4%
Fall 2020	6.7%	27.7%	39.9%	20.3%	5.3%

There was also a shift in the perceived difficulty level of the course, with the students in Fall 2020 finding the course to be less challenging. Table 6 shows the percent of students that selected each of the responses to the question, "For my learning purposes, this course was" A) Not at all challenging, B) Slightly challenging, C) Appropriately challenging, D) Somewhat too challenging and E) Much too challenging.

Table 6. Comparison of students responses to course difficulty

	Not at all challenging	Slightly challenging	Appropriately challenging	Somewhat challenging	Much too challenging
Fall 2019	7.3%	17.3%	51.8%	20.5%	3.0%
Fall 2020	6.4%	19.4%	60.9%	12.7%	0.5%

Course Evaluations - LEAP Sessions and LEAP Leader

Response rates on the LEAP Session and LEAP Leader Course Evaluations were 90.5% in Fall 2019 and 84.1% in Fall 2020. The percent of students that agreed with each statement is shown in Table 7. The results from Fall 2020 are fairly consistent with those from Fall 2019. However, there were slight increases in the percentage of students in Fall 2020 that agreed LEAP Sessions

helped them to learn the course material, and that they benefited from attending the LEAP Sessions. This reinforces that LEAP is a critical component of our course structure.

Table 7. Comparison of student responses on Courses Evaluations for LEAP Sessions

Question	% Agreement	
	Fall 2019 (n = 693)	**Fall 2020** (n = 570)
My LEAP Leader engaged students by encouraging team participation.	91.8%	92.3%
During class, the LEAP Leader provided sufficient guidance and assistance with the in-class activities.	86.9%	87.7%
During the LEAP Session, my LEAP Leader provided activities that helped me understand the course material.	89.9%	90.4%
My LEAP Leader displayed a personal interest in students and their learning.	89.3%	87.2%
I felt welcome in the LEAP session.	94.8%	94.7%
Having LEAP Leaders in class was helpful to my learning.	88.2%	88.6%
The LEAP Sessions helped me to learn the course material and reinforced course concepts.	83.0%	86.3%
I feel I have benefited from attending the LEAP sessions.	80.2%	83.2%

The item, “I felt comfortable approaching my LEAP Leader for questions or advice” was added to the Fall 2020 LEAP Session and Leader Evaluation. Encouragingly, 91.1% of students agreed with this statement.

Discussion and Conclusions

The active and collaborative learning environment in the first-semester, first-year engineering course was successfully maintained when the course modality was shifted from in-person to remote or hybrid classroom due to COVID. A comparison of three end-of-semester surveys from Fall 2019 to Fall 2020 are positive. The traditional face-to-face (Fall 2019) first semester engineering course, those that were enrolled in the synchronous remote and synchronous hybrid version reported a greater percentage of students who reported that they

- enjoyed the course.
- felt engaged and valued.
- were more prepared for lessons.
- engaged in peer learning.
- developed skills that will be useful in their future learning.
- saw value in the course and the skills they learned.

There are several possibilities that may have contributed to this increase in students' satisfaction with the synchronous remote and hybrid learning environments. First, we must consider self-selection. It is likely that only those students that were confident in their ability to be successful in a mostly online environment chose to attend their first-semester of college in Fall 2020. Second, the faculty made modifications to the course and course materials in an effort to provide more real-world applications for the material covered (mini-projects) and a more supportive environment (lower student to LEAP Leader ratio and faculty ratio, inclusion of student success and wellness readings and assignments). Third, the interactive nature of the course may have been a welcome reprieve for students during this time of physical distancing and online learning. Many of the classes taken by first-year students were either offered online asynchronously or were synchronous remote lectures with very little opportunity for students to interact with their peers. In ENG1101, students had the opportunity and were expected to talk with their team members in every class.

Additionally, we must consider that today's students may be more used to and comfortable in the online environment. They may be more comfortable joining class from the comfort of their own living space. Or perhaps the online classroom gives the students the familiar feel of accruing "badges" or points that they experience in online gaming. Whatever the reasons, these results indicate that students were as satisfied in the remote or hybrid classroom as in the traditional in-person classroom.