

Work in Progress: Senior Design Day During a Pandemic: Virtually the Same as In-person?

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Abstract

Senior Design or "Capstone" projects are an important aspect of undergraduate activity in engineering disciplines as they consist of a culminating major design experience incorporating appropriate engineering standards and multiple constraints, based upon skills acquired in earlier course work. Capstone activities include gathering requirements, technical design, presentations, and written documentation. Before the COVID-19 pandemic, the Ingram School of Engineering at Texas State University hosted a "Senior Design Day" at the end of the Fall and Spring semesters, in which projects and student presentations were showcased. At its peak, over 450 individuals attended this event, providing large audiences for student presentations. Attendees were also given the opportunity to evaluate student projects and to provide feedback regarding the event. With the social distancing directives from the university and local government, Senior Design Day became a virtual event. This work in progress compares past events held in person vs. two that were conducted virtually, and of those two virtual events, compares an event conducted with pre-recorded presentations vs. one held with synchronous video presentations. Participant and visitor evaluations and feedback are compared, as significantly more feedback was received for the virtual events than for the in-person events. The differences in how project sponsors, faculty, and students participated in each type of Senior Design Day is compared and discussed. Some elements of a virtual event provided improvements to the experience and their application to post-pandemic Senior Design Days is discussed.

Introduction

As engineering programs struggle with how to present senior design projects in the era of the pandemic, various lessons have been learned about virtual and previous large-scale events. While it is hoped that next year this event we will return to a face to face event some successful elements of the virtual will be blended in to future events. As Laura Ingalls Wilder wrote in the little house on the prairie book series “There's no great loss without some small gain.[1]” This work focuses on some of those gains.

In this work in progress, we set out to explore the following research questions:

- Do faculty and industrial partners prefer an in-person, or an online, event?
- Are live presentations, or pre-recorded presentations, preferred by faculty and industry partners?
- Do students prefer live or pre-recorded presentations?
- In what ways did we benefit from the experience of conducting two online Senior Design Day events?

Senior Design Day

Senior Design Day at Texas State University was a large, inclusive event akin to a mini-convention that drew 300-450 individuals. For years it was held at the nearby Convention Center which provided a very professional, conference-like atmosphere[2]. When the new engineering and sciences building opened in 2019 the event was held in the building. While conducting the event on campus created parking problems and took away the convention feel, it provided visitors with an insight into our engineering programs and facilities while saving about \$13,000 per event. This was significant as Senior Design Day is held twice per academic year, at the end of each long semester.

It was logistically straightforward to move an event of this size into our new engineering building given that the classrooms on the 2nd, 3rd, and 4th floor could seat a total of 890 individuals. While the excitement and energy levels were high due to having the event in-house, there was no increase in the number of faculty and professional evaluations we received. These evaluations sought feedback regarding the venue, the event, and the accomplishment level of the student teams.

We observed that interactions and discussions between students, faculty, and industry members provided much value when this event was live and in person, i.e., not virtual. The interactions between faculty member, industrial visitors, and university administration were also an important aspect of the value obtained. As a result, the event provided an easy and enjoyable way for such interactions to occur without being forced. The event was also an easy way to introduce underclassmen who were not yet in Senior Design to the capstone program so they could see

typical projects and have a glimpse of what would be expected of them. It was relatively easy to attract these students by providing free snacks procured from a local big-box store.

Pre- to post-covid comparison

Before the covid pandemic our Senior Design Day event had settled into being held in the engineering building. It included a 4-hour poster session, live formal student presentations, student snacks and lunches for faculty and industrial partners, and a live awards ceremony. At this ceremony awards were presented for Mentorship (second semester students mentoring first semester students) for project excellence. The Faculty Choice award and an Industry Choice award were given based upon voting with customized poker chips. At peak there were about 450 total attendees, and the cost of the event was approximately \$5,000.

When social distancing directives were put in place, the May 2020 event went fully virtual and asynchronous[3]. Presentations were pre-recorded and only for second semester students. The role of first semester students was purely passive and observational. What previously had been a poster session was converted into a set of 3-minute pre-recorded presentation with an accompanying PDF describing the project. Awards were announced on the website, and visitors were given a 5-day window in which to view the materials. The only award given was Faculty Choice, as there was very little mentorship, and we could not readily solicit and tally votes from industrial visitors given the short time that had transpired between the social distancing mandate and the May 2020 Senior Design Day event. Over 300 people viewed the event materials, and the cost was less than \$500 as the only expense was the award trophies. The academic and professional interactions previously described were virtually nonexistent, causing a disconnect in communication, as these interactions weren't successfully reproduced in the virtual environment.

December 2020 saw the second Senior Design Day incorporating social distancing requirements. The event was a combination of an asynchronous poster session, synchronous formal student presentations, and synchronous awards. As before, only the Faculty Choice award was given. For the first time we included a one-hour Showcase where the top project team from each engineering discipline presented and then subsequently received their award. In this manner, visitors desiring to experience a more compact form of the event highlighting the winning projects were able to watch the Showcase. Two hundred people attended and the cost again was less than \$500.

Methods

A method to conduct evaluations online had been in place for three years, replacing the hardcopy forms used in the past. Unlike the hardcopy evaluations, we had records of the online responses so a comparison of the number of responses received pre- and post-pandemic could be made. Then, when it became apparent that the December 2020 Senior Design Day event would be virtual, two surveys were constructed and were administered to explore the research questions stated in the Introduction.

Each of the two surveys contained several Likert items with a 5-point Likert scale, with 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree. The first survey was offered to faculty and industrial partners and consisted of the eight questions in the leftmost column of Table 2: Survey Responses from Faculty and Industrial Visitors. The second survey was administered to those students who presented at the event and consisted of the five questions in the leftmost column of Table 3: Survey Responses from Students Presenting at the Event.

Results

Table 1 compares the number of online evaluations received during the last three years. Previous to that time we used paper evaluations and, while we do not have exact numbers, the number of paper evaluations received was on the order of 200 or more.

Table 1: Senior Design Day Online Evaluations Received in the Last Three Years

	May 2018	Dec 2018	May 2019	Dec 2019	May 2020	Dec 2020
Event Mode	Live	Live	Live	Live	Virtual, Asynchronous	Virtual, Synchronous
Event Location	Convention Center	Convention Center	Inhouse	Inhouse	Online	Online
Industrial	6	6	6	3	21	7
Faculty	6	4	6	4	104	4
Students	0	0	0	0	145	45
Parents	0	0	0	0	17	0
TOTAL	12	10	12	7	287	56

Table 2 documents the survey responses from faculty and industrial partners. The overall number of responses was 11, which was quite small. Five faculty members responded to the survey while six industrial visitors responded.

Table 2: Survey Responses from Faculty and Industry Visitors

	n = 5	n = 6	n = 11
	Faculty	Industry	Overall
Assuming no pandemic or health risks I am more likely to attend an online event than a physical event	3.50	2.14	2.64
I prefer watching pre recorded video student presentations to attending live video student presentations	1.50	2.29	2.00
I would rather evaluate a virtual event than evaluate a live event	3.75	2.43	2.91
I derive greater value from watching an in person presentation than watching an online presentation	2.50	4.14	3.55
Live virtual presentations are more desirable than pre recorded virtual presentations	4.50	3.43	3.82

I tend to view more presentations in a virtual event than an event that I physically attend	3.50	2.43	2.82
There are some aspects of virtual events that are superior to in person events	4.00	3.71	3.82
Once the covid crisis has passed I would be more likely to attend a physical even rather than an online event	2.75	4.14	3.64

Table 3 captures survey responses from students who presented at the event. These are second-semester students, as the first-semester students did not present. A total of 45 students responded. Industrial Engineering (IE) only had two responses. While Electrical Engineering (EE) has the greatest number of students, more Manufacturing Engineering (MFGE) students responded to the survey.

Table 3: Survey Responses from Students Presenting at the Event

	n = 45 All Students	n = 20 EE	n = 2 IE	n = 23 MFGE
As a presenter I prefer presenting in person rather than presenting virtually	3.47	3.50	4.50	3.35
As a presenter I prefer pre recorded virtual presentation to live virtual presentation	3.00	3.10	2.00	3.00
It is more difficult to deliver an in person presentation than a virtual live presentation	3.47	3.85	4.50	3.04
In the future as an alumni I would prefer to attend a virtual live event rather than a virtual pre recorded event	3.18	3.10	4.50	3.13
In the future as an alumni I'd be more likely to attend an in person event than a virtual event	3.67	3.90	4.00	3.43

Discussion

The number of online evaluations received for the virtual asynchronous event increased from an average of 10 per semester from previous live events to 287 as shown in Table 1. Once the event went synchronous the number of online evaluations we received dropped from 287 to 56. While the number of data points is insufficient to draw a firm conclusion, the data hints that it may be possible that the number of individuals who submit an evaluation is inversely proportional to the degree of human interaction during the event. Fully face-to-face events had very few evaluations submitted, the fully “canned” online event had a large number of evaluations submitted, and the online synchronous event received a number of evaluations that was about five times the average for a fully live event, but about one-fifth the number of a fully online, asynchronous event. While there may be several factors contributing to the variation in the number of evaluations submitted, it may be possible that evaluations substituted in some way for the lack of interactions that would normally take place during the event.

Faculty and industrial partners were asked to complete a survey administered at the virtual synchronous event addressing our research questions and the results are contained within Table

2. Although the survey contained eight questions and could have been quickly completed, few faculty and industrial members responded. Reliable conclusions could not be drawn given the small sample size, thus the first two research questions (1. Do faculty and industrial partners prefer an in-person, or an online, event? 2. Are live presentations, or pre-recorded presentations, preferred by faculty and industry partners?) could not be reliably answered. It is unknown why so few responses were received.

Our evaluation forms contained a field for sponsor and faculty free-response feedback.

In support of synchronous virtual presentation, a corporate sponsor in Dec 2020 wrote, “The live demo was a good event. Watching teams improvise on the fly and manage unexpected events provided a good challenge and was interesting to watch. The pre-recorded videos were also nice. With more time to polish these videos, the presentation was good to see.”

Feedback of a similar nature was not received regarding the virtual asynchronous event. The feedback received supported the perception that sponsors feel more engaged and a part of the event at the in-person events.

A separate survey was offered to students who presented at the virtual synchronous event containing the questions reproduced in the leftmost column of Table 3. A total of 45 students responded. Their responses averaged 3.47 (approximately midway between Neutral and Agree) indicating that they slightly prefer in-person presentations to virtual presentations. However, with an average score of 3.00, students were neutral regarding preference of pre-recorded virtual presentation to live virtual presentation.

The average student response of 3.47 (approximately midway between Neutral and Agree) indicated that they slightly felt it was more difficult to deliver an in-person presentation than a virtual live presentation.

Combined with the previous response, there was a slight indication that students prefer in-person presentations yet feel that it is more difficult to present in person. Their preference for in-person presentations may result from their perceptions that this is an important skill for them to possess, and perhaps their project sponsors placed a high value on personal interactions.

With a response of 3.67, current students felt that they would be more likely to attend an in-person event as alumni rather than a virtual event. We were not expecting such a result, as we assumed that alumni would prefer to watch a video feed of the event to reduce time away from work and to avoid the parking challenges at our campus.

Lessons Learned

Many lessons were learned from changing our Senior Design Day event mode of delivery.

We learned that we had the capability to produce a higher quality website with more information, and more interesting information, than we ever had before. This includes an archive for visitors to see a past event in greater detail and with some on-demand videos. We intend to continue with this implementation. The detailed archives of the event may be useful for accreditation purposes.

These events showed us that we could recruit a different sector of corporate attendees. In our previous live events, corporate attendees consisted of those who could leave work for up to a half-day for the fully live event and for an hour or less for the virtual synchronous Showcase event. We intend to create a variant of our event to cater to the widest possible audience by combining elements of each delivery mode. The elements include:

- Incorporating a robust online presence with accessible student video presentations and posters to cater to those who cannot attend the live event,
- Providing live streaming of the showcase presentations and awards ceremony to engage those who wish to participate but cannot travel,
- Restructure the live poster session to allow participants to attend with greater schedule flexibility,
- Work towards reaching out to secondary schools to engage them in virtual participation in the event with hopes towards fostering a greater interest in engineering.

We also realized that the increased quality and presence of online documentation might make for a stronger resume, showcasing student accomplishments and skills. As a result, we have established a more rigorous set of guidelines for student work to be published online in addition to improving the organization and accessibility of our website. We also are now requiring that each project team submit a video, following rigorous guidelines, to demonstrate their project outcomes.

While virtual events allow for a broader participation and naturally lend themselves to a greater degree of archiving, there is still a strong case for in-person events. Statements from some sponsors gave the impression that some of them feel “part of the family” with their engagement with students at the live event. For example, a project sponsor from 2019 wrote, “I really appreciated all the work that was put in to make the industry sponsors feel welcome! I have never been to Texas State before and very quickly felt like part of the family. The faculty is amazing, especially Dr. [NAME REDACTED]! Many coordinators knew who I was before I even introduced myself and went out of their way to talk to me, offer the VIP lounge, and make me feel appreciated for helping their students.”

Strong statements of support of a similar nature were not recorded from the virtual event.

Given that students indicated a preference for an in-person event, whether they be a student or an alumnus, our plan is that Senior Design Day should return to being an in-person event but with improved and expanded digital content. We plan to continue to probe our research questions and take steps to increase the number of responses we receive.

References

[1] Wilder, Laura Ingalls, 1867-1957. *Little House on the Prairie*. New York, N.Y. :HarperCollins, 1963.

[2] Talley, A., and Compeau, C., “Senior Design Day – Multi-discipline and Multi-department Capstone Presentation Event,” 2018 American Society for Engineering Education Annual Conference, Salt Lake City, Utah, 2018.

[3] Texas State University, March 12, 2020 University Covid-19 Statements. Texas State University. <https://www.txstate.edu/coronavirus/university-statements.html>