



## **Work in Progress: Senior Design Day – Multi-discipline and Multi-department Capstone Presentation Event.**

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# **Work in Progress: Senior Design Day: Multidiscipline and Multidepartment Capstone Presentation Event**

## Abstract

Senior Design or "Capstone" projects are one of the most important aspects of undergraduate activity in engineering disciplines as they represent a culminating major design experience with multiple constraints. Most students enroll in capstone courses during their senior year and participate in team-based design of a system or component. Capstone activities include requirements gathering, specification development, technical design and troubleshooting, oral presentations and written reports. At the end of each Fall and Spring semester, Texas State University Ingram School of Engineering hosts "Senior Design Day" to showcase the projects and student accomplishments. Some projects are fully completed while others are halfway through the capstone sequence. Our event, hosted at a local convention center, includes presentations from teams from four disciplines with both engineering and engineering technology majors. The event is attended by students (both in the capstone class and those who have not yet taken it), faculty, sponsoring companies, industrial advisory board members, and members of the public. This is an evolving event that has changed significantly in the last four years, and now draws over 300 attendees. Multiple break out rooms host ongoing formal team presentations concurrently with poster presentations and corporate information booths. The day wraps up with a networking event for the students and companies in parallel with an industrial advisory board meeting. This paper will present the evolution of the event, logistics, and lessons learned via pros and cons.

Index Terms – Capstone, Senior Design, Design Day, Senior Design Day.

## Introduction

Senior design at Texas State University like many other schools has evolved through the years, often moving to have more integration with industry and multidisciplinary teams. Starting in 2014, Texas State University has held a unified day of presenting senior design projects to the public and to sponsors from the engineering program's three disciplines. This event has evolved from the first multidisciplinary event that was held in the student union ballroom with twenty back-to-back presentations to the very different experience that it is today. The event now integrates senior design projects from three engineering disciplines and engineering technology along with graduate student presentations, corporate sponsor booths, an interviewing skills workshop, and an Industrial Advisory Board (IAB) meeting with faculty. This Work-in-Progress practice is focused on the Senior Design day presentation event.

## Background

Most ABET accredited programs have formal design presentations at the end of the capstone/senior design course<sup>[1]</sup>. Many of the programs do this as a part of a single event that occurs on a designated senior design day<sup>[2,3,4]</sup>. The senior design day event at Texas State University started out as a single, on-campus ball room with each senior design team allotted a

twenty-minute presentation slot and directed to a larger audience that each individual discipline could attract on their own. As more projects moved towards external and corporate sponsorship and the number of student projects grew this became a long and complicated event. In the last four years the number of engineering students has doubled at Texas State University. This growth in enrollment made the event significantly longer. In an effort to accommodate industry, students, family and faculty wishing to see a majority of the projects, but who could not stay for the entire event, the program was split into twenty formal presentations in one part of the room while the poster session was open in the other part of the room. The goal was to facilitate a way to see all the projects at once, provide a forum for in-depth discussion, and still have a traditional formal presentation. The change in format and number of attendees necessitated a larger venue, so consequently the event was moved to the off-campus city hotel and convention center. The event at the convention center twice a year has led to many changes.

### Multidisciplinary Teams

Representation from industry and the nature of the design problems have led to a more multidisciplinary approach to senior design. To date the multidisciplinary projects are run as two separate teams, consisting of EE and MFGE students that work on one design problem. The teams scoped the problem and determine areas of responsibility. To date, EE projects were two semesters in duration but MFGE projects were only one. Senior Design Day has enabled a single format for the students to present their work both formally and in a co-located poster session. Future plans are to expand multidisciplinary senior design projects, and this effort is moving forward as curriculum catalog changes were made to create a unified two semester senior design sequence for all engineering majors. With better time alignment, more multidisciplinary teams are expected to form.

### Pros and Cons of Elements of Senior Design Day

In an effort to convey the lessons learned from our Senior Design Day, a Pro & Con list was made for the major decisions and changes that were made to the event. It is hoped that these Pros and Cons will be of value to schools seeking to expand their senior design day events, and that some of the lessons learned at Texas State University will help others to identify possible obstacles or pitfalls.

The major changes for the event were moving to an offsite venue, having all disciplines of engineering and engineering technology participate in the event, moving to a model of simultaneous multiple room formal presentations and main room poster presentations, and changing the event from an all-day affair to afternoon event with evening IAB meeting and dinner. Table 1 addresses some of the pros and cons of the event logistics.

Table 1: Logistics Pros/Cons

Aspect	Pro	Con
<b>Event held off-campus</b>	Venue can be very nice and professional. Plentiful free parking.	Very expensive, comparatively. Conference center staff doesn't always understand a setup map or scale drawing.

	<p>Less management involved, since the convention center is paid to manage and set everything up - and they are professional at such tasks. Fewer conflicts with university functions (such as graduation, etc).</p>	<p>Students have to drive or take the bus to attend. Project materials have to be transported over a greater distance. Can't inspect the wifi/net connections or setup sooner than the morning of the event.</p>
<b>Event held on-campus</b>	<p>May have greater control over venue. Food is far cheaper; we currently spend about 50% of our event budget for food at the convention center, which is several times the price of food elsewhere. If the venue is close to the engineering building then transporting project materials is easier. Underclassmen may easily attend. Parents &amp; family get to see the campus.</p>	<p>Campus venues are typically unavailable a semesters' end due to graduation, unless the engineering facility has large enough space. As a point of reference, we rent 14,400 s1 ft at the convention center. Parking is very limited and expensive at \$10/guest. Some guests will not find a parking space on campus as lots tend to fill.</p>
<b>Large event</b>	<p>300+ attend giving good exposure. Underclassmen have opportunity to see where they're headed. Recruiters &amp; industrial partners are more likely to attend. Students receive good practice presenting. It looks and feels professional as it models a conference.</p>	<p>The logistics require a few months of planning by an experienced committee. There are many things that can go wrong. (e.g., convention center didn't properly distribute power so the resulting brownout blew out EE projects; didn't know how to space tables so most projects were crammed into one side) Many things go wrong requiring an organized staff of faculty, staff, and grad students - some armed with walkie talkies. Many hours go into planning the event, e.g., the concurrent talks, food, etc. Hard to estimate how many will attend; this affects amount of food ordered, chair setups, etc.</p>
<b>Presentations</b>	<p>Presentations are good practice for students. It's a valuable soft skill to develop. Develops organizational skills.</p>	<p>Some disciplines want shorter or longer talks which makes multiple concurrent sessions difficult to schedule. Care must be taken so that entities sponsoring more than one project may see all of their presentations. The majority of outside attendees prefer to spend time at the poster session which is concurrent with talks - so as a result the talks are very poorly</p>

		attended, defeating the purpose of the talks.
<b>Half-day session</b>	Can devote more energy into the event if only half a day. Easier for corporate partners to take a half day off of work to attend. Do not need to cater a lunch, which cost about half of the current budget. It is not a 13+ hour day for those who organize and manage the event. Set up starts at 11:30 (instead of 7am as before) for a 1:00-4:30 event.	Must be very carefully organized: to have 45+ posters on display along with three concurrent rooms with 10-12 talks each requires much management. Some attendees will not be pleased as they want longer presentations and more time to visit the posters. Ordering is important; if a company sponsors more than one project their talks can't be concurrent.
<b>Busses from campus to the event</b>	Underclassmen & grad students who might not otherwise be able to attend are better facilitated	The first bus was 2-1/2 hours late. The cost was about 10% of our budget. Need 'ushers' on bus.
<b>Graduate students included</b>	Graduate projects & program are showcased.	This does not fall under the undergrad capstone domain. Logistics & organization can be problematic since "no one owns it."
<b>Audio/Visual</b>	Good A/V makes for more professional presentations. It is good practice for the students. It permits announcements in the large poster session area. Graphics can be clearly displayed. Speakers can be heard during the presentations and also at the IAB meeting.	At first we ordered 50 wifi passes but the first 50 students to log in blocked the usage, so we increased to 350. This increased cost. A/V is needed in the poster session area, the breakout rooms, and the IAB meeting room; it has never worked 100% upon our arrival. So we arrive early, first check everything out, and report problems to the convention center staff. We reduced computer problems by concatenating the student presentations (and including spacer slides to announce Capstone, Sponsorship, Co-Op, etc.) into one large PPT file. The downside is that this must be constructed in advance of the event.

## Communication

As the event has gotten larger communication has become a key issue. In many cases more formalized processes were required to ensure that the event went smoothly as the size and scope increased. Table 2 show the major pros and cons of aspects of the event communication. Some of the highlights are formal email marketing to nonstudent attendees, posters and signage at the event, on site communications, and evaluation feedback.

Table 2: Communication Pros/Cons

Aspect	Pro	Con
<b>Structured, regular e-blast mailings</b>	Professional look and feel. Widespread distribution. Can maintain separate contact databases. Embedded links for more info, registration, etc.	Have to be very carefully proofed, as our mailings go out to 200+ people. It's easy to make a mistake and proofreaders may not have the same level of vested interest.
<b>Professionally printed brochure</b>	Promotes the SoE. Gives schedule details and contact info. Serves as a secondary map for the event.	Diligent proofreading can be a problem; one time we had to reprint them all at \$250 cost due to date error. Must be done in advance at the print shop. Sponsors can add (or cancel) after the brochure is printed so it's not always accurate.
<b>Visio layout of areas</b>	Can visualize the traffic flow. Can group projects together, especially multidisciplinary. Guarantees everything 'fits' into the venue.	Convention center was not able to read a map or a scale drawing. Difficult to get peer review of layout.
<b>3'x4' Maps &amp; Posters</b>	Backs up the brochure. Can give more detail. Easy to read; stationed strategically. Professional look and feel.	Must be printed and mounted in advance. Requires floor standing easels – more to move. Requires time and expense to reprint if an error is discovered or if a change is made. Easy to make an error and hard to find someone to proof it carefully. Sponsors can add (or cancel) after the posters are printed so not always accurate
<b>Walkie-talkies</b>	Cell phones were not reliable, and/or could not be heard. FRS walkie-talkies require no license. We purchased a matched set of 4 – everyone hears a call for help. Lead grad student, Coordinators, and Registration desk gets one. Convention center is large so it's impractical (and tiring to walk!).	Users have to be trained how to use the walkie-talkie. They have to keep it on and turned up. Had to make sure it wasn't on the same FRS channel as staff of the Convention Center. Batteries have to be fully charged the night before.
<b>Electronic (QR code) evaluations</b>	Don't have to scan or transport hundreds of sheets of paper. Don't have to decipher bad handwriting.	Evaluators must have a smartphone, and QR app must be loaded. Harder for them to add comments, since they are typing on a small screen.

	Facilitates archived database of responses. Evaluators don't have to carry clipboards and pens – nor do we have to provide them.	Our system doesn't (yet) have passwords; students want to give themselves good evaluations; we added a field for student evaluations.
<b>Templates &amp; rubrics for evaluating</b>	Evaluation is somewhat standardized. (4-point rubric) Quick to evaluate. We can target aspects of performance.	Evaluators don't always grasp the rubric. They would like to write in other categories.

## Awards

Another aspect that has changed with time is awards. For many years the event has had awards, and much of the discussion centered about what awards should be given and how winning terms should be determined. For a while all nonstudent participants were given three tokens to put in a voting box, located in front of each project poster, for the project they liked best. This often led to the group that had the most sponsors/parents at the event receiving the award. Currently all nonstudent attendees get one token for each discipline to vote for the “Industry Choice Award,” and each discipline’s faculty determines the “Best Project Award.” Recipients of the awards had previously received \$25 gift certificate to the school book store, which was of little value to seniors only days away from graduation. Our Senior Design Day Committee has now changed the “Best Project Award” to a laser-engraved freestanding plaque suitable for display on a desk. The students have commented that they would like to earn the plaque, as it is a lasting memento. Table 3 shows the detailed pro and con list for senior design awards.

Table 3: Awards Pros/Cons

<b>Aspect</b>	<b>Pro</b>	<b>Con</b>
<b>Faculty chooses winning project</b>	Choice not subject to ‘gaming’ like poker chips. Winning projects are truly the best – in the eyes of the faculty.	Need to have two separate award categories, “Industry Choice” and “Best Project.” Some faculty are reluctant to vote for projects they advise/sponsor. Some faculty are prone to vote for projects they advise/sponsor. Must get these votes from faculty, which may take time.
<b>Lively awards ceremony</b>	More interesting and fun for attendees. Corporate partners tend to stay. Students like it. Breaks up the routine and adds some excitement.	Needs an individual who is flexible on their feet and not afraid to speak to a large crowd to act as a “DJ.” Must be planned in terms of flow otherwise it can rapidly degenerate. Needs a good wireless PA system (since the poster session is a large room) which is costly.
<b>Raffles</b>	Done before winning projects are announced.	Must procure suitable prizes in advance.

	<p>Only corporate partners and students are eligible – no family, no faculty, no guests.          Holds interest of attendees.          Students and corporate partners enjoy mementos.          Breaks up the intensity of the poster session and transitions into the Awards and Wrap Up.</p>	<p>Physical tickets unwieldy for 300+ attendees; we assigned a number to registered, qualified attendees and then used excel to generate random #'s. The Announcer read the random winning #, and the Assistant matched that to the name and an announcement was made. This required practice.          It can bog down if people have left.</p>
<b>Customized 'poker chips' for voting</b>	<p>Evaluators have fun voting for "Industry Choice Award".          Poker chips are a colorful and unique memento of the event.          It is quick and easy to count votes after the poster session concludes and before the Awards.</p>	<p>Chips have to be carefully proofed as they are custom and expensive.          Evaluators will 'game' the system, e.g., 3 evaluators from the same company put all their chips into the project they sponsored. We addressed this by having a different color for each engineering discipline, and only giving them one of each – but they can still pool their chips.</p>
<b>Ballot box voting</b>	<p>Poker chips are deposited in the ballot boxes.          Chips are color-coded to distinguish disciplines and so are the boxes.          Ballot boxes are in a separate area so students cannot see the voting.</p>	<p>Evaluators have to be trained to find and use the ballot boxes.          Even with color coded chips and boxes, blue chips still got into red boxes.          Time is required to set up / take down boxes.</p>

## Industry

The involvement of industry in Senior Design Day is very valuable to the faculty at Texas State University. A conscious effort has been made to have as many of the projects sponsored by industry and outside research groups (NASA, etc.) as possible. It has been expressed by the faculty that the student opportunity to interact with an outside contact with different goals and duties is very important. One major change to Senior Design Day was the inclusion of Industrial Advisory Board (IAB) meeting and dinner immediately after the event. Incorporation of this meeting at the end of the event significantly increased the number of IAB members that attend Senior Design Day. This serves the dual purpose of allowing the board member to see the projects and for the students to interact with more industry representatives, whether or not those representatives are sponsoring projects. This has led to a long day for the faculty but has resulted in many positive effects on the student and the event. Table 4 discusses the industry pros and cons for Senior Design Day.

Table 4: Industry Pros/Cons



Aspect	Pro	Con
<b>IAB Meeting co-located and immediately following event</b>	<p>IAB members are more involved in the event.</p> <p>Easier for them to carve out time for the event if it coincides with the IAB Meeting.</p> <p>IAB members more bought into the process since the event is discussed in depth at the IAB Meeting.</p> <p>Coupling this with SDD and with the banquet is a strong enticement for them to attend.</p> <p>There is an agenda but all are free to speak so good feedback is received.</p>	<p>Makes for a long day; faculty have to be 'on point' after the main event concludes.</p> <p>Industrial partners may have different ideas regarding what senior design should and should not be.</p> <p>IAB members have little time to reflect or process the event so sometimes the feedback emphasizes the 'problem du jour.'</p>
<b>Recruiting booths during the main event</b>	<p>Talent acquisition staff can more authentically assess student performance via presentations, questions, poise, dress, etc.</p> <p>A reasonable fee can be charged for the booth to help defray the expense of a Senior Design Day.</p> <p>Students are excited and foot traffic is good.</p>	<p>It is very difficult to find the corporate individuals with the authority to book / pay for a booth.</p> <p>Some recruiter responses were very last-minute so they weren't listed in the program credits.</p> <p>Companies may show up but not pay.</p> <p>The booths must be planned with respect to power, wifi, positioning for visibility, announcing to students, etc.</p>
<b>Networking session after the main event</b>	<p>Students and recruiters can network after the Awards. We allocated two hours for this purpose.</p> <p>Recruiters can home in on higher performing students.</p>	<p>No way to guarantee that the recruiters will stay for the session – or that there will be qualified students – or that students will stay.</p> <p>The shuttle bus must allow for the possibility of students staying that late, thus increasing cost (since rates are hourly).</p>
<b>Paying sponsors</b>	<p>Helps to support the program.</p>	<p>Sponsors may feel entitled to project outcomes, signage, preferential choice of projects</p>
<b>Cocktails</b>	<p>Makes for a nice transition into the IAB Meeting.</p> <p>“Social Lubricant” effect.</p>	<p>To be effective, the cocktail bar needs to be set up and ready to go before Awards are concluded. This requires planning and coordination with the convention center staff.</p> <p>What is the right number of drink tickets per person?</p>
<b>Banquet</b>	<p>Faculty, IAB Members, and Distinguished Guests are invited to Banquet after the IAB Meeting.</p>	<p>Makes for an even longer day.</p> <p>Those who worked hard really want a drink but this may not be the best time to imbibe.</p> <p>Not all faculty attend.</p>

## Evaluation

The Senior Design day event is done at the end of the fall and spring semesters. Due to the nature of course offering and academic calendar it is expected to have more participants in the spring event than in the fall event. The event is attended by students (both in the capstone class and those who have not yet taken it), faculty, sponsoring companies, industrial advisory board members, and members of the public. A formal Senior Design Day was first conducted in Fall of 2013 at the Student Center. In Spring 2015 it moved to the convention center.

One measure of evaluation of success of the event is the number of attendees. Figure 1 and Figure 2 show the overall attendance at the event for fall and spring respectively.

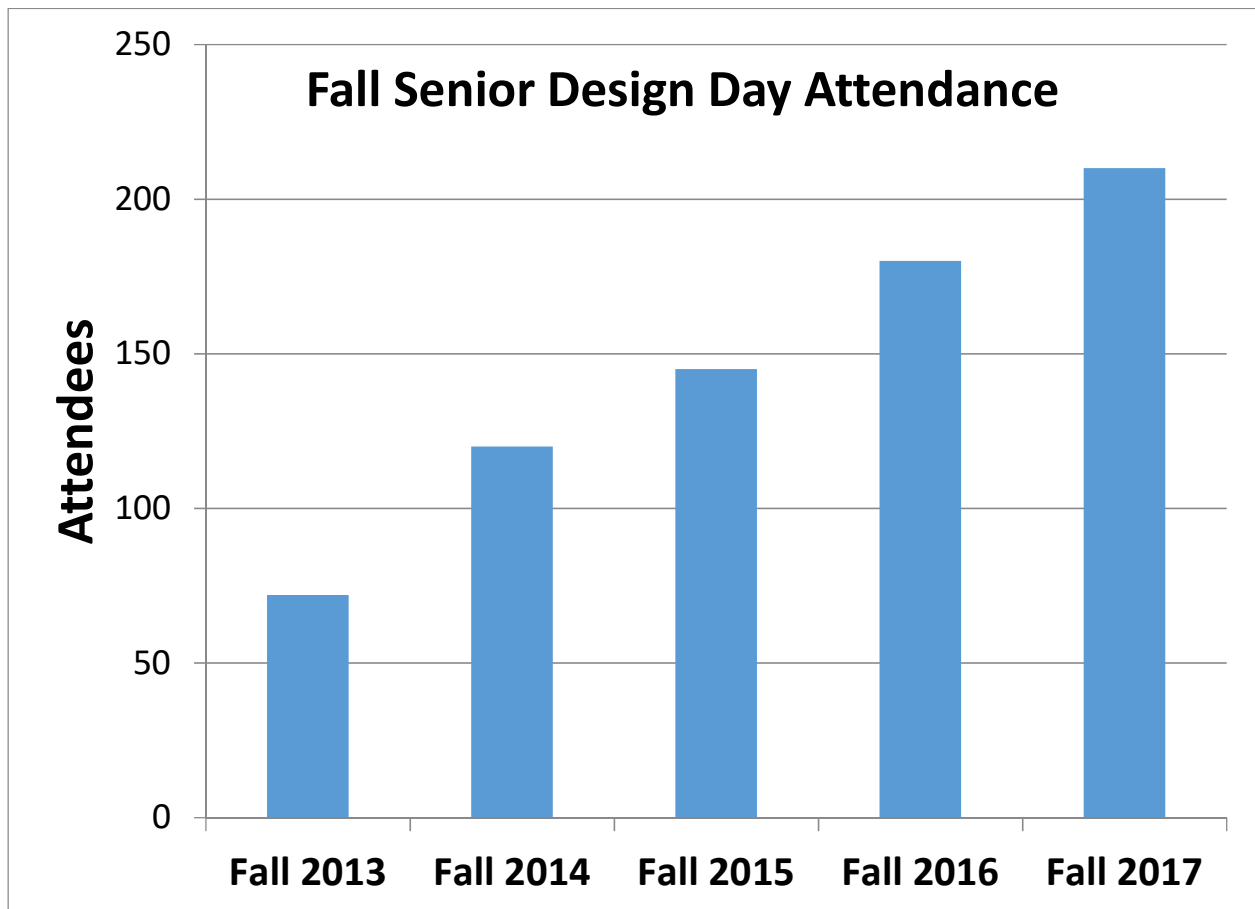


Figure 1: Fall Senior Design Day Fall Overall Attendance

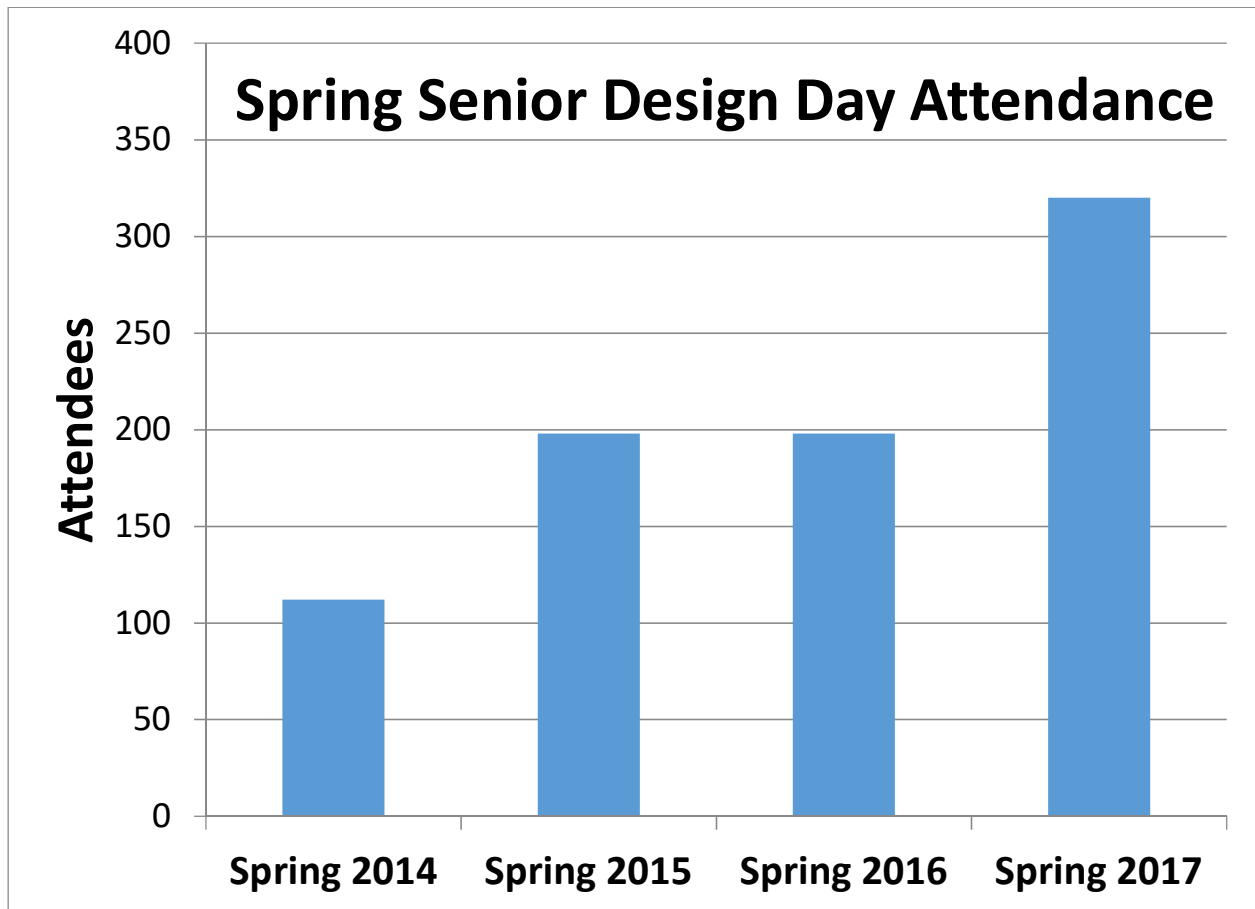


Figure 2: Spring Senior Design Day Fall Overall Attendance

The improving numbers of attendees are an indication of an effective event. The Senior Design Students, Faculty and Staff are required to attend, Figure 3 show the attendance in the spring event of the outside attendees. Those who saw value in the event and voluntarily choose to attend the event.

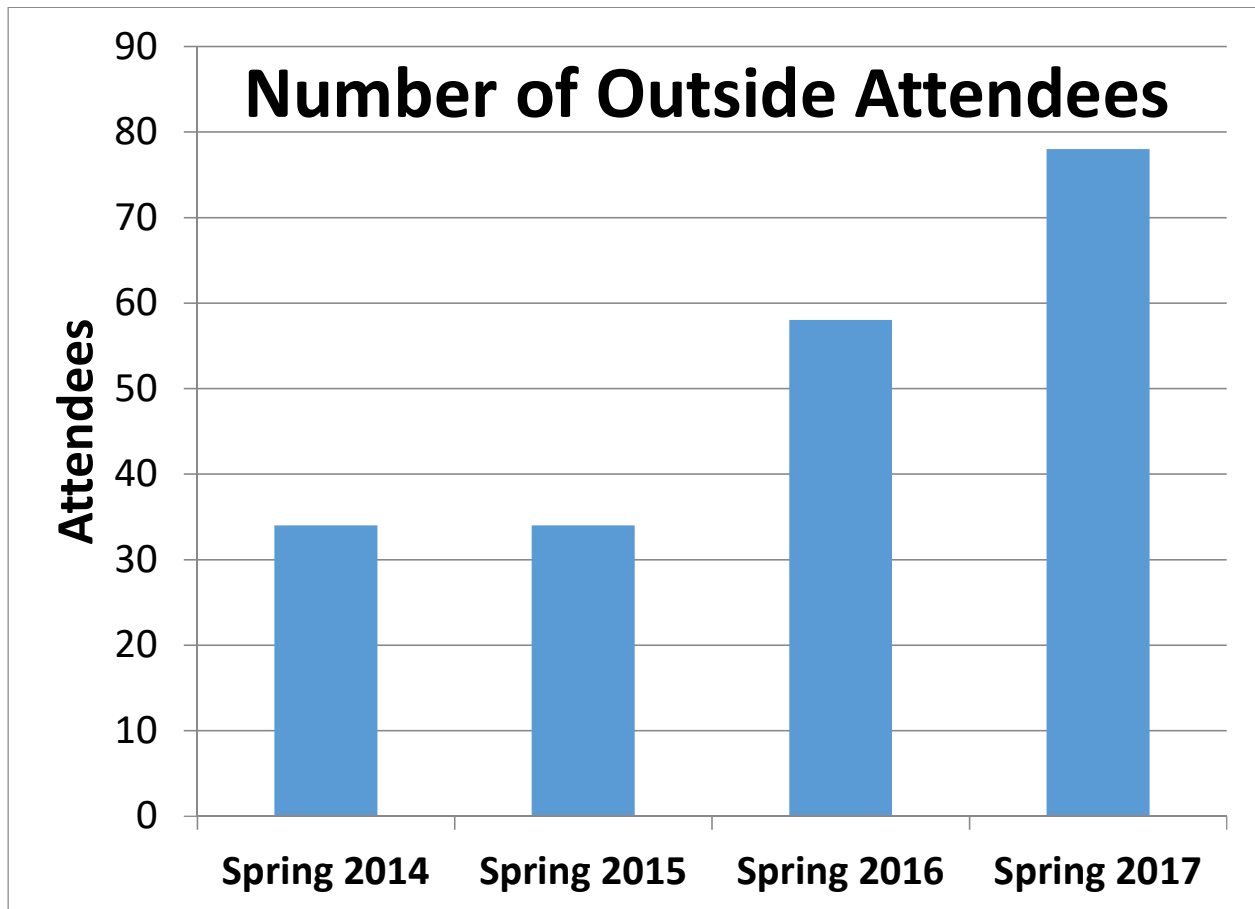


Figure 3: Number of IAB Member, Faculty, Sponsor, Family, & non-SD Students in Attendance  
Corporate sponsors are another indication of success of the event. Starting in 2017 corporation began paid sponsorship of recruiting events at the event as shown in figure 4.

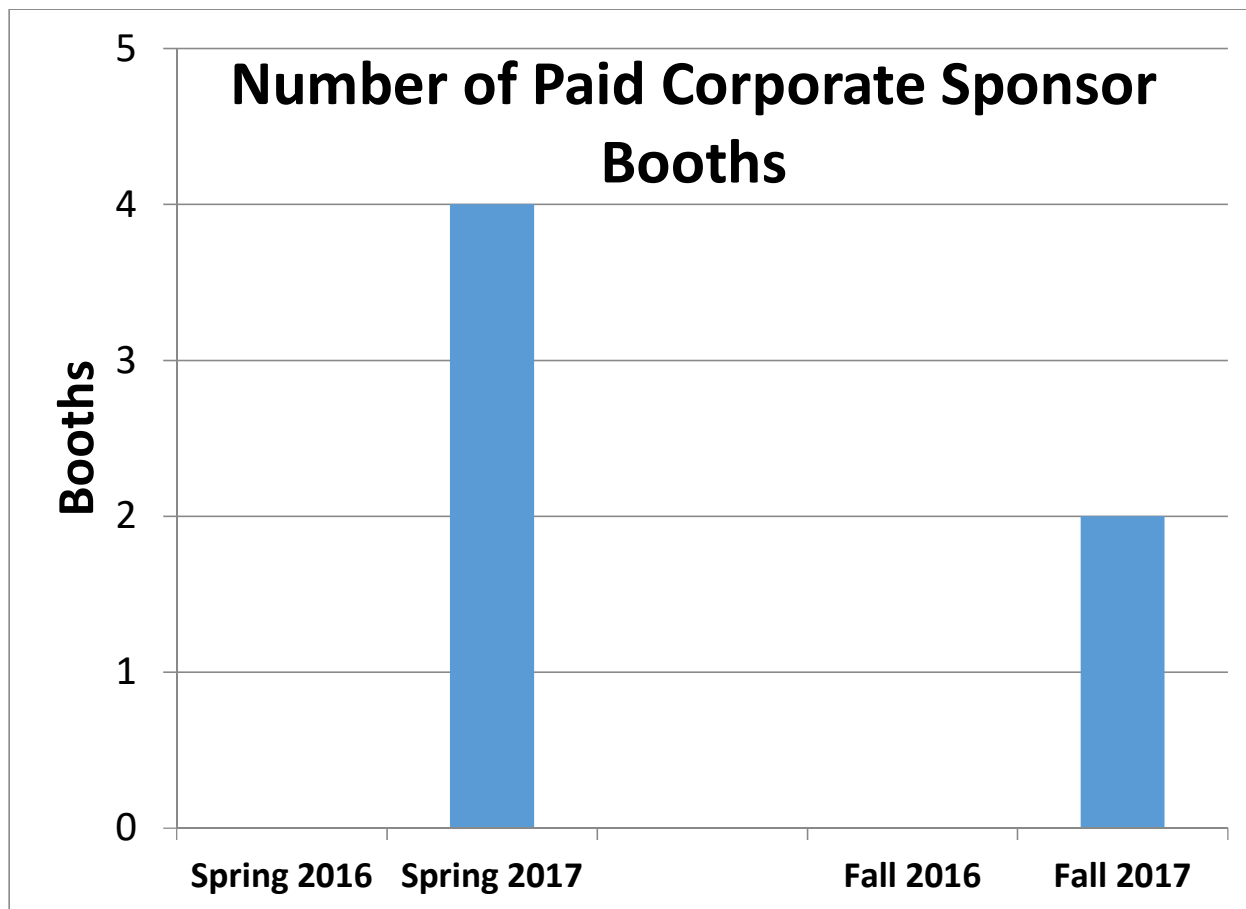


Figure 4: Number of Paid Corporate Sponsored Booths

After the event, a feedback survey goes out to the non-student attendees at the event. Like many surveys the response rate is not as high as desired but interesting comments are given. Representative comments from the survey have given insight into the outside attendee's perspective of the event and the students' work. The following comments give some insight into student presentation skills through the years.

*I believe the students should have a better idea of what to present during the EE short presentations. Some of them did not appear prepared for the presentation. (Spring 2014)*

*The students for the most part appeared to have difficulty speaking in front of a group to give a presentation. Better preparation for presenting needs to be considered. (Fall 2014)*

*While the quality of student presentations improved significantly from the past, there's clearly room for more improvement. (Spring 2015)*

*Projects really continue to improve & impress all who attend! One can tell that the teams are well prepped & prepared - kudos to the faculty advisors (Fall 2017)*

*While some were stronger than others, the students all seemed very ready to present and talk about their projects. Very well done. (Fall 2017)*

The following comments give some insight into the feedback on the event schedule.

*Schedule was rushed - I had a tough time listening to and interviewing 4 teams, I'd like to have done more. These issues aside, I think it was a dramatic improvement over my last senior design day 1 year ago. Congrats. (Spring 2015)*

*The presentations and poster sessions were both very good. The poster sessions allowed us to interact with the students and ask in-depth questions. (fall 2016)*

*It was terrific as usual. The atmosphere seemed better than it has previously (in the poster session area) and I can't say why this was, but it was better. (Spring 17)*

*I liked the half day format - much more efficient than the full day. (Fall 2017 Sponsor)*

For future analysis of this work-in-progress event, better evaluation is need. Targeted methods are required to ascertain whether or not the students are impacted by the event in a positive manner. One final quote from an industry advisory board member gave some general feedback on his interaction with Senior Design Day.

*Senior Design Day is one of the 2 highlights of my year. The other is Senior Design Day. (Fall 16)*

## Conclusions

Overall, the faculty of Texas State University feel that having a unified Senior Design Day for all engineering and engineering technology disciplines has produced positive outcomes. The unified event has allowed students to discuss and interact with a large variety of other students, faculty, and industry on what they are doing for their projects. The event has also helped the Texas State University Ingram School of Engineering Faculty with interactions with industry and university administration. It has been a great way for students not yet enrolled in the capstone course to attend the event and get a better understanding about senior design projects. Goals for the future include an expansion on participation of industry in a networking capacity and greater involvement of graduate students demonstrating their research outcomes.

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