Insights about an academic elevator pitch competition in undergraduate engineering curricula

Mrs. Sandra Furnbach Clavijo PE P.E., Stevens Institute of Technology (School of Engineering and Science)

Sandra Clavijo is the Director of Core Education for the Schaefer School of Engineering & Sciences. She coordinates the instructional delivery, student registration and scheduling logistics and collection of assessment data for all core courses in the undergraduate engineering and science programs. Sandra also teaches Senior Innovation and Introduction to Entrepreneurial Thinking. Sandra previously worked in the Office of Innovation & Entrepreneurship and managed programs encouraging and supporting entrepreneurship around Stevens Campus. Before coming to Stevens, Sandra worked as a consulting engineer with Stantec and T&M Associates specializing in Urban Land Redevelopment and Municipal Engineering. Sandra holds a B.S. Degree in Civil & Environmental Engineering, an A. B. degree in Art History, and a Master of Engineering degree in Engineering Management from Stevens Institute of Technology. She also holds a Professional Engineering license in NJ.

Matthew Wade, Stevens Institute of Technology

Matt is an enthusiastic and proven entrepreneur with 24 years experience focused on inventing and building solutions that generate and strengthen career plans of students, as well as improve retention, graduation rates, and speed to graduation. He is recognized within education circles as standing at the vanguard of the progressive technological movement.

He has taught students, trained corporate salespeople and career coaches, and advised entrepreneurs. His energy, passion, positivity, and attention to detail have served him well in bringing out the best in others.

Dr. Kishore Pochiraju, Stevens Institute of Technology (School of Engineering and Science)

Kishore Pochiraju is the Associate Dean for Undergraduate Education and a Professor in the Mechanical Engineering department at Stevens Institute of Technology. He recently served as the Founding Director of the Innovation, Design and Entrepreneurship Program at Stevens (IDEaS) and prior to that, as the Director of the Design and Manufacturing Institute, a research center at Stevens. Prof. Pochiraju received his Ph.D. in 1993 from Drexel University and joined Stevens after working as a postdoctoral fellow at the University of Delaware. His expertise spans product design, advanced manufacturing, materials insertion, and knowledge-based systems integration. His current externally-funded research is on the design of real-time lightweight robotic systems, high-temperature materials, and micro-/nano-scale devices. He is a member of ASME, ASEE and the American Society for Composites (ASC).

Insights about an academic elevator pitch competition in undergraduate engineering curricula

Introduction

The elevator pitch is an effective and efficient communication tool that entrepreneurs use to quickly sum up and forcefully present the uniquely salient aspects of their products or services, with the sole purpose of engaging with potential investors and raising capital. As such, this "soft" technique is highly desirable for engineers to master in order to rapidly, concisely and clearly convey the engineering value of their projects to prospective investors. A number of universities are already working to embed elevator pitch learning opportunities into their curricula.

At Stevens Institute of Technology, we have established Senior Innovation (SI): a required companion course to the senior design sequence. SI aims to teach students to understand, identify and communicate the essential value in their senior design projects. One of the final outcomes for this course is for every student group to prepare and deliver an elevator pitch for a business based on the respective senior design project. While SI is academic in nature, the top teams from each section of the course have a chance to compete for a $10,000 First Prize in a school-wide competition. This endowed Prize is a strong stimulus for many students who initially may not be particularly enthusiastic about entrepreneurship, to take the elevator pitch competition to heart.

In this paper we will discuss the development process for our elevator pitch competition and the pedagogy behind teaching the skill in the classroom. We will describe how we engage and train invited industry professionals as judges to provide consistent scoring at the semi-final and final stages of the competition. We will present and discuss our semi-final and final competition data from the past two years. These data include our pitch-rubric scoring, along with information about gender and academic discipline factors of team composition. We will show that both women and multidisciplinary teams excel at our elevator pitch competitions. In addition, we will look at the most recent exit survey to correlate the above data with students' perception of their learning.

Motivation

Engineering students take basic classes in writing and communication. However, recent efforts have focused on communicating with broader audiences [1], including actual users of the products/services designed by the engineers, prospective investors who may support the product/service development, and marketing professionals who can direct users' attention to the products/services. A recent study by the U.S. Census Bureau found that only 49% of college engineering graduates work in STEM fields [2]. Other research showed that engineers are more likely to become successful entrepreneurs than their colleagues with MBA degrees but without engineering degrees [3]. Moreover, even if they remain in technical fields, at various stages of their careers engineers must present and explain the value of their intended products/services to professionals of varying backgrounds, including politicians, lawyers, doctors, and accountants, in order to obtain support and funding [4] [5]. Current employers tend to find entrepreneurial thinking and other fundamental business skills beyond core engineering knowledge desirable in

potential new employees. In addition to the development of technical report-writing and data-presentation skills, many universities are working on including elevator pitch training for their students, either through the capstone senior design experience [6] or by implementing dedicated modules in existing classes [7].

The elevator pitch is a highly desirable skill the mastery of which aims to enable the presenter to effectively and concisely communicate, within two to three minutes (the time for an elevator ride), the salient engineering value of products or services, without using any presentation aids. Current large-scale elective business plan competitions can help create and nurture new business ideas but seem to favor investment-ready ideas or already formed companies. While this may be a boost for local economies and venture capital firms, we tend to agree with Bell [8], who mentions that learning opportunities can be lost if the bar is set too high to enter a competition. When a competition is overly selective (or narrow), only a small set of students find a stimulus to learn the importance and benefits of the elevator pitch, much less to expend the considerable effort of actually preparing and refining one. Furthermore, since such competitions are extra-curricular in nature, only a small percentage of undergraduate engineering students elect to participate: engineering coursework does not lend by itself to the practice of elevator pitching, and a crowded curriculum may not allow for engineering students to take business classes at all, or opt into elevator pitch competitions [9].

Thus far, we have found that the University of Rhode Island has introduced an elective course available for engineering students that is similar in nature to the one we offer at Stevens Institute of Technology (Stevens) in that it requires an elevator pitch competition as an outcome of the course. At the University of Rhode Island, the course is part of the Minor program in Engineering Entrepreneurship [10]. Our ultimate goal is to encourage other schools to consider adding required engineering pitch competitions to their engineering curricula, and create more opportunities for their students to master this important communication technique.

Background

In 2008, the Technology Transfer Office at Stevens noted that several patent applications originated from undergraduate senior design engineering projects. Evidently, the students had recognized the novelty of their designs, but had no understanding of the time frame, the financial resources required, or the actual process for bringing their innovative ideas to the market. To seek out promising entrepreneurial students and promote commercialization strategies beyond the classroom, the Technology Transfer Office, supported by the Provost's Office, launched an extracurricular elevator pitch competition. At the time, about ten teams, totaling about 20 students, chose to participate, from among an undergraduate population of approximately 2500. Most of the team members were in fact students who had already established their own businesses outside the school, and very few pitch topics were related to actual senior design projects. A local intellectual property law firm donated the cash prizes: $1,500 for First Prize, $1,000 for Second Prize, and $500 for Third Prize. In addition, participants had access to mentoring from alumni working in the intellectual property domain, and other professionals. Engineering students do not often have the time or ability to focus on a business project outside of their busy engineering. Neither do they have the opportunity, nor the desire, to take additional

business classes [9]. Therefore, at first most students were not particularly interested in this competition.

However, after the successful commercialization of a university-developed medical device, a requirement was instituted in our biomedical engineering (BME) program for students to participate in the competition [11]. Several BME instructors had industry experience and strong links to the medical world and medical-device manufacturers, which helped them prepare their teams. The BME students performed well in the pitch competition because of the guidance provided by these industry professionals, and other external stakeholders, during their senior design project development.

The value of the elevator pitch skill was quickly recognized, and soon, additional engineering programs introduced the requirement for their own students to participate in the competition. Initially, some academic departments lacked the required resources to properly mentor teams for the competition. It was also noted that if the competition were not explicitly required for the engineering senior design sequence, the students would rather not participate. In 2012, a pilot program was initiated to provide training in the technique to all students in the engineering disciplines. The pilot involved a collaborative effort with senior design program coordinators and an entrepreneurship professor from our School of Business, to define and clarify the learning outcomes needed to complement the technical projects. A group of 30 Seniors was used to test new content for teaching the engineering students to understand, identify, and communicate the unique features and value of their senior design projects. Coincidentally, after discussions among all senior design program coordinators, a standard senior design report template and a time frame were developed, which in fact helped launch several additional multi-disciplinary projects [12].

In 2013, the new course Senior Innovation (SI) was unveiled to the entire class of 500 students in the 11 engineering programs. The course was developed in collaboration with the School of Business, and is taught by adjunct instructors with backgrounds in engineering, product development, and entrepreneurship. Student class sections have the same SI instructors for their entire Senior academic year.

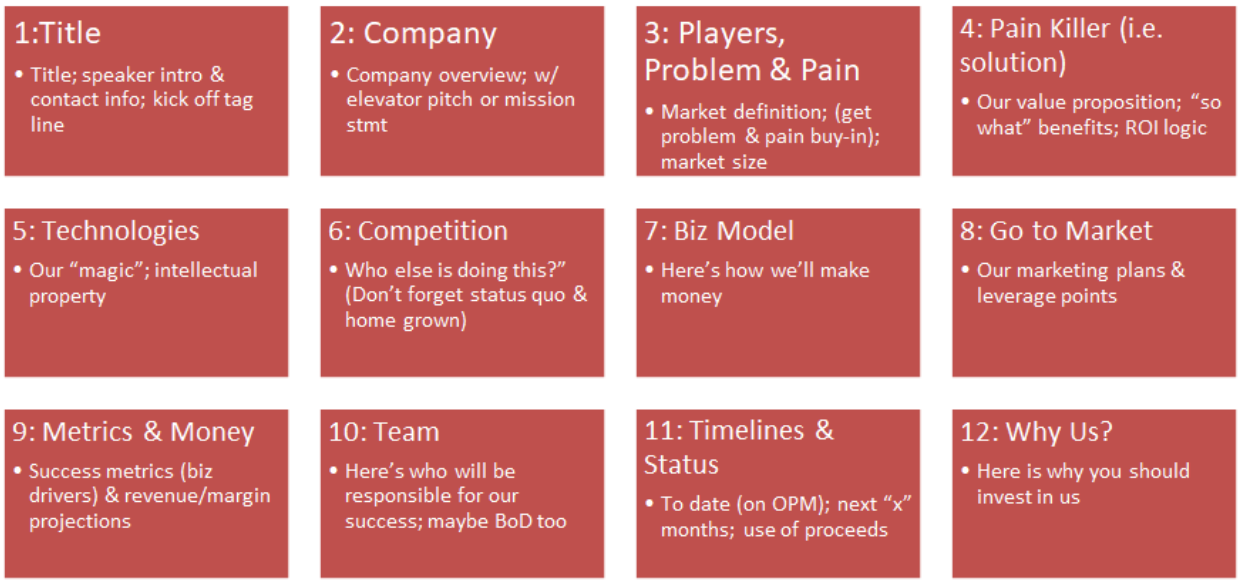
The Elevator Pitch Competition

Since 2013, the elevator pitch competition has been, and currently is, administered through the SI class. Students are placed into SI sections based primarily on their majors. The same teams are maintained as in the senior design sequence, so students can have additional class time together. Between 450 and 500 students are enrolled each year in these classes, and we try to keep the capacity of each section at about 35 students. Typically, there are 6 to 9 teams per section, for a total of 15 sections. Eight to 10 instructors with backgrounds in entrepreneurship, engineering and product development teach one or two sections each. In the two-semester SI course, Senior-level engineering students develop mission statements, interview stakeholders, and prepare Voice of the Customer tables, executive summaries, Value Proposition Canvases [13] and Lean Business Model Canvases [14]. These tools enable students to focus on and refine the components that will eventually become the building blocks of their elevator pitches. In addition, the students attain the following learning outcomes of the course:

- Outcome # 1: Define the business value proposition of a design project
- Outcome # 2: Estimate and identify prospective revenue streams
- Outcome # 3: Analyze the market viability of a given product/service
- Outcome # 4: Develop the basic components of a business plan
- Outcome # 5: Create an effective executive summary
- Outcome # 6: Develop and deliver an effective pitch

We utilize the following model to teach and prepare elevator pitches. It was adapted from an MBA-level entrepreneurship class. Following the model enables students deliver concise, consistent, well-structured and impactful pitches while specifically emphasizing the five items on the judging rubric: presentation, business model, value proposition, desirable amount of funding ("ask"), and viability.

Figure 1: Elevator Pitch Model



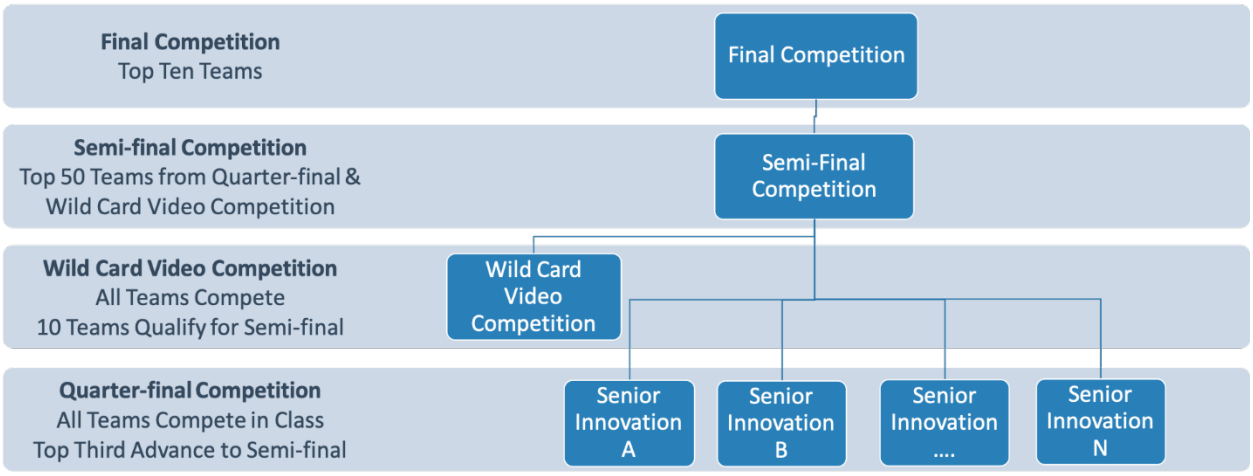
While student teams are given considerable leeway as to how they actually present the information in Figure 1, for a winning pitch, all items should be included and thoroughly addressed. Each instructor in the SI class presents these slides and example pitches from past projects in class and encourages teams to work together during class time. The classroom experience makes use of workshopping topics and allows for instructors to work with all individual teams to develop their pitches.

The elevator pitch competition in our SI program adheres to a three-minute limit, with no presentation aids, visual or otherwise. Students must rely solely on speech and body language to persuasively get their point across. The script for the elevator pitch is a graded class assignment. Student teams submit successive drafts of their elevator pitches for editing in order to converge on the final version. The pitch script is developed as a group assignment; however, each student is graded separately on an *individual* in-class performance of the pitch. This individual grading metric helps ensure that all students have practiced and are thoroughly prepared for the pitch, and therefore have acquired the benefits provided by participating in the competition. Individual

pitches are presented to the whole class, so the audience may provide feedback and suggestions for improvement and help a team decide which team member or members would best represent them in the quarter-final class-wide competition. This activity is very beneficial for shy presenters; it helps those presenters to gain confidence and represent their teams in the competition. It also helps students gain a critical perspective of what to look for in a successful pitch, by observing their classmates' performance and having the opportunity to provide constructive feedback.

The competition period typically spans from the beginning of April through the first week of May. The students begin developing their pitches in the spring semester, so typically eight weeks are dedicated to preparation, revision, enhancement, memorization and rehearsal. The class competition consists of four stages: a quarter-final, a wild-card round, a semi-final and a final (Figure 2).

Figure 2: Elevator Pitch Competition Stages



The quarter-final stage takes place within each SI class section. There are typically between 6-9 teams per SI class section, usually constituted of students in a single engineering discipline. Instructors hold the quarter-final competition in class, and invite their network of contacts and past student participants to help rank and score the teams. The top one-third of teams (two to three) move forward from each SI section to the semi-final competition. In the semi-finals, the equal participation of all majors is ensured since students register for classes according to their primary major.

An additional way to enter the semi-final competition is through the wild card video round, for which students create an online pitch video which they are required to promote to their social network community. We utilize a private YouTube channel to host the videos. All videos are unlisted, so students must use their entrepreneurial drive to obtain votes by reaching out to

friends, family, co-workers, professors, etc. Here is an example at our YouTube site: https://www.youtube.com/playlist?list=PLksm7cGFWhFw1-ZGxJ4E5W-ASvmrcmg6L

The top ten teams with the most "likes" on their wild card YouTube videos also advance to the semi-final competition. This allows very motivated students who may have just missed placement in the quarter-final to gain a spot at the semi-final stage.

The semi-final takes place during the senior design time period but uses external judges that are not affiliated with the respective SI or senior design class. Fifty teams typically compete in the semi-final, so two three-hour sessions are needed to present the three-minute pitches, because each of those is additionally followed by a two-minute question-and-answer period. To keep the scoring consistent, the same judges commit to both sessions. The ten top-scoring teams are promoted to the final stage.

The final stage of the pitch competition is an integral component of our annual Senior Design Project Showcase; the projects are featured in the mobile app specially developed for the event (http://www.stevens.edu/expoapp). We use a different panel of expert judges - prominent alumni and frequently state or local governmental officials. The final stage of the elevator pitch competition is usually the culmination of a very busy and exciting day on campus – the highlight of the academic year – and is attended by faculty, upper-level administrators, trustees, alumni, parents, and other students. The pitch competition typically caps off the day, and a networking reception is held afterwards.

Scoring

In an effort to provide for consistent scoring, we have developed a rubric and implemented it in the past two years to assess the elevator pitch participants' performance at the semi-final and final competition stages. We have elaborated the rubric through a few iterations, and we can state with confidence that it provides for accurate and consistent scoring.

Earlier versions of our scoring system were too narrow, with only 2 scores - one for presentation and the other for business model. The judges would use number cards and hold them up in the air after the pitches. We found this actually produced the best opportunities for photography; on the other hand, many judges felt uneasy holding up anything less than an 8. They felt pressured and didn't wish to be seen as "bad" judges. Consequently, with only using 8, 9 or 10 for a scoring index, the range of results was too narrow, and resulted in many tied scores. Audience guests would tally the scores along with the official scoring officiants, and that would sometimes lead to celebrations mid-competition, when only a few teams were remaining to present.

Our current scoring system is delivered via an online form for judges. We provide tablets, or judges can use their phones or other electronic devices to rank and score the pitches. The scores remain hidden during the competition. With anonymity guaranteed, the judges are unafraid to use the entire range of the scoring card: 1 - 10. The scoring form not only lists the category, but also a small explanation reminder to enable consistent scoring. A score of 10 reflects the highest achievement. The team can get a maximum score of 50. There are five overall categories to evaluate the delivery and content of a pitch.

- Presentation: verbal, non-verbal and ownership of the pitch. A "read straight from the script" situation is valued at the lowest score of 1; on the other end, a true "evangelist" would receive the maximum score of 10.
- Business Plan/Business Model details: no details, a couple of details, some details, most details or all details?
- Value Proposition: the quality of the presenter's stating the uniqueness and prominence of the idea, and how it differentiates itself from its competitors.
- Quality of Ask: Presenters require something from the judges (funding, etc.). Was the ask compelling, reasonable and sensible?
- Viability: Is this a problem worth solving and were the components of the business plan/model the correct and logical choices?

All twelve topics presented in Figure 1 are to be addressed in a pitch, and presented in an interesting, confident and compelling manner. The Business-plan and Business-model details are represented in items 7 and 9, while items 3-6 comprise the Value Proposition. Items 8, 10 and 11 comprise Viability. Items 10 and 12 constitute the Ask.

Judges

We work with several Units/Departments at Stevens to ensure that we can engage highly qualified judges. The President's Office connects us to state officials; the Alumni and Development Offices network us with recent alumni who have developed their own successful businesses; the Venture Center provides links to entrepreneurs-in-residence, who are already well-versed in the university culture, and are invested in successful outcomes. With collaborative efforts, we have established an expansive list of distinguished judges to invite. Since the judging panels for each round are different, we have the flexibility to assign judges to different rounds based on availability as well as diversity in background and expertise. Our panel of respected and successful judges helps raise both the visibility and prominence of the competition.

Engaging different judges and ensuring consistently fair results from year to year requires lengthy interactions prior to the competition. Our competition coordinator conducts phone conferences in which event details are discussed and questions answered. The coordinator meets with the judges once again on the day of the competition. A considerable amount of time is dedicated to familiarizing the judges with the nuances of the senior design and Senior Innovation courses and their learning outcomes. For example, disciplines such as electrical & computer engineering may have a senior design project that is software-based and targets many users, thus making it easier to commercialize than, say, a civil-engineering project focused on repairing a pedestrian bridge. Senior-design projects have different approaches to the final goal when commercial viability is factored in. We have installed bumpers in the scoring criteria to accommodate for this reality. Otherwise, the morale would be diminished among students whose projects are potentially more difficult to commercialize or whose revenues would be much lower than for other types of projects. Such students are at risk of not fully committing to the competition and therefore underperforming. Because of these realities, the "Viability" scoring criterion is explained to judges as a score which doesn't simply evaluate the market size and market potential of a project, but also assesses whether teams have made the best possible decisions *within their business-model canvas*. Questions regarding this criterion include: whether

the students' pitch not only identifies who the early adopters or potential clients for their project would be but whether those were the most *logical*; also, whether the target customer base is correct or the project is directed to an ill-fitting market. Revenue streams may have been identified, but are they sensible? Were any streams missed? By thus positioning the "Viability" criterion, we level the playing field, so notwithstanding the topic of a senior design project, the students' goal is to steer it into the best possible opportunity.

Fully engaged students who feel they have a realistic chance to win comprise a competitive pool of quality presentations and hence provide for a livelier competition.

Additionally, in the days prior to each round of competition, the finalized executive summaries of all teams' business ideas are supplied to the judges. We find that by providing the judges with this background information enables them to make more informed scoring decisions, and keeps students from making too bold claims during the pitch. The executive summaries are part of the course assignments of the SI course, and have already been graded by the class instructors.

All elevator pitches are videotaped at both the semi-final and final rounds of the competition. The videos from the Final are made available, and are used both as a teaching tool for subsequent students and for setting the judges' expectations in later competitions. High-quality videos showcase particularly good projects, and increase the visibility of the program. As student-related media may be of utility to the entire University, video-recording resource costs are generally shared by several administrative Units.

The prize money has always been a strong incentive for students to approach their projects with energy and dedication. The Prizes are awarded during the Senior Awards ceremony, but the winners are determined at the final competition, and big ceremonial checks are presented. The prize amounts have risen steadily through the years due to generous support from alumni and other donors interested in the competition. For the Final competition, the First Prize is now $10,000, the Second Prize $5,000, and the Third Prize $2,500. Additionally, the Development Office has been a steadfast partner in obtaining donations that form the basis of the prize fund. The event provides an opportunity for students, faculty, and college administrators to be photographed with the donors. In 2019, a formal endowment was obtained for the competition, so that the prize money will stay at its current level in perpetuity, without the need for further fund-raising. Such external financial support additionally helps motivate the students to take the competition seriously as they witness the broader impacts of their efforts on the Stevens community.

Findings and Broader Impact

In a previous paper [15] we discussed how the learning objectives of the course are met by all engineering students, even by those majoring in civil and chemical engineering, who mostly work on design projects or externally sponsored ones. Regardless of competition outcome, assessment data confirms that 85 percent of engineering students, and 88 percent of civil engineering students, believe they can identify and communicate value through an elevator pitch after having taken Senior Innovation courses. However, just a good grade in class, doesn't ensure you will win the competition.

Current pitch presentations are assessed by the external judges following the rubric described in the Scoring section. Figure 3 shows the competition data averaged over the past two years at each stage of the competition.

Figure 3. Scoring Data for the Elevator Pitch Competitions of 2019 & 2018

Pitch Components						2019 & 2018	Team Metrics					
Presentation	Business Plan & Model	Value Proposition	Quality of ASK	Viability	Total Score		Selectivity	Total Students Participating	% Multi-disciplinary Teams	Teams with Women Pitching	AVG # of Pitchers	AVG # team members
8.9	8.1	8.1	8.1	7.8	41.1	Winners (6 Teams)	3%	28	50%	66%	2.17	4.67
6.2%	9.7%	7.1%	9.6%	9.0%	8.5%							
8.4	7.4	7.6	7.4	7.2	37.9	Finals (20 Teams)	9%	86	45%	70%	2.35	4.3
7.5%	5.8%	3.3%	6.7%	7.0%	6.2%							
7.8	7.0	7.3	6.9	6.7	35.7	Semi-Finals (96 Teams)	45%	390	14%	48%*	2.48*	4.24

* 2019 data only

The judges scored each component of the rubric as shown on the left-hand side in Figure 3 (in green). Scores were assigned on a one-to-ten scale, with ten being the best. The data presented are the averages for each round. All pitch component scores, and the total score, continually improve at each stage of the competition, which shows that the best teams advance closer to the top, and they perform better in every subsequent round. The percentage values in red show the score increases between rounds: for example, from the semi-final competition to the final competition the overall team scores improved by 6.2 %. Interestingly, the first-place team from 2018 would have outscored both first-place teams of 2019 (which were tied); therefore, we conclude we have reached a solid scoring rubric, sufficiently detailed to allow for unambiguous team performance differentiation. In addition, clearly the judges do not feel compelled to limit themselves to scores between eight and ten.

The detailed scores for the top teams of the past two years are presented in Table 1 and examples of each of the pitch components are explained below:

Year	Result	Team	Pitch Components					
			Presentation	Businss Plan & Model	Value Proposition	Quality of ASK	Viability - Business Outlook	Final Average
2018	1st	OrthoInsight	9.6	8.6	7.9	8.7	8.7	43.4
2018	2nd	MiraView	9.0	8.0	8.0	7.7	8.0	40.7
2018	3rd	ApneAir	8.7	8.6	8.0	7.4	7.0	40.6
2019	1st (tie)	Castle Point Rocketry	9.0	8.0	8.0	8.8	7.1	40.9
2019	1st (tie)	Life Skills	8.3	7.6	8.8	8.1	8.1	40.9
2019	3rd	REDCap Reimagined	9.0	7.6	8.1	7.6	7.9	40.3

Table 1: Scores for 2018 and 2019 Competition Winners

Presentation: Verbal, non-verbal and "ownership" of the pitch. A monotonous, inexpressive presentation that drones on like being read "straight from the script" merits no higher score than 1, and a truly eloquent "evangelist" would receive a score of a 10. The Presentation facet of the pitch is the area where students tend to score the highest, and it levels the playing field for all types of projects: scores average about 7.8 at the Semi-final and 8.4 at the Final, with an ultimate winning score average of 8.9. Frequent technical presentations are required in the engineering curriculum, hence the students already have experience in and adjust well to changing and editing of content to be presented. For example, one of the highest-scoring presentations was delivered by a team of three women. The topic was EVisualize, a design solution providing notification to electric-vehicle owners as to when their cars are fully charged and when chargers are available. Two members of the three-person team offered arguing viewpoints, and the third member acted as a moderator. The team scored a 9.25 for Presentation (https://www.youtube.com/watch?v=YG1RQnEjYYc).

Business Plan / Business Model Details. This aspect of a pitch presentation is scored at 5 levels: no details, a couple of details, some details, most details or all details. The Business Plan & Model item can be somewhat challenging for the students; nonetheless, most teams averaged a score of 7 in the semi-final competition. However, in order to win the competition, a score above 8 must be achieved. ApneAir, the third-place winner in 2018, scored an 8.57, the highest score in the two years under discussion. They planned to license their software to hospitals and also sell disposable sensor devices that measure nasal air flow that could be sold and billed per patient. https://www.youtube.com/watch?v=Bv01-8soIcI&t=191s

Value Proposition: The quality of the presenter's statement about how the idea stands out from among its competitors - its uniqueness and importance. Customers typically purchase goods and services based on value, not on bells and whistles, and based on what a system does, not how it works. The Value concept is a very difficult one for engineers to grasp. Life Skills Software, one of the First Prize winners in 2019, had the highest-value Proposition score (8.75) for the two years of the competition we discuss here. That pitch presentation can be found here: https://www.youtube.com/watch?v=f6pkoB6Lk6I&t=188s

The team developed a platform that gamifies the learning of academic, social and transitional skill sets critical for special-needs students, and provides quantitative data to back up individualized education plans for school administrators. The judges found that this idea is truly unique and provides extreme value for both users and customers.

Quality of Ask: Did the presenters engage and request something from the judges? Was the presentation compelling and did it make sense for their project? Occasionally, teams ask for more than just funding to develop prototypes of their inventions; they also look for partners for licensing deals, or for community advocacy groups to move projects forward. Castle Point Rocketry asked for $2 million dollars for a 30% equity stake in their aerospace start-up company that wants to send small payloads for researchers up into space, they scored an 8.75, the highest over 2 years. https://www.youtube.com/watch?v=KwOnBQE_GAo&t=40s.
In a very non-traditional "ask", EVisualize, pushed for corporate sponsorship and state advocacy for a push in sustainability initiatives, as well as for assistance from marketing and business consultants who would help bridge the gap in their current skill sets. This team was awarded the next-highest average score of 8.63.

Viability: An indicator whether this project can actually move forward. This aspect tends to be the hardest for students to articulate. We asked the judges to decide if the problem assessed is worth solving and whether a team's proposition seems to be a sensible and logical choice to solve a particular problem. Viability also points to the core credibility of the pitch. Has an outsider been convinced that what is being offered is both credible and achievable? Ratings of 6-7 are indeed fair for that category, as these are academically late-stage design projects which will require considerable further development to become market-viable products or services. An example project was OrthoInsight, which was awarded the highest Viability score (8.75) in the two competitions of the past two years, and won First Prize in 2018. A recording of the pitch presentation can be found here: https://www.youtube.com/watch?v=I7mzXPmKVXo.
This was a collaboration project with Johnson & Johnson to develop the framework for a knee-replacement implant with an embedded sensor system, and a companion application to encourage patient proactivity and provide insightful historical data so that patients, surgeons and physical therapists can make better decisions. Students pointedly articulated that the interest they received from Johnson & Johnson to move the product forward was a clear indication of viability.

Metrics: On the right-hand side of the chart in Figure 3 are some metrics about the various project teams and students who participate in the competition. The selectivity to reach the semi-finals by winning either the quarter-finals or the wild-card competition is 45%. To rise to the final stage of the competition, teams have about 9% chance. Only 3% of all teams, a total of 28 students in the past two years, won a top Prize.

We wished to establish whether the number of presenters per team had an effect on pitch success. We observed a trend in recent years that having more than one person represent the team lessened the memorization load per team member. The typical pitch, where one person represents the team, can still be very effective in providing a consistent story, as demonstrated by

the second elevator pitch winner of 2019, Castle Point Rocketry (see https://www.youtube.com/watch?v=KwOnBQE_GAo).

Some students choose to use two presenting team members, one focusing on the unique value proposition and the business model aspects, the other on the viability and ask to the judges. Yet other groups used three team members, each separately tackling the potential of the problem, the value of the solution, and the viability and further steps. Examples of those include the previously mentioned OrthoInsight and EVisualize. There does not seem to be a single best method of how to win the competition, since two teams were tied for the first place this year: one with a single presenter, the other with a two-person pitching team, while the previous year the first-prize pitch was delivered by three persons.

We also tracked the student majors in each team in the semi-final competitions in the past two years. Our data concur with those of Hotaling et al. [16] that multi-disciplinary capstone design projects have better outcomes than those of teams from a single program. We found that only 14% of the teams in the semi-final competition were composed of members from different engineering majors. However, we found that 50% of the winning teams were multi-disciplinary.

We were further interested to establish whether senior design team size would vary significantly and determine whether this contributed to elevator pitch success. Team size is only slightly variable by department, but multidisciplinary teams tend to be larger by nature. It is not surprising that the team size increases as the competition pool gets smaller. We did not see a significance influence on performance in the Elevator Pitch competition.

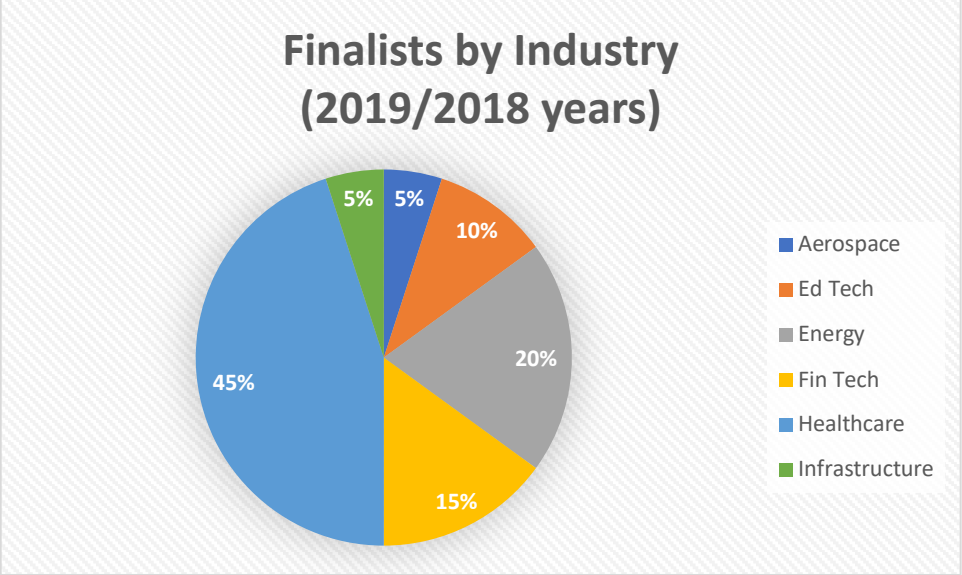
In addition, we wanted to determine whether our elevator pitch competition was equitable to female students. Women in STEM fields all too frequently experience gender disparities in their careers [17], and women who pitch for funding are less likely to obtain it from venture capital entities [18]. Stevens has about 28% women in its undergraduate engineering & science programs. At the semi-final level of the pitch competition, however, women comprise almost 48% of the team membership. Women had a greater chance of pitching at the final stage before a live audience, with 70 % of the top teams having women presenters and 66% of all winning teams in the past two years being represented by women.

The elevator pitch competition is intended to be academic in nature, i.e., we wish the students to learn how to prepare and deliver an effective pitch presentation because of the inherent value of the skill. Interestingly, despite that the pitch presentation serves primarily an academic purpose, we found that many students in fact proceeded to establish businesses based on their pitches, which they had not originally intended to do, or they participated in further competitions such as the Collegiate Inventors Competition [19] and the GIX Innovation Competition [20]. Of the 6 teams that have placed in the past two years, 4 have advanced their pitched ideas towards commercialization.

One of the limitations of the pitch competition is that judges can be swayed by the perceived impact of a project: one which could potentially impact human lives or cure diseases may score better than another that would aim at providing security, comfort, or luxury. Health-related projects seem to dominate the competition, as shown in Figure 3. Many Departments beyond the

Biomedical Engineering department (BME) work on projects related to healthcare or public health, so a diversity of majors represented in the final competition is maintained, with only 44% of the healthcare projects currently originating from the BME Department. However, some of our students feel their projects cannot compete with projects that save lives. Students typically have limited understanding of business models when entering their Senior year, so it takes a substantial amount of time and plenty of examples to encourage e.g. civil engineering or chemical engineering teams that they can perform on par with BME majors in the pitch competition. Prominent examples to the contrary are available, however: in 2015, a civil engineering team won a top prize for a structural-health bridge-monitoring sensor system, and in 2016, a chemical engineering team won for a novel process to reuse spent uranium for energy production.

Figure 4: Competition Finalists by Industry



Occasionally, a team that reaches the final round does not have a strong technical project. This tends to cause unrest among senior design program coordinators, who feel that predominantly technical projects should advance in the competition. If, however, the students develop a strong business model, demonstrate the market and market potential, deliver a stellar pitch, and convince the judges of the viability of the business, all involved in the competition are pleased. In addition, there are many other technical Senior awards that students can receive through their respective Departments.

Lastly, the skills developed for the pitch competition gains distinction for our engineering graduates on the job market. Students report that they have used their pitch or parts thereof at job interviews and for graduate school applications to succinctly describe their senior design projects. While we cannot attribute this solely to the elevator pitch competitions, the recent Class of 2019 career outcomes indicated that 93% of the engineering undergraduate students either found employment (69%) with average salaries of $74,500 or entered graduate school (24%).

Additionally, our Exit Survey asks the students some questions about their education experience. Seventy-eight percent of students surveyed agreed, or strongly agreed, that their education has provided them with the ability to communicate effectively and persuasively. Seventy-three percent of students agreed, or strongly agreed, that their education has provided them the fundamental knowledge and an appreciation of the technology and business processes necessary to nurture new technology from concept to commercialization.

Concluding remarks

The pitch presentation as a communication technique is an effective tool in the arsenal of entrepreneurial thinking. Considerable work, preparation and motivation are required to deliver an effective and persuasive presentation of this kind. At Stevens we have developed a companion course to the senior design sequence that involves a required participation in a pitch competition, involving prizes of considerable monetary value that are externally endowed in perpetuity. We have found that the format of our pitch presentation is well-structured, with both internal and external validation. The engineering teams select their best pitcher(s) to represent them. Instructors select the best teams to advance to a school-wide competition outside the classroom. External judges, mostly entrepreneurs and intrapreneurs, then select the winners at both the semi-final and final levels of the competition, using robust and well-tested scoring methodology.

Teams cannot win simply by presenting their work. They must have a clearly articulated *value proposition*, *business model* and *plan for viability*. A team must score high marks in all aspects of their pitch to take home a prize. Having well-trained judges is key to an equitable competition. Because real money is at stake, it is important that the judges remain impartial and consistent to avoid unease and dissatisfaction a few days prior to graduation.

A competition on this scale can truly benefit from collaboration and support from other administrative units at the University. Business-school colleagues can provide curriculum support and potential instructors to teach the content of the course in an academic setting. The Alumni Office is a potential resource both to recruit alumni as high-quality judges and to rally financial support for accumulating attractive prize pools. The Marketing and Communications units can provide the resources to create media tools to use as teaching aids for students and training aids for judges, and for the general promotion of advertisement packages for the event and the university as a whole. We have had a First-Prize videos from 2013 reach over 8900 views to date: https://www.youtube.com/watch?v=A4ahYj2je1Y&t=2s

Women engineers tend to perform very well in pitch competitions, successfully representing teams that win prizes in the final competition. Retaining and cultivating women in the STEM fields continues to remain the focus of strenuous efforts at many engineering schools, including ours. Our data strongly support the notion that a required elevator pitch competition is a good opportunity for female students to be role models in the engineering fields, which can be a particularly good stimulus to combat the high attrition of women in engineering programs and careers [21]. Any opportunity to create confidence can inspire further generations of women to pursue careers in engineering and entrepreneurship [22].

Works Cited

[1] E. A. Commission, "CRITERIA FOR ACCREDITING ENGINEERING PROGRAMS: 2016-2017 Criteria for Accrediting Engineering Programs," ABET, Baltimore, MD, 2015.

[2] L. C. Landivar, "The Relationship Between Science and Engineering Education and Employment in STEM Occupations," *American Community Survey Reports,* Vols. ASC-23, 2013.

[3] T. Keller, "New Research Shows Engineers Far More Likely Than MBAs to Start, Run Companies," Business Wire, 31 January 2012. [Online]. Available: https://www.businesswire.com/news/home/20120131006303/en/New%C2%A0Research-Shows-Engineers-MBAs-Start-Run%C2%A0Companies. [Accessed 4 January 2020].

[4] M. Miceli, "Say What?: The Importance of Effective Communication in Engineering," *JOM,* vol. 63, no. 12, p. 25, December 2011.

[5] National Academy of Engineering, The Engineer of 2020 : Visions of Engineering in the New Century, Washington, D.C.: National Academies Press, 2004.

[6] K. C. Davis and F. R. Beyette Jr., "Developing and Assessing Elevator Pitches in Capstone Design," in *ASEE Annual Conference*, Columbus, Ohio, 2017.

[7] University of New Haven, "KEEN: Fostering an entrepreneurial mindset through integrated e-learning modules," [Online]. Available: https://www.newhaven.edu/engineering/kern-entrepreneurial-engineering-network/elearning-modules/. [Accessed 2 January 2020].

[8] J. Bell, "Student business plan competitions: who really does have access?," in *Proceedings of the 34th Annual Conference of the Small Business Institute®.*, Albuquerque, New Mexico, Winter 2010.

[9] C. E., S. Gilmartin, Q. Jin, C. Dungs and S. Sheppard, "Business Program Participation and Engineering Innovation: An Exploration of Engineering Students' Minors, Certificates, and Concentrations," Winter 2017. [Online]. Available: http://jeenonline.com/Vol8/Num1/Paper_3_web.pdf. [Accessed January 2018].

[10] N. Nachbar, "The University of Rhode Island, College of Engineeirng," 20 December 2019. [Online]. Available: https://web.uri.edu/innovate/engineering-entrepreneurship-course-culminates-in-pitch-competition/. [Accessed March 2020].

[11] V. Hazelwood, A. Valdevit and A. Ritter, "A Model for a Biomedical Engineering Senior Design Capstone Course, with Assessment Tools to Satisfy ABET “Soft Skills”," in *Capstone Design Conference*, Boulder, CO, 2010.

[12] S. Clavijo, A. Choma, T. Lechler, K. Sheppard, C. Christodoulatos and K. Pochiraju, "Integrating entrepreneurial thinking concurrently with capstone senior design experiences in engineering curricula.," in *International Council of Small Business*, Buenos Aires, Argentina, 2017.

[13] A. Osterwalder, "Strategyzer," [Online]. Available: https://www.strategyzer.com/canvas/value-proposition-canvas. [Accessed 3 February 2020].

[14] A. Maurya, "https://canvanizer.com/new/lean-canvas," [Online]. Available: Canvanizer. [Accessed 3 February 2020].

[15] S. Clavijo, B. Leslie, K. Sheppard and K. Pochiraju, "Teaching Entrepreneurial Thinking through a Companion Course for all types of Capstone Senior Design Projects," in *ASEE Annual Conference*, Salt Lake City, 2018.

[16] N. Hotaling, B. Burkes Fasse, L. F. Bost, C. D. Herman and C. R. Forest, "A Quantitative Analysis of the Effects of a Multidisciplinary Engineering Capstone Design Course," *Journal of Engineering Education,* vol. 101, no. 4, pp. 630-656, October 2012.

[17] C. Funk and K. Parker, "Women in STEM see more gender disparities at work, especially those in computer jobs, majority-male workplaces," in *Women and Men in STEM Often at Odds Over Workplace Equity*, Washington, DC, Pew Research Center , 2018, pp. 55-71.

[18] L. Balachandra, A. R. Briggs, K. Eddleston and C. Brush, "PITCH LIKE A MAN: GENDER STEREOTYPES AND ENTREPRENEUR PITCH SUCCESS," *Frontiers of Entrepreneurship Research,* vol. 33, no. 8, June 2013.

[19] National Inventors Hall of Fame, "Collegiate Inventors Competition," [Online]. Available: https://www.invent.org/collegiate-inventors. [Accessed 3 February 2020].

[20] University of Washington and Tsinghua University, "Global Innovation Exchange (GIX)," [Online]. Available: https://gixnetwork.org/. [Accessed 3 February 2020].

[21] S. D. Herrman, R. M. Adelman, J. E. Bodford, O. Graudejus, M. A. Okun and V. S. Y. Kwan, " to date 19 Altmetric Original Articles The Effects of a Female Role Model on Academic Performance and Persistence of Women in STEM Courses," *Basic and Applied Social Physchology,* vol. 38, no. 5, pp. 258-268, 2016.

[22] E. Litzler, C. C. Samuelson and J. A. Lorah, "Breaking it Down: Engineering Student STEM Confidence at the Intersection of Race/Ethnicity and Gender," *Research in Higher Education,* vol. 55, no. 8, pp. 810-832, 2014.