# Impact of an I-Corps Site Program on Engineering Students at a Large Southwestern University: Year 3

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Magda Lagoudas, Executive Director for Industry & Nonprofit Partnerships, has been at Texas A&M University since 1992 and served on several capacities across the College of Engineering, including Director for the Space Engineering Institute and Associate Director for the Space Engineering Research Center. Current responsibilities include pursuing strategic partnerships with industry to provide engineering students with opportunities to collaborate on multidisciplinary teams addressing real world challenges and with industry engagement. College signature programs include the Texas A&M I-Corps Site, AggiE_Challenge, INSPIRES, and two annual Project Showcases. Magda is the Principal Investigator of the Texas A&M University I-Corps Site grant and has been active in promoting entrepreneurship both at the local and national level.

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**Mr. Rodney Boehm, Texas A&M University College of Engineering**

Rodney Boehm is the Director of Engineering Entrepreneurship and an Associate Professor of Practice in the Texas A&M University College of Engineering. He has broad industry experiences, including over 35 years in all aspects of the telecommunications industry (sales, marketing, manufacturing, business development, and technical design), the creation of a telecommunications standard (SONET - Synchronous Optical Network) for the fiber optics industry that is still in use internationally over 30 years later, a wide variety of business experiences in international companies, and startup experiences. This has helped him lead a very successful industry career.

Currently he is using his technical business experiences to develop and run innovation and entrepreneurial programs for the Engineering Innovation Center, a 20,000 sq ft rapid prototyping facility. These include Aggies Invent, TAMU iSITE, Inventeer, and Pop Up Classes. In addition, he mentors multiple entrepreneurial teams.

Formerly he was a Senior Vice President of Fujitsu Network Communications, headquartered in Richardson, Texas. With over 30 years of experience in telecommunications, Rodney was responsible for developing partnerships with leading network technology providers and driving marketing efforts for optical, access and data products developed by Fujitsu. Rodney was Chairman of the T1X1 Technical Sub-Committee (the organization responsible for SONET standardization) from 1990 through 1994. He has been active in SONET's National and International Standardization since 1985. In addition, Rodney has published numerous papers and presentations on SONET.

Rodney began his career with Fujitsu Network Communications in 1989 as the Director of Strategic Planning. He also held the positions of Director of Transport Product Planning, Vice President of Business Management, Senior Vice President of Sales Management, Senior Vice President of Manufacturing, and Senior Vice President of Business Development. Before joining Fujitsu, Rodney worked for Bell Laboratories, Bellcore (now Telcordia), and Rockwell International. He earned both his bachelor's and master's degrees in electrical engineering at Texas A&M University.

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Samantha Asbell is a graduate student at Texas A&M University currently pursuing her Masters of Science in Business. She received her undergraduate degree in Communication at Texas A&M. Following a research internship with the department of communication, Samantha applied for a role with the College of Engineering as an assistant for the I-Corps Site program. Samantha has a continuing interest in research as well as digital and marketing communications.

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## Abstract

In today's global market economy, equipping engineering students with a broader set of skills associated with an entrepreneurial mindset will empower them to create value for the companies they join or to launch their own startups. In recent years, institutions across the nation have been investing resources in developing maker spaces plus curricular and extracurricular programs to provide opportunities for students to acquire knowledge and skills, and pursue innovative ideas in a safe environment – while still in college. This study presented assessment data from a NSF I-Corps site program at a Southwestern university to understand the impact of the program on undergraduate and graduate engineering students' knowledge, perceptions, and practice of entrepreneurship. In the four-cohort assessment data, participants indicated significantly increased confidence in value proposition, self-efficacy in entrepreneurship, and customer discovery, while maintaining high interest in entrepreneurship. Furthermore, the data indicated that participants with a GO decision (to continue pursuing their technology) had significantly higher perception on the current status of technology and business model than did participants with a no-GO/unsure decision. In addition, this study presented a new pilot program to be offered in spring 2020 and aimed to further enhance the I-Corps Site efforts on campus for broader impacts.


## I. Introduction

### A. Program Overview

In February of 2017, the National Science Foundation awarded a large Southwestern university a total of $500K for an I-Corps Site Type I program. The program targets engineering students, both undergraduate and graduate, who are pursuing innovative ideas where the intellectual property belongs to student themselves or to the university. The program provides six weeks of training, connects students with mentors, and grants travel funds to allow and encourage students to pursue customer discovery beyond the campus and the local community. While the program is targeting engineering students, the program is open to other STEM majors on campus.

The program objectives are:

- Offer a comprehensive 6-week program three times per year (fall/spring/summer)
- Increase the number of engineering students, and in particular females and
- racial/ethnic minorities, gaining knowledge and skills on entrepreneurial mindset
- Increase the number of teams pursuing funding to support prototype development
- Increase the number of qualified teams pursuing the national NSF I-Corps program
- Enhance current network of innovation/entrepreneurship to support student or student/faculty led ventures.

The six-week program has been offered every semester since summer 2017 and a total of 72 teams ($n$ = 128) participated in the program until fall 2019. Overall, program participants represent diversity in gender (29% females), ethnicity (14.6%% Hispanics & 4.5% Blacks),

majors (with 10 or more majors), and classification (from freshman to graduate students) as shown in Figures 1 through 4 below.

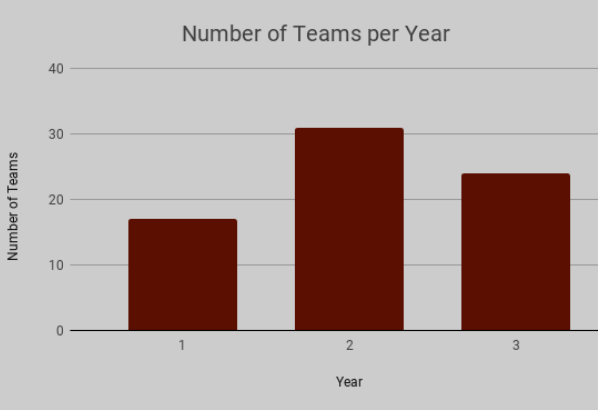


Figure 1. Number of Teams Per Year

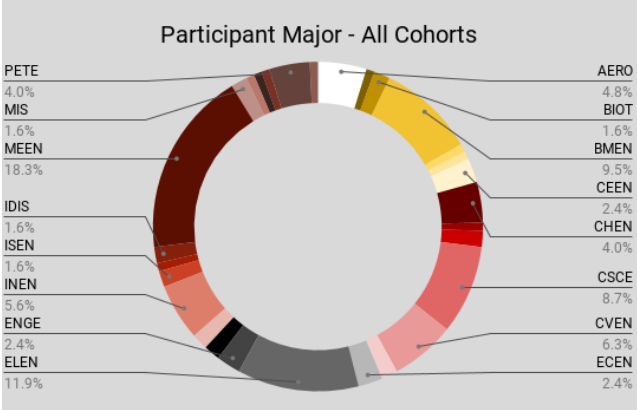


Figure 2. Participant Major Distributions (All Cohorts)

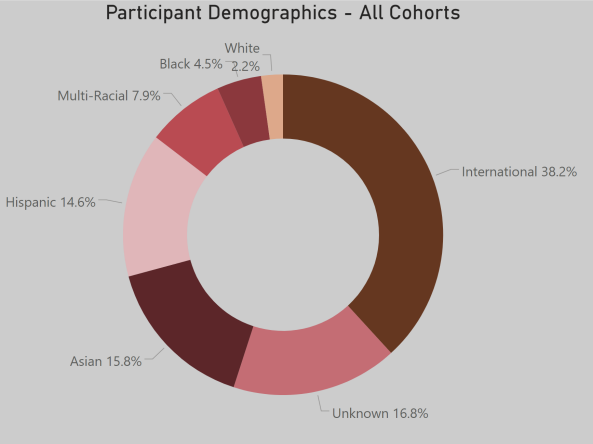


Figure 3. Ethnicity Demographics (All Cohorts)

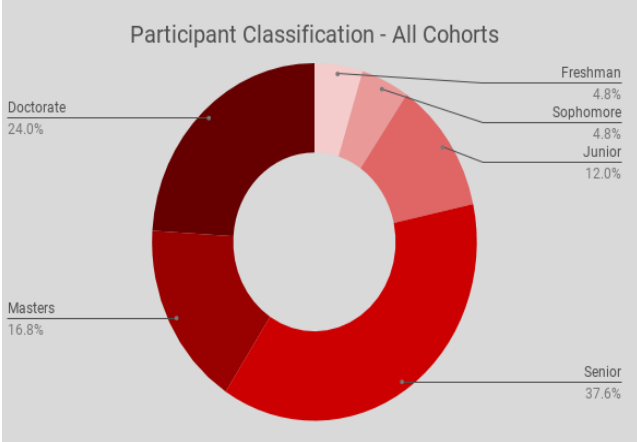


Figure 4. Classification (All Cohorts)

After a pilot study in spring 2018, as one way to evaluate the program, the I-Corps Site program has implemented pre-post surveys to understand the impact of the program on student changes in their knowledge, perceptions, and practice of entrepreneurship as aligned with the program goals since summer 2018 [1].Therefore, using the survey data, this study aimed to share findings from the formative evaluation of the programs with the engineering entrepreneurship education community.

## B. Purpose of the Study

This study focused on the investigation of the impact of the programs on student knowledge, perceptions, and practice of entrepreneurship, with the following research questions.

- How does the program affect student perceptions of entrepreneurship?
- How does the effect of the program on student perceptions of entrepreneurship differ by student gender (female vs. male), diversity (minority vs. majority), residency (domestic vs. international), and student level (undergraduate vs. graduate)?
- How do student perceptions of entrepreneurship relate to their go/no-go decision?

- How do students evaluate the learning environment and course of the program?

## II. Method

### A. Participants

During 2018 and 2019, 62 out of 64 participants of the Site program cohorts 4 to 7 at the university responded to at least one of the online pre- and post- surveys utilized to assess the effects of the program. Table 1 shows the demographic characteristics of the 62 respondents (97%). Among them, 39 students (61%) responded to both online pre- and post- surveys. Interestingly, undergraduate students were 35 (90%) out of 39 domestic students, while graduate students were 19 (83%) out of 23 international students. Majority of students were engineering majors, except two students in economics.

Table 1. *Demographic Characteristics of the Participants*

| Category | Total | | Pre-Post Survey Respondents | |
|---|---|---|---|---|
| | *N* | *%* | *n* | *%* |
| Gender | | | | |
| Female | 17 | 27.4 | 10 | 25.6 |
| Male | 45 | 72.6 | 29 | 74.4 |
| Residence | | | | |
| Domestic | 39 | 62.9 | 24 | 61.5 |
| International | 23 | 37.1 | 15 | 38.5 |
| Race/Ethnicity[a] | | | | |
| Hispanic | 9 | 14.5 | 4 | 10.3 |
| Asian | 5 | 8.1 | 2 | 5.1 |
| Black | 4 | 6.5 | 4 | 10.3 |
| White | 19 | 30.6 | 13 | 33.3 |
| Multiracial | 2 | 3.2 | 1 | 2.6 |
| Track | | | | |
| Undergraduate | 39 | 62.9 | 24 | 61.5 |
| Graduate | 23 | 37.1 | 15 | 38.5 |
| Major | | | | |
| Aerospace Engineering | 4 | 6.5 | 4 | 10.3 |
| Biomedical Engineering | 6 | 9.7 | 5 | 12.8 |
| Chemical Engineering | 2 | 3.2 | 2 | 5.1 |
| Civil Engineering | 7 | 11.3 | 5 | 12.8 |
| Computer Science | 4 | 6.5 | 3 | 7.7 |
| Electrical and Computer Engineering | 7 | 11.3 | 4 | 10.3 |
| Industrial and Systems Engineering | 7 | 11.3 | 5 | 12.8 |
| Mechanical Engineering | 8 | 12.9 | 6 | 15.4 |
| Total | 62 | 100.0 | 39 | 100.0 |

*Note*. [a]Race/Ethnicity was categorized for domestic students only.

**B. Measures**

Referring a number of assessment instruments for entrepreneurial mindsets (e.g., [2]), online pre- and post- surveys were developed and utilized as formative assessments to evaluate the effects of the program on students in this study. The online survey consists of four sections for the pre-survey and five sections for the post-survey: (a) current knowledge, (b) a scale on perceptions of entrepreneurship, (c) practice, (d) team and business model, and (e) program evaluation (post-survey only).

Among those several sections, this study only utilized the data from perceptions of entrepreneurship on the scale and practice of customer interview skills captured in open-ended questions. As shown in Table 2, the scale was designed to assess student perceptions of the six constructs indicated by 33 items: (1) interest in entrepreneurship, (2) confidence in value proposition, (3) self-efficacy in entrepreneurship, (4) self-efficacy in marketing/business planning, (5) self-efficacy in customer interview skills, and (6) current status of technology and business model. As an attribute-focused approach [3], we first identified the five constructs on entrepreneurship mindset that aligned with the Site program goals. Then, the items for each construct were generated by adopting items from the existing scales or constructing new items through the literature review [2], [4]. Students' responses were scaled on the seven-point Likert-type choices (1 = strongly disagree to 7 = strongly disagree). As reported in the previous study [1] the internal consistency reliability coefficients ranged from Cronbach's $\alpha = 0.867$ to 0.932 with the overall Cronbach's alpha = 0.951 ($n = 61$), which indicates good reliability evidence of the scale [5].

Table 2. *Definitions and Reliability Evidence of the Constructs on the Perceptions of Entrepreneurship Scale*

| Construct | Definition | No. of Items | Cronbach's $\alpha$ |
|---|---|---|---|
| Interest in Entrepreneurship | Students' interest in general aspects of entrepreneurship, including learning of entrepreneurship and being entrepreneur. (e.g., I have a general interest in the subject of entrepreneurship.) | 6 | 0.928 |
| Confidence in Value Proposition | Students' confidence in identification of value propositioning through identification of value proposition, customer discovery and exploration of product-market fit (e.g., I am confident in defining an effective value proposition for my next idea.) | 3 | 0.932 |
| Self-efficacy in Entrepreneurship | Students' personal belief in their ability to conduct entrepreneurship, taking various actions to set up business. (e.g., I can recognize when an idea is good enough to support a major business venture.) | 8 | 0.900 |
| Self-efficacy in Marketing/ Business Planning | Students' personal belief in their ability to plan on marketing and businesses, taking actions for market and business research and operation. (e.g., I can follow | 6 | 0.896 |

| | | | |
|---|---|---|---|
| | the steps needed to place a financial value on a new business venture.) | | |
| Self-efficacy in Customer Interview Skills. | Students' personal belief in their skills to conduct interview with customers to gather their constructive opinions on students' entrepreneurship activities. (e.g., I can develop interview questions, which allow me to collect qualitative and relevant data.) | 4 | 0.867 |
| Current status of technology and business model | Students' personal belief in the readiness of their technology, its market validation for a viable commercialization, and business model. | 6 | 0.881 ($n$ = 59) |
| Total | | 33 | .930 |

*Note.* The internal consistency reliability coefficient, Cronbach's $\alpha$ was calculated from the data who responded the scale items on either pre- or post-survey ($n$ = 61).

### C. Data Analysis

First, descriptive analyses were conducted for student responses on the scale items to identify any trends in the data and outliers. Second, after checking assumptions, inferential statistics including paired sample *t*-tests, independent samples *t*-tests, and analyses of covariance (ANCOVAs) were utilized to answer the research questions [5]. For example, the paired sample *t*-tests, were used to explore changes in participants' scores on perceptions of entrepreneurship on the scale before and after the program. The independent samples *t*-tests were used to explore any differences on student perceptions of entrepreneurship by their final decisions on go/no-go for their future plans. The analyses of covariance (ANCOVAs), considering pre-scores as covariate, were conducted for subgroup analyses, exploring any differences by subgroups. We also reported effect sizes, such as Cohen's *d* and Partial $\eta^2$ [6].

## III. Results

### A. Changes on Student Perceptions of Entrepreneurship

Table 3 shows paired sample *t*-statistics of the knowledge test scores and perceptions of entrepreneurship, such as interest in entrepreneurship, confidence in value position, and self-efficacy in entrepreneurship, marketing/business planning, customer interview skills, and perception of current status of technology and business model, on the pre- and post-measures.

Table 3. *Pre-post Changes in Student Perceptions of Entrepreneurship*

| Perceptions | *n* | Pre | | Post | | Paired sample *t*-test | | | | Correlation | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *M* | *SD* | *M* | *SD* | *t* | *df* | *P* | *D* | *R* | *P* |
| Interest in Entrepreneurship | 39 | 6.11 | 1.18 | 6.10 | 1.06 | -0.08 | 38 | 0.939 | -0.01 | 0.812 | < 0.001 |
| Confidence in Value Proposition | 39 | 5.42 | 1.35 | 6.20 | 0.79 | 3.56 | 38 | < 0.001 | 0.69 | 0.278 | 0.087 |
| Self-Efficacy in Entrepreneurship | 39 | 5.30 | 0.89 | 5.68 | 0.70 | 2.85 | 38 | 0.007 | 0.42 | 0.481 | 0.002 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Self-Efficacy in Marketing/ Business Planning | 39 | 4.35 | 1.21 | 4.93 | 0.98 | 3.31 | 38 | 0.002 | 0.52 | 0.511 | 0.001 |
| Self-Efficacy in Customer Interview Skills | 39 | 5.37 | 1.07 | 6.36 | 0.72 | 6.09 | 38 | < 0.001 | 1.06 | 0.411 | 0.009 |
| Current status of technology and business model | 36 | 3.94 | 1.01 | 5.07 | 0.86 | 5.09 | 35 | < 0.001 | 1.20 | -0.006 | 0.972 |

Note. *d* = Cohens' *d* for a paired sample difference

Similar to the previous study using two cohorts' data [1] the paired sample *t*-tests revealed no statistically significant changes between pre- and post-scores of student interest in entrepreneurship. However, there were significant changes in student perceptions of confidence in value proposition, self-efficacy in entrepreneurship, marketing/business planning, customer interview skills, and current status of technology and business model. They all increased with medium to large effect sizes ranging from Cohen's $d = 0.42$ to 1.20. Particularly, the effects of the improvement were large on self-efficacy in customer interview skills and perception of current status of technology and business model. Figure 5 delineates the changes in the perceptions of interests, confidence, self-efficacy on entrepreneurship, and personal belief on current status of technology and business model with 95% confidence intervals.

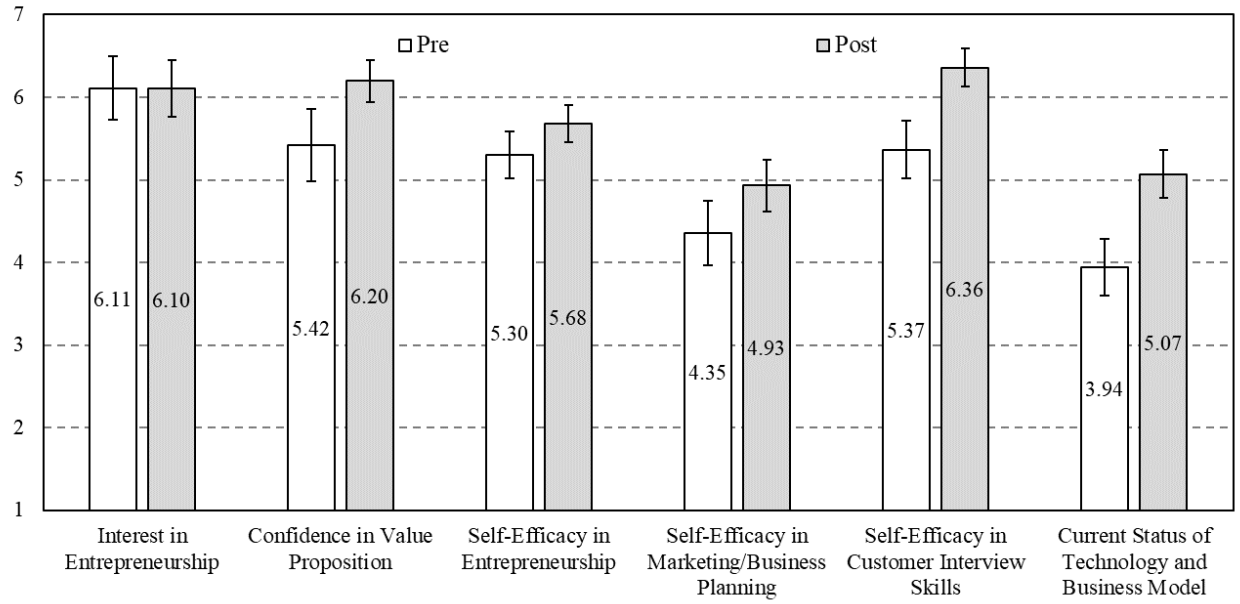


*Figure 5.* Changes in student perceptions of entrepreneurship

**B. Subgroup Differences in Student Perceptions of Entrepreneurship**

The analyses of covariance (ANCOVAs) revealed there were no statistically significant subgroup differences on the participants' perceptions of entrepreneurship after the program by gender, minority status, residency (domestic vs. international), and student level. Considering the improvements in the five perceptions of entrepreneurship between before and after the I-Corps

program (see Table 3), this implies that the I-Corps program made an equivalent impact on increasing confidence and self-efficacy in entrepreneurship of students, regardless of their demographic diversity, such as gender (female vs. male), minority status (White vs. non-White), residency (domestic, vs. international), and student level (undergraduate vs. graduate).

Table 4. Analyses of Covariance (ANCOVAs) on Subgroup Differences in Student Perceptions of Entrepreneurship

| Category | Construct | $F$ | $df_1, df_2$ | $p$ | Partial $\eta^2$ |
|---|---|---|---|---|---|
| Gender (Female vs. Male) | Interest in Entrepreneurship | 0.4 | 1, 36 | 0.519 | 0.012 |
| | Confidence in Value Proposition | 0.1 | 1, 36 | 0.717 | 0.004 |
| | Self-Efficacy in Entrepreneurship | 1.2 | 1, 36 | 0.289 | 0.031 |
| | Self-Efficacy in Marketing/Business Planning | 0.2 | 1, 36 | 0.637 | 0.006 |
| | Self-Efficacy in Customer Interview Skills | 3.7 | 1, 36 | 0.062 | 0.093 |
| | Current status of technology and business model | 0.7 | 1, 33 | 0.397 | 0.022 |
| Minority status (White vs. Non-White domestic students) | Interest in Entrepreneurship | 0.3 | 1, 21 | 0.605 | 0.013 |
| | Confidence in Value Proposition | 0.4 | 1, 21 | 0.512 | 0.021 |
| | Self-Efficacy in Entrepreneurship | 1.6 | 1, 21 | 0.213 | 0.073 |
| | Self-Efficacy in Marketing/Business Planning | < 0.1 | 1, 21 | 0.941 | < 0.001 |
| | Self-Efficacy in Customer Interview Skills | 0.1 | 1, 21 | 0.744 | 0.005 |
| | Current status of technology and business model | < 0.1 | 1, 19 | 0.829 | 0.003 |
| Residency (Domestic vs. International) | Interest in Entrepreneurship | < 0.1 | 1, 36 | 0.960 | < 0.001 |
| | Confidence in Value Proposition | 1.1 | 1, 36 | 0.310 | 0.029 |
| | Self-Efficacy in Entrepreneurship | < 0.1 | 1, 36 | 0.839 | 0.001 |
| | Self-Efficacy in Marketing/Business Planning | 3.7 | 1, 36 | 0.061 | 0.094 |
| | Self-Efficacy in Customer Interview Skills | 0.5 | 1, 36 | 0.492 | 0.013 |
| | Current status of technology and business model | 0.6 | 1, 33 | 0.436 | 0.018 |
| Student Level (Under-graduate vs. Graduate) | Interest in Entrepreneurship | 0.8 | 1, 36 | 0.377 | 0.022 |
| | Confidence in Value Proposition | 2.4 | 1, 36 | 0.129 | 0.063 |
| | Self-Efficacy in Entrepreneurship | 0.2 | 1, 36 | 0.647 | 0.006 |
| | Self-Efficacy in Marketing/Business Planning | 2.0 | 1, 36 | 0.164 | 0.053 |
| | Self-Efficacy in Customer Interview Skills | < 0.1 | 1, 36 | 0.861 | 0.001 |
| | Current status of technology and business model | 0.4 | 1, 33 | 0.491 | 0.014 |

### C. Perceptions of Entrepreneurship and Go/No-Go Decision

Table 5 presents descriptive statistics of student perceptions of entrepreneurship by their decision by the end of the I-Corps program. Here, students who were uncertain about their decision were grouped together with no-go decision students.

Table 5. *Pre-post Changes in Student Perceptions by Group of Go versus* No-Go/Uncertain decision

| Construct | Go | | | | | No-Go/Uncertain | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Pre | | Post | | | Pre | | Post | |
| | *N* | *M* | *SD* | *M* | *SD* | *N* | *M* | *SD* | *M* | *SD* |
| Interest in Entrepreneurship | 27 | 6.19 | 1.14 | 6.20 | 0.94 | 11 | 5.85 | 1.32 | 5.82 | 1.35 |
| Confidence in Value Proposition | 27 | 5.51 | 1.38 | 6.28 | 0.72 | 11 | 4.79 | 1.12 | 5.91 | 0.91 |
| Self-Efficacy in Entrepreneurship | 27 | 5.30 | 0.83 | 5.70 | 0.68 | 11 | 4.91 | 0.86 | 5.40 | 0.60 |
| Self-Efficacy in Marketing/Business Planning | 27 | 4.36 | 1.16 | 5.07 | 0.95 | 11 | 3.80 | 0.63 | 4.50 | 0.91 |
| Self-Efficacy in Customer Interview Skills | 27 | 5.46 | 1.13 | 6.38 | 0.74 | 11 | 4.84 | 0.60 | 6.25 | 0.72 |
| Current status of technology and business model | 26 | 3.85 | 1.07 | 5.37 | 0.76 | 11 | 4.11 | 0.81 | 4.41 | 0.68 |

Figures 6 and 7 visualized the pre-post changes of students' perceptions by their final decisions of go and no-go/uncertain status.

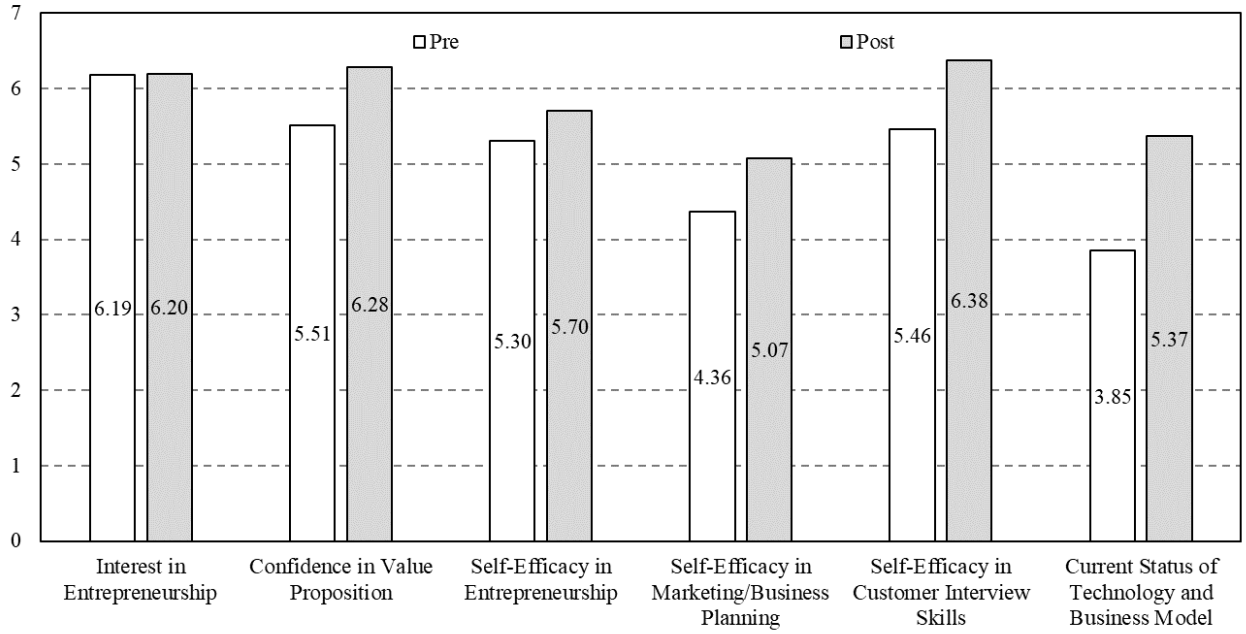


*Figure 6*. Changes in student perceptions of entrepreneurship by Go group ($n$ = 27)

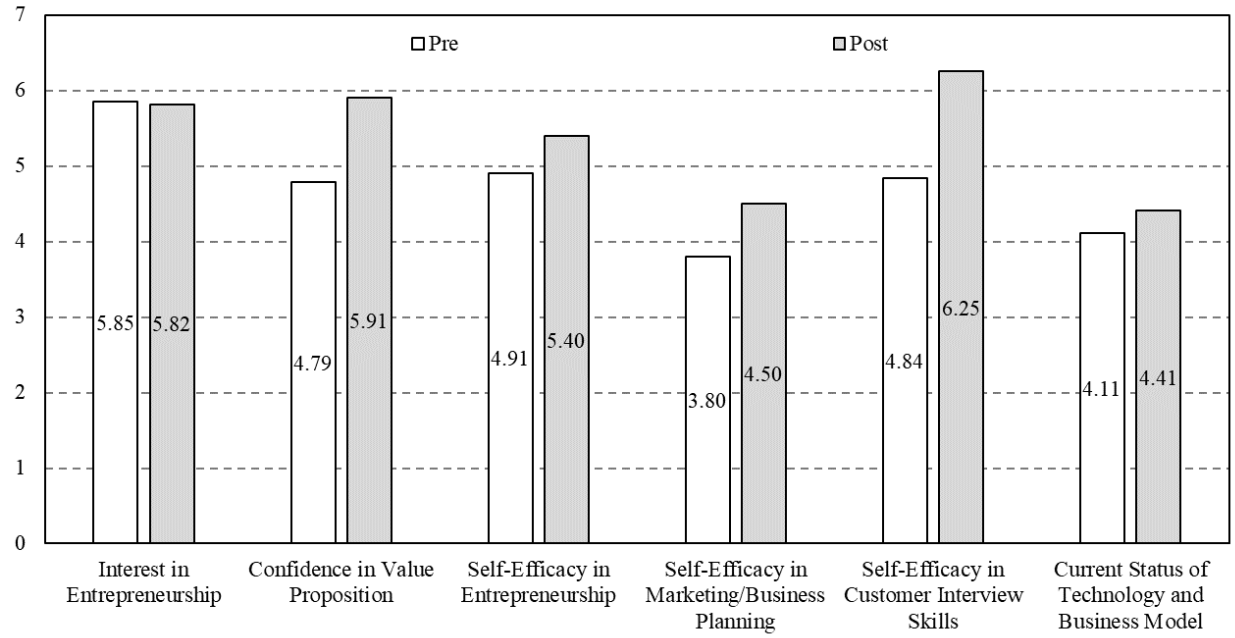


*Figure 7*. Changes in student perceptions of entrepreneurship by No-Go/Uncertain group ($n$ = 11)

The analyses of covariance (ANCOVAs) presented in Table 6 revealed that students who made go-decision had higher perspectives of current status of technology and business model than students who made no-go/uncertain decision.

Table 6. Analyses of Covariance (ANCOVAs) on Differences by Students' Go/No-Go Decision in Student Perceptions of Entrepreneurship

| Construct | $F$ | $df_1$, $df_2$ | $P$ | Partial $\eta^2$ |
|---|---|---|---|---|
| Interest in Entrepreneurship | 0.1 | 1, 34 | 0.713 | 0.004 |
| Confidence in Value Proposition | 1.6 | 1, 34 | 0.206 | 0.047 |
| Self-Efficacy in Entrepreneurship | 0.8 | 1, 34 | 0.373 | 0.023 |
| Self-Efficacy in Marketing/Business Planning | 3.4 | 1, 34 | 0.073 | 0.091 |
| Self-Efficacy in Customer Interview Skills | < 0.1 | 1, 34 | 0.969 | < 0.001 |
| Current status of technology and business model | 15.5 | 1, 33 | < 0.001 | 0.319 |

**D. Learning Environments and Course Evaluation**

As shown in Figure 8, students were all positive in describing the learning environment created during the course, such as collegial, motivating, productive, innovative, and positively challenging. While the course was neither harsh nor exhausting, it might be somewhat stressful, considering the rate of 4.28 over the neutral point.

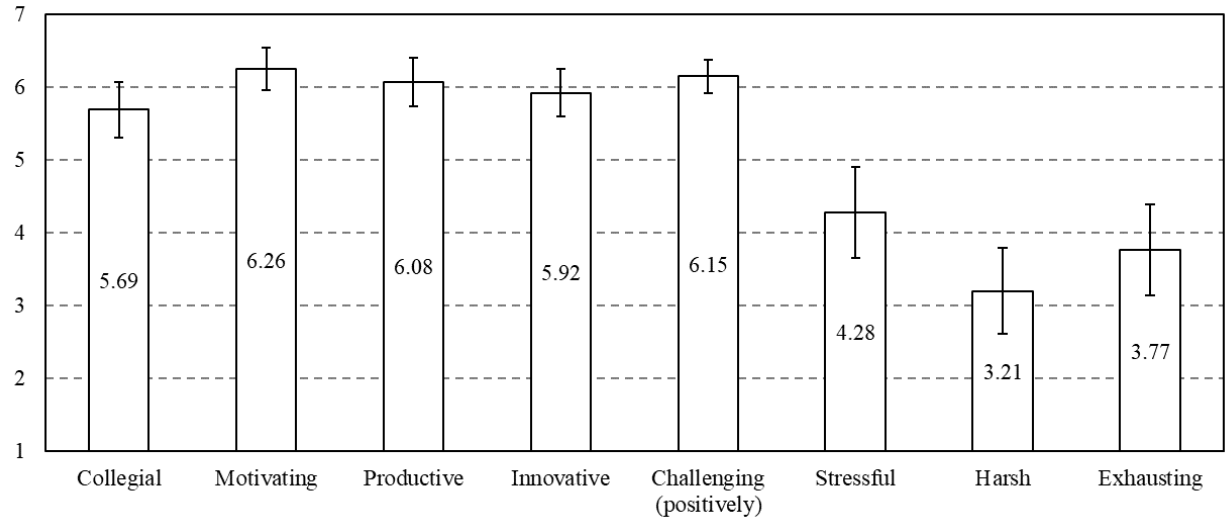


*Figure 8.* The Site learning environment

Students all positively reflected the delivery of the Site program as shown in Figure 9.

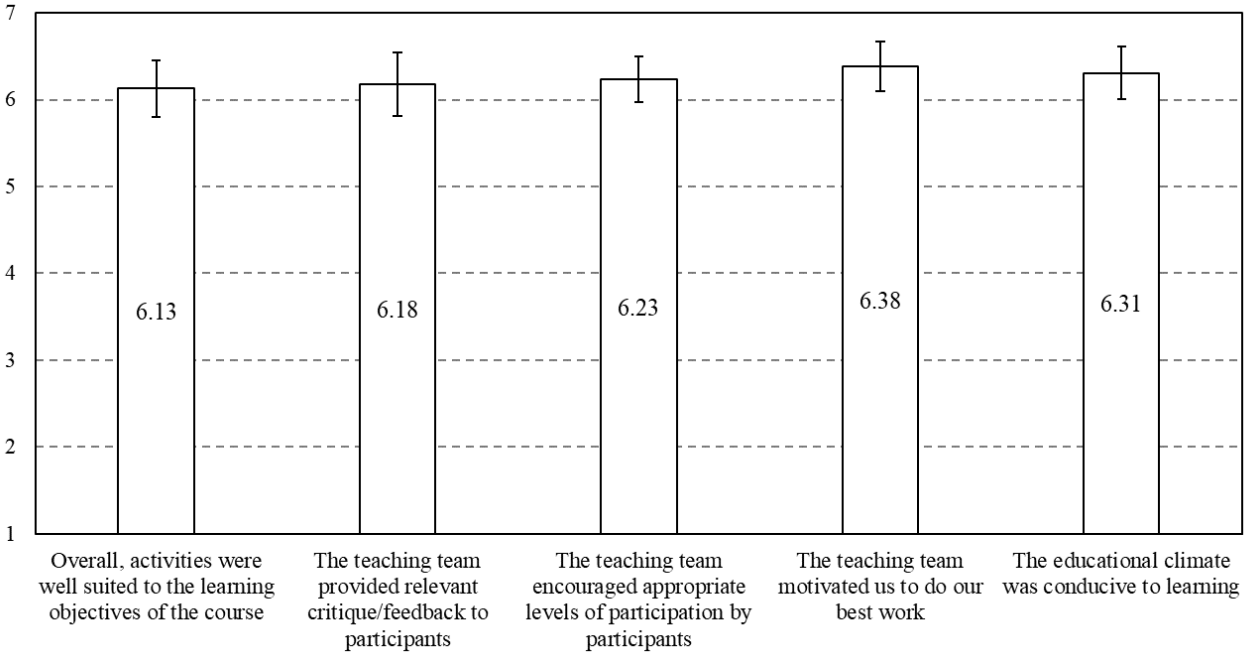


*Figure 9*. Overall delivery of the Site program

The effects of the Site program were all positive in their future plans, as presented in Figure 10.

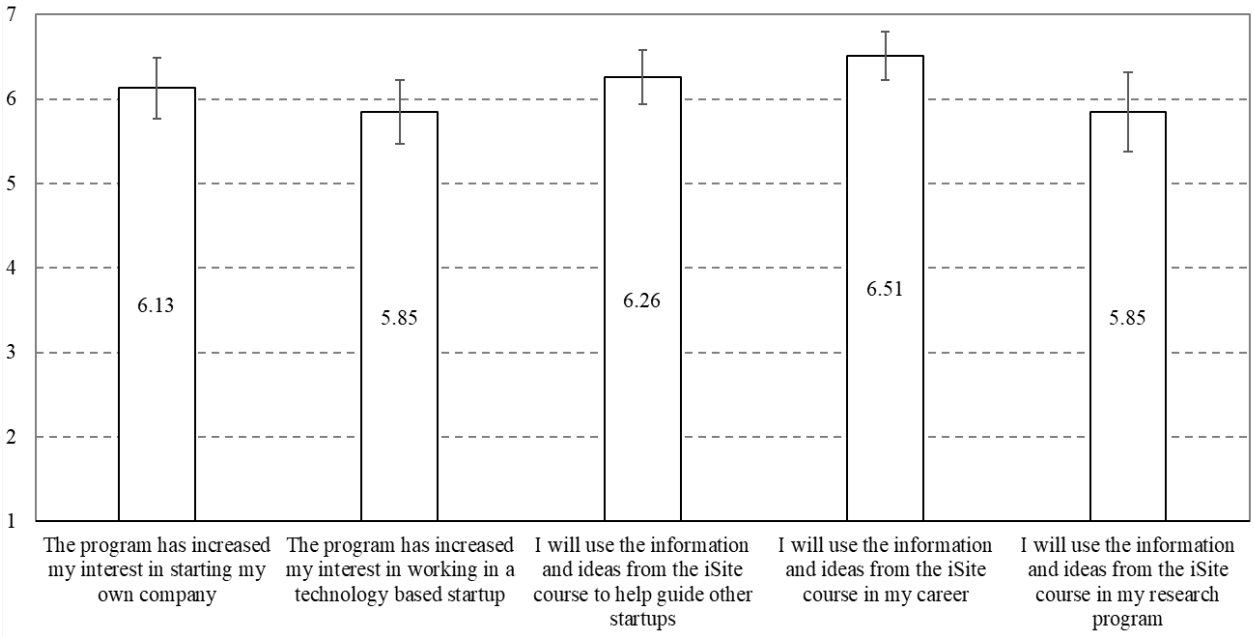


*Figure 10*. Impact of the Site program on future plans

## IV. Discussion

After three years of offering the I-Corps program, there are some notable findings below:

- The program attracted diverse populations of students in gender, race/ethnicity, majors, and classifications
- Program participants maintained high interest in entrepreneurship throughout the program
- Program participants reported significantly increased confidence in value proposition, self-efficacy in entrepreneurship, marketing/business planning, and customer interview skills
- The program affected students equally across diversity in gender, race/ethnicity, majors, and classification
- Students, who made the go-decision, had significantly higher perspective of current status of technology and business model than students who made the no-go/uncertain decision.
- The program provided positive learning environments while creating a certain level of stress for students.

The assessment data provided valuable input to PIs and will guide program changes in the future for further improvements. While the I-Corps Site programs are a valuable investment on each campus, successful implementation requires aligning I-Corps goals to the needs of students at each institution.

## A. Lessons Learned

Over the past three years, we have identified several challenges that students face in regard to participation in the program. These challenges were identified by face-to-face discussion as well as open-ended feedback in the post-program survey. From these issues, the teaching staff has made several changes to the program to further align it with the needs of students on our campus and learned the following lessons: (1) recruiting qualified teams is challenging and collaborations with faculty and staff involved with potential candidates is very important, (2) recruiting qualified mentors in the local areas further away from the large metropolitan areas is challenging, so faculty and staff with industry experience (e.g., professors of practice) may serve in that role, (3) participants tend to focus their customer discovery efforts locally, so they may need guidance in identifying appropriate trade shows and/or planning out-of-state travel, and (4) there is a growing need for additional support outside of the program for those students who wish to continue to develop their innovation.

In an effort to combat and mitigate the challenges the program is facing, the teaching staff has made significant efforts to (1) change recruiting strategies to better target qualified teams (specifically graduate students who are directly working with faculty on sponsored research projects), (2) collaborate with faculty teaching various courses on entrepreneurship and bring the I-Corps methodology to their course, and (3) collaborate closely with faculty and staff running the engineering incubator to further support the teams. In addition, a new pilot program was introduced which condensed the training into a 4-hour session with weekly follow-up meetings with mentors and teaching staff. These changes were focused on increasing recruitment in teams.

## B. Limitations of the Study and Suggestions for Future Research

There are several limitations in this study. First, there is still a need to find a way to increase the response rates and the sample size. Next, while the reliability evidence of the scale was sufficient, the scale used in the surveys has not been validated yet. While the scale items were generated based on the existing scales/surveys in the literature, there is a need of validation because the scale has only been administered to the Site program participants at this university, whose count has not reached sufficient numbers for scale validation. We also acknowledge that the validity evidence of the scale is necessary before any statistical analyses. Finally, since program participants represent a diverse group and also wide range of educational levels (freshman to Ph.D. students), we expect to evaluate the impact of the program with respect to gender, race/ethnicity, and classification in future studies with a bigger sample size. Therefore, further research is necessary to overcome the limitations of this study.

## C. Conclusion

In this paper, we presented experience-based practice on an I-Corps Site implementation at a large Southwestern public university, some of the challenges faced and how they were addressed, and initial findings from the systematic program assessment [3]. Overall, the program provides great value for our on-campus ecosystem and it is continually evolving to better meet the needs of our students. The survey data provided valuable feedback, confirming the effects of the program on students' perceptions and practice and identified areas that need further

improvement for participants. These improvements will be incorporated in future cohorts. Furthermore, this study may provide valuable information for institutions interested in pursuing an I-Corps Site grant and to those who already have a grant but are looking for additional ways to enhance the program impact on their campus. Future efforts will investigate also the impact of program on strengthening the engineering identify of freshman and sophomore student participants and their retention in engineering.

**Acknowledgement**

We conducted this work under the auspices of the National Science Foundation (NSF) under grant number # 1644743. However, any items expressed in this paper do not necessarily represent the views of NSF or its affiliates.

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