Entrepreneurial Intent in Commuter-school Students

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Abstract

This paper reports the results of a mixed-methods study of the factors leading students at a large public Hispanic-serving university, with a student body comprising primarily commuters, to choose an entrepreneurially oriented engineering major and to choose to pursue a startup. The study interviewed 36 lower-division engineering students, of whom 11 were enrolled in an engineering major with a significant emphasis on entrepreneurship and 25 were enrolled in other engineering majors. Structured interviews of covered the participants' family background, their motivations for enrolling in their major, their expectations with respect to career (including startups), their attitudes toward risk, and reflection on the interview. In the course of the interviews, participants were asked to rate their risk tolerance and their interest in pursuing a startup. Analysis of the interviews suggests that the principal indicator of entrepreneurial intent was interest in a startup, that most students' perceptions of the desirability of startups are negative, and that students see lack of knowledge and preparation and lack of resources as the biggest barriers to launching a startup. The analysis also suggests that students are held back by lack of confidence, fear of failure, and the perception that startups require too much time and effort. These factors can be addressed through a suite of programs and policies.

Introduction

A study of upper-division commuter-school students in courses that could lead to formation of new startups suggested, among other conclusions, that students completing their senior year do not want to take the risk of pursuing a startup because they could instead obtain a "real job" and because they are uncertain about the path forward for startups [1]. That study, though, did not address when and how students formed their attitudes toward entrepreneurship. What circumstances and factors influenced the extent of their entrepreneurial intent? And what circumstances and factors influenced their choice of an entrepreneurial engineering major?

Expectancy theory [2], applied to entrepreneurial intent, suggests that choice of an entrepreneurial career is a function of perceived desirability, perceived feasibility, and propensity to act [3]. A subsequent study [4] validated this model and each of its three constituent components. Perceived desirability is the personal attractiveness of starting a business. Perceived feasibility is the degree to which a person feels personally capable of starting a business, in other words the person's self-efficacy; this in turn is influenced by the presence of role models [5], [6] and access to resources [7], [8]. Propensity to act is the personal disposition to act on one's decisions, which can be understood as learned optimism [4]. Students' entrepreneurial intent is also a function of a range of situational factors, such as social norms reflected in the institutional environment [9], and of students' personal characteristics, such as propensity for risk-taking [10].

The feasibility and desirability factors are influenced by the breadth and positiveness of previous entrepreneurial experience [3]. For students, and especially lower-division students, this model can fall short, if only because such students are unlikely to have any entrepreneurial experience at all. This is particularly significant because engineering students' choice of career options can be disproportionately swayed by a single experience such as an internship [11]. Moreover, students in a

region with relatively low entrepreneurial activity can lack the role models through whom students can imagine a future self.

More generally, previous studies have identified sets of factors that influence students' career choices. For example, one model includes twelve career-choice factors: earning potential, association with others in the field, parental influence, cost of education, social status attainment, job satisfaction, years of formal education required, aptitude for subject matter, teacher influence, peer influence, previous work experience, and availability of employment [12]. Of these twelve factors, some can be classified as characteristics of the career (e.g., earning potential, job satisfaction), others can be classified as circumstances of job search (e.g., availability of employment, work experience), and others can be classified as factors that influence how these career characteristics are considered by the decision-maker (e.g., parental influence, teacher influence). The factors leading to career choices may include culture, family guidance, experiences in high-school, and experiences in college. Family and other outside forces can also influence career choices for engineering students, but deliberate career-choice assistance from their academic department is infrequent [11].

These results, though, come largely from studies of students at selective residential universities such as Stanford [9] and MIT [10]. Indeed, the needs of students at non-residential universities have long been ignored [11]. What factors play a role for students at commuter universities, especially for students from underrepresented groups such as Hispanic Americans? Do the students' experiences as immigrants or as children of immigrants affect their entrepreneurial intent? And what are the differences between students choosing an entrepreneurially oriented engineering major and other, more traditional engineering majors? To answer these questions, this paper reports the results of a mixed-methods study of the factors leading students at a large public Hispanic-serving university, with a student body comprising primarily commuters, to choose an entrepreneurially oriented engineering major and to choose to pursue a startup.

Methodology

Based on the factors identified in [3], [9], [10], and [11], and with a view to understanding the particular circumstances of Hispanic Americans at a commuter university, we posed four principal hypotheses. First, it could be that the need to have a "real job" may be more acute for first-generation students.

> Hypothesis 1: First-generation students will be less likely to be interested in pursuing a start-up.

Second, students may choose to be in the entrepreneurially oriented major because their tolerance for risk is higher than for students in other engineering majors.

> Hypothesis 2: Students in the entrepreneurially oriented engineering program will be more willing to take risks.

Third, because the entrepreneurially oriented engineering major is less traditional than the other engineering majors, it may be that these students felt less pressure from their family with respect to choice of major.

Hypothesis 3: Students in the entrepreneurially oriented engineering program will be less likely to have had family influence their choice of major.

Fourth, because the entrepreneurially oriented engineering major prepares students with broader skills and with more emphasis on business and leadership, these students may be less likely to choose a career in traditional engineering.

Hypothesis 4: Students in the entrepreneurially oriented engineering program will be more likely to expect a career outside professional engineering.

And based on the results of [1], we considered two additional factors that could influence students with respect to choice of an entrepreneurial career. It may be the case that students choose the entrepreneurially oriented engineering major, which covers multiple engineering disciplines as part of a general engineering program, because they are uncertain about specializing in a particular field of engineering.

Hypothesis 5: Students choosing the entrepreneurially oriented engineering major are less certain about their choice of career.

Finally, can the result from [1] that students prefer to take a "real job" rather than pursue a startup be confirmed across students both in the entrepreneurially oriented engineering major and other engineering majors? Do other factors play a role in this choice?

Hypothesis 6: Students do not want to take the risk of pursuing a startup when they could instead obtain a "real job."

To explore these issues, we conducted a mixed-method study through interviews of 36 first- and second-year engineering students, all of whom were American citizens or permanent residents. Of these, 11 were enrolled in an engineering major with a significant emphasis on entrepreneurship and 25 were enrolled in other engineering majors. The study's participants were compensated with $50 credited to their university spending account.

To avoid bias toward the hypotheses in the interviews, the interviewers were research assistants, with training and experience in interviewing, rather than the principal investigator. The interviews were conducted over the course of two months via teleconferencing, with interviews from students in the entrepreneurially oriented engineering major and students in the other engineering majors balanced across the two interviewers. The interviews' structured format covered the students' family background, their motivations for enrolling in their major, their expectations with respect to career (including startups), their attitudes toward risk, and reflection on the interview. In the course of the interviews, participants were asked to rate their risk tolerance and their interest in pursuing a startup on ten-point scale. The interviews were assessed (see Coding Book, Appendix A) through recording of categorical and numerical responses for:

- Immigration generation
- Parents' education
- Employment during college

- Switch of major
- Risk tolerance
- Startup interest

and through thematic content analysis [14] for:

- Family influence on major
- Career plans
- Career certainty
- Reasons for pursuing or not pursuing a startup

The students in the entrepreneurially oriented engineering major and the students in the other engineering majors had similar characteristics with respect to working while in college, change of majors, and their parents' education, as indicated in Table 1. None of the differences between groups was significant.

	Engineering Major	
	Entr-Oriented	**Other**
Working while in college	73%	60%
Switched majors	27%	24%
Parents' education (mean years of education after middle school)	5.9 years	5.7 years

Table 1. Characteristics of participants as a function of academic major.

Results

The study's six hypotheses were assessed from the coded data and tested with the t-test or Chi Square as appropriate. None of the study's four principal hypotheses was validated. However, the data indicate that students in the entrepreneurially oriented engineering program were somewhat more interested in pursuing a startup.

Hypothesis 1 was that first-generation students will be less likely to be interested in pursuing a start-up. The participants were about evenly divided between first-generation and later-generation Americans: 53 percent of the participants were first-generation, and 47 percent were second- or third-generation. The participants' responses suggest that Hypothesis 1 is not supported. As shown in Table 2, participants' mean interest in pursuing a startup was actually higher for first-generation students than for later-generation students. This difference was not significant ($p > 0.10$, 1-tailed t-test, unequal variance), and the effect size was between small and medium (Hedge's $g = 0.39$).

	Generation	
	G1	**G2, G3**
Mean	7.26	6.35
StDev	1.97	2.62

Table 2. Interest in pursuing a startup (1 = min, 10 = max) as a function of generation.

Hypothesis 2 was that students in the entrepreneurially oriented engineering program will be more willing to take risks. The participants' responses suggest that this hypothesis is not supported. As shown in Table 2, the mean scores for tolerance of risk were similar in the two majors and the minor difference was not significant ($p > 0.90$, two-tailed t-test, unequal variance).

	Engineering Major	
	Entr-Oriented	**Other**
Mean	6.09	6.16
StDev	1.58	1.95

Table 2. Tolerance of risk as a function of engineering major.

Although mean risk tolerance for participants from both majors was moderate and neither major had students with high tolerance for risk (9 or 10), both majors did have students with moderately high tolerance for risk (7 or 8), as shown in Figure 1.

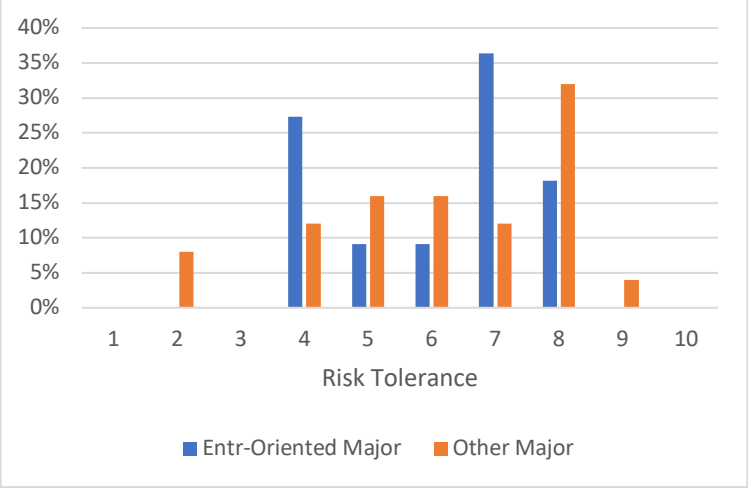

Figure 1. Percentage distribution of risk tolerance, by major.

Although risk tolerance did not differentiate students in the entrepreneurially oriented engineering major from students in the other engineering majors, students in the entrepreneurially oriented engineering program were significantly more interested in pursuing a startup. The participants' responses suggest that this is true, as shown in Table 3. This difference was significant ($p < 0.05$, 1-tailed t-test, unequal variance), and the effect size was between medium and large (Hedge's g = 0.62). Figure 2 presents the percentage distributions of interest pursuing a startup.

	Engineering Major	
	Entr-Oriented	**Other**
Mean	7.82	6.40
StdDev	1.89	2.38

Table 3. Interest in startup as a function of major.

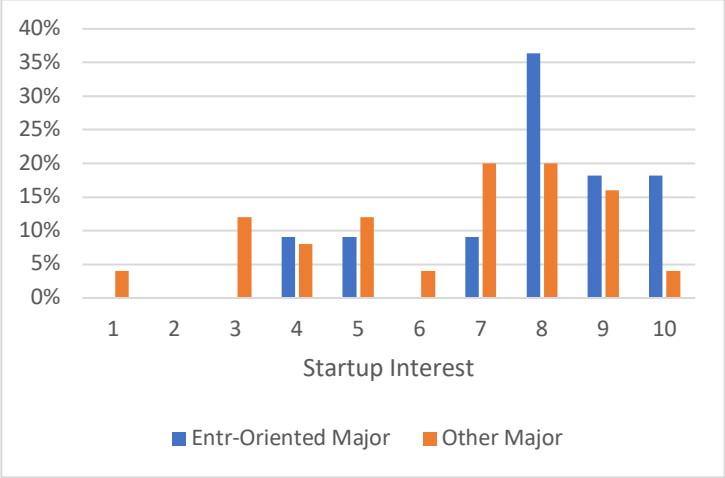

Figure 2. Percentage distribution of startup interest, by major.

In this study, risk tolerance and interest in pursuing a startup were not significantly correlated, as seen in the scatter plot in Figure 3. The correlation coefficient was 0.22, and R^2 was 0.05.

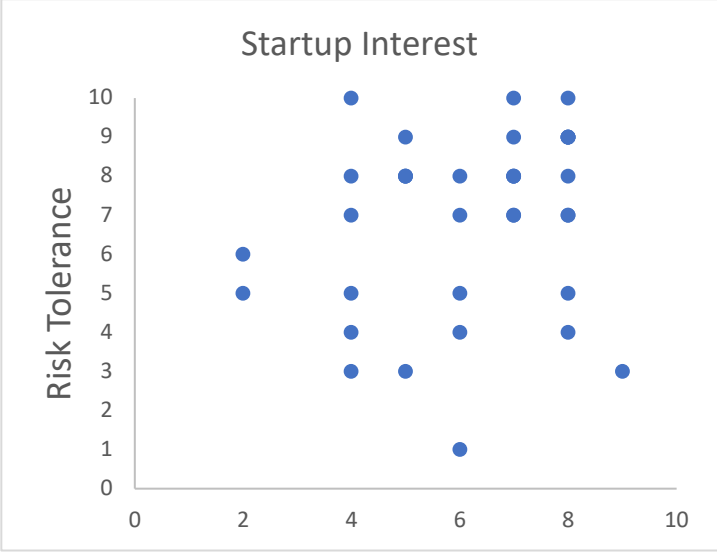

Figure 3. Scatter plot of risk tolerance vs. interest in pursuing a startup.

Hypothesis 3 was that students in the entrepreneurially oriented engineering program will be less likely to have had family influence their choice of major. The participants' responses suggest that this hypothesis is not supported. Of the students in the entrepreneurially oriented engineering program, 18 percent indicated that family had influence their choice of major; and of the students in other engineering majors, 20 percent indicated that family had influence their choice of major. Unsurprisingly, this minor difference was not significant ($p > 0.65$, ChiSq.).

Hypothesis 4 was that students in the entrepreneurially oriented engineering program will be more likely to expect a career outside professional engineering. The participants' responses suggest that this hypothesis is not supported. Of the students in the entrepreneurially oriented engineering program, 9 percent indicated that they planned a career outside of engineering; and of the students in other engineering majors, 8 percent indicated that they planned a career outside of engineering. This difference was not significant ($p > 0.66$, ChiSq.). Additionally, interest in pursuing a startup was not correlated with career choice; the correlation coefficient was 0.02, and R^2 was less than 0.0001.

Hypothesis 5 was that students choosing the entrepreneurially oriented engineering major are less certain about their choice of career. The participants' responses suggest that this hypothesis is not supported. Of the students in both the entrepreneurially oriented engineering major and in the other engineering majors, 64 percent indicated that they were certain about their choice of career.

Hypothesis 6 was that students do not want to take the risk of pursuing a startup when they could instead obtain a "real job." Analysis of the participants' reasons for pursuing, or not pursuing, a startup suggests that this hypothesis is partly true but that three other reasons are more important. As shown in Figure 3, the factors of greatest importance are not having enough knowledge or preparation, lack of resources, lack of confidence, need for mentoring, and then need for a "real job." Other factors mentioned by participants were startups taking too much time or effort, chance for financial gain, fear of failure, and having to prioritize family.

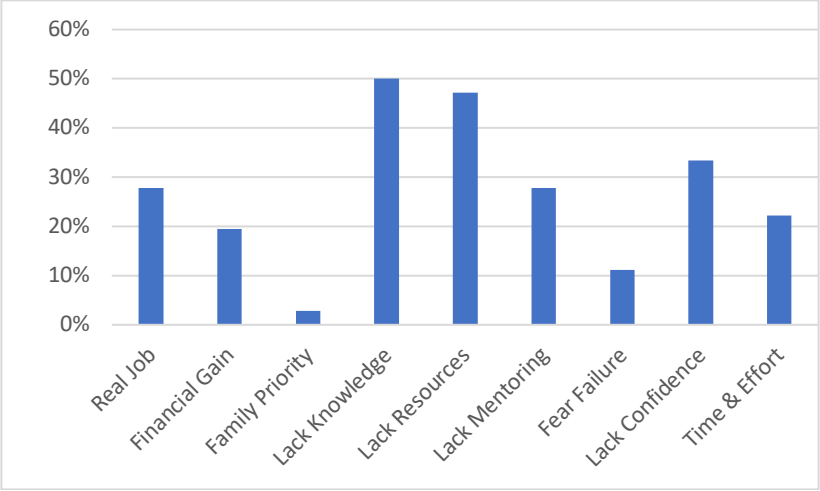

Figure 3. Percent of students indicating that a factor influenced their interest in pursuing a startup.

Interestingly, the data suggest that students in the entrepreneurially oriented engineering major and students in the other engineering majors differed significantly with respect to the relative importance

of these factors ($p < 0.01$, ChiSq). As shown in Figure 4, no students in the entrepreneurially oriented engineering major indicated that a startup would take too much time or effort, compared with 22 percent of students in the other engineering majors. Likewise, 9 percent of students in the entrepreneurially oriented engineering major expressed a need for a "real job," compared with 36 percent of students in the other engineering majors. The participants mentioned a few other factors that seemed to be associated with the factors coded in Figures 3 and 4. In particular, feeling that a startup would be a "side job" was mentioned four times in association with the need for a "real job."

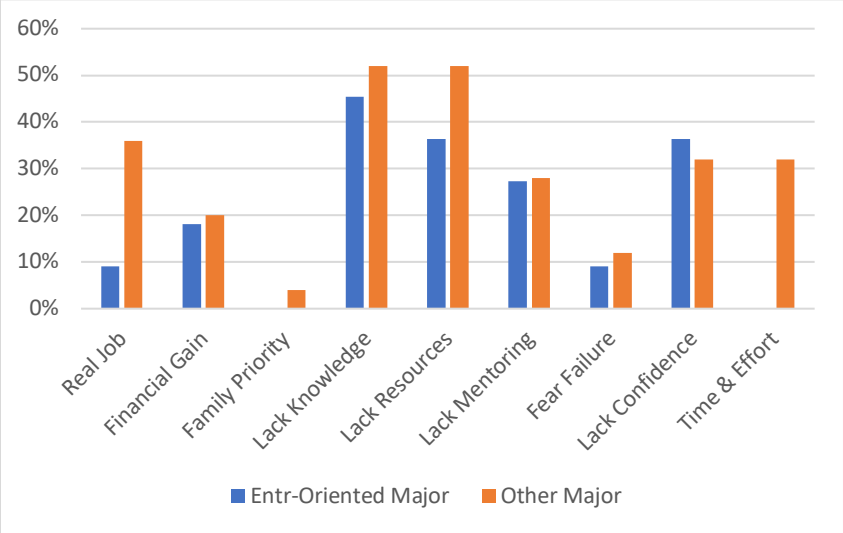

Figure 4. Comparison across majors of factors influencing interest in pursuing a startup.

Discussion

With respect to the factors that influenced the extent of the participants' entrepreneurial intent, the study's results suggest that some contextual and personality factors, particularly generation since immigration, risk tolerance, and career plans, do not play a large role. The principal indicator of entrepreneurial intent was interest in a startup, which was similar to the result found for MIT students [11]. For the students in this study, though, this differentiation is moderate, though, as many students in both the entrepreneurially oriented engineering major and in the other engineering majors expressed interest in pursuing a startup, as can be seen from the distributions in Figure 2. Similarly, the factors that influenced the participants' choice of an entrepreneurial engineering major do not appear to be related to risk tolerance, career choice, or uncertainty about their major or career plans. Rather, the principal differentiator again was interest in pursuing a startup.

The study's results for the factors of perceived desirability, perceived feasibility, and propensity to act appear to reflect more directly the context of the primarily Hispanic commuter students in the study's sample population. Perceived desirability did not appear to play a large role in students' interest in pursuing a startup. Financial gain from startups was cited by only 19 percent of the participants, and other desirability factors were not mentioned in the interviews. This suggests that the participants' social, economic, and academic contexts do not lead the participants to see pursuing a startup as desirable. In contrast, perceived feasibility appears to play a large role in the participants' attitudes toward pursuing a startup. The top two factors mentioned by the participants

in both groups of majors were (1) lack of knowledge and preparation and (2) lack of resources. Other factors mentioned were the need for a "real job," which was consistent with the finding in [1], and lack of mentoring. Propensity to act also appears to play a large role in students' interest in pursuing a startup. The study's interviews indicate that key factors include lack of confidence, fear of failure, and that startups require too much time and effort.

For students at commuter colleges and students at Hispanic-serving institutions, the study's results with respect to perceived desirability, perceived feasibility, and propensity to act suggest approaches that universities interested in increasing participation in entrepreneurship could adopt for lower-division students.

Perceived desirability. The low incidence of positive factors for perceived desirability of startups suggests that universities should, beyond helping students learn *how* to build startups, help students see *why* to build startups and, more generally, to develop an entrepreneurial mindset.

Perceived feasibility. The participants' need for mentoring, which can be viewed as a need for role models, and lack of resources track directly into the major factors of perceived feasibility in applying expectancy theory to entrepreneurial intent. If entrepreneurship education is delivered primarily in upper-division courses, students in lower-division would benefit from at least a preview that helps them understand that they will have significant academic preparation and mentoring in entrepreneurship in their upper-division courses. Indeed, connecting students with mentors need not be deferred until the students reach the upper division. For example, universities might consider helping rising sophomores obtain paid internships with startups and other entrepreneurial businesses and organizations (cf., [15]). And because the study's participants reported a perceived lack of resources as a key deterrent to pursuing a startup, universities could help students better understand the innovation ecosystem and its resources.

Propensity to act. Some aspects of students' propensity to act may not be addressable through education. In particular, students who are not interested in pursuing a startup because they think that startups take a lot of time and effort are likely realists who know themselves. But for fear of failure, programs could provide students with opportunities to fail constructively. In the Lean Launchpad model [16], invalidating a hypothesis about product-market fit, for example, helps the startup avoid wasting time and effort on something that will not succeed. Thus, students should be helped to understand that "failing" with an idea in this context does not mean failing in a course. Likewise, students' lack of confidence could be addressed through facilitating, in ways effective for commuter students, sociocultural conversations with peers [17]. Universities could also improve students' self-efficacy by avoiding unrealistic expectations about creating startups before graduation. Even at MIT, few students pursue startups while in school because of the high opportunity costs caused by high workload and high cost of tuition [11], factors that have analogues for commuter-university students in high workload and high need for employment while in school.

Limitations

This project's results and recommendations are subject to a number of limitations.

The relatively low number of participants in the study possibly limited the power of the statistical tests for Hypotheses 1 through 5. The study's design called for 60 total participants. However, even

raising subject compensation to the $50 maximum allowed by the university's Institutional Review Board did not lead to the planned participation levels, despite repeated calls for participation. Prior studies in this series did not encounter this problem, which could perhaps be attributed to the remote-learning context necessitated by the COVID-19 pandemic. Even so, given the effect sizes and variances, power analyses for Hypotheses 1 through 5 suggest that having 60 subjects would not have changed the results.

Because the study's participants were self-selected, the study's participants did not necessarily represent a random sample of the population of lower-division engineering students. This means, for example, that participants might be more entrepreneurial than lower-division engineering students generally. Also, comparisons of this study's results with results from residential and non-HSI universities were made difficult by differences in methods and instruments across previous studies and this study; this was due in part by inclusion of variables in this study, such as parents' education and students' generation since immigration, that seemed relevant to a commuter HSI but were apparently not addressed in previous studies.

More broadly, the results reported here should be interpreted in light of the specific demographics of the participant pool. That is, validation and invalidation of the study's hypotheses may not generalize from the largely Mexican-American student population studied here to different student populations at other colleges and universities. It is also possible that demographic or contextual factors not surveyed or analyzed in this study, such as gender, age, and parents' income, may play a role in shaping students' entrepreneurial intent.

With respect to methodology, the interviews could have been improved by inquiring directly about role models, which likely affect students' perceptions of self-efficacy and perceived feasibility [5], [6]. While participants frequently cited lack of mentoring as influencing their interest in pursuing a startup, and while mentoring and role models are related, the absence of role models for the participants could in itself have kept the participants from mentioning role models as a factor.

Finally, the study's most surprising result was the nearly complete lack of correlation between interest in pursuing a startup and tolerance for risk. It is not clear if this result reflects the subject population, the sample population, the methodology, or other unknown factors. A deeper understanding this result remains an issue for future work.

Conclusion

For lower-division engineering students at large public Hispanic-serving university, with a student body comprising primarily commuters, most students' perceptions of the desirability of startups are negative. Students see lack of knowledge and preparation and lack of resources as the biggest barriers to launching a startup, and students feel held back by lack of confidence, fear of failure, and the perception that startups require too much time and effort. Entrepreneurial intent was not predicted by generation since immigration, risk tolerance, or career plans. The principal indicator of entrepreneurial intent was interest in a startup, although many students in both an entrepreneurially oriented engineering major and students in other engineering majors expressed interest in pursuing a startup.

While many students will reasonably not pursue an entrepreneurial career, universities could provide a path for an entrepreneurial career for lower-division students who could and should do so by

- Helping lower-division students develop an entrepreneurial mindset and to see why to build startups,
- Connecting students with mentors,
- Helping rising sophomores obtain paid internships with startups and other entrepreneurial businesses and organizations,
- Helping students better understand the innovation ecosystem and its resources,
- Providing opportunities to fail constructively,
- Facilitating sociocultural conversations with peers, and
- Avoiding unrealistic expectations about creating startups before graduation.

Moreover, the numbers of students across all engineering majors who are interested in startups suggests that colleges of engineering should take these steps for all lower-division students, and not just for students in the entrepreneurially oriented engineering major.

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Appendix A: Coding Book

The study's data were compiled using the following coding book:

Code	**Items**
Generation	
G0	Immigrated
G1	First-gen American
G2	Second-gen American
GZ	Third+-gen American
Parents Education	
EN	No high school
EH	High school
ES	Some college
EC	College degree
EG	Graduate degree
Work	
WC	Employed while in college
WN	Not employed while in college
Reasons for Major	
MFI	Family influenced choice of major
MFN	Family not influenced choice of major
Switched Majors	
MSY	Switched major
MSN	Did not switch major
Career Plans	
CE	Career in engineering
CO	Career outside engineering
Career Certainty	
CC	Career certainty
CU	Career uncertainty

Risk Tolerance	
(Number from 1 to 10)	Code measured = 5
	Code not good at risk = 2
Startup Interest	
(Number from 1 to 10)	Code maybe = 5
Startup Consideration	(Can have more than one code)
RNJ	Financial (e.g., need "real" job)
RFG	Financial (e.g., chance for gain)
RNF	Family first
RNP	Not enough prep or knowledge
RLR	Lack of resources
RNM	Need mentoring
RFF	Fear of failure
RLC	Lack of confidence