Entrepreneurial Motivations for High-Interest Students

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Abstract

As the call to increase entrepreneurial training within academic engineering institutions increases, understanding the target audience and its motivations becomes increasingly important. This qualitative research study provides insight into the backgrounds and motivations of engineering students who exhibited high entrepreneurial interest during their sophomore or junior year. Students taking a Technical Communication for Engineers course were given a series of entrepreneurial interest questions. Those students whose scores indicated high interest were invited to participate in interviews to discuss their interest. Some of the students received entrepreneurship peer mentoring, while others did not. Grounded Theory analysis was performed, and the central theme of family role models was identified. Additional themes include other role models, communication, persistence, and overlap of skills between engineering and entrepreneurship.

Introduction

Entrepreneurship is receiving increased interest in academia as centers for entrepreneurship have been and continue to be established at many institutions across the country. Furthermore, industry sponsors are participating in competitions by rewarding students' entrepreneurial efforts. Engineering entrepreneurship is growing as a subfield of interest as well, with many institutions nationwide placing centers for entrepreneurship and innovation under their engineering schools and with the establishment of The Journal of Engineering Entrepreneurship.

A study was started at a western research university to better understand the impact of peer consultants in entrepreneurship for engineering students (Call, Goodridge, & Scheaffer, 2016). These peer consultants from the university's entrepreneurship center were invited into randomly selected sections of a Technical Communication for Engineers class to present information about entrepreneurship, the on-campus resources and competitions that promote student entrepreneurship, and introductory instruction on how to differentiate a real business opportunity versus an underdeveloped idea.

The presentations given by the peer consultants have varied in terms of depth and enthusiasm from semester to semester, and student responses have been mixed. However, we are fortunate to have had the opportunity to identify engineering students with high affinity for entrepreneurship and involve them in qualitative research to understand their motivations, backgrounds, and perspectives on entrepreneurship and its relation to them as engineering students.

The quantitative data have been useful in identifying students with an above-average affinity toward entrepreneurship. These students were specifically invited to participate in an interview phase of the study so that we could better understand what influenced their affinity for entrepreneurship, and if the visits from peer consultants had played a role. A qualitative research approach was deemed more appropriate for analysis of the interviews, and the results are presented in this paper.

Theoretical Framework, Research Questions, and Positionality

Entrepreneurial education is increasingly being recognized as aligning with the goals of engineering education (Duval-Couetil, Kisenwether, Tranquillo, & Wheadon, 2015), and is emerging as a trend in engineering education across America (Green, Smith, & Warner, 2012; Schar, Sheppard, Brunhaver, Cuson, & Grau, 2014; Tryggvason, Schaufeld, & Banks, 2010; Weaver & Rayess, 2010; Wheadon & Duval-Couetil, 2014). Many authors have focused on the implementation of new approaches to teaching engineers to participate in entrepreneurship. As we approach the topic of entrepreneurship, we recognize the critical aspect of items that are often better handled qualitatively than quantitatively – like motivation and relationships. As exemplified by Lutz, Hixson, Paretti, Epstein, and Lesko (2015), we feel it appropriate to use qualitative means for learning more about engineering students' experiences with and attitudes about engineering education. We hope to promote the use of qualitative research in this topic, and we will present the results of such a philosophy and its associated decisions in the Methodology section below.

As researchers who are new to the study of entrepreneurship education, it was important to us to A) control for our own assumptions about entrepreneurship or what students do know or should know on the topic of entrepreneurship, B) learn about the initial impressions of students instead of making assumptions about where they stand, and C) have an experimental flavor to our research to better understand if our new pedagogical approaches are effective through comparison between treatment and control groups.

As educators, we feel that authenticity is important for engineering education, so we hope to highlight courses where authentic practices are found; for example: teamwork, project-based approach to learning, incorporation of non-technical skills, and applications of learned material to realistic problems (Kirschner, 2004; Litzinger, Lattuca, Hadgraft, & Newstetter, 2011).

Despite the recent integration of entrepreneurship into engineering education, the concepts and attitudes of entrepreneurship were not explored as part of an engineering educational experience at the institution previously. Thus, it was important to find a venue where the implementation of entrepreneurial content would not be too abrupt for the students and to implement the content in small quantities that would be palatable to instructors and students. In other words, we felt it important to tread lightly and conduct a minimally-invasive study, which, of course, does prevent any attempt at extensive entrepreneurial education but does allow its introduction into an undergraduate community that previously had no training towards this area. We wanted to understand how to help students develop an affinity for entrepreneurship, and thus wanted to focus on those who are exemplary of our desired condition (high affinity for entrepreneurship), rather than focusing on those who resist an intervention.

The peer consultants invited to visit some of the classes received training from the university's Entrepreneurship Center on how to provide consulting for promising entrepreneurs. Training was given to the peer consultants before visiting the class and the training continued throughout the semester. The peer consultants – as described in (Call et al., 2016) – tended to be students between their sophomore and senior years, and were recruited from every college of the university. The Jeffrey D. Clark Center for Entrepreneurship at Utah State University (USU) is

based largely on the philosophies of Dr. Michael Glauser, and mentors receive training focused on the principles from Glauser's book (Glauser, 2016). These principles are embedded in a philosophy of people finding problems they can solve locally that will result in a sustainable business and desirable lifestyle in the location where they want to live – a "Main Street" rather than a "Wall Street" approach. Having the peer consultants visit a class section to provide training and advice constituted the treatment for this study. The control group consisted of class sections that did not receive visits from the peer consultants. We feel it is important to receive feedback from both perspectives, and thus both treatment- and control-group participants were recruited for interviews in this study.

In considering the effects that the introduction of entrepreneurial content could have on this Technical Communication class, three central questions were considered: How do engineering students associate entrepreneurship with the subject matter of the Technical Communication class? How do engineering students associate engineering and entrepreneurship? What motivates engineering students to pursue entrepreneurship?

The authors of this paper are white, middle-class professors (Scheaffer and Goodridge) and students (Call and Milliken) in colleges of engineering from two institutions (University of Tennessee for Milliken and USU for the other authors). Scheaffer is female, while the other three authors (Call, Goodridge, and Milliken) are male. The two instructors for the Technical Communication class (of which Scheaffer is the principal instructor) are both white females. The research was conducted within the College of Engineering at USU, which is predominantly white and male, particularly outside of the Department of Biological Engineering. USU, as the land-grant institution for the state, has a high suburban, middle-class student population, with a strong history of educating students from rural communities and providing relatively accessible admission – although entrance into the current engineering programs of study is considerably more challenging – to meet its mandate and mission within the state of Utah's educational system, while achieving Tier I research institution status. The students in the Technical Communication class come from every department of USU's College of Engineering except the Department of Biological Engineering. All participants who volunteered to participate in this study were male, and the majority of them were local students.

Methodology

Our research philosophy for this study, which is based on aligning new content with the existing classroom philosophies and avoiding pre-conceived notions during analysis, led us to look for examples of what engineering students who have an affinity for entrepreneurship think about entrepreneurship. It also led us to implement a small intervention in an experimental manner to talk to students about entrepreneurship while measuring any change in attitude during the semester. The intervention was enabled via the peer consultants provided by the Entrepreneurship Center as described in (Call et al., 2016).

Given our pragmatic nature as engineers, the consideration of how to proceed with our study was primarily driven by factors of convenience and by the theoretical framework. By "factors of convenience", we refer to identification of student populations that appeared to be most open to learning about entrepreneurship and accessible for purposes of this study. Looking for factors of

convenience helped us maintain our minimally-invasive ideal within the classroom and aligned well with looking for a class that has implemented authentic practices. The theoretical framework and our desire to control for our own assumptions and learn about students' perspectives lead us to a Grounded Theory approach. Internal Review Board (IRB) approval was obtained, and this study's protocol was defined in Protocol 7210.

Participant Population

Purposeful sampling for this study was criterion-based (defined below) from a convenience population – i.e. students enrolled in one particular course. The Technical Communication for Engineers course, which is taken during most students' junior year, was selected as a result of the factors of convenience previously mentioned. Specifically, the course seemed ideal because the instructors were receptive to the research idea, the themes of the class were aligned with some of the skills that engineers view as prerequisite for entrepreneurial education, the course curriculum regularly emphasized teamwork and project-based activities as well as communication, and there was a perceived need to increase student motivation for the projects.

The technical communication instructors, having experience teaching in the business school and department of English, were open to the idea of incorporating entrepreneurial themes within their classes. The focus of the course, largely designed to meet ABET's Student Outcome (g), "an ability to communicate effectively", focuses both on technical writing and on "soft skills" that many engineering students may identify with business and/or entrepreneurship. Thus, it was deemed an appropriate place to ask students about their views on entrepreneurship and to present information on entrepreneurship.

Student projects in the class culminated in team-developed project proposals. Prior to this research endeavor, students were instructed to write proposals to solve the Grand Challenges for Engineering (NAE, 2017), but those challenges proved to be daunting, and student motivation was seen as lacking. Entrepreneurship was seen to be a possible replacement for the Grand Challenges. By introducing entrepreneurial instruction, we hope to increase motivation in two ways: 1) We hope that allowing students to develop proposals for "Main Street" problems/solutions will help students have more passion for a problem with which they are familiar, make the problem set more tangible for the students, and increase the likelihood that students will develop solutions that they feel could realistically be achieved. 2) We also hoped to leverage the potential for increasing student motivation by showing them that their proposals could be modified and submitted to entrepreneurship competitions on campus.

Student participants in the study were selected based on the quantitative entrepreneurial affinity that students provided in their Likert-scale survey responses. All participants in the study took the surveys at the end of the semester; some also took a pre-test iteration of the same questions in the first half of the semester. Students were identified for high entrepreneurial affinity (and, thus, invitation for interviews) based on the first survey administered. However, students were not interviewed until after they had received visits from the entrepreneurship peer consultants. The interviews were conducted at the end of the semester (before and after finals). The survey questions were obtained from Solesvik (2013), which incorporated questions developed as parts of other studies and used entrepreneurial intent scores as the dependent variable in her paper. For

the purposes of this study, entrepreneurial affinity is defined as a combination of participants' intent to pursue entrepreneurship, which is quantified by the questions from Liñán and Chen (2009), used in Solesvik (2013), and the positive view they have of entrepreneurship, which is quantified by the questions from Gundry and Welsch (2001), used in (Solesvik, 2013). The questions asked are provided in Table 1. By looking at the average scores and standard deviations, we identified students who reported a significant affinity. Above-average affinity was based on individual scores for intent to pursue entrepreneurship or for a positive view of entrepreneurship (or a combination of both scores). We looked at responses to individual questions, questions summed by category, and the sum of both categories in our study to identify invitees. Quantitative determinations of high scores were made separately for each section of the class based on the mean and standard deviation for that section. This identified the subset of the population that we felt would provide examples of what motivates engineering students to have an interest in entrepreneurship. Out of 200+ students who responded to the survey questions, 90 were categorized as high on at least one question of interest in the survey, and 11 accepted the invitation and participated in an interview – 5 from one cohort and 6 from another.

Intent to Pursue Entrepreneurship – from Liñán and Chen (2009)
1. I am ready to do anything to be an entrepreneur
2. My professional goal is to become an entrepreneur
3. I am determined to create a business venture in the future
4. I have very seriously thought about starting a firm
5. I have got the intention to start a firm one day
6. I intend to start a firm within five years of graduation
Positive View of Entrepreneurship – from Gundry and Welsch (2001)
1. Being an entrepreneur implies more advantages than disadvantages to me
2. A career as an entrepreneur is attractive for me
3. If I had the opportunity and resources, I would love to start a business
4. Being an entrepreneur would give me great satisfaction
5. Among various options, I would rather be an entrepreneur

Table 1. Survey Questions for Entrepreneurial Affinity Found in Solesvik (2013)

Participants came from sections of the class offered in the fall and spring semesters, resulting in two separate cohorts. The students in each cohort did not work together, and the cohorts were simply classified chronologically – hence by the inherent influences of common peer consultant training and seasonal effects. Four sections of the course were offered each semester, and peer consultant visits were assigned in a stratified random manner to the sections (stratified in the sense that each instructor had as close to 50% of their courses assigned to visits as possible). The participants in the study were each assigned a random identifier which also included an indication of whether they had received the peer consultant visits or not. Transcription of the interviews was conducted, and the transcripts were saved digitally using the random identifiers to provide anonymity.

Methods - Grounded Theory Approach and Data Collection

A Grounded Theory (Creswell, 2013) approach was used to draw out themes and meaning from the interviews collected. This approach enabled us to control for some of our own bias toward

the topics being studied. While some proscribe a very strict definition of Grounded Theory research (Corbin & Strauss, 2008), others are more lax in their definition (Charmaz, 2006). We adopted a more pragmatic approach where repetition in themes represented saturation and left us satisfied with our findings. We feel that the impact of qualitative research is generally found in the discussion of present findings in light of the accepted theories of related findings in other publications. Thus, the themes uncovered through this study's analysis will be presented in the Findings section and then discussed in relation to pre-existing theories in the Impact section.

Initially, a set of questions were posed in a semi-structured interview that was meant to help us understand the impact of the course on the students in terms of what they learned and how they felt about the course. The questions were noteworthy in that they did not make entrepreneurship the focus. The list of questions is provided in Table 2. These questions were given to the first cohort of participants, and the original focus was on the impact of the course – particularly its focus on "soft skills" (particularly communication and grammar). The analysis of data collected in initial responses led to the identification of a few common themes: the importance of communication in engineering, entrepreneurial interest, the influence of family members and others on entrepreneurial affinity, and the sharing of ideas.

Initial List of Questions
1. What were the best parts of the class?
2. What did you unexpectedly learn in the class?
3. Did this class impact how you view the role of engineers?
4. What skill do you feel you learned that will be important after you graduate?
5. What aspects of this course engaged you to think soft skills found within engineering (i.e. not science, math, or technical)?
6. Did this class change how you see yourself?
7. What aspects of this course engaged you to think about entrepreneurship?
8. How did this class change what you think about entrepreneurship?
9. How did this class change what you think about your future career and where you will be directing your work?

Table 2. Initial List of Questions

The research group intentionally kept the focus away from entrepreneurship for seven of the nine questions given above. The intent was to discover which topics participants brought up unprompted. Questions 7 and 8 only focused broadly on entrepreneurship. Analysis of the responses lead to the identification of a "role model" as a common theme. In fact, given its prevalence, the topic began to emerge as the primary theme. We wanted to learn more about this theme, so we developed questions to explicitly ask about possible role models. We wanted to know if all future participants had an influential role model even if the initial question set (focused on the course) did not elicit mention of a role model. The most commonly mentioned type of role model was family members, but some participants also discussed past jobs and friends. This emergent theme of role model influence is of particular importance as it developed independent of initial questions. Not all students brought up entrepreneurial motivations outside of class, but we wondered how many students had family members, friends, or work relationships who had significantly influenced their entrepreneurial attitudes. Thus, we adapted questioning in the second cohort to reflect this emergent them of role models by adding

additional questions. It is important to remember that the redesigned questions qualitatively attempt to deeply investigate the role model theme seen in the first cohort and that its emergence represents an important practice in the grounded theory approach. Additionally, we also wrote questions to ask about the benefits that students see an engineering education having on entrepreneurial endeavors. We recognized that these participants, who scored particularly high on the attitude and intent survey questions, may hold an interesting perspective on the value of entrepreneurship and their identity as engineers. Hearing their perspectives could provide insight into their motivations and possibly define characteristics that separate them from lower-scoring participants. These questions are shown in Table 3.

Reviewing the responses and questions mid-way through the second cohort again led to more questions. The questions began to focus more on the interplay between entrepreneurship and engineering (i.e. how does entrepreneurship impact engineering), looking for outside influences that students sought in the form of books and mentors, and clarifying some of the questions asked above. These questions are shown in Table 4.

Second List of Questions
1. Ask about what experiences they have had with A) family (parents, siblings, aunts/uncles, cousins) B) friends (roommates, significant others) C) work/internships that have inclined them to be interested in entrepreneurship/have a positive attitude toward entrepreneurship.
2. Are you a part of any student organizations, and if so, do you feel this influences your ideas about entrepreneurship?
3. Have you read any books about business or leadership? If so, was it required curriculum or for fun?
4. Why do you think engineers become entrepreneurs?
5. Do you feel that your engineering degree would be beneficial if you decided to start a business? Why would it be more advantageous over another type of degree?
6. What skills does engineering provide over other majors in regard to entrepreneurship? (i.e. What engineering skills are beneficial to entrepreneurship?)

Table 3. Second List of Questions

Third List of Questions
1. [In question about books from list two, include “entrepreneurship” and “self-help” as categories of books, in addition to “business” and “leadership”]
2. Do you think that entrepreneurship and a career in engineering are separate, or intertwined? Why/how?
3. Do you see entrepreneurial skills as benefiting a career in engineering? What skills?
4. Summarize the benefits that you personally feel come from entrepreneurship.
5. Do you have anyone that you would call a mentor (for career, entrepreneurship, or anything else)? If so, what impact have they had on you? What advice have they given you? Has this impacted your attitudes toward entrepreneurship?

Table 4. Third List of Questions

This third list of questions simply augmented the first two lists, rather than replacing them for the rest of the second cohort. The semi-structured interview approach continued to be used so that questions of interest or clarification could be asked along the way.

Findings

With regard to the experimental topic of interest, formal peer consultation, we found that the qualitative results indicated that the peer consultants had low impact on the participants. Some of those participants who received visits from the peer consultants pointed out they were more aware of the competitions and local student Entrepreneurship Club organization as a result of the peer consultants' visits. As far as interest is concerned, it seems that the peer consultants had little overall impact for the students involved in this study, and previous experiences dominated participants' interest in entrepreneurship.

However, there were common themes and connections that we identified during our analysis of the interviews, and we will expand on each of those in the proceeding section. Themes were discovered as we highlighted and took notes in the margins of the transcripts. Over time, we realized that similar topics were being identified throughout this work. At that point, we began naming categories that might cover some of the similarly-grouped topics. As we progressed, we reviewed additional interviews to look for a fit for each of the topics or if the topics needed to be broadened, refined, or split into new categories. We tried to understand the relationships between the themes, and in the end the dominant theme was a role model. Typically, such role models were family members. The themes are represented graphically in Figure 1 and are described in more detail below.

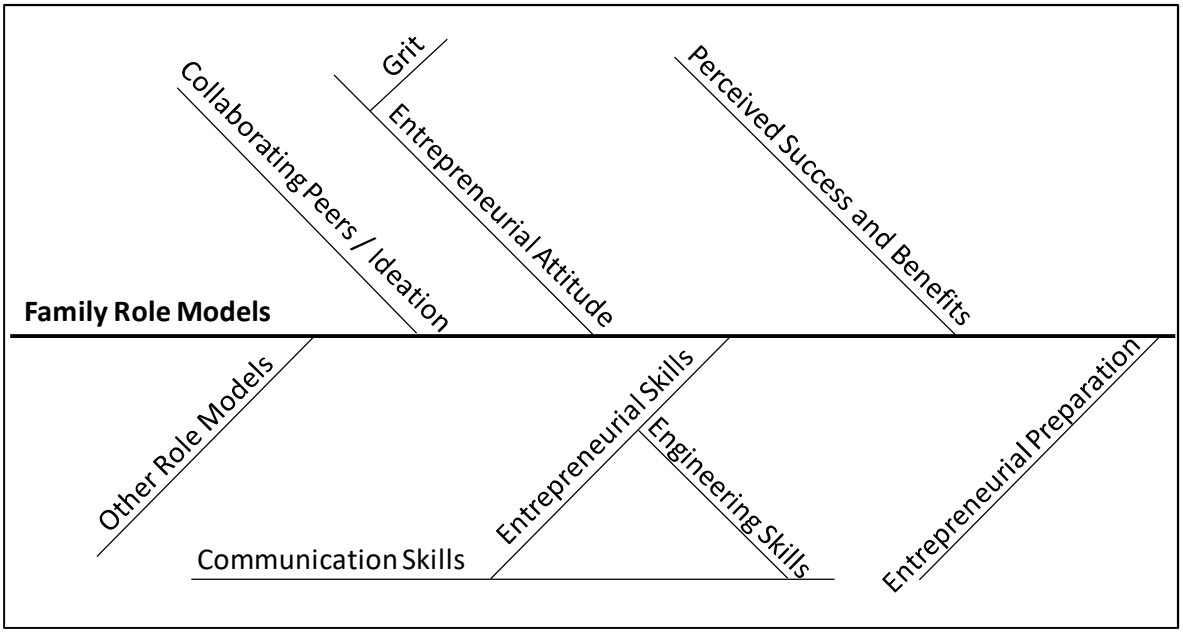

Figure 1 - Central Theme and Branches

Communication – Since this was a technical communication course and the initial questions asked about their feelings regarding the course, most participants spent time talking about

communication skills. In general, although many acknowledged they did not like writing or grammar, participants generally appreciated the improvement of their communication skills and reported they had learned to see their applicability as engineers. Participants also generally saw a connection between communication and entrepreneurship. Many seemed to classify it as a business-type skill.

Family role models – In the initial analysis, it quickly became obvious that most participants (who had been pre-selected as having high entrepreneurial intent and/or high positive attitudes toward entrepreneurship) had family members who had owned or currently own a business. Participants' experiences and attitudes regarding entrepreneurship seemed to revolve around their experiences with those family members or other role models in the absence of a family role model. As this family theme emerged in the initial question set on its own and continued to present itself under direct questioning, it became the central theme of our findings for this work. These entrepreneurial role models were defined by business ownership and typically were not active in their encouragement of the participants to pursue entrepreneurship. The family members cited as having influence via their example were most often fathers, grandfathers, or uncles. It should be noted that many students did not immediately associate the term "role model" with these figures, but after thinking out loud decided it was appropriate. This theme was likely reinforced by the direct questions in our second list, but not all participants responded in the affirmative, as described in the paragraph below. Many stories were shared that provided insight into how family role models provided opportunities for the study participants to take part in entrepreneurial activities with these family members. Watching the family role models, and working with them, often left the study participants with the impression that entrepreneurship was a lot of work, but still a worthwhile endeavor and something that imbued them with a sense of pride.

Friends and Other Role Models – Not all students had close relatives who were entrepreneurs. However, if not a family role model, participants generally reported having another type of role model. One participant – who was exemplary for the amount of entrepreneurial experience he was developing as a student – had received mentoring from members of his fraternity and had little to no family support. This exemplary participant had pursued entrepreneurial education, participated with the university's Entrepreneurship Center, and started businesses with fraternity brothers and others. Another student found his motivation after talking to a professor about an app that he wanted to write, following which the professor teamed up with him to help write the app over the course of a class – the support from his professor and the realization that he had something functioning at the end of class were very motivating for him. Regardless of who their primary role model was, nearly all participants reported having peers (friends and relatives – typically siblings, cousins, or their spouse) with whom they brainstormed business ideas regularly.

Attitude - Mindset/Grit/Persistence – As mentioned above, most family members who inspired entrepreneurial affinity did so through example and not active campaigning. This example typically included a lot of hard work, which left an impression on those we interviewed. Participants would often identify persistence – some also using the term "grit" as a required attribute for success in entrepreneurship. They recognized the "ups and downs" and "risks" associated with entrepreneurship. A few mentioned persistence as something needed for

engineering, but they often viewed the persistence required for entrepreneurship as exceeding the level required for success in engineering education. For example, one participant said "… *the innovation part [referring to engineering], I guess, is more of a positive … push forward. But then I think entrepreneurship, you just kind of have to work that personality in general because if you start getting down on yourself, well then, it's not going to work out.*" Another stated "*But I think anyone who has that grit, a mixture of passion and persistence, I think that plays into success in any role. As an engineer, having that grit and understanding, that passion for what you're doing and persistence for success or creating a solution is what's going to make the great engineers.*" It was also noted that participants often claimed that their role models were supportive of them (in engineering and entrepreneurship), even if they were not actively encouraging it. Whether they mentioned persistence or not, they demonstrated a can-do attitude with regard to entrepreneurship. The "*positive…push forward*" participant quoted above also said "I like that aspect of entrepreneurship because, usually, generally speaking, even if it doesn't work out, they find something else."

Overlap vs Separation of Skills for Engineering & Entrepreneurship – Some participants identified problem-solving skills as helpful for entrepreneurship. They felt the approach they were learning in their engineering curriculum to solving problems was particularly effective and believed it would benefit them in entrepreneurial efforts. One participant said

> "*…one of the biggest things I've learned that engineering teaches you is how to think. And a lot of people have talked about that, but actually going through engineering it's very true…. And that ability to critically think and critically analyze I think has been most beneficial to me personally…. And so, for example, if I'm like participating in an organization or if I'm looking at a product or researching something, you know, I just don't think about necessarily what I'm reading. In my mind I critically analyze it and almost create solutions in my mind if that makes sense.*"

That same participant also felt that entrepreneurial skills were helpful for engineers to have:

> "*I would definitely say, like, engineers who have the entrepreneurial skills are probably going to be more of a benefit for companies than engineers without it. Because I think the ability – within that ability to be an entrepreneur – I think it's more. I don't know it's very broad just to say entrepreneur. It relates to the ability to broaden your perspective, and to, like, not be close-minded in one sense or one way of thinking.*"

That sentiment of entrepreneurship being broader or higher than engineering was echoed by multiple participants. Additionally, some felt that the entrepreneurial perspective would benefit engineers. Other students, however, felt that engineering skills (with the exception of math – which was recognized as helpful with the finances of entrepreneurship) would only serve them in entrepreneurship if they started a technical business. Participants listed communication as a skill for both entrepreneurship and engineering (attributed to the Technical Communication class). It was noted that most entrepreneurial family members of the participants were not engineers, and thus, the examples of entrepreneurship were often not dependent on engineering. The planned business ventures ranged from engineering topics (e.g. app development, lean construction, and sensor system development) to non-engineering topics (e.g. real estate) to ambivalence, with one participant stating "*…I think if I were to try to go down and pursue a dream, and you know, start a business. I think it would take me away from some of the engineering, but it wouldn't have to.*"

This ambivalence about doing engineering (or not) as part of entrepreneurship is also interpreted as being indicative of the feeling that entrepreneurship is broader than simply engineering.

Benefits of Entrepreneurship – When asked about the personal benefits they felt came from entrepreneurship, most mentioned the flexibility (i.e. control of schedule) and fulfillment as something they looked forward to, and many mentioned their role model's flexibility and success. They recognized the potential for financial gain existed, but few seemed focused on it. That said, they all seemed to assume success was a benefit, and regularly cited the success of their role model even if that role model had left their self-owned business to work for someone else. One in particular mentioned a feeling that entrepreneurship would benefit society and found motivation in that belief.

Entrepreneurial Preparation – A few of the participants had enrolled in an entrepreneurship class or series from the College of Business. Many of the participants reported reading popular books on leadership or business (which some of them termed "self-help" books, hence the change in questions between Table 3 and Table 4 above). All of those who reported having read such books claimed to have done so without receiving an external requirement to do so. Those with close family members who owned a business reported having helped with those businesses while growing up. This activity had clearly not dissuaded them from pursuing business but had actively encouraged it. The student who was most actively pursuing entrepreneurial activities as a college student seemed motivated by his pursuits and made it clear that his current activities were not his end-goal as far as a career or entrepreneurship were concerned. He also reported having read the most books of any of the participants.

A brief note towards students' belief that they could choose to be an entrepreneur is warranted: While no general trends were identified, we did notice that the student who was actively pursuing entrepreneurial activities as a college student responded with slightly lower scores on the Perceived Behavioral Control questions than many of the others who were interviewed. There were many in the class who were not interviewed (including many who had low entrepreneurial affinity) that also reported very high Perceived Behavioral Control scores. Perceived Behavioral Control refers to a participant's perception that they have the ability to participate and succeed in entrepreneurship if they so choose, or their self-efficacy with regard to entrepreneurship (Carr & Sequeira, 2007). We measured Perceived Behavioral Control using three questions from Ajzen (2002) as cited in Solesvik (2013) ("If I wanted to, I could easily become an entrepreneur", "As an entrepreneur I would have sufficient control over my business", "It is entirely up to me whether or not I become an entrepreneur"). Question "PBC3" from Solesvik (2013) was left out per Solesvik (2013). We believe that Perceived Behavioral Control is an important topic for research in this field, connected to self-efficacy, but it appeared that many students reported high self-efficacy impressions regarding entrepreneurship in spite of having little experience being entrepreneurs.

It is also worth noting that not all participants appeared to have a common definition for "entrepreneurship." Providing the participants a consistent definition for entrepreneurship was not a purpose of this study, nor was it a focus of the analysis. However, that foundation may be useful for other studies, and it may be profitable to continue such a line of study identifying students' native conceptions of entrepreneurship as well.

Impact

In a review of the literature regarding entrepreneurial intent, one finds many mentions of the importance of family in the selection of entrepreneurship as a career path. It is widely recognized that parents influence their children's plans for study and career (Frome & Eccles, 1998; Wei-Cheng, 2003), particularly for engineering (Dick & Rallis, 1991). Studies on the topic often focus on Science, Technology, Engineering and Math (STEM) studies and careers, but just as Frome and Eccles (1998) include English in their study, we feel that the non-STEM fields would provide benefit if they were also investigated. In fact, a strong link has been demonstrated between parents' entrepreneurial activities and the likelihood of their children pursuing entrepreneurship (Carr & Sequeira, 2007; Solesvik, 2013; Van Auken, Stephens, Fry, & Silva, 2006). Our central theme aligns well with the published research on the topic. Of particular note to this study, given the all-male participant population, Schoon and Duckworth (2012) note that men are particularly influenced by having an entrepreneurial father, which aligns well with our finding that most participants who mentioned a family member mentioned their father, grandfather, or uncle.

The studies that identify themes in career paths and the influence of parents suggest validity for theories such as the Theory of Planned Behavior (Ajzen, 1991), which is typically founded on quantitative data. Others have applied the theory to entrepreneurial behavior (Carr & Sequeira, 2007; Solesvik, 2013), and similar graphics are seen in most publications on the theory of planned behavior. Based on the findings of this study, we desire to augment their work and add features to their model. Our additions are shown relative to the graphic from Carr and Sequeira (2007) in Figure 2, with their original features shown in gray and our additional features drawn in black. Essentially, we feel that more influencers should be included when considering entrepreneurial intent.

We feel there is potential for formal peer consulting to have influence on one's initial attitude toward a behavior. We propose a feature so-named and represented in Figure 2. However, we propose this influence with the realization that further work needs to be conducted to verify this theory. Others have discussed peer mentoring for entrepreneurship (Green et al., 2012), and we feel that it deserves an item in the theory presented by the graphic below. Others have shown that mentors are important for developing entrepreneurial intent (St-Jean & Mathieu, 2015), and we capture this emphasis in the graphic below as well. Peers who spend time with entrepreneurially-minded engineering students while brainstorming ideas may be considered part of the peer group that can influence attitudes or have mentor-like impact on subjective norms and perceived behavioral control.

As this study's participants expressed the applicability of skills in engineering, or those in the specific Technical Communication class, to entrepreneurship, we felt they were revealing an increase in perceived behavioral control. We also felt their descriptions of grit as a precursor to success in entrepreneurship factored directly into perceived behavioral control. We grouped this with engineering skills, as grit has been shown to be an important factor for some in completing an engineering education (Camacho & Lord, 2013).

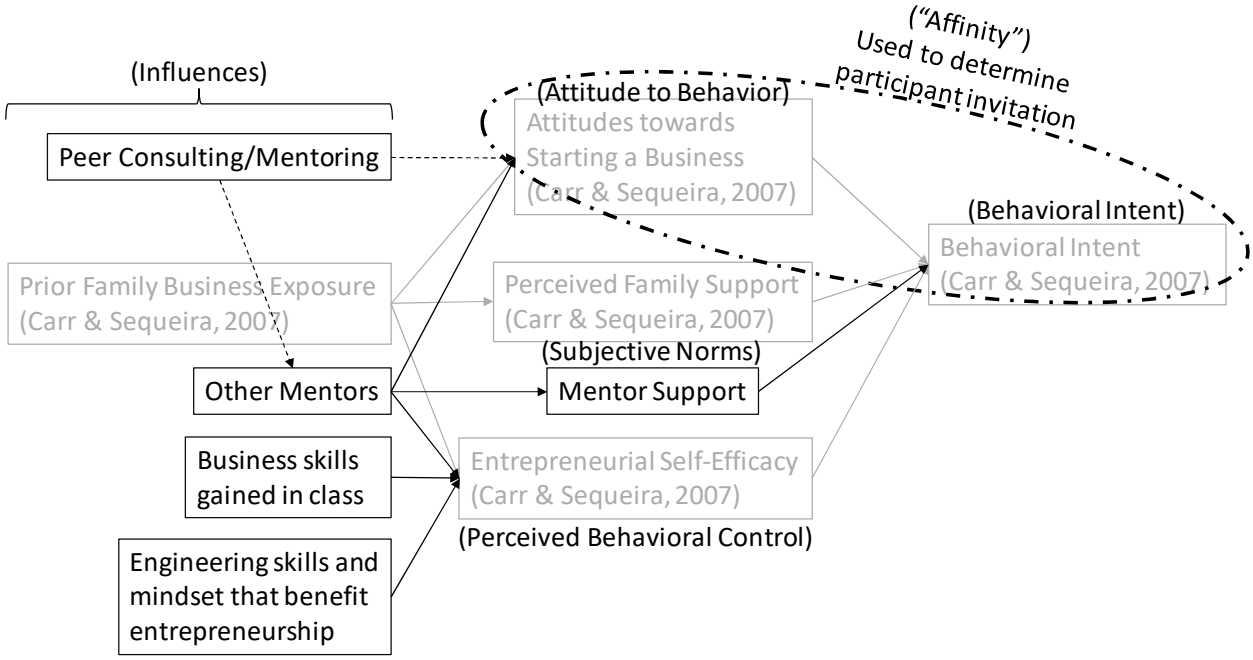

Figure 2. Findings Placed in the Theory of Planned Behavior – Adapted from Carr and Sequeira (2007) shown in gray

The entrepreneurial attitude mentioned above, including grit, appears to identify well with descriptions of perceived behavioral control in the literature. We recognize that things like grit may represent perceived behavioral control, and there were some participants who appeared to be connecting dots between their abilities and the implications for their behavioral control. Similarly, the connection between *entrepreneurial mindsets and skills* and *engineering mindsets and skills* – expressed by some of this study's participants – may also present an avenue that to pursue in recruiting more students into engineering. In particular, given the evidence of an increased entrepreneurial draw in the Mexican socio-cultural context (Van Auken et al., 2006), it may be reasonable to investigate the integration of entrepreneurship with engineering as a means of recruiting more minorities. This pursuit is made more interesting when considered in the light of Camacho and Lord (2013), wherein grit for Latina students who wish to persevere in engineering is identified as critical. This emphasis of entrepreneurial behavior and grit within engineering may provide a unique point of integration for future study and further understanding, particularly as it relates to a cultural subset of the American population. This is important to consider as direction is being given to expand the recruiting pool for engineering students, keeping minoritized populations at the forefront (President's Council of Advisors on Science and Technology, February 2012).

Many publications on research regarding the inclination to become entrepreneurs focus on self-efficacy (Bandura, 1991; Boyd & Vozikis, 1994; St-Jean & Mathieu, 2015), including concepts such as the Perceived Behavioral Control questions mentioned briefly above. At this point, those questions have not factored much into our analysis, although the theoretical backing for such questions provides some motivation to consider them more explicitly in future research and analyses.

Conclusion

As with more general studies on entrepreneurial intent, the influence of a role model on engineering students' affinity for entrepreneurship is a common factor. For engineering students with a high affinity for entrepreneurship, there are apparent benefits to pursuing engineering and entrepreneurship. However, the benefits perceived by the students are not all the same. Similarly, the grit and mindset needed for engineering and entrepreneurship are often described with similar terms but are not consistently perceived. For some engineering students, being an entrepreneur takes an extra level of grit. The skills gained in engineering studies and required in entrepreneurship are also seen inconsistently across a range of applicability. More research into the perceived benefits of this integration of engineering skills and mindset with entrepreneurship is recommended in hopes that it will shed light that can maximize student motivation, expand their interests, and aid in recruiting students to STEM academic programs and entrepreneurial activities.

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