



'Is Someone in Your Family an Entrepreneur?': Examining the Influence of Family Role Models on Students' Entrepreneurial Self-efficacy and its Variation Across Gender

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Abstract

Universities and institutions of higher education are increasingly introducing programs to expose undergraduate engineering students to entrepreneurship. However, there is a lack of research examining different factors that might impact student success and learning in these entrepreneurship education programs. Our study focuses on one such factor, Entrepreneurial Self-Efficacy (ESE), which is described as an individual’s confidence in his/her ability to perform different entrepreneurship-related tasks. ESE is widely being used as an important metric to assess student outcomes in entrepreneurship programs, particularly due to past research and theoretical support that recognizes ESE as a critical influencer of entrepreneurial intention. In addition, researchers have indicated that this ESE may be mediated by the presence of entrepreneur role models in students’ family and this mediating influence may differ across gender. However, these studies have been conducted in business and psychology courses. There is minimal work examining the influence of family role models on students’ ESE and differences of the influence across gender in engineering entrepreneurship programs. Furthermore, these studies have examined just general ESE and not the influence on different ESE sub-constructs. Using McGee’s validated ESE scale, we examined the influence of family role models on students’ five ESE constructs and differences across gender. The study was conducted in a senior-level entrepreneurship course in Fall 2016 and Winter/Spring 2017 semesters at a large research university located in the United States (US). In this paper, using descriptive statistics, bivariate Pearson correlation and hierarchical linear regression analysis, we present an examination of differences in ESE scores and statistically significant interactions of our dependent variables (searching, planning, marshaling, implementing people and implementing finance) with our two independent variables (gender and family role model). Our results show that overall, students with an entrepreneur in their family reported higher ESE for all the five constructs than students who did not have an entrepreneur in their family. However, statistically significant differences and interactions with gender were found for only searching, marshaling and implementing finance constructs. For searching, both the independent variables (family role models and gender) were noted as significant predictors. In contrast, only presence of family role models was found to be a statistically significant predictor for marshaling. Similarly, only gender was significant predictor for implementing finance. These findings show that presence of role model has different influence on ESE associated with different entrepreneurship-related tasks and this influence further varies across gender. Detailed results of analysis are presented in the paper and implications for entrepreneurship education are discussed.

Introduction and Literature Review

Entrepreneurship education has evolved from traditional business school model of teaching business content to more experiential methods aiming to develop a wide array of professional skills (e.g. opportunity identification, creativity and innovativeness) in undergraduate students [1]. Particularly in engineering, this experiential approach has been widely adopted by universities through creation of formal and informal entrepreneurship programs [2]. Students are exposed to business knowledge and entrepreneurial experience in project-based experiential

formal coursework, student incubators, pitch competitions and mentorship opportunities under practicing entrepreneurs. Shartrand, Weilerstein, Besterfield-Sacre, & Golding [3] have reported that, in 2010, more than half of ASEE-affiliated schools were exposing their students to entrepreneurship through formal coursework and/or extracurricular programs [3]. In the near future, these numbers are likely to increase as more institutions begin focusing on developing entrepreneurially minded engineers [4].

With this continuing growth of entrepreneurship education programs, it is imperative and urgent to develop a thorough research-based understanding of entrepreneurship education and identify best practices for program development. While research in engineering entrepreneurship is a relatively new area of inquiry, several researchers have examined student learning outcomes [5], student retention [6], and student attitudes [5], [7]. These studies have assisted in providing empirical insights on different curricular, pedagogical and administrative aspects of engineering entrepreneurship education. Our presented work is an exploratory effort to build an understanding of factors that might impact student success and learning in these entrepreneurship education programs. We focus on one such factor, Entrepreneurial Self-Efficacy (ESE), which is described as an individual's confidence in his/her ability to perform different entrepreneurship-related tasks. ESE is widely being used as an important metric to assess student outcomes in entrepreneurship programs, particularly due to past research and theoretical support that recognizes ESE as a critical influencer of entrepreneurial intention. We examine the influence of family role models on students' ESE and differences of the influence across gender.

Entrepreneurial Self-Efficacy

Originating from Bandura's [8] social cognitive theory, self-efficacy is defined as "people's judgements of their capabilities to organize and execute course of action required to attain designated types of performances" [8] (p. 391). Self-efficacy has been extensively examined in research investigating career goals [9], [10] and has been noted as a critical factor for studying individual behavior [8], [10]. In entrepreneurship domain, self-efficacy has been contextualized as entrepreneurial self-efficacy (ESE) or an individuals' self-perceptions of their skills and abilities related to successfully performing entrepreneurial tasks [11]–[13].

Due to its specificity to entrepreneurship practice, ESE has been widely studied in entrepreneurship research when compared to general self-efficacy due to its impact of several entrepreneurship-related attributes. Specifically, while several researchers have examined ESE as a precursor for entrepreneurial intent [11], [12], [14]–[16], other studies have examined a diverse range of variables that may impact individual's ESE such as personality [10], [13], [17], [18], previous entrepreneurial experiences [9], [10], [13], [19], and educational experiences [11], [13], [20], [21].

In addition, role models have been widely noted as an important factor influencing an individual's ESE [13], [16], [17], [22]–[26]. Role models are referred to as individuals who are sources for inspiration for pursuing various goals and careers [23], [27]–[29]. Prior research suggests that entrepreneurial role models positively impact ESE by serving as a source of inspiration [16], [19], [30], [31] and by providing individuals with strategies and tactics to cope with entrepreneurial tasks and challenges [13].

Role Models

Prior research has shown that role models impact entrepreneurship-related traits among individuals. For example, Quimby and DeSantis [26] investigated the effects of self-efficacy and role models on entrepreneurial intentions. Role models were found to have a significant direct effect on entrepreneurial intentions operating through self-efficacy. One key source for entrepreneurial role models are family role models. From an early age, parents significantly contribute to influencing children's behavior [8], [32]. Researchers have pointed out that many entrepreneurs had parents who were self-employed [33]–[35]. There are several plausible reasons explaining this influence. For instance, having an entrepreneur in the family brings an individual closer to an entrepreneur's network, providing easier access to mentoring and other resources [23], [36]. Furthermore, researchers have noted that the presence of family role model may assist in developing entrepreneurial traits and skills in individuals. Particularly, exposure to entrepreneurship at an early age can provide valuable learning experiences on topics such as business operations or coping with risks [37]. In addition, researchers have suggested that presence of family role models are beneficial in strengthening entrepreneurial characteristics such as autonomy and perseverance and overall interest in entrepreneurship [37]–[39].

Also, several researchers have noted that the influence of role models on individuals may differ across gender. In one such study, Schiller and Crewson [40] revealed different effects of family role models between men and women. They reported that a woman's decision to become an entrepreneur is heavily influenced by their mother's self-employment status while mother's and father's self-employment has minimal effect on men's decision. In another study, Boissin et al. [22] found a correlation between gender and entrepreneurial role models while investigating entrepreneurial behavioral beliefs and identified role models as a mechanism to increase entrepreneurial intentions in women than men. Particularly in the context of ESE, Barnir et al. [16] examined how gender mediates the interaction between the presence of role models and self-efficacy. The researchers reported an overall positive impact of role models on ESE. In addition, they found that gender was a moderating variable. Among women, role models were found to have a stronger influence on entrepreneurial self-efficacy than men.

In summary, these findings highlight that the presence of family role models may differently influence individuals depending on their gender. In other words, the presence of family role models may influence ESE and this influence may differ between genders. The examination of this influence in students enrolled in engineering entrepreneurship courses has been minimally addressed in the literature. Although there are few studies that focus on undergraduates, they are conducted in business [22] or psychology [26] courses. Thus, there is minimal work examining the interaction of family role models and gender on ESE of students enrolled in engineering entrepreneurship programs. Guided by this gap, in our presented work, we examined the influence of family role models on students' ESE and differences between male and female students.

Methodology

Undergraduate students enrolled in a senior-level entrepreneurship course offered by the College of Engineering in Fall 2016 and Winter/Spring 2017 semesters at a large research university

located in the US participated in the study (Table 1). These programs are unique because they offer entrepreneurial training to students who do not preselect into business majors. Students completed the Entrepreneurial Self-Efficacy (ESE) scale [41] at the beginning of semester. The 19 item survey included 5 point Likert-scale questions examining five ESE constructs - searching, planning, marshalling, implementing people and implementing finance. The *searching* construct examined confidence in developing and/or identifying an opportunity. The *planning* construct examined the ability to perform activities that transform the identified opportunity into a business plan. The *marshalling* emphasized on one's ability to gather and organize resources needed to launch a venture. Lastly, *implementing people* and *implementing finance* catered to managing human and financial resources to sustain the venture respectively. In addition, the survey asked students about their gender identity and if any member of their family was an entrepreneur. The responses to these two questions were used as independent variable in our data analysis.

A total of 144 student responses were received for the administered survey with self-identified 91 men and 53 women (total response rate = 90%). Our reliability analysis of the survey scales yielded high Cronbach alpha values for the five constructs: 0.78 (searching), 0.72 (planning), 0.77 (marshalling), 0.84 (implementing people), and 0.90 (implementing finance). Final scores for these five constructs were calculated by averaging the responses to the constituent items. These mean scores were used for all data analysis. First, descriptive statistics were used to provide overall differences in mean scores for the ESE five constructs. Second, bivariate Pearson correlation analysis was used to identify whether the dependent variables (five ESE constructs) were significantly correlated with student gender and presence of entrepreneur in the family. For the purpose of this paper, we use the term 'family role model to identify the second independent variable. Lastly, hierarchical multiple regression analysis was used to examine whether the independent variables were significant predictors of the five ESE constructs. Only variables which held significant correlation were examined in the regression analysis. Hierarchical multiple regression allows the researcher to enter variables in steps to understand whether the added variable still explain the variance in the dependent variable. In our analysis, family role model was entered in the model followed by gender. The results of descriptive statistics, bivariate Pearson correlation and regression analysis are presented in the following sections.

Table 1: Study participants

	With Family Role Models	With No Family Role Models	Total
Men	51	40	91
Women	31	22	53

Results

Descriptive Statistics

Overall, students with an entrepreneur in their family reported higher ESE for all the five constructs than students who did not have an entrepreneur in their family. This difference was largest for searching and marshalling when compared to other three constructs. For example, in case of searching, students with family presence reported a higher mean score of 3.67 when

compared to 3.30 for students with no family presence. Similarly, for marshalling, students with family presence reported a higher mean score of 3.85 when compared to 3.48 for student with no family presence. In contrast, the mean score differences between the with and without family presence students for planning and implementing finance constructs was 0.16 and 0.22 respectively. For implementing people, this difference was further less (0.06) between the two groups. The mean scores for the five constructs are reported in Table 2.

Table 2: Overall mean ESE scores

Constructs	Family Presence			No Family Presence		
	N	Mean	Std Dev	N	Mean	Std Dev
Searching	82	3.67	0.77	62	3.30	0.72
Planning	82	3.14	0.76	62	2.98	0.73
Marshaling	82	3.85	0.67	62	3.48	0.82
Implementing People	82	3.68	0.75	62	3.62	0.77
Implementing Finance	82	3.56	0.61	62	3.34	0.65

Similar differences were also noted within male and female students. For female students, ESE scores were higher for students with a family presence of entrepreneurs. The largest difference between mean ESE scores of students with family presence and mean ESE scores of students without family presence was 0.52 for the marshalling construct. Planning and implementing finance also showed differences of 0.22 and 0.28, respectively, between students with and without family presence. The smallest differences between mean ESE scores of female students with and without family presence were seen in the searching (0.13) and implementing constructs (0.12). The mean ESE scores of the five constructs for female students are reported in Table 3.

Table 3: Mean ESE scores for female students

Constructs	Family Presence			No Family Presence		
	N	Mean	Std Dev	N	Mean	Std Dev
Searching	31	3.39	0.91	22	3.26	0.72
Planning	31	3.06	0.77	22	2.84	0.62
Marshaling	31	3.75	0.80	22	3.23	0.72
Implementing People	31	3.73	0.75	22	3.61	0.87
Implementing Finance	31	3.51	0.69	22	3.23	0.60

Male students also reported ESE scores higher for students with a family presence of entrepreneurs. The largest difference was in the searching construct with a mean ESE score of 3.84 for male students with a family presence and 3.32 for male students without a family presence. The marshalling construct also had a relatively large difference of 0.29 between mean ESE scores of males with and without family presence. The difference was further less for the implementing finance (0.15) and planning (0.14) constructs. The smallest difference between mean ESE scores with family and without family was seen in the implementing people construct (0.03). The mean ESE scores of the five constructs for male students are reported in Table 4.

Table 4: Mean ESE score for male students

Constructs	Family Presence			No Family Presence		
	N	Mean	Std Dev	N	Mean	Std Dev
Searching	51	3.84	0.63	40	3.32	0.74
Planning	51	3.19	0.75	40	3.05	0.78
Marshaling	51	3.92	0.58	40	3.63	0.85
Implementing People	51	3.65	0.76	40	3.62	0.73
Implementing Finance	51	3.58	0.57	40	3.43	0.68

Correlation and Regression Analysis

Bivariate Pearson correlation analysis was performed to identify significant correlations for the five ESE constructs (searching, planning, marshalling, implementing people and implementing finance) with gender and family influence. The results of the analysis are presented in Table 5. The asterisks indicate significance level for the correlations. A negative correlation implied that high values on one variable are associated with low values in the other. In our data, male and family presence were reported as '1' and female and no family presence were reported as '2'. Thus, in our case, negative correlations imply that high searching score was associated with 'male' student when correlated with gender and a 'yes' response when correlated with presence of entrepreneur in the family.

Table 5: Pearson correlation coefficients

	Searching	Planning	Marshalling	Implementing People	Implementing Finance
Family Role Model	-.241 **	-.109	-.242**	-.040	-.071
Gender	-.174*	-.105	-.161	.030	-.258**

*p<.05, **p<.001

Presence of statistically significant correlations varied between the ESE constructs. For searching, statistically significant correlations were found with gender (p<.001) and family role model (p<.05). Both planning and implementing people constructs did not significantly correlate with either family role model or gender. For marshaling, statistically significant correlations were found for family role model (p<.001). However, there were no significant correlation with gender. In contrast, implementing finance significantly correlated with gender (p<.001) and not with family role model. In summary, while family role model significantly correlated with searching and marshalling, gender was found to significantly correlate with searching and implementing finance constructs. These statistically significant constructs identified here were further examined in a hierarchical multiple regression analysis.

The regression analysis results only for the three constructs are presented in Table 6. The independent variables family role model and gender were entered in the analysis in that order. The table summarizes the variance accounted for at each step (R^2), change in variation accounted for after addition of gender variation (ΔR^2), beta estimates (B), standard error of beta estimates

(S.E. B), and standardized beta estimates (*B*). The results further enhanced the correlation findings. Both family role model and gender were noted as significant predictors for searching. The variation account for (R^2) increased from .058 to .090 when gender was added to analysis. In other words, family role model accounted for 58% of variance when predicting the searching score. When gender was added to the analysis, both variables together accounted for 90% of variance in students searching score. For marshalling, only family role model was noted as a significant predictor. Family role model accounted for 58% of variance when predicting students marshalling scores. In contrast, family role model was not found as a significant predictor of implementing finance. It accounted for only 5% of variance. However, addition of gender variable in the analysis resulted in a change in R^2 to .073. Thus, addition of gender accounted for 68% of variance when predicting implementing finance scores. In other words, instead of family role model, gender was a significant predictor of students' implementing finance scores.

Table 6: Hierarchical multiple regression

	Variable	R²	ΔR²	B	S.E. B	B
Searching	<i>Family Role Model</i>	.058		-.382	.125	-.245*
	<i>Gender</i>	.090	.032	-.288	.128	-.180*
Marshalling	<i>Family Role Model</i>	.058		-.376	.123	-.246*
	<i>Gender</i>	.086	.028	-.262	.126	-.167
Implementing Finance	<i>Family Role Model</i>	.005		-.161	.168	-.078
	<i>Gender</i>	.073	.068	-.553	.172	-.260*

* $p < .05$

Results demonstrated that constructs were specifically influenced more by either gender or family role models. Searching and marshalling constructs were most effected by the presence of family role models, while implementing finance was most effected by gender. Gender and family role models have unique impacts on various constructs of ESE including searching, marshalling and implementing finance, but not the planning or implementing people constructs.

Discussion

The influence of family role models on entrepreneurial self-efficacy has been widely hypothesized in the literature. In concurrence with existing research [16], [31], [42], the findings of our study show that students with an entrepreneur in their family have higher ESE than students who do not have an entrepreneur in their family. In addition, we also found that these reported higher ESE scores were noted across both men and women. In other words, both men and women with an entrepreneur in their family had higher ESE than men and women who did not respectively. Our work adds to the current body of literature by providing a more granular, construct-level examination of the influence of family role models and gender on ESE. Our correlation and regression analysis unpacks how presence of family role models and gender correlate differently with various ESE constructs.

First, both presence of family role model and gender were noted as significant predictors for students' *searching* scores. High searching scores were associated with male students and students with entrepreneurs in their family. While other ESE constructs (planning, marshalling,

implementing people and finance) are equivalently important, searching holds a more fundamental importance in the entrepreneurial process. Our findings show that women with no family role models will be more susceptible to having low *searching* self-efficacy which might negatively impact their success in the entrepreneurship programs and also their willingness to enroll in them. Researchers have noted that absence of encouragement (e.g. role models) may lead to women being less inclined to pursue entrepreneurship in spite of receiving education and training [16]. Therefore, to ensure success of women in entrepreneurship programs, administrators and instructors should place greater emphasis on providing female students with opportunities to engage in opportunity identification process (searching). Researchers should further examine the searching aspect of entrepreneurial training to identify best pedagogical practices for teaching relevant skills to women and assisting in the development of confidence in successfully performing searching activities.

For *marshalling*, only the presence of entrepreneur in the family was a significant predictor. This indicates that one's confidence in his/her ability to gather and organize resources to launch a venture (*marshalling*) does not depend on whether a student identifies as a male or female rather by the presence of an entrepreneur in his/her family. This seems logical because the presence of an entrepreneur in the family gives an individual easier access to entrepreneur's network and increased social capital to invest in accessing needed resources [23], [36]. Thus, both male and female students who do not have an entrepreneur in their families will be prone to lower confidence pertaining to gathering and organizing resources for venture launch. Since it is more likely that majority of the students will not have entrepreneurs in their family, special attention should be paid to provide experiences through which students' gain confidence in their marshalling abilities. Some ways through which this can be achieved is by providing more mentorship opportunities with practicing entrepreneurs, alumni, sponsors, and industry partners so that students who do not come from entrepreneurial families will develop more confidence in their ability to gather or organize needed resources.

Interestingly, for *implementing people*, no significant correlations were noted with gender and presence of entrepreneur in the family. Implementing people assesses one's confidence in managing human-related aspects needed to sustain a venture. No correlation with gender indicates that men and women did not differ in confidence about their abilities to manage human-related aspects of entrepreneurial process. This finding supplements related research that has found minimal difference in the human networks accessed by male and female entrepreneurs [43]. In addition, we found that presence of family role model also did not correlate with implementing people scores. This indicates exposure to family role models might not impact students' confidence in managing human-related aspects. This is unsurprising because although family role models provide motivation and access to resources, their presence does not necessarily provide individuals with experiences needed to develop confidence in managing human-related aspects.

Similarly, for *planning* scores, no significant correlations were noted with gender and presence of entrepreneur in the family. Planning score assesses one's confidence in his/her ability to perform activities that transform the identified opportunity into a business plan. The finding that gender was not noted as a significant predictor of planning scores sheds light on the decision stage of the entrepreneurial process. Zwan, Verheul, & Thurik [44] identify five stages of

engagement in entrepreneurial process: never considered starting a business; thinking about starting a business; taking steps to start a business (nascent entrepreneurs); running a business for less than three years; running a business for more than three years. To become a nascent entrepreneur, one has to transform from thinking about starting a company to actually taking steps to start the business. In other words, performing activities to transform identified opportunity into a business plan (*planning*) is a fundamental step in the entrepreneurial process. To create better environments for women to succeed in the entrepreneurial process, it is important to identify in which stages of the entrepreneurial process women underperform men [44]. Our findings show that gender might not impact one's confidence in transforming ideas into a business plan (*planning*), rather it is the searching for opportunities stage in which differences might occur across gender (gender was a significant predictor of *searching* scores). Also, while it is reasonable to postulate that family role models might assist in increasing confidence in one's ability to transform opportunity into the business plan, our study indicates contradictory results. The presence of family role model was also not found to be a significant predictor of *planning* scores. Future work should perform more detailed analysis to build a better understanding of the influence of family role models on self-efficacy associated with business plan development.

In contrast, only students' gender and not presence of entrepreneur in family was found as a significant predictor for *implementing finance* scores. In other words, male students were associated with higher scores on their ability to manage financial resources to sustain the venture when compared to women. This shows that women are more likely to have lower confidence in their ability to perform finance-related aspects of the entrepreneurial process than men. Social role theory offers explanation for this finding [45]. The theory argues that gender-based occupational stereotypes lead to men being attracted to more 'masculine' roles (e.g. paid workforce) and women to more 'feminine' roles (e.g. parenting). In business context, men have traditionally handled financial responsibilities and are more confident in financial roles when compared to women [46]. Researchers have noted that women are more risk-averse when it comes to making financial decisions when compared to men [47]. Our study reiterates the findings from past research in an undergraduate entrepreneurship education setting. Furthermore, our results also show that the presence of entrepreneur in the family did not have any influence on *implementing finance* scores for both men and women. While researchers have noted that role models are beneficial in strengthening several entrepreneurship-related traits such as autonomy, perseverance, and coping with risks [37]–[39]; our results point out that the presence of family role models may not impact confidence associated with managing financial resources of an entrepreneurial process.

This finding is particularly noteworthy from a curricular standpoint. Typically, engineering entrepreneurship programs place more emphasis on exposing students with opportunities to engage with customers and iterate on their product design (e.g. [49]–[51]). Training on financial aspects are usually covered in more detail in entrepreneurship programs run by business schools when compared to their engineering counterparts. This is because business schools' focus is on venture creation, while the engineering schools aim at skill-development by exposing students to entrepreneurship in an experiential setting. One simple recommendation based on our findings would be to create entrepreneurship programs which provide more training on financial aspects

to help instill confidence in women. However, our finding highlights a more critical question about the aimed outcomes of engineering entrepreneurship for the engineering education community. Although engineering entrepreneurship has evolved from venture creation to a skill-development emphasis, there has not been any consensus or discussion on what specific areas of business-content knowledge should be taught in engineering entrepreneurship programs. As a result, a diverse range of curricular approaches have been implemented in engineering entrepreneurship programs by different universities. While we do not imply that a standardized curriculum should be used in engineering entrepreneurship programs, rather we argue that these programs will benefit if the intended learning outcomes, curriculum and instruction, and assessment measures are aligned with the each other.

Conclusion

While there has been a significant growth in engineering entrepreneurship programs, the extent of research in the area is still emergent. Recent engineering education research has started to examine the impact of engineering entrepreneurship programs on student retention, career choices and learning outcomes. However, emphasis on examining the factors impacting student success in entrepreneurship programs is still scarce. Our presented work provides preliminary evidence on factors that might inform student success in entrepreneurial process. Rather than studying the outcomes of entrepreneurship education, we uniquely focused examining the influence of family role models on entrepreneurial self-efficacy and gender differences of the influence for students enrolled in engineering entrepreneurship programs. The findings identify key aspects of entrepreneurial self-efficacy that are influenced by family role models and notes differences across gender.

This study was conducted at a large research-focused university; we acknowledge that the results might differ for students at different institution types. Nonetheless, this exploratory study points on that differences in self-efficacy associated with different entrepreneurial tasks differs between gender and also is mediated by the presence of entrepreneurs in one's family. Future work should examine similar differences across student demographics such as race and socio-economic status. Identification of factors that may negatively/positively impact student success will assist in designing engineering entrepreneurship programs that benefits a diverse student body.

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References

- [1] J. Ochs, T. Watkins, and B. Boothe, "Creating a truly multidisciplinary entrepreneurial educational environment," *J. Eng. Educ.*, vol. 90, no. October, pp. 577–583, 2001.
- [2] A. Shartrand, P. Weilerstein, M. Besterfield-Sacre, and K. Golding, "Technology entrepreneurship programs in U.S. engineering schools: Course and program characteristics at the undergradate level," in *American Society for Engineering Education*, 2010.
- [3] A. Shartrand, P. Weilerstein, M. Besterfield-Sacre, and K. Golding, "Technology

- entrepreneurship programs in U.S. engineering schools: course and program characteristics at the undergraduate level,” 2010.
- [4] KEEN, “Kern Entrepreneurial Engineering Network,” 2017. .
- [5] N. Duval-Couetil, T. Reed-Rhoads, and S. Haghighi, “The engineering entrepreneurship survey: An assessment instrument to examine engineering student involvement in entrepreneurship education,” *J. Eng. Entrep.*, vol. 2, no. 2, pp. 35–56, 2011.
- [6] M. W. Ohland, S. A. Frillman, G. Zhang, C. E. Brawner, and T. K. Miller, “The effect of an entrepreneurship program on GPA and retention,” *J. Eng. Educ.*, vol. 93, no. 4, pp. 293–301, 2004.
- [7] Q. Jin *et al.*, “Entrepreneurial Career Choice and Characteristics of Engineering and Business Students,” *Int. J. Eng. Educ.*, vol. 32, no. 2, pp. 598–613, 2016.
- [8] A. Bandura, *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, N.J: Prentice-Hall, 1986.
- [9] S. R. Brunhaver, S. Sheppard, A. L. Antonio, and S. R. Barley, “Early career outcomes of engineering alumni: exploring their connection to the undergraduate experience,” Stanford University, 2015.
- [10] G. Rameseder, M. Reithmann, and S. Sheppard, “The roots of entrepreneurial career goals among today’s engineering undergraduate students,” in *2017 ASEE Annual Conference and Exposition*, 2017.
- [11] F. Wilson, J. Kickul, and D. Marlino, “Gender, entrepreneurial self-efficacy, and entrepreneurial career intentions: implications for entrepreneurship education,” *Entrep. Theory Pract.*, pp. 387–406, 2007.
- [12] C. Chen, P. Greene, and A. Crick, “Does entrepreneurial self-efficacy distinguish entrepreneurs from managers?,” *J. Bus. Ventur.*, vol. 13, pp. 295–316, 1998.
- [13] H. Zhao, C. Seibert, and C. Hills, “The mediating role of self-efficacy in the development of entrepreneurial intentions,” *J. Appl. Psychol.*, vol. 90, no. 2, pp. 1265–1272, 2005.
- [14] N. Boyd and G. Vozikis, “The influence of self-efficacy on the development of entrepreneurial intentions and actions,” *Entrep. Theory Pract.*, pp. 63–77, 1994.
- [15] N. Krueger, “The impact of prior entrepreneurial exposure on perceptions of new venture feasibility and desirability,” *Entrep. Theory Pract.*, vol. 18, no. 1, p. 5, 1993.
- [16] A. BarNir, W. E. Watson, and H. M. Hutchins, “Mediation and moderated mediation in the relationship among role models, self-efficacy, entrepreneurial career intention, and gender,” *J. Appl. Soc. Psychol.*, vol. 41, no. 2, pp. 270–297, 2011.
- [17] S. Chlosta, H. Parzelt, S. B. Klein, and C. Dormann, “Parental role models and the decision to become self-employed: the moderating effect of personality,” *Small Bus. Econ.*, vol. 38, pp. 121–138, 2012.
- [18] E. J. Douglas and D. A. Shepherd, “Self-employment as a career choice: attitudes, entrepreneurial intentions, and utility maximization,” *Entrep. Theory Pract.*, pp. 81–90, 2002.
- [19] M. Minniti and W. Bygrave, “A dynamic model of entrepreneurial learning,” *Entrep. Theory Pract.*, vol. 25, no. 3, pp. 5–16, 2001.
- [20] L. Cox, S. Mueller, and S. Moss, “The impact of entrepreneurship education on entrepreneurial self-efficacy,” *Int. J. Entrep. Educ.*, vol. 1, no. 2, 2002.
- [21] A. Huang-Saad, C. S. Morton, and J. Libarkin, “Unpacking the impact of engineering entrepreneurship education that leverages the Lean LaunchPad curriculum,” 2016.
- [22] J. Boissin, B. Branchet, S. Delanoe, and V. Velo, “Gender’s perspective of role model

- influence on entrepreneurial behavioral beliefs,” *Int. J. Bus.*, vol. 16, no. 2, pp. 182–206, 2011.
- [23] N. Bosma, J. Hessels, V. Schutjens, M. Van Praag, and I. Verheul, “Entrepreneurship and role models,” *J. Econ. Psychol.*, vol. 33, pp. 410–424, 2012.
- [24] H. Dryler, “Parental role models, gender, and educational choice,” *Br. J. Sociol.*, vol. 49, no. 3, pp. 375–398, 1998.
- [25] E. Mungai and S. R. Velamuri, “Parental entrepreneurial role model influence on male offspring: is it always positive and when does it occur?,” *Entrep. Theory Pract.*, pp. 337–357, 2009.
- [26] J. L. Quimby and A. M. DeSantis, “The influence of role models on women’s career choices,” *Career Dev. Q.*, vol. 54, no. 4, pp. 297–306, 2006.
- [27] S. Basow and K. Howe, “Role-model influence: Effects of sex and sex-role attitude in college students,” *Psychol. Women Q.*, vol. 4, pp. 558–572, 1980.
- [28] E. Shapiro, F. Haseltine, and M. Rowe, “Moving up: Role models, mentors, and the ‘patron system,’” *Sloan Manage. Rev.*, vol. 6, no. 1, pp. 19–47, 1978.
- [29] S. Wright, A. Wong, and C. Newill, “The impact of role models on medical students,” *J. Gen. Intern. Med.*, vol. 12, pp. 53–56, 1997.
- [30] A. P. Buunk, J. M. Peiro, and C. Griffioen, “A positive role model may stimulate career-oriented behavior,” *J. Appl. Soc. Psychol.*, vol. 37, pp. 1489–1500, 2007.
- [31] L. R. Rivera, E. C. Chen, L. Y. Flores, F. Blumberg, and J. G. Ponterotto, “The effects of perceived barriers, role models, and acculturation on the career self-efficacy and career consideration of Hispanic women,” *Career Dev. Q.*, vol. 56, pp. 47–61, 2007.
- [32] A. Bandura and R. Walters, *Social learning and personality development*. New York: Holt, Reinhart & Winston, 1963.
- [33] F. Delmar and P. Davidsson, “Where do they come from? Prevalence and characteristics of nascent entrepreneurs,” *Entrep. Reg. Dev.*, vol. 12, no. 1, pp. 1–23, 2000.
- [34] A. Shapero and L. Sokol, “The social dimensions of entrepreneurship,” *Encycl. Entrep.*, pp. 72–90, 1982.
- [35] G. de Wit and F. A. A. M. van Winden, “An empirical analysis of self-employment in the Netherlands,” *Small Bus. Econ.*, vol. 1, pp. 263–272, 1989.
- [36] M. S. Granovetter, “The strength of weak ties,” *Am. J. Sociol.*, vol. 78, no. 6, pp. 1360–1380, 1973.
- [37] P. H. Kim, H. E. Aldrich, and L. A. Keister, “Access (not) denied: The impact of financial, human, and cultural capital on entrepreneurial entry in the United States,” *Small Bus. Econ.*, vol. 27, pp. 5–22, 2006.
- [38] M. Hout and H. S. Rosen, “Self-employment, family background, and race,” *J. Hum. Resour.*, vol. 35, pp. 671–694, 2000.
- [39] D. R. Miller and G. E. Swanson, *The changing american parent: A study in the detroit area*. New York: Wiley, 1958.
- [40] B. R. Schiller and P. E. Crewson, “Entrepreneurial origins: A longitudinal inquiry,” *Econ. Inq.*, vol. 35, no. 3, pp. 523–531, 1997.
- [41] J. E. McGee, M. Peterson, and S. L. Mueller, “Entrepreneurial self-efficacy: refining the measure,” *Entrep. Theory Pract.*, pp. 965–988, 2009.
- [42] A. P. Buunk, J. M. Peiró, and C. Griffioen, “A Positive Role Model May Stimulate Career-Oriented Behavior1,” *J. Appl. Soc. Psychol.*, vol. 37, no. 7, pp. 1489–1500, 2007.
- [43] J. Watson, “Networking: Gender differences and the association with firm performance,”

- Int. Small Bus. J.*, vol. 30, no. 5, pp. 536–558, 2012.
- [44] P. van der Zwan, I. Verheul, and A. R. Thurik, “The entrepreneurial ladder, gender, and regional development,” *Small Bus. Econ.*, vol. 39, no. 3, pp. 627–643, 2012.
- [45] A. H. Eagly, *Sex differences in social behavior: A social-role interpretation*. Psychology Press, 1987.
- [46] B. J. Orser, A. L. Riding, and K. Manley, “Women entrepreneurs and financial capital,” *Entrep. Theory Pract.*, vol. 30, no. 5, pp. 643–665, 2006.
- [47] M. Powell and D. Ansic, “Gender differences in risk behaviour in financial decision-making: An experimental analysis,” *J. Econ. Psychol.*, vol. 18, no. 6, pp. 605–628, 1997.
- [48] P. R. Brown, M. Williams, Julia, and S. M. Sipes, “Assessment of the Rose-Hulman Leadership Academy Assessment of the Rose-Hulman Leadership Academy,” *122nd ASEE Annu. Conf. Expo.*, 2015.
- [49] M. M. Z. Lagoudas and A. Texas, “Assessment of Innovative Skill Development in Weekend Challenges Assessment of Student Outcomes in a 48-Hour Intensive Innovation Experience Introduction,” 2015.
- [50] D. Pistrui, J. K. Layer, and S. L. Dietrich, “MAPPING THE BEHAVIORS , MOTIVES, AND PROFES- SIONAL COMPETENCIES OF ENTREPRENEURIALY MINDED ENGINEERS IN THEORY AND PRACTICE : AN EMPIRICAL INVESTIGATION,” in *American Society for Engineering Education, 2012*, 2012.