

Teaching to Innovate: Beliefs and Perceptions of Instructors Who Teach Entrepreneurship to Engineering Students*

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The number of entrepreneurship programs at universities targeting engineering students has grown substantially in the last decade. However, few research studies have examined the practices and beliefs of instructors in these programs. Understanding these beliefs will help the development of pedagogical and theoretical models to drive entrepreneurship education. The purpose of this paper is to gather information on instructors' beliefs and teaching practices relating to engineering entrepreneurship education. Three research questions were addressed in the study: 1) How do faculty members define the entrepreneurial mindset? 2) Do faculty members believe that the entrepreneurial mindset is something that can be developed? 3) How do faculty members teach entrepreneurship; is there a relationship between their teaching practices and their beliefs? The study was conducted in two phases. In the first phase, twenty-six instructors of entrepreneurship participated in an in-depth structured interview focusing on their perceptions of entrepreneurship education. The results of this study led to the construction of an online survey that was administered to 37 instructors at three institutions in the second phase of the study. Results showed that faculty tended to believe that the entrepreneurial mindset is a function of both innate characteristics and skills that can be built through instruction. Faculty also felt that entrepreneurship programs should focus on venture and be taught through formal programs. The participants advocated for the use of experiential learning for teaching entrepreneurship.

Keywords: entrepreneurship education; instructor beliefs; innovation

1. Introduction

Formal entrepreneurship education within engineering is fairly new at universities and colleges. However, the number of programs dedicated to entrepreneurship education both within and outside engineering is continuing to grow. In 2003, Katz estimated that over 1600 universities had established entrepreneurship programs within business, engineering, or an interdisciplinary context. Although the number of entrepreneurship programs in engineering has grown, and will likely continue to grow, little research has been done to systematically examine program models or faculty beliefs and teaching practices. Much of the literature in entrepreneurship education within the engineering context has focused on the description or assessment of individual entrepreneurship programs, courses, or other individual program components [1–3].

Understanding faculty beliefs of entrepreneurship education will help in the development of pedagogical and theoretical models to drive entrepreneurship education. Mars argued that a theory of entrepreneurship education needs to be further developed in order to guide pedagogical development in the discipline [4]. As he stated, “. . . entrepreneurship education should provide students with

a theoretical compass useful in navigating the future economic and/or social conditions that will in a large part determine the outcomes of new ventures. The principles, methods, and philosophies embedded in entrepreneurial theory and subsequently entrepreneurship education are applicable to a wide range of applications and environments” (p. 46). In an earlier paper, Fiet examined a small sample of syllabi from 18 faculty members who were teaching entrepreneurship courses [5]. He discovered a lack of commonality across the syllabi with the typical coverage areas coming from other disciplines. He found that, “. . . many of the teaching choices were highly correlated with the training and research streams of individual respondents” (p. 4). Much like Mars, Fiet argued that entrepreneurship education needs a theoretical foundation to drive both the content covered in the classroom and the pedagogical decisions, focusing on theory-based, student-centered activities.

Faculty members may have inherent beliefs about the skills, knowledge, and characteristics that individuals must possess in order to successfully become an entrepreneur, and how these attributes are acquired. Faculty beliefs likely influence how entrepreneurship programs are structured and the content of the component courses. This paper uses survey data to examine faculty beliefs regarding

engineering entrepreneurship and entrepreneurship education to gather information on the current state of the discipline. This information will be helpful to researchers and practitioners interested in developing theoretical and pedagogical models of entrepreneurship education within engineering. The results can also be helpful to faculty who seek to create new, or to improve upon, existing student experiences in entrepreneurship.

1.1 Research on teacher beliefs

Educational research has supported a connection between teacher beliefs and practice. The consistency theory, as termed by Fang [7], holds that classroom practice is highly influenced by teachers' beliefs, attitudes, and perceptions. While the terminology "beliefs" may encapsulate many different concepts and terms [8], the research has generally held that teacher beliefs are highly influential in the selection of instructional methods and the content covered within a class. As Pajares notes, "Few would argue that the beliefs teachers hold influence their perceptions and judgments, which, in turn, affect their behavior in the classroom, or that understanding the belief structures of teachers . . . is essential to improving their professional preparation and teaching practices" [8, p. 307]. Within any discipline, understanding teacher beliefs is important in order to provide suggestions for improvement, to provide information for new teachers entering a discipline, and to understand the nature of a discipline.

In addition to influencing classroom environment, culture, and course content, teachers' beliefs can potentially impact student outcomes. As Fang notes, ". . . [a] teacher's beliefs or philosophy can affect teaching and learning in one way or the other. For example, studies have shown that a teacher's expectations can have significant impacts on students' behavior and academic performance . . . On the other hand, a teacher's implicit theory about the nature of knowledge acquisition can also affect his/her behaviors and ultimately his/her students' learning" [7, p. 50].

In the educational literature, one of the major challenges in the study of teacher beliefs is in the definition of what constitutes a belief. As Pajares states, beliefs have been called many different aliases, including, "attitudes, values, judgments, axioms, opinions, ideology, perceptions, conceptions, conceptual systems, preconceptions, dispositions, implicit theories, explicit theories, personal theories, internal mental processes, action strategies, rules of practice, practical principles, perspectives, repertoires of understanding, and social strategy, to name but a few that can be found in the literature" (p. 308).

Kagan outlined two separate research areas that

have emerged regarding teacher beliefs. The first is the examination of teacher self-efficacy, which may be defined as, "a teacher's generalized expectancy concerning the ability of teachers to influence students, as well as the teacher's beliefs concerning his or her own ability to perform certain professional tasks [9, p. 67]. The second area that has emerged is the study of beliefs within specific content areas, for example, math, science, or history. Examinations of this type may include, "the teacher's epistemological conceptions of the field to be taught, as well as his or her judgments about appropriate instructional activities, goals, forms of evaluation, and the nature of student learning" (p. 67). The study presented here is an example of this latter area, as it strives to examine the beliefs of faculty members and instructors regarding the teaching of engineering entrepreneurship to undergraduate students.

Research on teacher beliefs has focused on instruction, primarily at the primary and secondary levels; less research has focused on beliefs of faculty and instructors in higher education: "Although the construct of teacher beliefs is critical to teaching enhancement, we still know little about the complexities of the educational beliefs that academics bring to their teaching in higher education" [10, p. 41]. Additionally, research in higher education has tended to focus on more general beliefs of teaching practices, rather than beliefs within a specific content area, such as engineering or business. In one of the few engineering-related studies of faculty beliefs, Quinlan investigated the beliefs of mechanical engineering faculty members using interviews and observations. She focused on their perceptions of individual courses, gathering information on course goals, course content and structure, perceived role as teachers, perceptions of students, and student evaluation. Interestingly, she found differences in faculty beliefs based on whether the faculty members primarily taught technical content such as thermodynamics or taught design-based courses. Her research supports the assertion that beliefs are situated within a specific discipline and thus must be investigated within that discipline.

Given that entrepreneurship education is unique regarding subject matter and student goals, it is advantageous to study faculty beliefs within this context. The next section discusses the nature of entrepreneurship education, particularly with respect to engineering in order to better situate the beliefs that faculty may possess regarding their teaching.

1.2 Faculty beliefs and engineering entrepreneurship education

As mentioned above, when examining teacher beliefs, researchers need to consider the character-

istics of a specific discipline, to consider what facets may influence teachers' beliefs and ultimately instructional practice. In the unique domain of entrepreneurship education, there are several areas that might be explored when investigating faculty beliefs. First, instructors of entrepreneurship courses may have inherent beliefs about the skills, knowledge, and characteristics that individuals must possess in order to successfully become an entrepreneur, and how these qualities are acquired. These beliefs may be a result of prior experiences of the instructors, as many often have experience as entrepreneurs themselves. They also may vary as a result of instructional background, as some educators of entrepreneurship in engineering come from the business realm while others have an engineering background. A second area of interest pertains to understanding the instructional practices that entrepreneurship instructors feel are most effective in teaching entrepreneurship. These two areas are discussed further below.

1.3 Beliefs regarding the entrepreneurial mindset

What do faculty and instructors believe are the necessary skills and attributes that students need to learn or acquire in order to be an entrepreneur? This question has not yet been investigated fully in the literature. Although a thorough exploration of this question has not been conducted in the research on entrepreneurship education, researchers and practitioners have hypothesized the characteristics that they believe are necessary to be a successful entrepreneur. For example, a 1998 article by Hisrich and Peters lists categories of skills required to be a successful entrepreneur, which includes technical skills, (i.e., written and oral communication), business management skills (i.e., planning, accounting, financials), and personal entrepreneurial skills (i.e., inner control, innovation, risk taking) [11]. Gurol and Atsan defined the "entrepreneurial profile" of students as high need for achievement, inner locus of control, a risk-taking propensity, high tolerance for ambiguity, innovativeness, and high self-confidence [12]. Morris describes the entrepreneurial personality as having six generally agreed upon characteristics: motivation, internal locus of control, calculated risk-taking, high tolerance of ambiguity, independence and autonomy, and tenacity [13].

Some authors discuss these characteristics in terms of the "entrepreneurial mindset" [14]. For example, Bilén and colleagues defined the desired outcomes of an engineering entrepreneurship minor and the entrepreneurial mindset as risk taking, motivation, leadership, innovation, customer orientation, communication skills, teamwork, and business skills [1]. More recently, a panel presentation at the 2010 annual conference of the National Collegi-

ate Inventors and Innovators Alliance (NCIIA) as summarized by Kriewall, defined a vision of the "entrepreneurially minded engineer [15]." According to the summary, "An entrepreneurially minded engineer will place product benefits before design features, and will be able to uniquely leverage technology to fill unmet customer needs." The characteristics of this person include, "integrity, tenacity, ethics, creativity, intuition, a deep knowledge of engineering fundamentals, the ability to engineer products for commercialization, a penchant for lifelong learning, and ability to see how their ideas fit into the larger context of society, and a proficiency in communicating his or her ideas." Overall, there are some similarities in the literature regarding the skills necessary to become an entrepreneur or in the definition of the entrepreneurial mindset.

One of the questions that has been discussed and explored throughout the literature on entrepreneurship education is whether or not the entrepreneurial mindset is innate to an individual or whether it can be developed through experience and instruction. Henry, Hill, and Leitch reviewed the literature on whether the characteristics and skills necessary to be an entrepreneur can be taught [16, 17]. The authors concluded, "While there has been much debate in the literature as to whether entrepreneurship can be taught, most commentators believe that at least some elements associated with the subject can be developed and enhanced via education and training" [17, p. 165]. With the advent of entrepreneurship education programs in engineering schools around the country, it is evident that there is a widespread belief that at least some of the skills associated with the entrepreneurial mindset can be acquired through instruction. Recent literature, such as Kuratko, focuses not on whether entrepreneurship can be taught, but rather on how it should be taught [18]. As the author states, ". . . the question of whether entrepreneurship can be taught is obsolete . . . [T]he more relevant question regarding entrepreneurial education [is] what should be taught and how should it be taught?"

In this study, the first research area that will be explored will be examining faculty and instructors' beliefs regarding the entrepreneurial mindset. What do instructors feel are the necessary skills and attributes of the successful entrepreneur? Are the skills and attributes of the successful entrepreneur innate or can they be learned? And finally, what skills and characteristics should be taught or instilled in an engineering entrepreneurship program?

1.4 Beliefs regarding instructional practices

A second area to be examined is faculty beliefs regarding the appropriate and ideal instructional

techniques to teach entrepreneurship to engineering students. A search of recent conference papers from the American Society of Engineering Education (ASEE) revealed a variety of teaching practices used in teaching entrepreneurship including problem-based learning (PBL) [19], online courses [20], case studies [21], and “learning by doing” [22]. Other articles discuss instructional strategies specific to the domain, including product development [23] and integration of entrepreneurship into senior or capstone design courses [24].

Most theoretical papers in the literature focus on using a student-centered approach to teaching entrepreneurship. For example, Fiet [6] argues that the approach to teaching entrepreneurship should focus less on descriptions of what entrepreneurs do and learn, but rather what to do to be successful. According to Fiet, teachers should ask themselves, “not ‘What am I going to teach today,’ but, ‘What am I going to have my students do today?’” (p. 108). Henry, Hill, and Leitch support that a variety of methods are typically used to teach students entrepreneurship [17]. Advocating for an unstructured active learning environment, the authors noted that instructors need to model entrepreneurship education to what true entrepreneurs would likely experience. Similarly, Hanke provided an argument why PBL is appropriate for teaching entrepreneurship, as the instructional method is student-centered and focuses on the use of rich problems [25]. In addition, dealing with ambiguous problems and working in interdisciplinary teams in the PBL approach can potentially increase students’ motivation, interest, teamwork, and communication skills, which are necessary attributes for successful entrepreneurs. In regards to entrepreneurship within engineering, Okudan and Rzasa suggested a classroom environment of “affective socialization,” (p. 197) structured in a manner in which students can experiment with the experience of being an entrepreneur, while addressing key processes and attributes such as autonomy, innovativeness, risk-taking, and competition [26].

The literature search also identified two studies that examined faculty beliefs concerning the instructional strategies that should be used to teach entrepreneurship. Michael conducted a study of “thought leaders” of entrepreneurship, in other words, faculty who were members of editorial boards of leading entrepreneurship journals [27]. He asked them questions regarding how the faculty members would most likely want to structure entrepreneurship education programs. The authors concluded, “No dominant mode of instruction emerged” (p. 9); instructional techniques that were reported included case studies, lectures, discussions, and experiential learning. Faculty members in the

study described a variety of instructional strategies that should be used and content that should be covered in an ideal entrepreneurship course. It is important to note that the professors surveyed in Michael’s study came from the business field.

In another study, Bennett surveyed lecturers in the United Kingdom, again primarily from the business domain, who taught entrepreneurship courses [28]. According to Bennett, an individual’s belief regarding the innateness of the entrepreneurial mindset could potentially influence instructional techniques. Bennett described two approaches to teaching entrepreneurship in the United Kingdom: “skills-based” programs focus on the mechanics of business and the skills necessary to be an entrepreneur. In contrast, programs that focus on “attribute development,” attempt to instill attitudes, values, and psychological mindsets into student, viewing entrepreneurship as a “learned competency.” According to Bennett, proponents of the attribute development approach are more likely to believe that entrepreneurship is a “learned competency” rather than an innate disposition.

Individuals who are more likely to believe that the entrepreneurial mindset is innate to an individual would likely advocate for the skills-based approach of instruction. This belief, in turn, may relate to the instructional techniques used in the classroom. For example, Bennett hypothesizes that proponents of the skills training approach are more likely to take an instructor-centered approach with the goal of transmitting knowledge. In this approach, students assume a more passive role, “learn[ing] by reading and listening to a teacher” (p. 172). In courses or programs advocating for the attribute development approach, the approach is more student-centered. Characteristics of this environment include asking that students “learn by doing things for themselves . . . ,” “are encouraged to solve problems quickly using imagination, ‘gut feeling’ and personal values,” and “are taught how to search for opportunities” (p. 172).

Interestingly, Bennett’s survey found that most respondents felt that courses should focus on practical business skills, rather than focusing on development of personal characteristics such as creativity. The instructional techniques used by most instructors also reflected a skills training approach, using formal lectures, assigned readings, seminars, tutorials, and case studies. “Most of the lecturers taught entrepreneurship in the same sorts of ways as they taught other subjects, normally using ‘conventional’ teaching methods such as lectures, tutorials, assigned readings, and content-based examinations” (p. 183).

As mentioned above, both Michael’s and Bennett’s studies primarily focus on the beliefs of

lecturers with a business and non-engineering background. These beliefs and practices may be different for faculty who teach entrepreneurship in the engineering community, where models such as the “Engineer of 2020” discuss the importance of personal attributes such as creativity, leadership, and dynamism [29]. Faculty beliefs regarding the appropriate and ideal instructional techniques to teach entrepreneurship have not been explored in the engineering domain, an investigation that will be described in this paper.

1.5 Research questions

The purpose of this study is to examine faculty members’ beliefs related to teaching and learning entrepreneurship and how these beliefs may be translated into practice in entrepreneurship programs and courses. Faculty beliefs may vary in specific ways, including what faculty members believe are the critical components of entrepreneurship education, how individuals can develop an entrepreneurial mindset, and whether necessary characteristics can be developed (or whether some of these characteristics are inherent to an individual’s personality). The following three research questions guided the investigation of faculty members’ beliefs about teaching entrepreneurship:

1. How do faculty members define the entrepreneurial mindset, or the characteristics necessary to be an entrepreneur?
2. Do faculty members believe that the entrepreneurial mindset is something that can be developed? Or do they feel that certain characteristics that are necessary to be an entrepreneur are innate to the person?
3. How do faculty members teach entrepreneurship? Is there a relationship between the faculty beliefs and the way that they teach entrepreneurship?

2. Methods

Data were collected from faculty and instructors who were associated with the entrepreneurial programs or had experience teaching entrepreneurship-related courses at their respective institutions. Specific focus was placed on identifying instructors who taught entrepreneurship to engineering undergraduate students, although participating instructors may have also taught students from other disciplines as well. All data were collected from faculty and instructors at three large research-oriented universities in the Mid-Atlantic, Midwest, and Southern states. The research to explore instructors’ beliefs and perceptions occurred in two distinct stages, using a mixed

methods approach [30]. In the first phase, a series of semi-structured interviews were conducted with faculty and instructors from the three institutions. In the second phase, a survey called the *Entrepreneurship Faculty Beliefs Survey* was administered to faculty and instructors at the same institutions. The information collected from the semi-structured interviews served as the content for the qualitative portion of the present study. The responses from the survey were analyzed using quantitative data analysis techniques.

2.1 Phase 1: Collection of interview data

2.1.1 Participants

Interview response data were collected from 26 instructors and faculty members who had taught, or were actively teaching entrepreneurship courses. Of the faculty who participated, 22 were male (86.6%) and four were female (15.4%). Roughly 42% of the participants were from engineering departments, 19% were from entrepreneurship departments, and 23% were from business-related departments, with the remainder reporting being from other departments. Approximately 61% ($N = 16$) of the participants were instructors or lecturers; the rest held tenured (31%, $N = 8$) or tenure track (8%, $N = 2$) positions. The participants had experiences with entrepreneurship outside of their academic roles. The majority of the participants (81%) indicated that they had worked for a small start-up company; half (54%) worked for an “innovation” segment of a large company. Roughly one third (35%, $N = 9$) held patents.

2.1.2 Interview protocol

The interview protocol was developed based on focused meetings with the research group. Advice on the questions was also provided by the project advisory board, which consisted of experts in engineering education and entrepreneurship education. The interview protocol included the following questions:

- What are the critical components of entrepreneurship education?
- How do individuals develop an entrepreneurial mindset?
- Are necessary entrepreneurial characteristics developed through experiences or are they inherent to an individual’s personality?
- How can students’ self-efficacy to be an entrepreneur be cultivated?
- What strategies are used in the classroom to teach entrepreneurship?

A semi-structured interview format allowed the researchers to gather information systematically

about specific questions. Additional follow-up questions were asked as necessary to clarify responses or to probe more deeply into participants' beliefs about entrepreneurship education. Because the focus of the paper was to capture instructors' beliefs about entrepreneurship, a definition was not imposed on the participants. Rather, participants used their own perceptions and definitions of entrepreneurship to frame their responses to the interview questions.

2.1.3 Interview procedures

The interviews took place during the spring 2009 academic semester. The interviews for participants at one of the institutions took place in person (i.e., face-to-face); the interviews for the participants at the other two institutions were conducted over the phone. Most of the interviews were roughly one hour long. Following the guidelines of the authors' Institutional Review Board, participants were asked to provide informed consent to participate in the research study and to be recorded.

2.1.4 Data analysis

The interview transcripts were analyzed using content analysis in NVivo 8, a software program that facilitates coding of qualitative data [31]. A coding scheme was developed based on an analysis of themes from one sample interview. The coding scheme was then applied to the other interviews, with new codes and code categories added as necessary. Further details on the coding process, including methods for examining reliability and validity of the coding scheme, were discussed in Hochstedt and Zappe [32]. The coding scheme was found to have acceptable evidence of reproducibility, as reflected by an 82% agreement between the two scorers.

2.2 Phase 2: Collection of survey data

2.2.1 Participants

Survey response data were collected from 37 faculty members who had taught, or were actively teaching, entrepreneurship courses at the three institutions. Faculty members who were associated with the targeted entrepreneurship programs, or had experience teaching entrepreneurship-related courses at those institutions, were asked to complete the *Entrepreneurship Faculty Beliefs Survey*. More male (81%, $N = 30$) than female (19%, $N = 7$) faculty members were surveyed across the institutions. Eighty-four percent ($N = 31$) of respondents considered themselves to be entrepreneurs. Management, engineering, or entrepreneurship were cited most frequently as respondents' departmental membership. Respondents held the following aca-

dem positions: Full Professor (17%, $N = 6$), Associate Professor (17%, $N = 6$), Assistant Professor (19%, $N = 7$), and Instructor or Lecturer (28%, $N = 10$). Research Associate was the most frequent response to the option Other (11%, $N = 4$). Slightly more than a third of faculty respondents identified themselves as tenured or on the tenure track (36%, $N = 13$).

It should be noted that several of the following questions had the option to "select all that apply"; thus percentage totals may be greater than 100%. Most respondents indicated they primarily taught undergraduate students (89%, $N = 32$) while roughly a third (36%, $N = 13$) taught graduate students. All faculty respondents were actively teaching entrepreneurship classes or had done so in the past. These classes enrolled *engineering students* (83%, $N = 30$), *business students* (75%, $N = 27$), *information technology students* (61%, $N = 22$), and *other students* (67%, $N = 24$). The most frequent response to *other* was "all majors." When respondents were asked what entrepreneurship courses they had taught at their respective institutions they listed the following courses most often: engineering, technology, entrepreneurship, innovation, management, and marketing. Eighty-six percent ($N = 30$) of the faculty members interviewed had worked for a small start-up company and 57% ($N = 20$) had worked in an "innovation" segment of a large company. Slightly less than two-thirds of those interviewed held patents (63%, $N = 22$). Most respondents considered themselves to be entrepreneurs (84%, $N = 31$).

2.2.2 Instrument

The *Entrepreneurship Faculty Beliefs Survey* was developed in fall of 2009 in an effort to answer the three research questions. Specifically, the purpose of the survey was to collect information on faculty beliefs about teaching entrepreneurship and examine the relationship to their respective pedagogy. The survey was constructed based on the qualitative analysis of interview data garnered from entrepreneurship faculty during Phase 1 of this study. Expert feedback from the project advisory board and from other faculty members who teach entrepreneurship was used to refine the preliminary versions of the survey. The survey contains 19 core questions, as well as 14 demographic items, and 3 items concerning ethical issues. Item-types utilized in the survey vary. Survey item-types include: multiple response, Likert-type scale, brief response, rank order, and innovative items. Innovative item-types include: "sliders" or sliding scale items. A sliding scale question is answered by moving an indicator marker or "slider" along an axis that represents the continuum between two,

typically divergent, constructs. Another interactive item-type involves an item sorting task whereby the examinee sorts, or groups, items by dragging and dropping them into boxes representing different constructs. As was the case with the interview protocols, a definition of entrepreneurship was not imposed on the participants, given that the purpose of the study was to explore their beliefs about the construct.

2.2.3 Data collection procedures

The survey was administered in the fall of 2010 using Qualtrics, an online commercial survey package [33]. Faculty members were invited to participate in the survey based on their respective institution's entrepreneurship program association. Potential participants were sent e-mail invitations reminding them to complete the survey from both fellow department faculty or program directors and the researchers conducting the investigation.

Using the trimmed mean to remove outliers, the average amount of time that faculty respondents required to complete the survey was 36 minutes. The response rate was calculated by dividing the number of faculty who responded (partial and complete responses were included) by the number of faculty who were invited to participate. Thirty seven of the 47 faculty invited responded, which yielded a total response rate of roughly 79%.

2.2.4 Data analysis

The majority of the item response results were generated using the reports function in Qualtrics. Descriptive statistics, including frequency of response, central tendency information, and counts, were used to facilitate item response analyses. A project member analyzed the responses to open-ended questions by grouping them by similar content. Additionally, the aggregate faculty responses to the sliding scale items were represented by boxplots. R statistical computing and graphics language was used to generate these plots [34]. It should be noted that statistical hypothesis testing could not be used to analyze the item response data due to sample size limitations.

3. Results

The results of the interview and survey data are described separately below.

3.1 Phase 1: Interview results

The research questions are discussed in relation to the key themes that emerged during the content analysis of the interviewees' responses.

1. How do faculty members define the entrepreneurial mindset, or the characteristics necessary to be entrepreneurs?

When asked to define the "entrepreneurial mindset" most interviewees described personality characteristics rather than skills. Interviewees were asked whether they felt that the entrepreneurial mindset was a real construct, or set of characteristics that individuals might possess either inherently or through development. Most interviewees believed that the entrepreneurial mindset was a real construct that students may potentially possess. However, three business faculty members were reluctant to use the terminology of the entrepreneurial mindset. These individuals explained that necessity, desire to start a venture, skills, knowledge base, and experiences are central to defining an entrepreneur. Other faculty who were reluctant to use the term did not believe that any one prerequisite trait, or set of characteristics, was necessary to become an entrepreneur. Further, they believed that individuals can learn skills necessary to become a successful entrepreneur.

Nearly 40% of the interviewees identified characteristics related to "risk tolerance" when asked to define an entrepreneurial mindset. For example, one interviewee responded, "They're risk takers by nature or unafraid of risks." Of note, the definition several interviewees gave with respect to risk concerned moderating, managing, and/or being aware of the consequences when taking risks, which is akin to the concept of "informed risk-taking" [e.g., 35]. As one interviewee stated, "The next question has to do with risk and how you deal with risk. And how you understand how much risk you are taking and what is the downside [of the] risk? How much are you willing to lose if things don't work out? And what is the upside? So it is having a feel for the relationship between risk and success."

Interviewees mentioned the concept of "drive or motivation" about as often as risk tolerance when defining an entrepreneurial mindset and how one develops this mindset. Descriptions characterized as "drive or motivation" included: "ambition," "self-starter," "persistence," "dogged determination," "the spark," "innate drive," "perseverance," "motivated and directed," "forcing themselves," "self-motivation," and "hardheaded hard work."

Interviewees also said "being driven" was something an individual could do to achieve the entrepreneurial mindset. One interviewee described a message he gives to his students: "Take on hard challenges. Don't avoid something because you think it's tough. Go for it and [be] single-minded. And especially if you think you are not able to do it. Because once you've done it, you'll look back and realize that the only thing limiting you is you, and

that will lead you to that mindset.” Another interviewee held a similar point-of-view: “Someone who believes in what they are doing, hard enough, that they are willing to put in tremendous amounts of work and not give in to occasional disappointment. I think that is what separates the entrepreneurs, especially the successful entrepreneurs.”

However, one interviewee stressed that classroom training is not adequate to support a student who has the drive or motivation develop an entrepreneurial mindset: “How do you actually help the student [who] has the spark and [who] does want to develop it? From an academic standpoint there is only so much we can do inside the classroom.”

Other characteristics of an entrepreneurial mindset that interviewees frequently mentioned included: “learns from failure,” “able to adapt or be flexible,” “marketing skills,” “acts on opportunities,” “outgoing or self-confident,” “passionate,” “resourceful or not impeded by limited resources,” and “comfortable with ambiguity.”

Interviewees were asked how they felt people developed an entrepreneurial mindset. Their responses were diverse and there was no clear consensus; however, passion, drive, and self-efficacy were cited most often. For example, one participant said, “To be passionate about it, meaning you live it 24/7. It doesn’t go away and you have to be passionate about the idea because it is going to own you. I think the key to this is, if you are truly, truly passionate about it, and you educate yourself, then anybody can do anything.” One notable response concerning drive follows: “The spark is motivation. To me it’s the self-motivation. You know there are other things that other people do to help motivate you, but there has to be a self-motivation that says, ‘I want to try this.’” Finally, an example quote concerning self-efficacy follows: “You see self-efficacy bloom when somebody actually does—however small it is—something successful. You have to bite off just as much as you can chew so you can get successful and not fail the first time.”

When interviewees were asked, “What can an individual do, or experience, to facilitate this development (i.e., the entrepreneurial mindset)?” they mentioned participating in experiential learning, mentoring, obtaining an education, and honing of skills through practice. For example, one interviewee described what role education plays in assisting in this development through experience:

“. . . I think the way to develop that [mindset] is to [experience] it. And each time you do it you learn something. And unfortunately that’s a rather slow process. The idea of college is to speed that process up whether it be calculus or whether it be English, or in this case entrepreneurship. We are trying to make it so maybe you don’t have to walk down quite as many unfruitful paths until you find something fruitful.”

Other faculty focused specifically on getting practice at honing their skills. For example, one participant stated, “You don’t necessarily have to start when you are young, but you have to start by practicing and in simple ways. [For example] start using eBay, putting things on eBay. Getting a feel for what makes people interested. Why do they do this or that?”

Interviewees identified mentoring as a critical component of gaining experience. As one interviewee stated, “The whole idea of guiding them, especially [in] entrepreneurship, is to give them examples that hopefully they will remember about how to evaluate ideas and how to think about these problems and what questions to ask when you face a fork in the road.” Another interviewee mirrored this sentiment concerning mentorship: “[Students need to find] somebody who is willing to be that person that pushes. As faculty members in the [entrepreneurship] minor that’s part of what we are trying to do is push them through those valleys and get them so they are more and more capable of doing that themselves.”

2. Do faculty members believe that the entrepreneurial mindset is something that can be developed? Or do they feel that certain characteristics that are necessary to become an entrepreneur are innate to the person?

Interviewees gave a variety of responses when asked whether the entrepreneurial mindset is something that can be developed or if certain characteristics necessary to be an entrepreneur are innate to the person. Approximately two-thirds of the interviewees expressed agreement with both perspectives, indicating that the entrepreneurial mindset was a combination of innate characteristics and teachable skills. However, four interviewees (15%) believed that the characteristics to be an entrepreneur are entirely developed or made (two were from business-related departments and two had business backgrounds).

The majority of interviewees (77%, $N = 20$) responded that while the entrepreneurial mindset could be developed, this development partially depends on, or can be mediated by, the individual’s innate characteristics or qualities. As one interviewee asserted, “I think there are some characteristics that maybe cause people to move a little easier into entrepreneurship, but I don’t think the lack of those characteristics really excludes anyone from the opportunity or the ability to be successful in that [area].” Another faculty member voiced a similar concern regarding the relationship between innate and developed characteristics: “I think that the drive and passion are things that you are born with. And I think that everybody has those [char-

acteristics] to a degree and some people have to work harder to develop those [characteristics] than others do.”

In contrast, several interviewees (23%, $N = 6$) stressed the importance of cultivating an individual's entrepreneurial mindset through practice and training. As one interviewee emphatically stated, “But I think even those that are born [with the entrepreneurial mindset], and there's probably a lot, if they never really practice this [entrepreneurship] or trained in how to use these skills, nothing happens!” Another interviewee echoed this position, but emphasized prerequisite entrepreneurial characteristics: “Lots of potential entrepreneurs are born. Few are developed. There's a whole big pool of people who are born that could be entrepreneurs and you've got to find them, train them, and teach them. But again, people who weren't born to be entrepreneurs, no amount of academic training is going to change that.”

3. How do faculty members teach entrepreneurship? Is there a relationship between the faculty beliefs and the way that they teach entrepreneurship?

Perceptions of teaching practices

When interviewees were asked, “What is your approach to teaching entrepreneurship?” they mentioned experiential learning (i.e., “hands-on” learning) most often, and also mentioned using case studies, active learning, and problem-based learning (PBL). Acting as a mentor, facilitator or “coach” to the entrepreneurial students was also mentioned often. Roughly 60% ($N = 16$) of the interviewees provided responses that characterized their instructional approach as experiential. For example, one example quote follows: “[My instruction is] primarily experiential, but always underpinned by a theoretical understanding of why the experience is valuable.” Another individual stated, “My approach is to try and create a classroom environment that is more like a small business setting.”

When asked, “How is your teaching style impacted by your vision of how individuals develop an entrepreneurial mindset?” approximately 70% ($N = 18$) of interviewees said that their teaching style had been affected by their beliefs. Roughly half of the interviewees stated that their career and entrepreneurial experiences influenced the way they teach entrepreneurship. They cited influences such as their own interests, personal learning style, and personal characteristics or personality less frequently.

Of the four faculty members who indicated entrepreneurs are developed or made, one stated his teaching style was not impacted by how individuals develop an entrepreneurial mindset since he did not

think that the entrepreneurial mindset exists. Another faculty member said the entrepreneurial mindset develops through “learning skills” while the other faculty member stated that individuals “can learn to do whatever they need to do” and “completely transcend any [apparent] bounds based on personality.” Only one interviewee said entrepreneurs are developed while still indicating that the construct “entrepreneurial mindset” impacted his teaching style and could be developed; however, he was unsure whether this mindset was innate or not: “This is where I was kind of tripping over this one. I very much believe that they can be developed. Can they be developed in everybody? I don't think so. There are some people that just don't want to be [entrepreneurs]. I believe it could be developed in anybody who truly decides that they want it.”

Over 70% of the faculty members indicated they had faced challenges teaching entrepreneurship. The most commonly cited challenges, in descending order, were related to students' backgrounds (e.g., students' prior knowledge), the workload associated with teaching entrepreneurship (greater amount and types of work), institutional policy, how other colleges within the institution define or teach entrepreneurship, and curriculum design.

Several faculty members also acknowledged limitations when trying to provide experiential learning opportunities to their students. One faculty member indicated many undergraduate students lack the skill set necessary to work on actual projects. Other faculty members encountered similar challenges working with students, such as students' limited prior knowledge, diversity of student majors within a course, students' varied interests and level of interest in entrepreneurship, and preconceived notions when working on entrepreneurial projects: “[S]tudents are not into understanding the creative energy that needs to go into these things because they've been acculturated to non-creative learning styles. It is using what I call ‘lightning strikes’ in the classroom to hit their brain and create the tension.”

Several faculty members said insufficient financial resources (e.g., small amounts of seed money) impeded students' ability to make mock-ups, launch websites, and start ventures. One faculty member said he had funded student teams with his own money.

Perceptions of entrepreneurship programs

When asked what they felt were the critical components of entrepreneurship programs, interviewees mentioned experiential components most frequently (27%, $N = 7$). Business skills and drive were mentioned less frequently. For example, one interviewee advocated the use of real life experience:

“I think you need an opportunity for hands-on experience. And I think [potential entrepreneurs] need to develop in an environment where they are able to interact with the local entrepreneurial community so they can invent themselves with local entrepreneurs and gather experiences from working with them.”

When interviewees were asked, “If you were designing an entrepreneurship program, what would you include?” the most frequent response was that it should include an experiential component. As one interviewee affirmed, “First of all I would make it 100% hands-on. Completely. That would be the number one thing I would do. Entrepreneurship really is a contact sport [a term coined by Tina Seeling, executive director of the Stanford Technology Venture Program, 36]. You have to get your hands dirty and you have to really do it. You have to play the game.” Participants in the interviews also mentioned interdisciplinary elements, case studies, and communication skills.

Tellingly, when the faculty were asked, “How would you change the program at your institution to best help students develop an entrepreneurial mindset?” nearly a third said they would like to see the programs offer real life and hands-on business experiences to students. Several interviewees stated that their programs were designed to allow for real life experiences, or were in the process of being reorganized to allow for these experiences, however, some expressed there could always be more of these opportunities. One faculty member said, “It would be nice if we had an incubator type capstone program that would allow you to actually operate a business.”

In addition to having more experiential learning opportunities, others mentioned interdisciplinary

collaborations and using case studies. Faculty members also stressed the importance of having students develop communication skills through such activities as “elevator pitches,” student presentations, working in teams, and talking with customers.

3.2 Phase 2: Survey results

The following section describes the results of the survey data, collected during phase 2 of the study.

1. How do faculty members define an entrepreneurial mindset, or the characteristics necessary to become entrepreneurs?

When asked to rank a list of characteristics with respect to the degree to which they define an entrepreneur, a third of respondents ranked *acts on opportunities* as the most defining characteristic. Characteristics ranked two through five, based on mean rank, were as follows (from most to least): *believes he or she can be successful*, *has drive*, *is passionate*, and *is resourceful*. (See Table 1 for the complete characteristic ranking and percentage of respondents ranking for each characteristic.)

2. Do faculty members believe that the entrepreneurial mindset is something that can be developed? Or do they feel that certain characteristics necessary to be an entrepreneur are innate to the person?

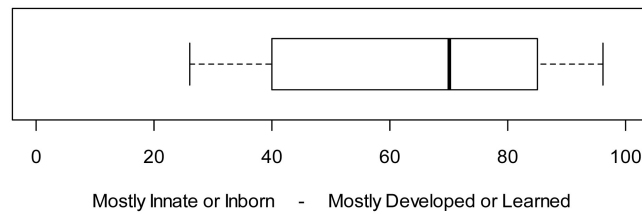
A sliding scale question was employed to quantify faculty beliefs about whether an entrepreneurial mindset is something that can be developed or is something that is innate. Respondents were asked to complete the statement “The necessary characteristics to be an entrepreneur are:” by moving a “slider” between *Mostly Innate or Inborn* (represented by 0) and *Mostly Developed or Learned*

Table 1. Rank the listed characteristic with respect to the degree to which they define an entrepreneur

Characteristic	Mean rank	Percentage of respondents selecting rank value									
		1	2	3	4	5	6	7	8	9	10
Acts on opportunities	2.84	32.43	18.92	27.03	8.11	0.00	5.41	2.70	2.70	0.00	2.70
Believes he or she can be successful	4.25	13.89	25.00	8.33	25.00	5.56	2.78	8.33	0.00	0.00	2.78
Has drive	4.78	13.51	16.22	13.51	16.22	5.41	10.81	2.70	5.41	5.41	2.70
Is passionate	5.43	13.51	10.81	10.81	5.41	18.92	8.11	5.41	0.00	16.22	2.70
Is resourceful; not impeded by limited resources	5.89	8.11	10.81	10.81	5.41	8.11	13.51	0.00	16.22	16.22	10.81
Is able to adapt	6.49	0.00	5.41	5.41	5.41	21.62	13.51	24.32	5.41	8.11	5.41
Is comfortable with ambiguity	7.11	5.41	0.00	8.11	5.41	13.51	10.81	10.81	16.22	10.81	2.70
Is comfortable with taking risks	7.97	2.70	5.41	8.11	8.11	0.00	8.11	13.51	8.11	10.81	10.81
Learns from experiences	9.72	0.00	2.78	0.00	5.56	5.56	2.78	5.56	5.56	2.78	19.44
Learns from failure	10.03	2.70	0.00	0.00	0.00	2.70	8.11	5.41	8.11	10.81	10.81
Has marketing skills	10.70	0.00	0.00	0.00	5.41	2.70	10.81	5.41	5.41	8.11	8.11
Learns from practice (e.g., “trial and error”)	11.06	0.00	2.78	2.78	5.56	5.56	2.78	5.56	5.56	0.00	8.33
Learns from interacting with others	12.03	0.00	0.00	2.78	0.00	0.00	0.00	2.78	2.78	2.78	2.78
Learns from observing others	12.61	0.00	0.00	0.00	0.00	5.56	2.78	0.00	5.56	5.56	0.00
Is outgoing	12.35	0.00	0.00	0.00	0.00	0.00	0.00	2.70	13.51	2.70	10.81
Other	12.22	8.33	2.78	2.78	5.56	5.56	0.00	5.56	0.00	0.00	0.00

Note. Boldface values represent the largest percentage of respondents that selected the characteristic. Lower mean rank indicates higher ranking. The table is truncated such that mean rank values 11–16 were trimmed for conciseness.

The necessary characteristics to be an entrepreneur are:



Minimum Value	First Quarter	Median Value	Third Quarter	Maximum Value	Average Value	Standard Deviation
26	40.00	70.00	84.25	96	64.35	24.11

Fig. 1. Complete the statement by sliding the scale along the listed options.

(represented by 100) with neutral being *Equally Innate and Developed* (represented by 50). The median response of 70 indicated that responses to this item ($N = 26$) tended towards the *Mostly Developed or Learned* side of the scale. (See Fig. 1 for boxplot.)

Respondents were also asked another question about innate versus developed characteristics. Specifically, respondents were given a list of characteristics and asked to indicate whether they were “more inherent to personality” or “more easily developed or learned.” *Drive, outgoing, passion, curious, comfortable with ambiguity, and comfortable taking risks* were more often grouped as “more inherent to personality” (in descending order, based on the response count). *Business skills, technical skills, problem solving ability, communication skills, ability to learn from failures, interpersonal skills, and ability to act on opportunities* were more often grouped as “more easily developed or learned” (in descending order, based on the response count). *Vision (i.e., can visualize a future state)* and *ability to adapt* fell between in between inherent and developed (based on the response count). Not surprisingly, items that

were viewed as easier to develop or learn represented skills and abilities. Within the group of characteristics that were deemed “more inherent to personality,” *passion, vision, and drive* ranked most important, whereas *problem solving ability, ability to act on opportunities, and business skills* were ranked as the most important within the group of characteristics that were seen as “more easily developed or learned.” (See Table 2 for the complete ranking.)

3. How do faculty members teach entrepreneurship? Is there a relationship between the faculty beliefs and the way that they teach entrepreneurship?

The faculty participants were questioned regarding instructional methods to determine how they teach entrepreneurship and whether or not their beliefs are associated with their teaching practices in entrepreneurship.

Perceptions of teaching preparation

In response to the open-ended question: “Did you have any preparation to teach entrepreneurship classes?” survey respondents cited entrepreneurial

Table 2. Indicate if the items listed to the left below are more inherent to personality or more easily developed or nurtured. Then rank order the items from most (number 1) to least important

Item	More inherent to personality: Mean rank (Response Count)	More easily developed or learned: Mean rank (Response Count)
Drive	3.94 ($N = 32$)*	8.50 ($N = 2$)
Outgoing	5.81 ($N = 32$)	8.67 ($N = 3$)
Passion	3.28 ($N = 32$)*	6.40 ($N = 5$)
Curious	4.56 ($N = 32$)	7.20 ($N = 5$)
Comfortable with ambiguity	4.43 ($N = 28$)	8.13 ($N = 8$)
Comfortable with taking risks	4.57 ($N = 23$)	6.75 ($N = 12$)
Vision (i.e., can visualize a future state)	3.76 ($N = 17$)*	4.28 ($N = 18$)
Ability to adapt	4.40 ($N = 15$)	4.56 ($N = 18$)
Ability to act on opportunities	4.00 ($N = 11$)	3.88 ($N = 24$)*
Interpersonal skills	6.91 ($N = 11$)	5.62 ($N = 26$)
Ability to learn from failures	4.33 ($N = 9$)	5.12 ($N = 26$)
Communication skills	6.40 ($N = 5$)	4.41 ($N = 32$)
Problem solving ability	5.33 ($N = 3$)	3.76 ($N = 34$)*
Technical skills	4.00 ($N = 1$)	5.28 ($N = 36$)
Business skills	0 ($N = 0$)	4.03 ($N = 37$)*

Note. Boldface values denote category with higher response count.

* Indicates the three highest ranked items based on mean rank for each category. Lower mean rank value indicates higher ranking.

experience, entrepreneurial background, experience developing entrepreneurship-related courses, being mentored by an entrepreneur, mentoring students working on entrepreneurial projects, working in industry, start-up and/or a business, having an academic degree in the field, having informal training or preparation, having an interest in entrepreneurship, being a consultant to entrepreneurs, and conducting research in entrepreneurship. There were six respondents who said they had “no preparation” or “no formal preparation.”

When respondents were asked the question, “Which aspects of your background influence the way you teach entrepreneurship?” they were asked to rate their responses using a four-point Likert-type rating scale (range was from *not at all influences* to *highly influences*). Almost two-thirds (63%, $N = 22$) of respondents said their entrepreneurial experiences *highly influenced* how they teach entrepreneurship. Over half (57%, $N = 20$) of respondents said their career experiences *highly influenced* them and half (50%, $N = 17$) said their personality *moderately influenced* them. Slightly less than half (46%, $N = 16$) of the respondents said their beliefs about how people become entrepreneurs *highly influenced* how they teach entrepreneurship. (See Table 3 for complete data.)

To elucidate their teaching methods and beliefs,

faculty participants were asked to define features of the ideal entrepreneurship instructor. Respondents were asked to select all options that applied (as such, some percentage totals are greater than 100%). The five characteristics selected most frequently by respondents were *is passionate* (91%), *has experience being an entrepreneur* (89%), *is a mentor, facilitator, or “coach”* (89%), *uses active learning techniques in the classroom* (89%), and *uses case studies or real life examples in the classroom* (83%). The five least frequently chosen characteristics were, in ascending order, *has environmental concern* (26%), *is interested in social change* (26%), *has international professional experiences* (26%), *other* (26%), and *is outgoing* (31%). The most common response to *other* was “communication skills”; however, no predominant response pattern was identified. (See Table 4 for complete data.)

3.3 Perceptions of teaching practices

When asked what strategies were most important to promote students’ understanding when teaching entrepreneurship, the majority of respondents said they had used most of the instructional techniques listed. Respondents selected the following instructional techniques frequently: *have students give presentations* (97%), *mentor or coach students* (94%), *share personal experiences* (91%), and *have*

Table 3. Which aspects of your background influence the way you teach entrepreneurship?

Question	Not at all influences	Slightly influences	Moderately influences	Highly influences
My entrepreneurial experiences	2.86%	8.57%	25.71%	62.86%
My career experiences	2.86%	14.29%	25.71%	57.14%
My personality	0.00%	11.76%	50.00%	38.24%
My beliefs on how people become entrepreneurs	2.86%	17.14%	34.29%	45.71%
My professional interests	2.86%	31.43%	28.57%	37.14%
My successes and failures	11.76%	11.76%	41.18%	35.29%
Reading books, cases, article literature	0.00%	24.24%	42.42%	33.33%

Note. Boldface values denote category with higher response count.

Table 4. If you could define the characteristics of the ideal entrepreneurship instructor, what would these characteristics be? Select all that apply.

Characteristic	Percentage (Response Count)
Is passionate	91% ($N = 32$)
Has experience being an entrepreneur	89% ($N = 31$)
Is a mentor, facilitator, or “coach”	89% ($N = 31$)
Uses active learning techniques in the classroom	89% ($N = 31$)
Uses case studies or real life examples in the classroom	83% ($N = 29$)
Uses his or her life experiences as educational examples	77% ($N = 27$)
Is driven	71% ($N = 25$)
Has networking ability	69% ($N = 24$)
Comfortable with taking risks	63% ($N = 22$)
Currently has entrepreneurial venture(s)	49% ($N = 17$)
Uses technology tools in the classroom	34% ($N = 12$)
Is outgoing	31% ($N = 11$)
Has international professional experiences	26% ($N = 9$)
Is interested in social change	26% ($N = 9$)
Has environmental concern	26% ($N = 9$)
Other	26% ($N = 9$)

Table 5. I use these when teaching. Select all that apply.

Option	Percentage (Response Count)
Have students give presentations	97% (N = 34)
Mentor or coach students	94% (N = 33)
My personal experiences	91% (N = 32)
Have guest speakers	91% (N = 32)
My passion	89% (N = 31)
Have students give elevator pitches	89% (N = 31)
Use active learning	86% (N = 30)
Have students develop a business plan	83% (N = 29)
My professional background	80% (N = 28)
My drive	77% (N = 27)
Use case studies	71% (N = 25)
My educational background	69% (N = 24)
Have students conduct interviews	69% (N = 24)
Have students practice (e.g., "trial and error")	69% (N = 24)
Use long-term project(s)	66% (N = 23)
Use technology teaching tools (i.e., clickers, podcasts, etc.)	46% (N = 16)
Use textbooks	34% (N = 12)
Other	29% (N = 10)

guest speakers (91%). Respondents reported using textbooks (34%) and technology teaching tools (46%) less frequently. No predominant response was identified among other responses. (See Table 5 for complete data.)

Respondents were asked, "If you were developing a new entrepreneurship program for undergraduate engineering students, what would you include? Select all that apply." Some curricular components were viewed as more essential than others (based on the response percentages). Particularly, *capstone projects* (97%), *introductory entrepreneurship courses* (89%), *course work on business skills* (89%), *intellectual property coursework* (83%), and *development of a business plan* (80%) were the five most frequently selected options. The options selected least often (in ascending order) were *global competitiveness element* (40%), *internship/practicum* (49%), *leadership training* (51%), *innovative thinking course* (63%), *entrepreneurship ethics modules and cases* (69%), and *formal mentoring program* (71%). Although some elements were cited more frequently than others, most of the options listed were selected by the majority of the respondents.

We expected that entrepreneurship instructors might experience challenges while trying to implement the curriculum, since some administrators view entrepreneurship as peripheral to the core curriculum. To examine this issue, the respondents reviewed several scenarios and were asked to identify challenges they had experienced: "Which of the following prove to be challenges when teaching entrepreneurship?" It was requested that faculty select all options that applied. Based on the percentage of faculty respondents selecting the provided options, they had been confronted with various challenges. The four most frequently reported challenges were *the intuition's bureaucracy* (58%), *students' prior knowledge* (52%), *the different type of*

workload involved with teaching entrepreneurship (42%), and *budget constrains* (42%). The least frequently cited options (in ascending order) were, the *entrepreneurship program's learning objectives* (3%), *tenure and review policies do not recognize entrepreneurship* (18%), *how other colleges within the institution define or teach entrepreneurship* (27%), *students' beliefs* (27%), and *designing entrepreneurial curriculum* (30%).

Teaching philosophy

When asked the open-ended survey question, "How do you think your teaching style is impacted by your vision of how individuals become entrepreneurs?" respondents provided a range of answers. Many responses indicate that both innate and developed characteristics were important. One respondent stated, "I think that every student has skills and characteristics that can help them in entrepreneurship if they understand how to develop and utilize them effectively. My teaching centers around helping individuals learn how to develop themselves in terms of entrepreneurship and entrepreneurial development." Similarly, another respondent affirmed, "I believe we have talents and if we work hard and we learn, we can become great. The way I teach focuses on giving students the opportunity to do great things based on their talents, interests, and effort."

Several responses suggest entrepreneurship can also be construed as a learned or developed behavior, for example:

- "Because I think many entrepreneurial components can be learned and developed, I was optimistic and proactive in the process of teaching them how to become successful entrepreneurs."
- "[T]he spark of e-ship can be ignited in students who never thought [or] dreamt that they could be

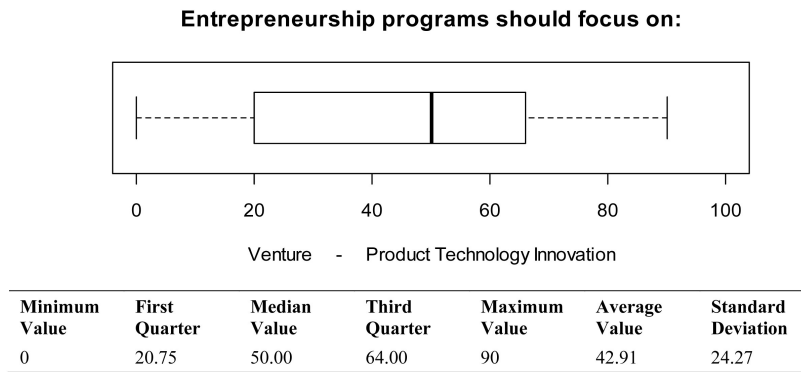


Fig. 2. Complete the statement by sliding the scale along the listed options.

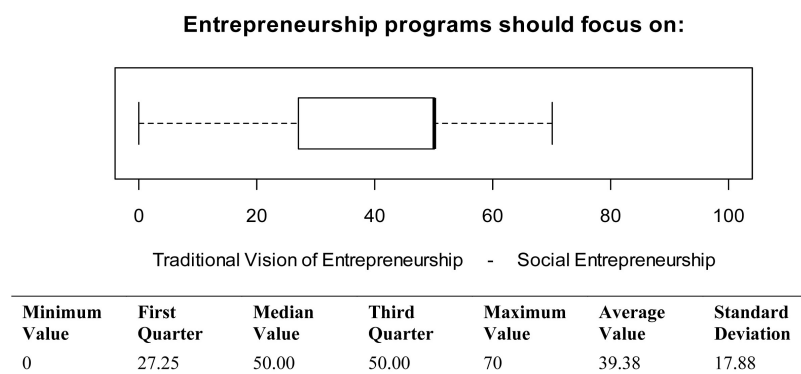


Fig. 3. Complete the statement by sliding the scale along the listed options.

entrepreneurs. It necessitates immersing students in the context and encouraging them to build something out of nothing.”

Others responses indicate that a universal maxim for becoming entrepreneur does not seem to exist: “I don’t believe that there is one right answer for entrepreneurial success, and therefore it is important for students to be exposed to a wide variety of ‘lessons learned’.”

Based on these analyses, it is clear that it is not a simple task to differentiate and quantify faculty views and beliefs concerning teaching entrepreneurship.

To measure faculty members’ views and beliefs about educational practices with finer precision, five slider items were used to ascertain faculty perceptions of the ideal methods for teaching entrepreneurship. These items required respondents to select a point along a continuum, with roughly opposing constructs listed at each end of the slider axes. The results for each item follows.

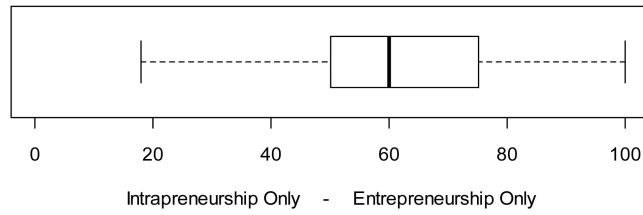
The median response to the item, “Entrepreneurship programs should focus on:” *Venture* versus *Product Technology Innovation* was 50. Responses were closer to the *Venture* side of the

scale, with the middle 50% of responses falling between 20.75 and 64.00. (See Fig. 2 for boxplot.) The median of the faculty responses to the item, “Entrepreneurship programs should focus on:” *Traditional Vision of Entrepreneurship* versus *Social Entrepreneurship* was 50. Responses were closer to the *Traditional Vision of Entrepreneurship* side of the scale with the middle 50% of responses falling between 27.25 and 50.00. (See Fig. 3 for boxplot.)

The item, “Entrepreneurship programs should focus on:” *Intrapreneurship Only* versus *Entrepreneurship Only*, yielded a median of 60 based on the faculty responses. Responses that fell in the middle 50% were between 50.00 and 75.00, indicating the responses were closer to the *Entrepreneurship Only* side of the scale. (See Fig. 4 for boxplot.)

The median response for faculty who responded to the item, “Entrepreneurship should be taught through:” *Unstructured Experiences* versus *Institutionalized Programs* was 70, indicating responses were closer to the *Institutionalized Programs* side of the scale. Responses that fell in the middle 50% were between 50.00 and 75.75. (See Fig. 5 for boxplot.)

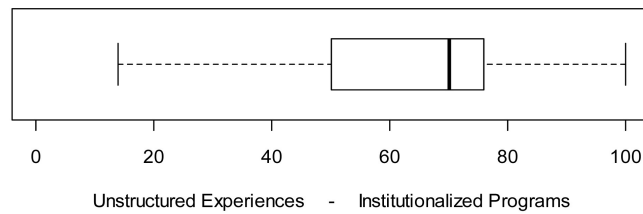
Entrepreneurship programs should focus on:



Minimum Value	First Quarter	Median Value	Third Quarter	Maximum Value	Average Value	Standard Deviation
18	50.00	60.00	75.00	100	62.68	17.66

Fig. 4. Complete the statement by sliding the scale along the listed options.

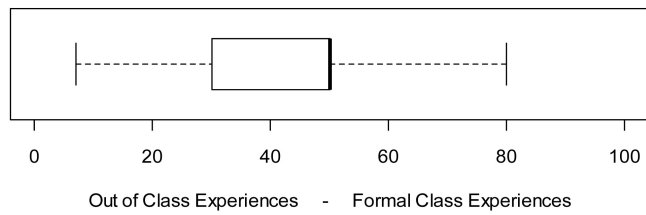
Entrepreneurship should be taught through:



Minimum Value	First Quarter	Median Value	Third Quarter	Maximum Value	Average Value	Standard Deviation
14	50.00	70.00	75.75	100	63.50	23.66

Fig. 5. Complete the statement by sliding the scale along the listed options.

The best way for students to learn entrepreneurial skills is through:



Minimum Value	First Quarter	Median Value	Third Quarter	Maximum Value	Average Value	Standard Deviation
7	30.25	50.00	50.00	80	45.21	18.56

Fig. 6. Complete the statement by sliding the scale along the listed options.

Finally, the median response was 50 to the item, “The best way to learn entrepreneurial skills is through:” *Out of Class Experiences* versus *Formal Class Experiences*. Responses that fell into the middle 50% range were between 30.25 and 50.00, indicating responses were closer to the *Out of Class Experiences* side of the scale. (See Fig. 6 for boxplot.)

4. Discussion

The investigation of faculty beliefs about entrepreneurship education yielded some interesting results. Most of the faculty who participated in this study believed that the entrepreneurial mindset is a function of both the students’ innate characteristics and skills that can be cultivated through instruction.

Faculty tended to believe that programs should focus on venture and on entrepreneurship as compared with intrapreneurship. Most felt that entrepreneurship should be taught through formal programs, rather than using unstructured experiences. Few felt that programs should focus on social entrepreneurship. Many of the faculty seemed to support using experiential learning, focusing on creating an environment of affective socialization, as termed by Okudan and Rzasa [26].

In some respects, the results of this study run contrary to the findings of Bennett [28]. As described above, Bennett had found that most respondents to his survey had subscribed to teaching in a skills-based approach. The faculty in this study seemed to advocate an environment focusing *both* on skill acquisition and on the cultivation of the attributes deemed necessary to be an entrepreneur. One possible explanation is that the programs involved in the study are very well-established in entrepreneurship education; many of the faculty involved in the study had published articles on how entrepreneurship should be taught. Therefore, the populations surveyed between this and Bennett's study could possibly be different.

One interesting point is that faculty do acknowledge that many of their teaching practices stem from their own experiences. This is not surprising, as Kagan stated, "[t]eachers appear to obtain most of their ideas from actual practice . . ." rather than from research [9](p. 75). Fiet was concerned that many instructors of entrepreneurship approach their courses from a framework of "academic autobiography", which might bias the content covered in the course [5].

The study did have two primary limitations. First, one limitation of the study is that the sample of faculty for both phases of the project were from three large research-oriented universities. The faculty taught within institutionalized programs of entrepreneurship at their respective universities. The schools are well-known for having cultures of entrepreneurship within the Colleges of Engineering or at the university level. Beliefs and practices of faculty teaching entrepreneurship at smaller schools, with less institutionalized programs, may have different perspectives on the questions. A second limitation of the study is that the sample size is still relatively small. While the sample of 26 members of faculty for the interviews is likely sufficient to gather preliminary data for instrument construction, the sample of 37 for the survey is too small to be generalizable beyond these three institutions. In order to address both of these limitations, the authors are currently working on expanding the survey data collection to include faculty and instructors at a variety of different universities that have

entrepreneurship courses or programs in engineering.

Another future area of investigation is to further explore beliefs with respect to instructor background. Owing to the small sample size, statistical comparisons of the data by faculty background or discipline could not be conducted. However, we believe that beliefs are likely influenced by the characteristics of the faculty member. For example, engineering faculty members may have different viewpoints than business faculty members regarding the educational value of different instructional techniques, such as case studies. Additionally, faculty members who have been entrepreneurs will likely bring different perspectives toward entrepreneurship to their teaching compared with those who have little or no entrepreneurial work experience. Program characteristics may also influence faculty beliefs. Faculty members who teach courses strictly designed for engineering students may have different perspectives than those who teach within interdisciplinary programs that bring together students in engineering, business, and information sciences. Given the small sample size, and the focus on only three institutions, these types of comparisons could not be considered.

5. Conclusions

Below is a list of several broad beliefs that the faculty members in this sample held regarding engineering entrepreneurship education:

1. Most faculty members believe that the entrepreneurial mindset is a function of both innate characteristics and developed skills, although some have reluctance in using this term.
2. The primary characteristics that faculty members associate with the entrepreneurial mindset are risk tolerance and drive.
3. Faculty members believe the entrepreneurial mindset can be cultivated through instruction, however, some note the importance of students' drive.
4. Faculty members believe that cultivation of the entrepreneurial mindset can occur through experiential learning, practice, and mentorship. This sentiment is echoed in their instructional practices.
5. Faculty members believe that entrepreneurship programs should focus on venture and entrepreneurship, as compared with intrapreneurship. They also favor formal programs over unstructured experiences.

How faculty members define the entrepreneurial mindset is likely to influence their classroom practices and can impact course content and instructional

methods. This study begins to scratch the surface on understanding what is currently being done in teaching entrepreneurship to engineers and can provide a foundation for future research in this area.

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