



# Women STEM faculty's intentions to engage in entrepreneurship education programs

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## Abstract

Recognizing the socioeconomic importance of STEM-based entrepreneurial initiatives, several entrepreneurship education programs (EEPs) have been initiated to foster and incentivize the translational of academic scientific and technological research into commercially offered products. However, STEM-focused entrepreneurship continues to be challenged by diversity, equity, and inclusion issues, with limited research examining women STEM faculty's perspectives in regard with EEPs. We argue that to develop EEPs that are inclusive to women, one of the foremost needs is to better understand their intentions behind engagement in EEPs. The purpose of this qualitative study is to investigate women STEM faculty's intentions to engage in entrepreneurship education programs. In-depth, semi-structured interviews were conducted with 32 self-identified women STEM faculty who have ( $n = 13$ ), and have not participated ( $n = 19$ ) in EEPs. The participants represented different STEM fields and were situated across multiple institutions in the USA. Five core themes emerged from analyzing the qualitative interviews using first and second cycle coding methods. These themes identify different intentions behind women STEM faculty's engagement in entrepreneurship programming—translation intent, innovation intent, intent to engage students, personal intent, and entrepreneurial intent. Overall, the findings suggest that the singular “venture-creation” focus in EEPs does not sufficiently capture the varied intentions that inform women STEM faculty's engagement in EEPs. Implications of the findings in regard with improving inclusivity in entrepreneurship program development and implementation, and entrepreneurship education research are discussed. We call for further research that examines how women STEM faculty navigate academic entrepreneurial pathways that include broader issues within the mainstream entrepreneurial ecosystems. We anticipate that continued research efforts paired with administrative implementations will assist in addressing systemic issues and contribute to the broadening participation of STEM women faculty in EEPs.

**Keywords** Entrepreneurship education · Diversity · STEM · Faculty

## Introduction

Science, Technology, Engineering and Mathematics (STEM) disciplines continue to meet a critical need in driving technology-focused new product development and entrepreneurship efforts throughout the global economy. As such, STEM-based entrepreneurial initiatives have the potential to serve as a platform to enhance economic development and social mobility, resulting in an increased quality of life. Yet, STEM-focused entrepreneurship continues to be challenged by the limited participation of STEM female faculty. This reality is concerning, especially given that women are enrolling and completing college at a faster rate than men. Moreover, females (in comparison to their male counterparts) are more likely to see a market need and fill the market need (Weeks, 2007). However, the limited participation of females engaging in STEM-based entrepreneurship provides a perilous hurdle for effectively improving upon the innovation economy. Technology-sector statistics are abysmal in that female founders only represent 3% of technology companies and 1% of high-technology companies (Tinkler, Whittington, Ku, & Davies, 2015). In addition, females account for a narrow 12% of innovators in the USA. Finally, women represent about 18% of forty-year-old inventors; although this gender gap continues to improve, researchers predict gender parity will take more than a century (Bell et al., 2019).

To foster entrepreneurship among women in STEM fields, one approach in the USA has been to establish programs to better prepare STEM-focused academics, scholars, and researchers for entrepreneurship endeavors. The Epicenter Program: National Center for Engineering Pathways to Innovation and I-Corps Program are two key professional development experiences aimed to instill and improve entrepreneurial skillsets within the STEM fields Weilerstein, P., & Byers, T. (2016). Fueled by the national-level effort, several professional development experiences for faculty and students continue to be implemented with the support of engineering professional societies (ASEE Entrepreneurship Engineering Innovation Division), and private foundations (Engineering Unleashed; VentureWell). These efforts are evidence of advancements towards integrating the entrepreneurship fields with STEM disciplines to promote technology-entrepreneurship, and subsequent socio-economic innovation.

Entrepreneurship education programs (EEPs) that engage STEM faculty provide a platform to promote diversity in STEM entrepreneurship, so minoritized individuals who traditionally have been on the receiving end of socio-economic disenfranchisement, can be part of high-value and high-impact STEM entrepreneurship. Moreover, capitalizing the potential of STEM women in entrepreneurship can contribute to the continued growth in science and technology sectors. However, challenges related to social justice, accessibility, and inclusion continue to be a barrier to advancements in STEM education. Although diversity-related problems are being researched at a faster rate, STEM education literature lacks research centering around how exclusionary structures, systems, and practices continue to perpetuate in the US education system (Riley, Slaton, & Pawley, 2014). This trend is also accurate for EEPs where there is a dearth of research that focusses on women, as noted in key systematic reviews of literature conducted in the education (Huang-Saad, Morton, & Libarkin, 2018) and business fields (Poggesi et al., 2016, 2020). In the context of our exploratory study, we argue that examining the drivers informing faculty's intention to engage in EEPs is the first step towards building inclusive EEPs. Thus, we examine the research question: what are women STEM faculty's intentions to engage in EEPs? We anticipate that this new research-based understanding can serve as a resource for administrators and educators to create EEPs that are inclusive to women.

## Literature review

Having garnered significant attention in entrepreneurship literature, *intent* is a construct that describes an individual's goals to complete a behavior (Tornikoski & Maalaoui, 2019). In the entrepreneurship context, intent has been extensively used in the literature (Fayolle & Liñán, 2014; Krueger Jr et al 2000). Schlaegel and Koenig (2014) conducted a meta-analysis to understand how entrepreneurial intentions can be used to predict one's propensity to start a business. Describing entrepreneurial intention as a person's intention to start a firm, the authors conceptualized entrepreneurial intent as an outcome variable driven by six factors. These factors were informed by two commonly used theories in the entrepreneurship assessment literature (Shekhar et al., 2018). First, the theory of planned behavior identifies three factors—attitudes towards performing the behavior, social approval for performing the behavior, and their perceived ease/difficulty in performing the behavior (Ajzen, 1991, 2020). Second, the Shapero's entrepreneurial event model posits another three factors as drivers of entrepreneurial intention; these include perceived desirability, propensity to act, and perceived feasibility (Shapero & Sokol, 1982).

In recent years, intent has been critiqued for its narrow conceptualization of decision making (Sniehotta et al., 2014). However, it thus has been (re)theorized and broadened to account for the sociocultural context (Conner, 2015; Conner & Abraham, 2001; Nunkoo & Ramkissoon, 2010). Adopting this perspective, we identified intent to engage in EEPs (hereby referred to as EEP intent) as a critical construct contributing to women STEM faculty's participation in EEPs. This construct reflects why women STEM faculty might ultimately pursue an EEP and serves as an explanatory precursor to participation. In the following sections, we first synthesize broader entrepreneurial intent literature, focusing on how entrepreneurial intent is defined by itself, and in relation to other constructs. Then, we present pertinent literature on entrepreneurial intent that has focused on women (ASEE Entrepreneurship Engineering Innovation Division, 2023).

## Entrepreneurial intent

First, one body of literature has examined entrepreneurial intent in relation to entrepreneurial orientation. In these studies, while entrepreneurial intent is viewed from the perspective of one's intention to become an entrepreneur, entrepreneurial orientation encompasses personal characteristics such as risk taking, innovation, and pro-activeness. For example, Robinson and Stubberud (2014) examined how elements of entrepreneurial orientation correlate with entrepreneurial intent. Derived from the survey validated by Cooper and Lucas (2006), the researchers measured entrepreneurial intent using questions around starting a business, joining start-up company, and appeal towards high risk/high payoff venture. Based on the pre-post assessment in an entrepreneurship course, the researchers found that there was no negative impact of the course, with no participants moving from the high intent group to the low intent group. While some participants moved from the low intent group to the high intent group, the majority participants saw no change. Intriguingly, the researchers found that, no entrepreneurial orientation variables were correlated with entrepreneurial intent as measured in the pre-test. However, innovation and risk-taking aspects of entrepreneurial orientation were both correlated with entrepreneurial intent as measured in the post-test. Along similar lines, Ismail et al. (2015) explored how entrepreneurial

orientation and entrepreneurial intent can drive commercialization among faculty and students in Malaysia. Entrepreneurial intent was defined to be a natural precursor and driver of entrepreneurial activity (e.g., commercialization of scientific research). Regression analysis results noted that both entrepreneurial intent and orientation were significant predictors of intention to commercialize.

Second, taking a socio-cultural stance, researchers have argued that entrepreneurial intent is not solely dependent on the individual and their personal characteristics, rather is informed by social, demographic, and societal factors in which the individuals are placed. For example, defining entrepreneurial intent as one's intention to create a startup, Engle et al. (2011) posit that there are three drivers of entrepreneurial intent—behavioral beliefs, normative beliefs, and control beliefs. While behavioral beliefs represent one's attitude towards a behavior, normative beliefs encompass the extent by which individuals believe that their referent group (e.g., family, mentors, and friends) would motivate them to engage in a behavior and their likelihood to comply with the motivation received from the referent group. In contrast, control beliefs ascribe to an individual's perceived ability to successfully engage in a behavior. Similarly, Gilmartin et al. (2019) examined the extent by which the entrepreneurial intentions of engineering students are influenced by individual and contextual variables such as context, background demographics, and personal attributes. In this study, the authors use a similar but slightly nuanced conception of entrepreneurial intention, which is defined in terms of the importance students accredit to creating a startup. Specifically, it is measured by the future desire to start or develop a business, and/or change the operations of a business.

Third, researchers have examined entrepreneurial intent in the context of EEPs. For example, van Ewijk and Belghati-Mahut (2019) examined students' entrepreneurial intent (EI) beginning and after taking an EEP. The researchers found that while women held significantly lower EI when compared to men at the beginning of the course, there were no significant differences after the course (van Ewijk & Belghiti-Mahut, 2019). The findings underscored the positive impact of EEPs. However, the authors underscored that the women have lower EI because "they might consider entrepreneurship as less desirable and less feasible, due to gender stereotypes that shape their perception of social norms regarding appropriate career choices for women against entrepreneurship and that affect how they evaluate their own entrepreneurial skills (p. 12)" (van Ewijk & Belghiti-Mahut, 2019). In another instance, examining the impact of EEPs on entrepreneurial entry among graduates, researchers have reported a significant impact of EEPs but found no moderating effect of gender, indicating that EEPs have a positive impact on both men and women (Ramadani et al., 2022). This result is in line with extant literature that has found that there is no moderating effect of gender on the impact of EEPs on entrepreneurial intent (Bae et al., 2014).

## Entrepreneurial intent and women

A significant proportion of research on women in entrepreneurship has followed a deficit framing in which the "lack of" certain aspects have been examined to explain underrepresentation of women in entrepreneurial spaces (Marlow & Swail, 2014). Alternatively, Matherne III et al. (2020) investigated the relationship between individuals' entrepreneurship pathways and entrepreneurial intent and reported that while small business-based entrepreneurship pathways had a weaker relationship with entrepreneurial intent, social entrepreneurship had a stronger relationship with entrepreneurial intent for women (Matherne III et al., 2020, p. 989). In a slightly different approach, Santos et al. (2016) takes an

explanatory stance to investigate the formation of entrepreneurial intentions across men and women. In their work, while no specific definition is provided, entrepreneurial intention is described as a pre-requisite to new venture creation. More importantly, entrepreneurial intention is proposed to result from variables commonly used in entrepreneurship research and assessment (e.g., personal attitude, perceived behavioral control, subjective norms) and on two relatively less frequently used variables—closer valuation and social valuation. In the paper, closer and social valuation refer to people's perception of how the entrepreneurial activity is valued in "one's closer environment (family, friends, and ethnic group)" and "society, as a consequence of macrosocial values and culture" (Santos et al., 2016, p. 52). Along similar lines, Armuna et al. report a positive relationship between competencies and entrepreneurial intent, but they note that gender does not have a moderating effect on the relationship for the studied sample of STEM students (Armuña et al., 2020).

In contrast, recently emerging scholarship has shifted perspectives by focusing on social and contextual factors that affect women's participation in entrepreneurship. For example, Abreu & Grinevich (2013) examined multi-year survey data across male and female academics to determine factors contributing to the gender gap in academic entrepreneurship. Among other factors, they argued that greater male representation in high commercialization research fields (e.g., engineering) contributes to lower female representation in academic entrepreneurship (Abreu & Grinevich, 2013). Piva & Rovelli (2022) note the influence of university course work and experience on entrepreneurial entry for women, noting how experiences in undergraduate work that positively support employment discourage entrepreneurship. Also, researchers explore the duality that women face between being a "woman" versus an "entrepreneur," noting the masculinization of entrepreneurial spaces (Blickenstaff, 2005).

Other recent work takes a critical perspective towards how we have conceptualized measurement of entrepreneurial entry, particularly around intent. For example, in their multi-national study, Nikou et al. (2019) examined the factors predicting entrepreneurial intentions and difference across men and women. Similar to others (Iglesias-Sánchez et al., 2016; Maresch et al., 2016; Zhang et al., 2015), the results noted that perceived behavioral control and attitude toward entrepreneurship were decisive in predicting entrepreneurial intentions for both men and women. However, the configurations leading to entrepreneurial intentions differed between men and women. Specifically, it was found that in contrast with men, self-efficacy in addition to perceived behavioral control and subjective norm are the central conditions forming entrepreneurial intentions among women. Furthermore, the researchers critique previous work examining entrepreneurial intent on the basis of the breadth of ways different genders might approach entrepreneurial work. They argued for a need to expand how research conceptualizes pathways to entrepreneurial intent (Nikou et al., 2019). Similarly, Di Paola (2021) joins Nikou et al. in arguing for a more expanded understanding on entrepreneurial intention. The author points to the centrality of self-efficacy in this work but also names how social perception of entrepreneurship plays a role in developing entrepreneurial intention (Di Paola, 2021). Cumulatively, the authors called for gender-focused examination of antecedents to entrepreneurial intentions, and highlighted that "entrepreneurial intentions are meaningless" if examined without considering the contextual factors driving it (p. 364). This claim is consistent with findings from systematic literature review which has underscored that entrepreneurial intentions are impacted by a multitude of contextual, educational, social, demographic, cognitive, and environmental factors (Maheshwari et al., 2022). More importantly, noting the lack of research examining demographic factors and the literature being dominated by quantitative studies, the authors called for more contextualized (or situational) work that goes beyond theory of planned

behavior factors (Ajzen, 1991). Lastly, this call resonates with growing scholarship in STEM women entrepreneurship that calls for contextually examining gendered nature of these spaces (Sinell et al., 2018; Treanor, 2022).

## Methodology

### Sampling

Purposive sampling formed the basis for our sampling approach (Campbell et al., 2020), in which participants were selected based on the criteria that they were women-identifying faculty with appointments in a STEM school or college. The sample included 32 self-identified women faculty, either who have or have not participated in an EEPs. In this paper, we refer to them as EEP participants and EEP non-participants. Within the participant (13) and non-participant (19) pools, we recruited similar (if not equal) participants from 4 racial and ethnic identities—Black, Latina, Asian, and White. Also, a maximum variation approach (Cohen et al., 2000) was used such that the sample included faculty from different STEM disciplines, academic rank (assistant, associate, and full professors), and institutions. Of our EEP participants, 13 were housed in engineering departments and 6 were housed in natural science departments. Of our non-EEP participants, 11 were housed in engineering departments and 2 were housed in natural science departments. As we recruited and interviewed the participants, we used snowball sampling, where participants were asked for colleagues who fit the criteria for the study (Johnson, 2014). The demographic information reported by the participants is summarized in Table 1.

### Data collection

Echoing the calls for investigating STEM education topics using epistemically and methodologically diverse approaches (Case & Light, 2011), we used an interpretative, qualitative approach using semi-structured interviews. The hour-long interviews with the 32 participants were conducted virtually by one member of the research team. The interview recordings were transcribed using a professional transcription service. Two versions of the interview protocol were developed to capture both EEP participant and non-participant perspectives. A subset of general interview questions is presented below:

1. Probing knowledge EEP awareness.
  - (a) How and when did you learn about the EEPs?
  - (b) Do you know if other faculty was similarly aware of EEP opportunities?
2. Probing reasons for engagement EEPs.
  - (a) Why did you enroll in these EEPs?
  - (b) What were your prior experiences that motivated your interest in EEPs?
  - (c) Can you describe what motivated you to pursue EEPs?
3. Probing experiences and/or perspectives on EEPs.

**Table 1** Participants' demographic information

| Pseudonym | Racial/ethnic identity | Pronouns     | EEP participation | Title               | Institution type                           |
|-----------|------------------------|--------------|-------------------|---------------------|--------------------------------------------|
| Dr. A     | Asian                  | She/her      | No                | Associate professor | Baccalaureate college                      |
| Dr. B     | Asian                  | She/her      | No                | Assistant professor | Doctoral University: R1                    |
| Dr. C     | Asian                  | She/her      | No                | Professor           | Doctoral University: R1                    |
| Dr. D     | Asian (South)          | She/her      | No                | Assistant professor | Doctoral University: R1                    |
| Dr. E     | Black                  | She/her      | No                | Professor           | Doctoral University: R1                    |
| Dr. F     | Black                  | She/they     | No                | Associate professor | Doctoral University: R1                    |
| Dr. G     | Black                  | She/her      | No                | Professor           | Engineering/technology focus 4-year school |
| Dr. H     | Black                  | She/her      | No                | Assistant professor | Doctoral/Professional University           |
| Dr. I     | Latina                 | She/her      | No                | Undisclosed         | Undisclosed                                |
| Dr. J     | Latina                 | She/her      | No                | Assistant professor | Doctoral University: R1                    |
| Dr. K     | Latina                 | She/her      | No                | Associate professor | Doctoral University: R1                    |
| Dr. L     | Latina (Afro)          | She/her/ella | No                | Associate professor | Doctoral University: R1                    |
| Dr. M     | Middle Eastern         | She/her      | No                | Assistant professor | Doctoral University: R1                    |
| Dr. N     | White                  | She/her      | No                | Assistant professor | Doctoral University: R2                    |
| Dr. O     | White                  | She/her      | No                | Assistant professor | Doctoral University: R1                    |
| Dr. P     | White                  | She/her      | No                | Assistant professor | Doctoral University: R1                    |
| Dr. Q     | White                  | She/her      | No                | Assistant professor | Doctoral University: R1                    |
| Dr. S     | White                  | She/her      | No                | Assistant professor | Doctoral University: R1                    |
| Dr. T     | White                  | She/her      | No                | Associate professor | Doctoral University: R1                    |
| Dr. U     | Asian                  | She/her      | Yes               | Professor           | Doctoral University: R1                    |
| Dr. V     | Asian                  | She/her      | Yes               | Part-time faculty   | Doctoral University: R1                    |
| Dr. W     | Asian (South)          | She/her      | Yes               | Professor           | Doctoral University: R1                    |
| Dr. X     | Black                  | She/her      | Yes               | Assistant professor | Doctoral University: R1                    |
| Dr. Y     | Black                  | She/her      | Yes               | Professor           | Doctoral University: R1                    |
| Dr. Z     | Black                  | She/her      | Yes               | Professor           | Doctoral University: R1                    |

**Table 1** (continued)

| Pseudonym | Racial/ethnic identity | Pronouns | EEP participation | Title               | Institution type        |
|-----------|------------------------|----------|-------------------|---------------------|-------------------------|
| Dr. AB    | Latina                 | She/her  | Yes               | Associate professor | Doctoral University: R1 |
| Dr. BB    | Latina                 | She/her  | Yes               | Associate professor | Doctoral University: R1 |
| Dr. CB    | Latina                 | She/her  | Yes               | Professor           | Doctoral University: R2 |
| Dr. DB    | Middle Eastern         | She/her  | Yes               | Professor           | Doctoral University: R2 |
| Dr. EB    | White                  | She/her  | Yes               | Associate professor | Doctoral University: R1 |
| Dr. FB    | White                  | she/her  | Yes               | Assistant Professor | Doctoral University: R2 |
| Dr. GB    | White                  | She/her  | Yes               | Professor           | Doctoral University: R1 |

- (a) How would you describe the EEP you participated in to someone unfamiliar with it?
- (b) In your current role as a faculty member, what is your perspective on EEPs?
- (c) What does it mean to be an entrepreneur in your field?
- (d) How well do you think EEPs have done at engaging women faculty?

## Data analysis

Multiple rounds of qualitative coding were used to analyze the data (Saldaña, 2021). In the first round, *in vivo* coding provided a sense of the data, wherein short codes were created based on participants' responses. In the first round, a total of 11 codes pertinent to intent formed the initial coding inventory (summarized in Appendix). To ensure trustworthiness in research quality, two researchers independently coded 30% of the data, and compared the coding on a line-by-line level (O'Connor & Joffe, 2020). All discrepancies were resolved through multiple rounds of discussion to reach 100% consensus. In addition, the two researchers captured their initial thoughts and analytical process during the first-round coding by maintaining an analytical memo, which acted as an audit for subsequent coding by tracking if and how the analytical process evolved (Birks et al., 2008; Miles, Huberman, & Saldaña, 2018). In the second round, the research team collaboratively classified the specific first-round codes into broader categories. After the categorization, the two researchers independently coded 15% of the data, which was followed by comparisons and discussions to establish the interrater reliability. The intraclass correlation coefficient (0.94) indicated 94% agreement between the two researchers. Also, 100% consensus was achieved on the codes through discussion. After establishing the interrater reliability, the two researchers coded the remaining interviews using the category-level code book. Lastly, themes synthesizing the findings in regard with the research questions were identified. Similar to the first round, the two researchers engaged in the development of memos which further served as an audit as the data analysis advanced from coding to thematic explanation building.

## Findings

Intentions are widely studied in education research in different forms such as career intentions (Turner et al., 2019), educational intentions (Kurup et al., 2019), and entrepreneurial intentions (Krueger Jr et al., 2000). These intentions are often driven by wide array of factors including but not limited to self-efficacy, individuals' intrinsic and extrinsic motivations, personality, cognition, and environments (Bandura, 1977; Liñán, 2004; Maheshwari et al., 2022; Papacharisis et al., 2003). The presented study focused on intentions to engage in EEPs for women STEM faculty. In this regard, five core themes emerged from analyzing the qualitative interviews as summarized in Table 2. These themes identified different sub-factors describing women STEM faculty's intentions to engage in EEPs—translation intent, innovation intent, intent to engage students, personal intent, and entrepreneurial intent. In the following section, each theme is explained in detail with representative quotes from the analyzed interview data.

**Table 2** Summary of findings

| Theme/subfactor           | Description                                                                                                                    |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| Translation intent        | When participants engage in EEPs to pursue the translation of their science and technology to positively impact or help people |
| Innovation intent         | When participants engage in EEPs to “innovate” or engage in “innovation”                                                       |
| Intent to engage students | When participants engage in EEPs to support students with their involvement in entrepreneurship                                |
| Personal intent           | When participants engage in EEPs for personal reasons                                                                          |
| Entrepreneurial intent    | When participants engage in EEPs to start a business or company                                                                |

### Translation intent

Likely constituent to engaging in academic STEM research, the first subfactor within *EEP intent* was *translation intent*, which captured participants seeking out an EEP to support translating their science to positively impact or help people. Translation intent was extensively noted across both EEP and non-EEP participants. For example, Dr. J shared the following when asked if she was inclined to entrepreneurship:

I would like to remain in academia, but I want to be able to translate. That’s what I was also doing in industry; I was taking the base product into the pilot and bring it to commercialization. And I love that. I would like to use our science to develop some kind of pilot that can be translated into commercial. I don’t see myself leaving academia and become the manager of a company. I don’t want to do that. I don’t think that that’s my role, but I do see myself bringing things to the market and helping people to design a company that they can use those products. So, if that’s what you call entrepreneurship, then, yes. That’s what I see myself (Dr. J Interview, pp. 5-6).

Similarly, EEP participant Dr. GB shared the following when asked the same question:

No, no. Yes. My passion is the research, in the discovery and the opportunity to translate that discovery to the treatment of human disease, yes and [the EEP] is a unique opportunity to do so (Dr. GB Interview, p. 6).

Both Dr. GB and Dr. J describe that the goal of translation, getting their science to a population that needs it, is an important goal of their work and something they are particularly passionate about. The EEP was a means to this end for Dr. GB and other interviewed EEP participants. It is important to note that non-EEP participant Dr. J questioned if her translation goals were entrepreneurial. This distinction is an important consideration that is explicated in the discussion section.

### Innovation intent

While innovation and entrepreneurship are often used together, we use the conceptualization that entrepreneurship is a consequence of innovation (Duval-Couetil & Dyrenfurth, 2012). In our study, women STEM faculty predominantly used the word “innovation,” in opposition to entrepreneurship, to describe their intent. For example, EEP participant Dr. V shared why she had engaged in the EEP path she had taken:

So, I like innovation. I like innovating for really tough challenges. And I think those tough challenges really come from constraints like how much money does a population or a healthcare system have? What is the environment? Why doesn't the current practice work? (Dr. V Interview, p. 5).

For Dr. V, innovating against constraint drove her intent to engage in entrepreneurial spaces. Similarly, *innovation intent* reflected the potential of contributing to something new or groundbreaking for non-EEP participants. Dr. C, a non-EEP participant, shared this context where she might seek out an EEP:

Yeah. If I find a really great project that I think it would revolutionize the field, sure. I would consider at least contacting the university [entrepreneurship office] and have incubated a lot of small start-ups since its formulation three, four years ago, so it's much easier to see how to move forward... (Dr. C Interview, p. 5).

For Dr. C, the opportunity to support advances in the field seemed to guide engagement with EEPs. Both Dr. V's and Dr. C's experiences reflect the complexity of what may lead them to an EEP. Like *translation intent*, *innovation intent* captures how academic STEM women's research is often the origin of entrepreneurial activity and EEP participation.

### Intent to engage students

Emerging from the STEM academic context, the *intent to engage students* reflects women STEM faculty's goals to support students they mentor or teach. Operationalized in our discussions, we observed this subfactor specifically when EEP participants shared their goal to engage their students in entrepreneurship as a driving purpose for their EEP participation. For example, Dr. AB discussed why she would never want to pursue a start-up, although she had participated in I-Corps:

Well, I feel like I really like, my passion is to see people grow. And my passion is mentoring people. And I'm not really into making a million dollars in a start-up and selling a product, I'm into helping individual students develop as researchers and develop as future academics, future industry leaders and making the best of their time at the university. So, and what it takes to do that I feel like it does take a little bit of being an [entrepreneur], but it's in a different way. I think the final intent is to mentor people and to see people grow and not necessarily to become a millionaire or whatnot (Dr. AB Interview, p. 11).

In describing her passion, Dr. AB names that she intends to support the next generation of academics, a goal shared by several of her EEP colleagues. Similarly, non-EEP participants shared exposing students to entrepreneurship or growing their entrepreneurial skills and potential reasons to participate in EEPs. For example, non-EEP participant Dr. A shared:

I am 100% supportive of entrepreneurship mindset. I think it is important for our students, and it is important, me as a mother, that we build up a population that they come in, learn the basics, learn the theory, have a solid grasp of it with the knowledge that they can if they want to, go into business. They can in sense not taking advantages of, if they come up with some scientific breakthrough that they're able to navigate the system and they have that knowledge. So, I want them to have that

knowledge, have that mindset, but I don't want them to think about everything as a product (Dr. A Interview, p. 3).

For Dr. A, gaining or engaging with an EEP would be particularly guided by her role as an academic mentor. Notably, this thought process was common for non-EEP participants, regardless of the size of their institution or teaching load. Although not every woman STEM faculty discussed student engagement as their ultimate reason for EEP participation, it is important to note that this intention may align more easily with other goals fundamental to STEM academia.

## Personal intent

As a subfactor, *personal intent* is reflected when participants describe personal reasons, such as family support, in relation to their intent to engage in an EEP. This subfactor was less common than the above three; however, we include it to illustrate the breadth of ways academic STEM women ultimately decided to participate in EEPs.

For example, Dr. Y credited her son with her decision to pursue I-Corps ultimately:

For me, I just love the world of innovation and technology, and I like the idea to create something that people can use. My research has always been to help [inaudible] living, either for the environment or for human health. And so, my research has always had the bench towards that application, even though there's a lot of fundamental work that I also do as well. But I've never really thought about actually taking technology to the market until my son said, "No, mommy, have you thought about..." I said, "Well, I could explore it. Let's explore it" (Dr. Y Interview, p. 2).

For Dr. Y, her goal of pursuing an EEP was deeply guided by her family. Other participants described their personal goals or sense of self supporting their *EEP intent*. For example, Dr. H reflected on pursuing an EEP in future years:

I'm very optimistic about that because it's definitely a part of my career trajectory that I kind of have for myself, like a goal. I've enjoyed the times that I've worked on teams with that. I really enjoyed the course that I took in graduate school for that. I think I'm a good people person in terms of getting out and marketing and kind of selling my idea. I think I'm pretty good at that. So yeah, it is something I have in the forefront of my mind of what I want to do (Dr. H Interview, p. 8).

Dr. H's example reflects how some academic STEM women might want to pursue an EEP not for a particular career outcome, like a translation or starting a business, but because it reflects their families' goals or interests. While occurring less commonly in our data set, *personal intent* for women STEM faculty's entrepreneurial activity continues to broadly emerge as an area for continued research.

## Entrepreneurial intent

The final identified subfactor, *entrepreneurial intent*, reflects original theorizing from the participation in EEP (PEEP) model (Shekhar et al., 2021). We defined it as the intent to engage in entrepreneurial behavior, like starting a business. Notably, *entrepreneurial intent* was the least common subfactor in *EEP intent* emerging across the data. Furthermore, *entrepreneurial intent* was often seen in conjunction with other intent subfactors. For

example, EEP participant Dr. CB shared how she originally sought out an EEP with her business partner, a doctor:

So, you have an engineer and a doctor. Interdisciplinary research, and they were like, “Wait a second. Why can’t we develop this product, build it, and sell it?” That’s how it started. It really started from the ... obviously the research, an interdisciplinary one because it’s an interdisciplinary problem, right? Doctors cannot solve it, but they are the ones getting the pain, and engineers cannot work on a medical problem without an expert, right? (Dr. CB Interview, p. 6).

Dr. CB notes that her initial driving goal was to build a commercial product. However, she also noted that she also wanted to address an interdisciplinary problem, which would consider *innovation intent*. Like with many of the intent subfactors, these goals existed together. Similarly, non-EEP participant Dr. B shared the following response to why she was attracted to the potential of EEPs:

Yeah, I guess so I have been fortunate to recruit students who are also very interested in innovation and entrepreneurship...When you’re thinking about forming a company or something, it would most likely not be you. It would most likely just be you and the students or maybe even primarily the student. So, if it is something where you can have whole lab teams be involved in something, I think that would attract me even more, could attract other people the same way as well (Dr. B Interview, p. 3).

Dr. B’s example illustrates how *entrepreneurial intent* interacts with other types of EEP intent subfactors. *Intent to engage students* is at play in her case as she considers developing a business. Prominent across all women STEM faculty participants, although business creation and commercialization were not disregarded as a reason to participate in an EEP, it was often supporting or interacting with other types of entrepreneurial intent. This finding suggests that reframing the goals of outcomes of EEP may support a wider variety of women STEM faculty’s professional and personal goals.

## Discussion

Academic entrepreneurship is a complex ecosystem that involves the exploration of scholars (including researchers, faculty, and students) towards the utilization of university lead spin-offs and startups, patent applications and approvals, licenses issued and revenue made, and industry collaborations to transfer lab-tested innovations into the commercial environment (Neves & Brito, 2020). As a result, the drivers of academic entrepreneurial intentions are bound to be varied and include economic variables (including individual and organizational) and psychological variables. Individual economic variables include demographic background, educational background, motivations, social capital, and human capital. Organizational economic variables include support, quality, and climate. Finally, rooted in the theory of planned behavior, the psychological variables include personal attitude, subjective norms, and perceived behavioral control. Considering this diversity in drivers, the EEP intent is likely to include multiple constructs. Recent literature on gender and entrepreneurial intent calls for greater exploration of how and why women enter entrepreneurial work (Piva & Rovelli, 2022), and an expansion of our conceptualization of entrepreneurial intent. Our study contributes to the needed literature by unpacking women STEM faculty’s

intentions to engage in EEPs to include *innovation*, *translation*, and *personal* intent, in addition to anticipated *entrepreneurial* intent or the intention to start a company.

Overall, our findings overlap with the aspects of closer valuation and social valuation conceptions which were noted in the literature review. For example, the findings on *personal intent* align with closer valuation, which is defined as the way one perceives an “entrepreneurial activity to be valued in their closer environment” (Liñán et al., 2011). Specifically, we found that women STEM faculty’s engagement in EEPs was valued in their families, which manifested in the form of support and encouragement to engage in EEPs. Similarly, regarding *innovation* and *translation intent*, we found that these interrelated aspects were grounded in the overarching idea of solving problems for greater societal and human good. This finding was in line with the conception of social valuation, described as the “way individuals perceive the entrepreneurial activity is valued in society, as a consequence of macrosocial values and culture” (Santos et al., 2016, p. 5). In other words, women STEM faculty’s EEP intent were also based on a wide array intrinsic motivations (e.g., personal need to innovate), rather than solely relying on extrinsic motivations such as monetary gains (Ryan & Deci, 2000).

In addition, majority of our study participants had the intention to innovate and translate to solve societal and human problems; and their reported perspectives on entrepreneurial intent were often mentioned in conjunction with other types of intents (e.g., innovation, translation, and personal intent). These reports are in alignment with the entrepreneurial trends noted in the literature. Specifically, the literature on women academic entrepreneurship shows that women are less-inclined to participate in entrepreneurial endeavors when based solely on the desire to making money (Abreu & Grinevich, 2013; Murray & Graham, 2007); this trend is plausibly due to the lack of alignment between women’s intrinsic motivations that relate to the feminist ethic of caring (Riley, 2013). The ways that entrepreneurship is perceived differs across gender (van Ewijk & Belghiti-Mahut, 2019). Thus, without explicit inclusion of diverse intentions behind participants in EEP programming and outreach efforts, prospective participants may perceive that EEPs are only associated with the predominantly “profit-only” picture of entrepreneurship which is often portrayed in popular media. This portrayal is in congruence with extant research that has argued against a “top-down, one size fits all” approach for entrepreneurship training, and called for a “bottom up” approach in which women “provide input on their needs and solutions” to ensure that EEPs are not gendered and masculinized (Nikou et al., 2019, p. 365). Furthermore, the idea of solving problems that impact people and society aligns with the emerging sub-area of social entrepreneurship which continues to gain traction in higher education, research, and industry (Sekliuckiene & Kisielius, 2015). Although social entrepreneurs tend to demonstrate similar attributes and skillsets as “traditional for-profit entrepreneurs,” a major distinction exists in their values and underlying motivation for entrepreneurship (Shaw & Carter, 2007). In general, social entrepreneurship respects altruistic incentives, whereas traditional for-profit entrepreneurship perceives economic return on investment and revenue generation as a primary motivator. Although it seems to be logical to revise new and/or create EEPs that has a focus area of “social entrepreneurship” (Matherne III et al., 2020), we posit that this approach should be followed with caution. Specifically, while focusing on “social entrepreneurship” will include “diverse” perspectives and formulate “inclusive” environments, it may not sufficiently address systemic issues in EEPs. Without meticulous research-driven implementation, we risk social entrepreneurship being treated as another “non-masculine” sub-area within the masculinized field of entrepreneurship; reinforcing the gender norms and socio-economic roles that deter women from participating in entrepreneurship. Thus, the academic STEM entrepreneurship community should be cognizant and intentional in articulating how entrepreneurial intentions that conform with bringing

“societal change” as primary and “monetary gains” as secondary objectives are embedded within the mainstream models of EEPs.

Finally, this study’s research objective sought to leverage the voice of women faculty in better understanding their liminal positioning at the cusp of participating in STEM academic entrepreneurship, taking into consideration that STEM contexts “have been constructed and reconstructed by people in evolving power-laden environments” (Hesse-Biber & Leavy, 2010). Power-laden forces lead to marginalization by placing those in liminal positions in systems that follow worldviews envisaged by the dominant group (Cairns, 2013; Downey et al., 2020; Pitts et al., 2014). In our case, this implies that women STEM faculty are placed in entrepreneurial ecosystems that follow a masculine worldview which influences how STEM EEPs are portrayed, implemented, and researched (Treanor, 2022). Macro-social factors such as gender-stereotypes in conjunction with social perceptions of femininity and masculinity are major deterrents for women’s engagement in entrepreneurship (van Ewijk & Belghiti-Mahut, 2019). Guided by the research questions, and under the assumption that “meaning does not exist independent of the human interpretive process” (Hesse-Biber & Leavy, 2010), our qualitative approach examined the intentions behind women STEM faculty’s participation in EEPs. Our work contributes to shifting the discourse around entrepreneurship, which tends to be highly masculinized (van Ewijk & Belghiti-Mahut, 2019). Our findings concur with the swath of research summarized in the literature review that underlines how understanding and studying contextual factors is important in understanding the gender gap in entrepreneurship and calls for specific focus on women’s specific stories (Piva & Rovelli, 2022).

From a methodological standpoint, our study underscores the importance of using qualitative methods to (1) identify and unpack peoples’ perspectives, particularly those who have been minoritized in STEM entrepreneurship spaces, and to (2) inform the development of quantitative survey instruments. As noted in the literature review section, *entrepreneurial intent*, which has been mostly studied using quantitative surveys, often relies on asking participants on their intent to start a company for assessment/interpretation (Muel-ler, 2011). Our study shows that while one would assume that the intent to start a company would be a primary driver to engage in EEPs, that is not necessarily the case for women STEM faculty. It is of note that our work does not intend to undermine the research efforts and subsequent contributions that scholars have made in the entrepreneurship education field. Rather, we pose the question to the community that if typical entrepreneurial intent instruments are used to examine low engagement of women STEM faculty in academic entrepreneurship spaces, the research is bound to produce results skewed negatively for women and echo a “deficit-narrative” that places the onus on women STEM faculty, rather than the structure of academic entrepreneurship ecosystems in general, and EEPs in particular. For example, a study that examines whether intent to start a business predicts participation in EEPs may have limited applicability for women STEM faculty, because, as noted in our findings, the intentions to “innovate” and “translate academic research” might be a more important predictors for this population. Concurring with recent systematic review (Treanor, 2022), we suggest that further qualitative research is needed in the area, and more importantly that the qualitative finding should be used to develop multi-faceted, inclusive quantitative instruments that are applicable for minoritized populations in STEM fields. Lastly, since our presented work focused on women STEM faculty, future research may examine in what ways and to what extent the EEP intentions identified in our study apply for men. Researchers may follow the approach used by Fouad et al. (2020) who examined women’s persistence in engineering in their initial work (Singh et al., 2013), and conducted further comparative examination to include men engineers (Fouad et al., 2020). The authors reported gender differences in the reasons for not entering and leaving

engineering (Fouad et al., 2020). We anticipate that similar research conducted in the EEP intent context may provide valuable insights, especially when influence of institutional type, academic environment, and rank, are considered.

## Conclusion

National reports and research widely note that the issue of diversity and underrepresentation continues to be a recurring concern in the entrepreneurship industry, particularly in technology-oriented areas. Fostering academic entrepreneurship among women STEM faculty is a logical step to address the issue. As a result, EEPs continue to grow in institutions of higher education to educate, train, encourage, and support women STEM faculty in academic entrepreneurship. However, we argue that participation in EEPs is not merely an access-issue, rather a multi-faceted conversation about the exclusionary practices and structures that hinder women STEM faculty's participation in EEPs. Our findings show that starting a company held less importance in regard with women STEM faculty's intentions to engage in EEPs when compared to other emergent intentions. Thus, these findings imply that marketing and structuring EEPs as "profit-only" platform may discourage participation in entrepreneurship-related training endeavors among minoritized individuals in STEM fields—women faculty in the presented case. We suggest that targeted efforts regarding outreach and program implementation that align with the reasons informing women STEM's faculty's intentions to engage EEPs will assist promoting diversity and inclusion in academic entrepreneurial ecosystems. Also, from a systemic standpoint, instead of reinforcing the "deficit" approach, administrators and program developers may focus capitalizing on "translation and innovation" assets.

This work calls for further research that examines how women STEM faculty navigate academic entrepreneurial pathways that include broader issues within the mainstream entrepreneurial ecosystems. This research can provide research-based inputs to foster inclusivity in academic entrepreneurial ecosystems that prepare minoritized populations in STEM academia for success, by addressing systemic and structural barriers and capitalizing on their assets (such as, the pursuit of innovation and translation) instead of reiterating a deficit viewpoint to examine underrepresentation. Our study lays the beginning for future research and theoretical work that critically examines women STEM faculty's engagement in the academic and broader STEM entrepreneurship. We anticipate that continued research efforts paired with administrative implementations will assist in addressing systemic issues and contribute to the broadening participation of STEM women faculty in EEPs.

## Appendix

| Theme                     | Constituent codes                                                                   |
|---------------------------|-------------------------------------------------------------------------------------|
| Entrepreneurial intent    | Business success; promising business                                                |
| Intent to engage students | Students interest in entrepreneurship; teaching students                            |
| Personal intent           | Family                                                                              |
| Translation intent        | Application; impact; real world connection; translation; and things people need/use |
| Innovation intent         | Engaging in innovation                                                              |

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## Declarations

**Conflict of interest** The authors declare no competing interests.

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