ASEE 2022 ANNUAL CONFERENCE
Excellence Through Diversity
MINNEAPOLIS, MINNESOTA, JUNE 26TH-29TH, 2022 ASEE
Paper ID #38352

Examining Women STEM Faculty's Participation in Entrepreneurship Programming

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Introduction

The past decade has seen a rise in academic interest in innovation and entrepreneurship in science, technology, engineering, and mathematics (STEM) fields. Given its economic impact, fostering STEM innovation through entrepreneurship programming is increasingly becoming necessary for higher education. Academic entrepreneurship education programs (EEPs) continue to increase in adoption and scale, signaling the STEM community's growing embrace of innovation and entrepreneurship directives [1]. This growth presents an opportunity to broaden our understanding of entrepreneurship initiatives, specifically to support diversity, equity, inclusion, and justice. As broadening participation and addressing inequity remains a paramount concern within the broader academic STEM community [2], examining the participation of women faculty in entrepreneurship education programs (EEPs) is a critical area needing theoretical and research attention since they remain underserved in entrepreneurial spaces. This research is imperative to assure that a broader STEM faculty population reaps the benefits of entrepreneurship education programs (EEPs) given the growing interest and resources associated with these programs. The presented work addresses this gap by examining why women STEM faculty choose to engage or not engage in EEPs.

Conceptual Framing

This work aims to understand why women STEM faculty may or may not choose to participate in EEPs amidst their broader work as academics. This requires both attention to why adults might choose to participate in non-compulsory educational programs (like EEPs) broadly, and also particular attention to EEPs as a specific type of educational program. Thus, to frame our work, we drew on both adult learning and entrepreneurship education literature to examine our research question. Specifically, the Participation in Entrepreneurship Education Programming (PEEP) model conceptualized by a systematic review of literature coalesces adult learning theories [3] and theories used in entrepreneurship education literature [4], [5]. This operationalization around entrepreneurial-specific participation offers direction in examining factors that may inform women STEM faculty's participation/non-participation in EEPs.

Further, to address diversity concerns in academic STEM fields, this work requires a critical understanding of the marginalization and potential challenges facing women academics, who are operating in STEM disciplines in which they might be minoritized. Critical feminist perspectives provide a lens to examine nuanced pathways and participation accounting for the lived experiences of STEM women faculty within STEM fields and in the context of entrepreneurship programming [6]–[8]. Unfortunately, structural racism, sexism, classism, and other forms of exclusion continue to persist within STEM fields [9]–[11]. This also applies to entrepreneurial spaces, which sees lower participation of people living marginalized identities in academia [12]. Critical feminist perspectives of STEM seek to critique the culture, norms, and practices, locating conversations of broadening participation to be about the failures of the disciplinary spaces, as opposed to those marginalized. Taking this literature together, we seek to holistically capture women STEM faculty's experiences, exploring both the internal and external factors

driving pathways to or away from EEPs. Further, his work aims to support EEP stakeholders in developing better programming for increased participation of women STEM faculty.

Methods

Our study examines women STEM faculty's participation and nonparticipation in entrepreneurship programming through qualitative research methods with in-depth interviews as the data source [13], [14]. We interviewed a total of 32 self-identified women faculty, including 16 EEP participants and 16 EEP non-participants. Within the participant and non-participant groups, we purposively recruited a racially and ethnically diverse sample. Particularly, within the groups, similar (if not equal) representation was achieved across four racial and ethnic identities: Black, Latina, Asian, and White. We also strove for maximum variation to ensure the participants were from different STEM disciplines (including, but not limited to: colleges of engineering, natural sciences, or mathematics) [15]. Each interview lasted roughly 1 hour, and each was transcribed for future reference and analysis. All names reported in this summary are pseudonyms.

To analyze the interview data, we first used *in vivo* coding [16] to provide a sense of what women STEM faculty were saying about their experience in academia and around entrepreneurship. Two researchers coded 30% of the data separately for intercoder reliability and compared the coded transcripts on a line-by-line basis. The researchers reached 100% consensus on *in vivo* coding through multiple discussions. Our research team then categorized the first-round codes to develop a second-round codebook. Again, two researchers coded 10% of the data separately and compared it to establish intercoder reliability. The codebook was flexible throughout the analysis; any added codes were retroactively applied to previous data. After the final coding cycle, we generated themes and assertions most supported by the primary data and searched for disconfirming evidence.

Emerging Findings

Based on our ongoing data analysis, we note that women STEM faculty traverse a breadth of pathways and experiences to academia and EEPs, and these experiences are shaped through women's understanding of themselves within academia. Examining across both EEP and Non-EEP participants, in the emerging findings we have found distinct ways by which women STEM faculty described why they had or had not participated in EEPs. For the purposes of this poster summary, we present two key findings related to our research question. First, we present distinct ways women faculty described their non-participation, and second, we describe the "accidental" ways EEP-participants describe their participation. Selected emerging findings are summarized below.

Critical vs. Disinterested Non-EEP Participants

From our initial analysis, we noted two ways EEP non-participants described why they had not participated in EEPs. First, some women STEM faculty shared that they were broadly disinterested in entrepreneurship. Reasons for this included that entrepreneurship did not support their academic goals, their STEM discipline was misaligned from entrepreneurship, and/or their

passion aligned with research. For example, Dr. Coric, an assistant professor of Mechanical Engineering, shared:

> "It's more just a thing of what excites me. And I think being devoted to the development and sale is not quite what I... not necessarily direct sale, but promotion and development of just a single object, a single product is less interesting to me, than this ability to pursue a variety of fundamental science questions" (Coric Interview, 04/28/2021).

Like other faculty we spoke with, Dr. Coric desired to spend their time on what excited and interested them, which was more aligned with their research. 10/17 of EEP non-participants shared this perspective. Distinctly, a subset of EEP non-participants also shared criticism of entrepreneurship and EEPs, moving beyond disinterest into specific concerns about entrepreneurial spaces. These women STEM academics described critiques or concerns about the practices of entrepreneurship conflicting with their personal ethics and/or stances that academia should not be about making money. For example, Dr. Madani shared:

> "I just want to be on the record as saying I am flat-out straight against entrepreneurship because as a scientist, I don't want our students to grow up thinking, "I'm making this to sell it." I am 100% supportive of entrepreneurship mindset" (Madani Interview, 04/29/2021)

Dr. Madani's exemplar animates the challenges some women STEM faculty raised, in balancing critiques of entrepreneurial work for themselves and those they mentor. 11/17 EEP non-participants shared this perspective.

Accidental EEP Participants

Looking at the experiences EEP participants shared with us, we noted a common way women STEM faculty described their engagement in EEPs. We call this pathway "Accidental" because the EEP participant joined the program in reaction to others' suggestions or supports and self-described how they were not seeking entrepreneurship prior to particularly targeted suggestions to pursue entrepreneurial work. This is potentially counter to "active" pathways, in which EEP participants described an active desire to seek out entrepreneurial work. As an example of an "accidental" pathway, Dr. Cagley shared:

> So the way I got started as an entrepreneur was accidental. I didn't seek out entrepreneurship at all. I was fundraising with the university for a clinical food allergy center, and we prepared a white paper…. So I was showing [a philanthropist] the data I had and at that time, the companies that are now the big microbiome companies were still very small. And they were asking me to test their candidates in my models. And he said to me, 'Why would you do that? You get no intellectual property out of that. You have candidates yourself. You have the models. Why don't you make your own company? And, I'll give you $800,000 to get you started'" (Cagley Interview, 10/27/2021).

In Dr. Cagley's exemplar, she "accidentally" began a journey in EEPs and entrepreneurship based on suggestions from those around her. Like other faculty we spoke to, 9/13 EEP-

participants, she categorized her experience in entrepreneurship as one of chance and guided by others' suggestions, not driven by her initial interests.

Conclusions and Future Work

These emerging findings lay the groundwork for significant future analysis. Most immediately, we seek to develop a conceptual framework that explicates factors informing women STEM faculty's participation/non-participation in EEPs. This process will involve key-linkage and framework analysis [17], connecting to the broader theoretical work in adult learning, education and entrepreneurship literature [5]. In the next steps, we intend to explore other emerging spaces related to how women STEM faculty navigate oppression in broader academia and how that relates to their EEP participation. Furthermore, we seek to characterize how women STEM faculty see themselves in relation to entrepreneurship and EEPs. Understanding their sense of self as academics offers potential insights into how these women experience belonging – or not – in entrepreneurial spaces within broader academia. To conclude, learning from women STEM academics' experiences offers significant considerations for developing more diverse, equitable, and inclusive EEPs. As we build our understanding of their lived experiences, we also seek to provide actionable guidance to EEP stakeholders for promoting the participation of women STEM faculty, unpacking evidence-based strategies for promoting diversity, equity, and inclusion in EEPs.

Acknowledgements

This work is supported by the U.S. National Science Foundation through grant number 2126978. The opinions are those of the authors and do not necessarily represent the National Science Foundation.

References

[1] C. G. Brush, "Exploring the Concept of an Entrepreneurship Education Ecosystem," in *Innovative Pathways for University Entrepreneurship in the 21st Century*, vol. 24, Emerald Group Publishing Limited, 2014, pp. 25–39. doi: 10.1108/S1048-473620140000024000.

[2] J. A. Bianchini, "Expanding underrepresented minority participation: America's science and technology talent at the crossroads," *Science Education*, vol. 97, no. 1, pp. 163–166, 2013, doi: 10.1002/sce.21032.

[3] K. P. Cross, *Adults as Learners. Increasing participation and facilitating learning.* 1981.

[4] P. Shekhar and A. Huang-Saad, "Examining engineering students' participation in entrepreneurship education programs: implications for practice," *IJ STEM Ed*, vol. 8, no. 1, p. 40, Jun. 2021, doi: 10.1186/s40594-021-00298-9.

[5] P. Shekhar, A. H. Saad, and J. Libarkin, "Understanding student participation in entrepreneurship education programs: a critical review," *The International journal of engineering education*, vol. 34, no. 3, pp. 1060–1072, 2018.

[6] S. Harding, *Objectivity and Diversity*. 2015. Accessed: Oct. 02, 2016. [Online]. Available: http://www.press.uchicago.edu/ucp/books/book/chicago/O/bo19804521.html

[7] D. Riley, “Engineering and Social Justice,” *Synthesis Lectures on Engineers, Technology and Society*, vol. 3, no. 1, pp. 1–152, Jan. 2008, doi: 10.2200/S00117ED1V01Y200805ETS007.

[8] D. Riley, “Hidden in Plain View: Feminists Doing Engineering Ethics, Engineers Doing Feminist Ethics,” *Sci Eng Ethics*, vol. 19, no. 1, pp. 189–206, Mar. 2013, doi: 10.1007/s11948-011-9320-0.

[9] M. Ong, J. M. Smith, and L. T. Ko, “Counterspaces for women of color in STEM higher education: Marginal and central spaces for persistence and success,” *Journal of Research in Science Teaching*, vol. 55, no. 2, pp. 206–245, 2018, doi: 10.1002/tea.21417.

[10] A. D. Ong, C. Cerrada, R. A. Lee, and D. R. Williams, “Stigma consciousness, racial microaggressions, and sleep disturbance among Asian Americans.,” *Asian American Journal of Psychology*, vol. 8, no. 1, pp. 72–81, 2017, doi: 10.1037/aap0000062.

[11] National Science Foundation, “Women, Minorities, and Persons with Disabilities in Science and Engineering: 2017,” National Center for Science and Engineering Statistics, Arlington, VA., Special Report NSF 17-310, 2017. [Online]. Available: www.nsf.gov/statistics/wmpd/

[12] A. Epstein, N. Duval-Couetil, and A. Huang-Saad, “Gender differences in academic entrepreneurship: experience, attitudes and outcomes among NSF I-CORPS participants,” *International Journal of Gender and Entrepreneurship*, vol. ahead-of-print, no. ahead-of-print, Jan. 2021, doi: 10.1108/IJGE-10-2020-0166.

[13] S. N. Hesse-Biber and P. L. Leavy, *The Practice of Qualitative Research*. SAGE Publications, 2010.

[14] S. N. Hesse-Biber and P. Leavy, *Feminist research practice: a primer*. SAGE Publications, 2007.

[15] J. A. Maxwell, *Qualitative Research Design: An Interactive Approach*, Third edition. Thousand Oaks, Calif: SAGE Publications, Inc, 2013.

[16] J. Saldana, *The Coding Manual for Qualitative Researchers*. SAGE, 2015.

[17] J. Ritchie and L. Spencer, “Qualitative data analysis for applied policy research,” in *Analyzing Qualitative Data*, Routledge, 1994.