

Board 212: Building a Conceptual Understanding of Women STEM Faculty's Participation in Entrepreneurship Education Programs

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Building a conceptual understanding of women STEM faculty's participation in entrepreneurship education programs

ABSTRACT

Discipline-based education researchers (DBERs) often adopt theories and methodologies that are finely tuned to the specific contexts of their respective disciplines. This localized approach is indeed valuable on a disciplinary level, but the greater efficacy of DBER as a field of study hinges on scholars finding a common ground to construct a broadly applicable understanding that transcends disciplinary boundaries. This NSF-funded project ventures into DBER that has the potential to be transformative in the field of STEM education, particularly in the emerging sub-area of STEM entrepreneurship education research. The project investigates entrepreneurship education programs (EEPs) from a conceptual perspective, seeking to understand the factors influencing women faculty's participation in these educational programs. Specifically, this project draws from research conducted in disparate fields to capture the essence of adult participation theories and theoretical foundations from entrepreneurship education literature. This confluence of these theories culminates in creating a unified, overarching framework that serves as a model for systematic investigations into entrepreneurship program participation across various academic disciplines. Furthermore, it situates itself within the intricate socio-cultural landscape of STEM academia, ensuring that the developed conceptual understanding encapsulates the lived experiences of women STEM faculty within the systemic norms of STEM disciplines.

In this paper, we illuminate the complex and multifaceted factors influencing women STEM faculty's involvement in EEPs, shedding light on the interplay between personal experiences, systemic challenges, and the broader socio-cultural context. Moreover, we provide a synthesis of interdisciplinary theoretical perspectives that serve as a lens for conducting and analyzing in-depth interviews with a diverse sample of 32 women STEM faculty. Overarching, the project aims to contribute to the development of EEPs that engage a more extensive and diversified women STEM faculty population. The project's findings are anticipated to provide the entrepreneurship education community with a research-based conceptual understanding for the development of EEPs that are inclusive and, in turn, promote the participation of women STEM faculty.

In summary, this research endeavors to advance the understanding of factors influencing women STEM faculty's participation in entrepreneurship education programs and contributes to the creation of an inclusive and equitable landscape for entrepreneurship education across STEM disciplines [1]. By merging multiple theories into a unified model, this project offers a creative way of leveraging interdisciplinary perspectives, underscoring the importance of a shared theoretical foundation for effective education research.

INTRODUCTION

Discipline-Based Education Researchers (DBERs) often use theoretical concepts from disparate fields and tailor them to the specific contexts of their discipline [1]. While this localized approach is essential for disciplinary advancements, the research impact of DBER as a field can be enhanced by contributing to establish common theoretical understanding of researched topics that connects bodies of research across traditional disciplinary silos. This NSF-funded project represents a unique endeavor within STEM education, particularly in the realm of STEM entrepreneurship education research. Focused on entrepreneurship education programs (EEPs), the project takes a conceptual perspective to unravel the factors shaping women faculty's participation in these programs. Drawing from diverse fields [2], this project combines adult participation theories and theoretical foundations from entrepreneurship education literature. The focus is to develop an overarching conceptual framing that is grounded in faculty perspectives, poised to drive systematic investigations into entrepreneurship program participation across academic disciplines. Crucially, the framing embeds itself in the socio-cultural landscape of STEM academia, ensuring a nuanced understanding that encapsulates the lived experiences of women STEM faculty within the systemic norms of STEM disciplines.

This paper presents the ongoing results of a larger study that examines the factors influencing women STEM faculty's engagement in EEPs [3], [4]. Through an in-depth, qualitative examination, this project seeks to uncover factors unique to this demographic and their situated contexts, with the overarching goal of informing interventions that can increase STEM women's entrepreneurial activity.

METHODOLOGY

Using in-depth interviews with a diverse multi-institutional sample of 32 women STEM faculty [5], we synthesize conceptual factors, shedding light on the interplay between personal experiences, systemic challenges, and the broader socio-cultural STEM academic context. Using qualitative coding methods [6], we analyzed data on women STEM faculty's participation/non-participation in EEPs. In the first round, *in vivo* coding captured participants' experiences and perspectives, ensuring intercoder reliability through consensus [7]. In the second round, codes were grouped into larger categories, which was internally auditing through a code-count matrix to enhance the trustworthiness of the findings. The final codebook was developed, and categories were organized into factors (internal and external) and dimensions (systemic/programmatic) based on emergent participant responses.

FINDINGS

The findings from this study revealed that the engagement of STEM faculty in EEPs was shaped by an interplay of internal and external influences, which related with systemic and programmatic dimensions relevant to entrepreneurship and EEPs. We define *internal influences* as interactions within the individual, such as identity and self-efficacy. *External influences* involved interactions found in the structures or setting outside of the individual, such as their academic setting or family structures. *Programmatic dimensions* focused on aspects related to the design and execution of EEPs. Conversely, *systemic dimensions* embraced the broader

context of STEM academia and entrepreneurship, influencing engagement within the academic sphere.

Internal influences encompassed factors such as the faculty members' perceptions of entrepreneurship, self-efficacy, STEM academic and entrepreneurial identity. These factors were rooted in the subjective experiences and thoughts of the individual faculty members. For instance, their motivation to participate in EEPs may be influenced by how they personally identify with the entrepreneurial aspects of their field, their confidence in their own abilities, and their understanding of the potential benefits and challenges associated with entrepreneurship.

External influences, originating outside the individual faculty member, impacted their decisions, attitudes, and behaviors related to entrepreneurship and EEPs. Examples of external influences include the faculty members' interactions with their academic setting, family structures, personal role models, mentors, and the broader support for entrepreneurial initiatives from their professional networks. For instance, the support from professional mentors were external influences that motivated or discouraged faculty members from participating in EEPs. Additionally, external influences included the broader cultural and organizational norms within the academic environment that either facilitate or hinder engagement in entrepreneurial activities.

The *systemic dimension*, or the broader context that extends beyond individuals and encompasses the larger environment, refers to the institutional and contextual factors at the systemic level. For example, systemic dimension involves understanding how the organizational and cultural aspects of the academic and entrepreneurial ecosystems impact faculty members' decisions and experiences in participating or not participating in EEPs. Examples of systemic factors include the academic reward structures, institutional policies, cultural norms within STEM disciplines, and the overall environment that may encourage or discourage faculty engagement in entrepreneurial activities. The systemic dimension provides insights into the overarching influences that stem from the academic and entrepreneurial systems, offering a comprehensive understanding of the factors affecting STEM faculty involvement in entrepreneurship education.

The *programmatic dimension* pertains to the specific elements related to the design, development, and implementation of EEPs. This dimension focuses on the features and characteristics pertinent to the structure and content of entrepreneurship education initiatives. Programmatic dimensions encompass various aspects, such as the resources, communication strategies, and overall organization of EEPs. For instance, programmatic factors may include the format and content of workshops, availability of resources (financial, informational), communication strategies employed by the programs, and the overall design of the educational interventions.

The study explores how the internal and external influences and systemic and programmatic dimensions play a role in the perspectives of STEM faculty regarding their engagement with EEPs, as summarized in Table 1.

Table 1. Summary of findings

Factor	Internal vs External	Programmatic vs Systemic
Perception of entrepreneurship	<i>Internal</i>	<i>Systemic</i>
STEM academic identity	<i>Internal</i>	<i>Systemic</i>
Self-efficacy	<i>Internal</i>	<i>Programmatic</i>
Entrepreneurial identity	<i>Internal</i>	<i>Programmatic</i>
Personal role models	<i>External</i>	<i>Systemic</i>
Professional mentors	<i>External</i>	<i>Systemic</i>
Program resources	<i>External</i>	<i>Programmatic</i>
Socioemotional support	<i>External</i>	<i>Programmatic</i>

CONCLUSION AND ONGOING WORK

The overarching goal is to contribute to the development of EEPs that attract a broader and more diversified women STEM faculty population, fostering inclusivity. Anticipated findings from this project promise to equip the entrepreneurship education community with a research-based conceptual understanding, paving the way for the development of EEPs that are inherently inclusive and promote the active participation of women STEM faculty. In essence, this research seeks to advance the understanding of factors influencing women STEM faculty's participation in entrepreneurship education programs, championing the cause of creating an inclusive and equitable landscape for entrepreneurship education across STEM disciplines. Through the fusion of multiple factors into a unified model, this project focuses on research-driven conceptual synthesis, addressing the need of a shared theoretical foundation for effective education research in the realm of academic entrepreneurship education.

ACKNOWLEDGEMENTS

This work is supported by the US National Science Foundation through grant number 2126978. The opinions are those of the authors and do not necessarily represent the National Science Foundation. We acknowledge Dr. Jacqueline Handley's contribution to data collection and preliminary analysis. We also thank Dr. Aileen Huang-Saad and Dr. Joi Mondisa for their advisory roles in this project.

REFERENCES

- [1] National Research Council, *Discipline-based education research: understanding and improving learning in undergraduate science and engineering*. Washington (D.C.): The National academies press, 2012.
- [2] P. Shekhar, H. S. Aileen, and J. Libarkin, “Understanding student participation in entrepreneurship education programs: A critical review,” *Int. J. Eng. Educ.*, vol. 34, no. 3, pp. 1060–1072, 2018.
- [3] P. Shekhar, J. Handley, A. L. Ruiz, and L. Bosman, “Women STEM faculty’s intentions to engage in entrepreneurship education programs,” *High. Educ.*, Sep. 2023, doi: 10.1007/s10734-023-01095-9.
- [4] A. L. Ruiz, P. Shekhar, A. Huang-Saad, and J. Handley, “Examining Entrepreneurship Education Program Experiences of Women Faculty Engaged in Biomedical Research,” *Biomed. Eng. Educ.*, vol. 3, no. 2, pp. 279–290, Jul. 2023, doi: 10.1007/s43683-023-00114-6.
- [5] K. Witz, D. Goodwin, R. Hart, and H. Thomas, “An essentialist methodology in education-related research using in-depth interviews,” *J. Curric. Stud.*, vol. 33, pp. 195–227, Feb. 2001, doi: 10.1080/00220270119026.
- [6] J. Saldaña, “Researcher, Analyze Thyself,” *Int. J. Qual. Methods*, vol. 17, no. 1, p. 160940691880171, Dec. 2018, doi: 10.1177/1609406918801717.
- [7] N. Cofie, H. Braund, and N. Dalgarno, “Eight ways to get a grip on intercoder reliability using qualitative-based measures,” *Can. Med. Educ. J.*, vol. 13, no. 2, pp. 73–76, May 2022, doi: 10.36834/cmej.72504.