# Work-in-Progress Abstract: Exploring the Co-construction of Entrepreneurial Identity in Engineering Students: A Phenomenological Study.

**Mr. Emmanuel Tetteh Teye, Montana State University**

Emmanuel Teye is a doctoral student at Montana State University. He is interested in exploring the connection between entrepreneurship and engineering

Dr Bryce Hughes is a professor at the department of Education., Montaña State University. He is studies Diversity and Equity in STEM and engineering fields

**Dr. Bryce E. Hughes, Montana State University - Bozeman**

Bryce E. Hughes is an Associate Professor in Adult and Higher Education at Montana State University. His research interests encompass diversity and equity in engineering education, with a focus on LGBTQ students. He was recently awarded an NSF CAREER grant to study the experiences of LGBTQ undergraduates in STEM fields. He holds a Ph.D. in education from the University of California, Los Angeles, an M.A. in student development administration from Seattle University, and a B.S. in general engineering from Gonzaga University.

**Seth Yeboah Ntim**

# Work-in-Progress: Exploring the Co-construction of Entrepreneurial Identity in Engineering Students: A Phenomenological Study.

## Background

The purpose of this work-in-progress (WIP) phenomenological study is to explore how engineering students perceive entrepreneurship and envision their future entrepreneurial selves, with a specific focus on understanding the personal and social factors that shape their evolving entrepreneurial identity within the engineering field**.** Many engineering departments across the U.S. have implemented curricular and co-curricular programs aimed at promoting entrepreneurship and innovation. The primary goal of these efforts is to produce graduates who contribute to creating personal, economic and societal value through an entrepreneurial mindset. For instance, the Kern Entrepreneurial Engineering Network (KEEN) has been instrumental in these initiatives, fostering entrepreneurial thinking within engineering education through patterner institutions [1] . Developing this mindset implies not only technical expertise but also the ability for engineering students to identify as entrepreneurs[2]. Identity then becomes a useful lens for understanding individuals' academic and career motivation [3]; [4]. However, integration and compartmentalization of these identities can be challenging, as engineering and entrepreneurial skill sets often do not coexist easily within the same individual, leading to a tension in identity formation[5]. Though, this integration of engineering innovations with sustainable entrepreneurship principles presents an area requiring further exploration [6] there is a notable absence of entrepreneurship focus STEM identity development and engineering education research[7]. Recent research highlights the growing importance of entrepreneurship education for engineering students but reveals gaps in our understanding of how students develop entrepreneurial identities.

Some engineering programs have recently incorporated entrepreneurship courses and activities designed to foster entrepreneurial thinking [8], [9] yet there is limited insight into how engineering students, particularly at the university level, construct these entrepreneurial identities[10]. Further evidence shows that engineering students tend to develop a strong sense of identity around technical problem-solving, often neglecting non-technical roles such as entrepreneurship[11]. Thus, the focus on technical expertise can sometimes impede the development of entrepreneurial thinking among engineers, which demands competencies such as

risk-taking, innovativeness, curiosity, value creation, proactivity and leadership skills. While engineering students often develop strong technical identities, the shift toward entrepreneurial thinking implies they adopt these new behaviors [12]. This compartmentalization of identities emphasizes the capacity to innovate while leveraging technical knowledge to create new business opportunities or social value. Furthermore, studies on earlier stages of identity development, such as how pre-adolescents form engineering identities, have gained more attention[13], leaving a gap in understanding the process of entrepreneurial identity formation during university years.

Therefore, engineering entrepreneurship as an emerged discipline needs more research exploring diverse theoretical frameworks and themes. For example, little to nothing is known about how students form entrepreneurial identities and perceive themselves in entrepreneurial roles especially as these students typically navigate educational and professional environments where entrepreneurial actions are not always emphasized [12]. This phenomenological study presents preliminary results in the attempt to fill these gaps by exploring the lived experiences of engineering students as they construct their entrepreneurial identities, informed by Godwin's (2016) engineering identity construct and the concept of future possible selves [14]. The development of an entrepreneurial identity among engineering students is crucial for their future professional success, as today's engineers are expected to not only possess technical expertise but also demonstrate entrepreneurial skills, such as innovation, leadership, and the ability to recognize and capitalize on opportunities.

**Theoretical framework**

Our study is rooted in Godwin's (2016) engineering identity framework and the concept of future possible selves [14] to explore how engineering students construct entrepreneurial identities through their lived experiences. Godwin's framework, developed to understand students' motivation to pursue and persist in STEM fields, identifies three key dimensions of identity: interest in the subject matter and career, recognition by others as belonging to the field, and competence/performance in related knowledge and tasks. The engineering identity model has been widely applied in STEM education, degree apprenticeships and careers [3]; [15] making it a robust lens for studying entrepreneurial identity development. Research suggests that developing a strong field-based identity is crucial for students' belonging and persistence in

learning and professional careers [16]). The concept of future possible selves reveals what participants are working toward as they construct an entrepreneurial identity, both in terms of what they desire for and fear about that future as an entrepreneur providing a motivational structure for their current behavior. In this sense, we explore how students come to identify as both engineering entrepreneurs now as well as what they anticipate for the future. These frameworks together help to understand how engineering students perceive entrepreneurship and come to identify as engineering entrepreneurs as well as how their present identities and social experiences shape their goals, such as creating businesses, taking leadership roles, or making societal impacts through entrepreneurship. For instance, students' aspirations, coupled with systemic and personal experiences, act as motivational guides that drive their decisions and behaviors. These future-oriented identities not only inform students' current efforts but also shape their ability to integrate entrepreneurial and engineering identities into a cohesive sense of self.

**Methodology**

This study achieves its purpose through the Interpretative phenomenological analysis (IPA). IPA is particularly suited for examining how individuals make sense of their lived experiences and the meanings they ascribe to those experiences within their unique contexts. This phenomenological approach within a social constructivist framework captures the ways in which engineering students interpret and make sense of their journey toward entrepreneurship. Together, these paradigms allow for an exploration not only of the personal, internal dimensions of entrepreneurial identity but also of how these identities are embedded within broader social structures that shape them. Since entrepreneurial identity is deeply personal and evolves through unique social interactions, phenomenological inquiry is ideal for exploring how engineers perceive and interpret these experiences. Conklin [17] used a similar approach to explore leadership identity through lived experiences and social interaction and [18] in examining how entrepreneurial identities were constructed among ethnic minority female entrepreneurs. As well as in examining entrepreneurial decisions and strategies, [19] applied this method to understand how different types of founder identities shaped entrepreneurial behaviors.

Students in engineering majors are being recruited for this study. 3 students have participated in the interviews thus far, and we plan to conduct additional interviews in the

coming semesters. Participants' demographics were as follows: Grace, a graduate student in Mechanical Engineering, comes from a rural Midwestern family with deep entrepreneurial roots, including dairy farming and cheese production for global markets. She currently manages a research lab. Wes, a first-year mechanical engineering student from an urban background, has no family history of entrepreneurship but is exploring his identity within the field. Cortex, a fourth-year mechanical engineering student and Vice President of the Bridger Solar Team, combines technical and entrepreneurial skills influenced by his father's cattle ranching business.

Open-ended, semi-structured interviews lasted approximately 45-60 minutes in length and were transcribed. The data analysis followed a deductive coding approach grounded in Godwin's three dimensions of engineering identity—interest, competence/performance, and recognition—and the framework of future possible selves (hoped-for and feared selves). For instance, "interest" was coded using statements such as, "I like tinkering with things and fixing stuff" (Cortex), while "competence" was identified through descriptions of abilities, such as, "I was the only mechanical engineer working on the project." Similarly, "recognition" was coded from comments like, "My parents always said I'd be good at this." Future possible selves were then incorporated into the analysis, with hoped-for selves including aspirations such as, "I'd like to lead my own company someday," and feared selves reflected in concerns like, "A future with no work-life balance would be tough."

**Preliminary Results**

For this paper, we present preliminary results of the three interviews using 5 main themes extracted from the interviews: (1) interest, early exposure and autonomy, (2) competence and ability, (3) recognition by others, (4) hoped for selves (5) Feared selves. The question "How do engineering students perceive entrepreneurship as part of their identity formation, and how do they envision their entrepreneurial futures?" guided these results.

**Interest, Early Exposure, and Personal Autonomy**

Participants' entrepreneurial interest was deeply influenced by early exposure to problem-solving and a desire for independence. For Wes, entrepreneurship was tied to autonomy, as he reflected: *"I would define entrepreneurship as working for yourself, generating income on your*

*own. My interest started in high school with a handyman business... the freedom we enjoyed was great."* Similarly, Grace attributed her passion for entrepreneurship to her upbringing in a business-oriented family: *"I was very much exposed to it growing up... To me, entrepreneurship is about turning ideas into something tangible and making them work in the real world."* These early experiences fostered a foundation for their entrepreneurial aspirations, intertwining with their engineering skills and shaping their visions of the future.

**Competence and Ability**

Entrepreneurial competence emerged as a dynamic interplay between participants' technical skills, confidence, and commitment to growth. Grace demonstrated confidence in her persistence and ability to innovate: *"I think I have a lot of persistence... I'm still learning, especially in areas like business management, but I'm confident that I'll be able to apply the skills I have to succeed."* Wes echoed this sentiment, highlighting his hands-on learning approach: *"We took on jobs we didn't know how to do and figured them out. I feel like I'm always trying to learn more and improve my skills."* Their narratives revealed a balance between recognizing current strengths and addressing areas for development, underscoring the growth-oriented mindset central to entrepreneurial competence.

**Recognition by Others**

Recognition from family, peers, and mentors played a crucial role in participants' entrepreneurial identity development. Grace shared how her family's encouragement bolstered her self-efficacy: *"My family has always encouraged me to pursue my entrepreneurial dreams. They see my work ethic and think that I have what it takes."* Similarly, Cortex described how peer validation reinforced his leadership identity: *"I naturally gravitated towards this vice president role... because I showed up and liked the club."* Such external recognition strengthened their confidence and reinforced their belief in their potential as entrepreneurs.

**Future Possible Selves (Hoped-for)**

Participants' hoped-for selves highlighted ambitions to innovate and lead while leveraging their engineering skills. Cortex envisioned a leadership role in the outdoor gear

industry: *"Owner, leadership, boss... I enjoy helping people and planning. Creating a product, potentially in the outdoor industry."* Grace articulated a broader vision: *"In the future, I want to create something of my own—whether it's a product or a company... I want to bring my engineering knowledge into entrepreneurship to create real solutions that impact lives."* These aspirations reflect their drive to integrate technical expertise with entrepreneurial goals to create meaningful impacts.

**Future Possible Selves (Feared)**

Fears about work-life balance, resource scarcity, and complacency emerged as significant concerns. Cortex expressed apprehension about burnout: *"I fear a future where I have absolutely no work-life balance... Being an entrepreneur can mean demanding a lot."* Wes feared losing the courage to pursue his entrepreneurial ambitions: *"I fear getting stuck working for a company and never trying to implement my own business plans."* Grace emphasized the challenges of bridging technical and business skills: *"My biggest fear is that I won't be able to bring my ideas to life because of a lack of resources or knowledge."* These fears drive participants to proactively acquire skills and resources, ensuring progress toward their desired entrepreneurial futures

**Discussion**

The findings from this study reveal the multifaceted nature of entrepreneurial identity formation among engineering students, shaped by early exposure, competence, social recognition, and envisioned futures. Early exposure emerged as a pivotal factor, with participants attributing their entrepreneurial interests to formative experiences that fostered autonomy, curiosity, and problem-solving inclinations. These resonates resonate with previous research emphasize the significance of practical engagement and early environments in cultivating entrepreneurial aspirations[8]. Competence and ability were also central to entrepreneurial identity, with participants demonstrating confidence in their technical skills while acknowledging areas for growth, such as business acumen. This dynamic aligns with Bandura's (1997) social cognitive theory, which underscores the role of self-efficacy in motivating entrepreneurial behaviors. Social recognition further reinforced participants' entrepreneurial self-concepts, as validation from family, peers, and role models contributed to their confidence and aspirations. [20]. The integration of the concept of future possible selves offered deeper insights into participants' aspirations and concerns. Hoped-for selves centered on leadership, innovation, and

societal impact, motivating current entrepreneurial behaviors. Conversely, feared selves highlighted challenges such as work-life balance, resource scarcity, and complacency, emphasizing the need for supportive systems to navigate these risks. These findings align with [14] assertion that envisioned futures serve as powerful motivational guides.

## Implications

First, integrating experiential learning opportunities, such as innovation labs, entrepreneurial competitions, and interdisciplinary projects, into engineering curricula can foster autonomy, competence, and recognition, thereby supporting entrepreneurial identity formation. Second, the study highlights the value of mentorship and peer networks in reinforcing entrepreneurial aspirations. Structured mentorship programs that connect students with experienced engineering-entrepreneurs could provide essential guidance and validation. Addressing feared selves requires targeted interventions, such as workshops on financial literacy, resource acquisition, and business skills, to bridge gaps in non-technical knowledge. Additionally, promoting work-life balance and resilience through tailored programs can alleviate concerns about burnout and prolonged failure, enabling students to pursue sustainable entrepreneurial careers. Finally, integrating entrepreneurship as a minor or core element of engineering curricula could provide students with the foundational knowledge and confidence needed to navigate both technical and entrepreneurial domains effectively.

## Future work

Our immediate next steps are to continue recruiting additional participants and complete a full analysis of our data using both deductive and inductive methods. We expect to present full results at future conferences. We anticipate a diverse sample among other dimensions of identity, including race and ethnicity, gender orientation, and demographics such as year in school, geographic origin, and entrepreneurial history. We believe these demographics may offer rich insights and variability into our future results.

## Contribution

Our study informs the design of engineering curricula and professional development programs aimed at fostering entrepreneurial self-efficacy and supporting engineers in visualizing entrepreneurial futures. It contributes to engineering education and identity research by expanding [4] engineering identity framework to include entrepreneurial dimensions and the concept of future possible selves. All put together, we provide new insights into how aspirations and fears influence entrepreneurial identity development. Additionally, we enrich vocational identity theory by illustrating how engineering students navigate a dual identity that merges technical expertise with entrepreneurial ambitions [21]. With the growing emphasis on innovation and entrepreneurship in engineering practice [22], engineers who also identify as entrepreneurs might better focus on innovation and development, [23] and better positioned to evaluate ideas not only on technical merit but also from organizational and strategic perspectives[24]

## References


[1] J. Wheadon and N. Duval-Couetil, "Elements of Entrepreneurially Minded Learning: KEEN White Paper," *The Journal of Engineering Entrepreneurship*, vol. 7, no. 3, pp. 17–25, 2016.

[2] R. Korte, "Identifying as an entrepreneur: A social identity perspective of the entrepreneurial mindset," *Adv Eng Educ*, vol. 7, no. 1, pp. 1–9, 2018.

[3] H. B. Carlone and A. Johnson, "Understanding the Science Experiences of Successful Women of Color: Science Identity as an Analytic Lens," *J Res Sci Teach*, vol. 44, no. 8, pp. 1187–1218, 2007, doi: 10.1002/tea.20237.

[4] A. Godwin, "The Development of a Measure of Engineering Identity: American Society for Engineering Education," *Paper ID #14814*, pp. 1–16, 2016, [Online]. Available: https://monolith.asee.org/public/conferences/64/papers/14814/view%0Ahttps://www.asee.org/public/conferences/64/papers/14814/view%0Ahttps://monolith.asee.org/public/conferences/64/papers/14814/view%0Ahttps://www.asee.org/public/conferences/64/papers/14814/

[5] J. Whittaker, "Engineers, entrepreneurs and the commercialization of technology," *PICMET '01. Portland International Conference on Management of Engineering and Technology. Proceedings Vol.1: Book of Summaries (IEEE Cat. No.01CH37199)*, pp. 81–84, Jul. 2001, doi: 10.1109/PICMET.2001.952007.

[6] J. O. Olurin, “Engineering Innovations And Sustainable Entrepreneurship: A Comprehensive Literature Review : LSBU Open Research.” Accessed: Feb. 16, 2025. [Online]. Available: https://openresearch.lsbu.ac.uk/item/95z5z

[7] A. Cardenas-Figueroa and A. Olmedo-Navarro, “Exploring the Future of the Engineer Profession: The Effect of the Entrepreneurial Engineers’ Mental Models on Their Opportunity Recognition Capabilities,” *IEEE Trans Eng Manag*, vol. 71, pp. 5616–5626, 2024, doi: 10.1109/TEM.2024.3364711.

[8] N. Duval-Couetil, A. Shartrand, V. Amherst, M. A. And, and T. Reed, “The Role of Entrepreneurship Program Models and Experiential Activities on Engineering Student Outcomes.,” *Adv Eng Educ*, vol. 5, no. 1, 2016, Accessed: Feb. 16, 2025. [Online]. Available: www.venturewell.org,

[9] N. Duval-Couetil, T. Reed-Rhoads, and S. Haghighi, “Engineering Students and Entrepreneurship Education: Involvement, Attitudes and Outcomes*,” *International Journal of Engineering Education*, 2012.

[10] W. Mei and L. P. Symaco, “Students’ Entrepreneurial Identity Construction: Role and Social Identity Influences,” *Sage Open*, vol. 12, no. 2, 2022, doi: 10.1177/21582440221089961.

[11] C. Stevens, “SOCIAL ENTREPRENEURSHIP AND EARNED INCOME OPPORTUNITIES: AN EXAMINATION OF THE IMPORTANCE OF INSTITUTIONAL FACTORS IN PREDICTING ENTREPRENEURIAL ACTION AMONG NONPROFIT ORGANIZATIONS,” 2008.

[12] S. Nambisan and R. A. Baron, “Entrepreneurship in innovation ecosystems: Entrepreneurs’ self-regulatory processes and their implications for new venture success,” *Entrepreneurship: Theory and Practice*, vol. 37, no. 5, pp. 1071–1097, Sep. 2013, doi: 10.1111/J.1540-6520.2012.00519.X/ASSET/IMAGES/LARGE/10.1111_J.1540-6520.2012.00519.X-FIG1.JPEG.

[13] B. M. Capobianco, B. F. French, and H. A. Diefes-Dux, “Engineering identity development among pre-adolescent learners,” *Journal of Engineering Education*, vol. 101, no. 4, pp. 698–716, Oct. 2012, doi: 10.1002/J.2168-9830.2012.TB01125.X.

[14] H. Markus and P. Nurius, “Possible Selves,” *American Psychologist*, vol. 41, no. 9, pp. 954–969, Sep. 1986, doi: 10.1037/0003-066X.41.9.954.

[15] A. Godwin and W. C. Lee, “A Cross-sectional Study of Engineering Identity During Undergraduate Education,” *ASEE Annual Conference and Exposition, Conference Proceedings*, vol. 2017-June, Jun. 2017, doi: 10.18260/1-2--27460.

[16] L. Mann, P. Howard, F. Nouwens, and F. Martin, “Professional Identity: A Framework for Research in Engineering Education,” 2008.

[17] T. A. Conklin, “Method or madness: Phenomenology as knowledge creator,” *Journal of Management Inquiry*, vol. 16, no. 3, pp. 275–287, Sep. 2007, doi: 10.1177/1056492607306023.

[18] C. Essers and Y. Benschop, “Enterprising identities: Female entrepreneurs of Moroccan or Turkish origin in the Netherlands,” *Organization Studies*, vol. 28, no. 1, pp. 49–69, 2007, doi: 10.1177/0170840607068256.

[19] E. Fauchart and M. Gruber, “Entrepreneurship and Identity,” *The Oxford Handbook of Identities in Organizations*, pp. 765–779, Jan. 2020, doi: 10.1093/OXFORDHB/9780198827115.013.11.

[20] A. Godwin, G. Potvin, Z. Hazari, and R. Lock, “Identity, Critical Agency, and Engineering: An Affective Model for Predicting Engineering as a Career Choice,” *Journal of Engineering Education*, vol. 105, no. 2, pp. 312–340, Apr. 2016, doi: 10.1002/JEE.20118.

[21] H. Hoang and J. Gimeno, “Becoming a founder: How founder role identity affects entrepreneurial transitions and persistence in founding,” *J Bus Ventur*, vol. 25, no. 1, pp. 41–53, Jan. 2010, doi: 10.1016/J.JBUSVENT.2008.07.002.

[22] T. Byers *et al.*, “Entrepreneurship: Its Role in Engineering Education,” *Bridge (Kans City)*, no. Summer, 2013.

[23] B. A. Schuelke-Leech, “A model for understanding the orders of magnitude of disruptive technologies,” *Technol Forecast Soc Change*, vol. 129, pp. 261–274, Apr. 2017, doi: 10.1016/J.TECHFORE.2017.09.033.

[24] A. Hsiao, “Developing Entrepreneurially-Minded Engineering Students,” 2012.