Research Article

Exploring Students' Perceived Values, Cost, and Barriers for Inclusive and Diverse Entrepreneurial Ecosystems

Entrepreneurship Education and Pedagogy
2024, Vol. 0(0) 1–27

DOI: 10.1177/25151274241263070
journals.sagepub.com/home/eex


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Abstract

Student innovation competitions and programs (ICPs), including hackathons, start-up competitions, and customer discovery labs, have had a transformative impact on the higher education entrepreneurial ecosystem. They have also facilitated students' experiences in Science, Technology, Engineering, and Math (STEM). However, there is a disparity in the number of underrepresented students and dominant student groups participating in STEM fields. While research supports the benefits of ICP participation, literature discussing students' perceptions of these programs remains limited. This study addresses three research questions about participation motivation (perceived values and associated costs), participation barriers, and differing perceptions among groups. Semi-structured, in-depth interviews were conducted with 38 students (25 females/13 males, 17 participants/21 non-participants). The analysis focused on the Situated Expectancy-Value Theory (SEVT) and the Theory of Planned Behavior (TPB). The research findings contribute to fostering diversity and inclusion within educational or professional environments by uncovering values (e.g., acquiring professional skills) and costs (e.g., opportunity costs) that students associate with motivation to engage in ICPs. Institutional and individual barriers were identified, including limited program awareness, lack of diversity, and identity mismatch. Therefore, the study intends to

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inform STEM educators and ICP organizers, foster inclusivity and diversity in the entrepreneurial ecosystem, and offer guidance for interventions.

Keywords
entrepreneurial ecosystem, co-curricular, student perception, inclusivity, diversity

Introduction

Innovation Competitions and Programs (ICPs), such as hackathons, idea pitch competitions, start-up incubator competitions, design challenges, boot camps, and customer discovery labs, are among the foundational elements of university entrepreneurship ecosystems (Liu et al., 2021). Moreover, ICPs foster students' experiences in Science, Technology, Engineering, and Math (STEM) and serve as a gateway for career readiness. These special co-curricular activities support the start and growth of university entrepreneurial ecosystems through (i) introducing students to entrepreneurship for the first time, (ii) identifying students with innovative ideas, encouraging them, and facilitating the process of taking their ideas into reality, (iii) increasing students' innovation and entrepreneurship mindset (Bodolica & Spraggon, 2021; Bridgestock, 2022), (iv) connecting students with internal and external mentors (Prince et al., 2022), (v) helping students develop their networks (Mikesell et al., 2012; Schuster et al., 2006), and (vi) increasing their technical and entrepreneurship/innovation skills (James & Brookfield, 2014; Kayastha, 2017; Samson, 2010).

Despite these expected benefits and positive outcomes of the ICPs, students are often reluctant to engage in them. In particular, traditionally underrepresented students in STEM (*women, people with disabilities, and three racial and ethnic groups – Black* or *African American, Latino or Hispanic, and American Indian or Alaska Native*) participate in ICPs at lower rates, compared with their counterparts (Bryant et al., 2012; Walden et al., 2015, 2016; Wilson et al., 2007; Wilson & Patón-Romero, 2022). Because ICPs are gateway programs for higher education entrepreneurial ecosystems and companies increasingly seek graduates with innovation skills, student groups with low ICP participation rates might be disadvantaged at the start of their careers and are less likely to be involved in entrepreneurship subsequently. Therefore, a better understanding of how students from various groups make decisions about participating in ICPs, their motivation, and perceived barriers are highly relevant to increasing the diversity and inclusivity of university entrepreneurial ecosystems. Furthermore, research indicates that efforts to enhance the diversity of ICPs, such as promoting gender equality in hackathons (Falk et al., 2021; Lavínia Paganini & Kiev Gama, 2020; Paganini et al., 2021; Richterich, 2019), often prove ineffective as they fail to address the perceived obstacles that hinder the participation of a broader spectrum of students. Moreover, the existing literature on ICPs has not extensively investigated the various

strategies that can be employed to promote diversity in ICPs (Bryant et al., 2012; Htun, 2019; Lavinia Paganini & Kiev Gama, 2020; Lavínia Paganini & Kiev Gama, 2020; Richard et al., 2015; Wilson et al., 2007). The topic of Diversity, Equity, and Inclusion (DEI) is not commonly addressed in STEM entrepreneurship ecosystems (Huang-Saad et al., 2018; Zappe et al., 2021), which presents an opportunity for theory-driven research about the barriers to ICP participation among underrepresented groups. A comprehensive examination of these obstacles is crucial in promoting greater inclusivity and equity within ICPs. This paper attempts to develop a theoretical framework to elucidate the factors influencing students' participation in ICPs, addressing the following research questions (RQs):

- RQ1: What motivates/demotivates students in participation ICPs?
- RQ2: What are the perceived barriers that discourage student participation in ICPs?
- RQ3: Are there any differences in perception among dominant and underrepresented groups (e.g., male vs. female, White/Asian vs. underrepresented racial/ethnic groups)?

The paper explores the motivation and barriers to student participation in ICPs. This novel insight is derived from an interview-based study, making a significant contribution to the existing literature in an understudied area. By analyzing these findings through theoretical frameworks, the study offers new insights into the motivations and deterrents influencing student participation in ICPs. Building on these insights and previous research, the paper proposes strategies and interventions to foster inclusivity for underrepresented students in ICPs.

Literature Review

College-Level Entrepreneurial Ecosystems and ICPs

This paper centers on ICPs, encompassing hackathons, start-up incubator competitions, design challenges, boot camps, and customer discovery labs. These specialized co-curricular activities are designed to enhance students' innovation mindset (Kulturel-Konak et al., 2023a). A meta-analysis by Shulruf (2010) shows a significant correlation between co-curricular activities and positive educational outcomes. Apart from contributing to students' academic development, these co-curricular activities facilitate the cultivation of 21st-century skills, provide practical applications for classroom learning, introduce students to diverse interests, and help them make informed career choices. Over the past decade, engineering programs have increasingly prioritized innovation and entrepreneurship to equip students with the necessary skills to address the complex challenges posed by the global economy and climate change (Alves et al., 2019; Byers et al., 2013; Da Silva et al., 2015; Karim, 2016), and ICPs play a pivotal role in such entrepreneurship initiatives. In addition, ICPs serve as vital components of university

innovation and entrepreneurial ecosystems, functioning as recruitment grounds for various co-curricular programs. Moreover, these ICPs offer students invaluable exposure to entrepreneurship and innovation, fostering a culture of creativity and critical thinking within the academic environment (Liu et al., 2021). While the industry seeks to hire students with co-curricular experiences, many do not regularly participate in those experiences (Olewnik et al., 2023). Within the existing literature, only a limited number of studies have addressed the specific barriers that hinder student participation in ICPs (Kulturel-Konak et al., 2023c), particularly for underrepresented groups. Several authors indicate a lack of diversity in ICPs (Htun, 2019; Richard et al., 2015; Taylor & Clarke, 2018; Walden et al., 2015, 2016). Despite this, the specific reasons for students' avoidance of these events have not been thoroughly discussed within the context of theoretical models. For example, it has been observed that hackathon environments often implicitly exclude women, contributing to gender disparities within these settings (Warner & Guo, 2017). The overrepresentation of white and Asian male participants in hackathons may create an unwelcoming environment, leading to marginalized student groups feeling excluded from these events (Kos, 2018). Scholars agree that strategies for enhancing diversity in ICPs are insufficiently explored in the literature (Bryant et al., 2012; Htun, 2019; Lavinia Paganini & Kiev Gama, 2020; Lavínia Paganini & Kiev Gama, 2020; Richard et al., 2015; Wilson et al., 2007). A notable gap in the literature is the absence of theory-driven analyses, with existing research often relying on anecdotal evidence or exploratory empirical data.

Research on hackathons, explicitly designed to promote engagement in STEM fields, represents an exception within this literature (Falk et al., 2021; Schmitt et al., 2023). While the data is limited, the underrepresentation of women in hackathons may stem from factors such as perceived low self-esteem, belonging to a minority group, and the influence of 'toxic masculinity' (Paganini & Gama, 2020; Paganini et al., 2021). These factors are further compounded by the lack of explicit anti-discriminatory policies (Punjwani, 2018), a competitive and unwelcoming atmosphere, and the absence of prior experience (Warner & Guo, 2017). According to Richterich's (2019) ethnographic study, computing hackathons tend to reinforce traditional gender-based divisions of labor. Additionally, lacking diverse representations in hackathon promotional materials can discourage student participation (Murphy et al., 2007).

Motivational Theories

The research mentioned above aimed to depict the constraints on students' involvement in ICPs without adopting a theoretical framework. Psychological theories that elucidate human motivation, including the Theory of Planned Behavior (TPB) (Ajzen, 1991), Self-Determination Theory (SDT) (Ryan & Deci, 2000), and Situated Expectancy-Value Theory (SEVT) (Eccles & Wigfield, 2020) hold relevance for the research questions and the interpretation of findings in this paper. In the subsequent sections, we provide a concise introduction to these motivational theories, accompanied by

examples of studies that have employed them as a theoretical framework within the context of ICPs.

The TPB explains individual behavior as determined by behavioral intention, shaped by attitudes, subjective norms, and perceived behavioral control. This perception is influenced by internal factors, such as personal skills, capabilities, and knowledge (Ajzen, 1991) and external factors, including the availability of resources or support structures that facilitate or hinder behavior (Ajzen, 2001). Dang and Nguyen Viet (2021) utilized the TPB to investigate the factors influencing students' intention to participate in co-curricular activities, noting that students with part-time jobs were less likely to engage in these activities due to time constraints. The TPB is commonly employed to study students' entrepreneurial intentions.

The SDT (Ryan & Deci, 2000) distinguishes between intrinsic motivation, driven by internal factors such as interest and enjoyment, and extrinsic motivation, propelled by external factors like rewards or penalties. To foster personal development, the SDT emphasizes supporting intrinsic motivation and satisfying the three basic psychological needs: autonomy, competence, and relatedness. According to a study by Garcia (2022), intrinsic motivation significantly influenced the intention to participate in hackathons, while extrinsic motivation was crucial for sustained involvement. Researchers have also combined the SDT with the TPB to explain students' entrepreneurial intentions (Al-Jubari et al., 2019; Baluku, Leonsio, Bantu, & Otto, 2019).

According to the SEVT, students' decisions to undertake a task are influenced by their perceived likelihood of success in the task, the subjective value they attach to it, and the associated cost in comparison to other available alternatives. Eccles et al. (1983) propose that for a student to engage in a task, they must respond affirmatively to two fundamental questions: 'Can I do the task?' and 'Is it worth doing the task?' The first question reflects an individual's belief in their ability to succeed in a given task (Expectation of Success or Expectancy). In contrast, the second question encompasses the perceived value of engaging in the activity. These expectancies and values are subjective beliefs that develop over time, influenced by previous experiences (Putwain et al., 2019), self-efficacy (Bandura, 1982), personal characteristics, the social environment, and other pertinent factors. The values derived from task engagement are commonly classified into three categories according to Eccles and Wigfield (2020): (i) *intrinsic value*, the expected enjoyment of a task or interest in a domain; (ii) *utility value*, the subjective value of a task for attaining an extrinsic goal, such as a career goal; (iii) *attainment value*, the perceived importance of a task to one's identity, (e.g., gender-role and ethnic-racial identity). As ICPs typically lack traditional academic rewards, such as course credits or grades, participating students need to perceive a compelling value proposition to foster their engagement. The *perceived cost* component encompasses student perceptions of (i) *effort cost*, the amount of effort and time required for success in the task; (ii) *opportunity cost*, representing the potential trade-off of missing out on other activities (Eccles, 2009); (iii) *psychological costs*, adverse outcomes or anxiety stemming from the struggle or failure in the task (Eccles et al., 1983);

and (iv) *outside effort cost*, negative appraisals of time, effort, or amount of work put forth for a task other than the task of interest (Flake et al., 2015).

Kulturel-Konak et al. (2023b) designed a survey based on the SEVT (Eccles & Wigfield, 2020; Kosovich et al., 2014) and SDT (Ryan & Deci, 2000) to examine students' motivation and identify barriers to participating in ICPs. Their findings underscored critical factors influencing students' decisions, such as the significant time commitment, limited awareness, and a lack of understanding of how ICP participation can contribute to academic and career objectives. Additionally, students' preconceived notions about the relevance of ICPs to their majors, particularly among Art/Sciences students, were noted. They also reported that students with entrepreneurial family backgrounds appreciated ICPs. Shekhar (2023) employed the SEVT to explore gender-based differences influencing participation in engineering entrepreneurship programs. The research emphasized the subjective influence of peers, particularly the 'inspirational role' that played a more significant part for female students compared to their male counterparts. Furthermore, the SEVT has been employed in various other studies to gain insights into students' motivations related to their involvement in entrepreneurship programs (Hsu et al., 2014; Parra & Knobloch, 2022; Shekhar & Huang-Saad, 2021) and entrepreneurship intentions (Shi et al., 2019).

Methodology

Creating Interview Questions & Interviewee Selection Procedures

The interview questions were collaboratively crafted by the extended research team, which comprised project consultants and research students. After an extensive review of the current literature, we decided to focus on the frameworks of the TPB, SDT, and SEVT to guide our research and analysis of interviews. Given that our research questions pertain to emerging topics that have not been extensively investigated in the literature before, we opted for an inductive research methodology. As a result, we avoided crafting questions that were overly focused on the theories informing our research. This strategy allowed us to acquire novel perspectives and cultivate a deeper comprehension through students' feedback. After receiving input from both independent domain experts and a student panel, we revised the interview questions accordingly. We prioritized evaluating the questions' face validity during the student panel review. Furthermore, we conducted pilot interviews to assess the interview questions and the overall interview procedures. The pilot interviews showed that some students did not elaborate enough in their responses to certain questions. Consequently, we streamlined the number of topics while supplementing the finalized interview guide with probing questions, aiming to prompt interviewees to elaborate and clarify their responses.

Students enrolled in various STEM programs at a land-grant university in the Northeastern United States were recruited for interviews using a survey that included demographic and Likert-scale questions regarding their perceptions of ICPs. Apart from the main campus, this university has 24 additional campuses across the state.

Together, they make up 27% of the student population in 2023. The university has approximately 20,000 STEM students, with 12,000 (20% women and 12% underrepresented minorities) in engineering and 8000 in science programs (57% women and 20% underrepresented minorities). The recruitment survey link was distributed to the entire target student population and specific student groups, programs, and clubs whose input and insights were considered valuable for this research. We invited interviewees from the list of respondents while ensuring that the sample included diverse interviewees and that traditionally underrepresented students in STEM and the target student groups were represented adequately in our interviews. Out of 249 students who completed the survey, 160 students indicated a willingness to participate in the interviews. Following the recruitment survey, we conducted interviews with 38 students, comprising 25 females and 13 males, including 17 ICP participants and 21 non-participants, as well as 13 individuals from the White(9)/Asian(4) demographic (overrepresented in ICPs) and 25 from demographic groups that are underrepresented in ICPs. About 85% of interviewed students were from STEM-related majors. When selecting students for interviews, we aimed to ensure the inclusion of a diverse cohort of ICP participants and non-participants. Initially, we assessed the types of events in which students participated and prioritized events that aligned most closely with our research scope. Subsequently, we considered demographic factors to prioritize students from underrepresented backgrounds. At the same time, we aimed to achieve theoretical saturation in our interviews by ensuring the representation of students across various demographic groups. During the student interview invitation process, we made sure to include a balanced cross-section of students with diverse experiences and perspectives by adjusting our sampling channels to gather comprehensive insights.

Interview Procedure

Interviews were conducted remotely through video conferencing by two research team members, who had undergone consistent training on the objectives and techniques of the interviews. These sessions were scheduled in advance and lasted between 20 to 40 minutes, ensuring uniformity in data collection. The interviewers secured informed consent from the interviewees and sought permission to record the interviews via video. The interview recordings were transcribed into text through an automated system and then carefully reviewed for accuracy. In instances where necessary, accuracy was verified by cross-referencing the transcripts with the original video recordings. The interview transcripts were organized and categorized by specific questions in preparation for their upload into NVivo.

Analytical Approaches

Data analysis was carried out using NVivo, Release 1. Our data analysis followed three steps using an abductive analysis approach (Timmermans & Tavory, 2012). We first reviewed the interview transcripts and used an “open-coding” approach from these data

to identify distinct concepts repeated in the data (Creswell, 2006). This initial coding round produced 188 distinct codes. Some examples from the first round of coding include codes related to how students perceived innovation competitions and programs (e.g., fun, interesting, take too much time, and so forth), codes pertaining to time cost (e.g., time-consuming, busy schedules with classes in major, and so on), and codes related to benefits (e.g., monetary awards, learning a lot, resume building, and so forth). In developing these codes, we iterated between the data and theory, tentatively evaluating the appropriateness of distinct theoretical frameworks for understanding the evolving coding structures. Three independent research assistants coded the transcripts of the questions using the identified codes by the research team. The inter-rater reliability package in *R* was used to calculate the Fleiss' Kappa value, which measures inter-rater agreement between multiple raters. Table 1 summarizes the interview questions, Fleiss's Kappa statistics, and the total number of times the three raters identified a code related to the question (denoted as "Mentions"). The obtained Kappa values indicated moderate (.41 < Kappa <.6) to substantial (.61 < Kappa <.8) agreement

Table 1. Inter-Rater Reliability (Fleiss's Kappa Statistics) for First Step Coding of the Questions by Three Independent Raters (*p*-Value = 0 for All Questions, Y: Questions for ICP Participants, N: Questions for Non-Participants).

Question No	Question	Number of Codes	Mentions	Kappa	z-Value
Q1N	Have you heard of ICPs? Have you thought about being involved?	13	274	.687	20.4
Q1Y	What made you want to participate?	13	238	.553	14.8
Q2N	What made you want not to participate?	5	546	.562	22.8
Q3Y	How would you describe your experience in participating in an ICP?	20	442	.634	23.1
Q3N	Do you think participating in an ICP would be a positive experience for you?	13	273	.448	14
Q4Y	What would you say were the major drawbacks of your participation in the X competition?	12	195	.758	18.3
Q4Y	What would you say were the major benefits of your participating in X competition?	17	288	.464	13.7
Q4N	Do you see any benefits to participating in ICPs?	5	350	.482	15.6
Q4N	What barriers or challenges, if any, do you perceive in your participation in innovation competitions or training programs?	11	240	.564	15.1

between the coders (Landis & Koch, 1977). All calculated p-values were less than .00001, rejecting the null hypothesis that the agreements were due to chance.

We continued to code and refine the data, discussed each code, and distilled the codes into first-order concepts. This step in the analysis allowed us to understand many of the key themes in our data, including the multifaceted dimensions of time cost and variations in coding patterns across gender, race/ethnicity, and major.

As a second step, we interpreted the data more closely through various theoretical lenses, as suggested by abductive analysis (Timmermans & Tavory, 2012). Given the importance of how students perceived the costs and benefits of ICPs, we settled on SEVT (Eccles & Wigfield, 2020) as a specific lens and started examining the data for evidence of constructs such as values, costs, and barriers. We found that some of the data fit well within the existing SEVT framework, but other aspects of the data did not. Therefore, we categorized the data using both existing and novel constructs for our analysis. We discussed the codes until we reached a consensus (Miles & Huberman, 1994). When the coding process was complete, the categories were grouped together to form broader themes.

The third step involved assembling the key constructs into theoretical arguments. In this step, these constructs became the building blocks for our theoretical model. Throughout the theorizing process, we compared our emerging theoretical findings with SEVT and TPB, focusing on fundamental differences among student groups. Our attention is increasingly centered on the examination of values, costs, and barriers linked to ICPs. Additionally, we examined emerging data patterns to identify any inconsistencies and unexplored mechanisms.

Findings

Emergent Themes

After analyzing the codes through the theoretical lenses of SEVT and TPB, three high-level themes emerged from the identified codes: values, costs, and barriers to student participation in ICPs. The themes related to values encompass the perceived task characteristics of ICPs, including intrinsic value, utility value, and attainment value (Eccles & Wigfield, 2020). Costs are conceptualized as what an individual must give up doing a task and the anticipated effort one will need to put into task completion (Eccles & Wigfield, 2020). Our study identified teamwork cost as a unique cost, in addition to effort, opportunity, and psychological costs, which are typically considered in SEVT. Barriers are factors that prevent students from participating or make students unmotivated to invest time, energy, and resources (Barron & Hulleman, 2015) in ICPs, consequently leading to their non-engagement in ICPs. Table 2 provides detailed descriptions of the themes and presents the results of a crosstab query, indicating the frequency and the number of interviewees, both ICP participants and non-participants, who mentioned codes related to each theme. We conducted a z-test of two proportions to compare the ratio of interviewees who mentioned the themes across the participant

Table 2. Identified Themes, Their Descriptions, and the Results of a Crosstab Query (*Freq. and Ref. Indicate the Percent and Number of Interviewees Mentioning a Code Related to a Theme, Respectively. (*) Indicate Statistically Significant Proportions between the Groups with p = .05*).

			Participated in ICPs			
			Yes (*n* = 17)		No (*n* = 21)	
Category	Theme	Theme Description	Freq. (%)	Ref	Freq. (%)	Ref
Values	Intrinsic value*	Students' expected liking, enjoyment, and interest in ICP participation	82	14	0	0
	Utility value*	Students' perceived usefulness of ICPs in fitting their current or future plans	94	16	24	5
	Attainment value*	Students' perceived fit of ICPs with their social and personal identities	53	9	5	1
Costs	Effort cost*	Students' perceived effort and time required to participate in ICPs	29	5	5	1
	Opportunity cost*	Students' perceived cost of missing out on other activities due to ICP participation	0	0	76	16
	Psychological cost	Students' emotional costs of pursuing ICPs	0	0	5	1
	Teamwork cost	Students' perceived challenges in collaborating in teams in ICPs	29	5	24	5
Barriers	Low program awareness	Students were unaware of the benefits and availability of ICPs	12	2	24	5
	Lack of diversity or inclusiveness*	Underrepresented students' ideas are not valued in ICPs	18	3	0	0
	Not matching self-identity*	Perceived ICPs are irrelevant to forming students' professional identity	12	2	52	11
	Low expectancy of success*	Having low confidence in one's skills, e.g., technical and professional skills, no promising ideas	0	0	43	9
	Confirming subjective norms	Students' perception that most people who are important to them think they should (not) participate in ICPs	0	0	10	2
	Lack of financial resources	Financial difficulties, such as funds to support housing, the cost of participating in ICPs	0	0	14	3
	Limited discretionary time*	Limited time for out-of-class activities	29	5	67	14

and non-participant sub-groups. The subsequent sections elaborate on these three categories, including pertinent quotes extracted from the interview transcripts.

Values

Values are motivators for students to participate in ICPs (RQ1). Intrinsic value is the expected liking, enjoyment, and interest a student expects to gain from involving in ICPs (Eccles & Wigfield, 2020). Given the emphasis on task-related factors, conceptualizing intrinsic value in the context of ICPs closely aligns with situational interest.

> *"It was really fun. I really enjoyed it to be able to brag about it in terms of money. To get up there and say, look, you should… give us money because this product is amazing… I really enjoy the entire experience overall."* (Female, Black, Graduate Science)

Utility value is conceptualized as usefulness regarding how well ICPs fit into a student's current or future plans, such as participating in an ICP to enhance their resume or connect with the entrepreneurial ecosystem. In some respects, utility value is related to extrinsic motivation, as ICPs serve as a means to an end rather than an end themselves (Ryan & Deci, 2017).

> *"When you're going to do an internship, there are definitely skills that will be valued that you could take away from competition. And the world is competitive out there. Trying to be slightly less harsh situation in college for better prize, you then like going straight into (the real world)."* (Male, Asian, Undergraduate Engineering)

Lastly, attainment value is determined by the relative importance that students associate with participating in ICPs based on their identities. The perceived alignment of ICPs with their social and personal identities influences students' attainment value, reflecting the degree to which these programs enable or prevent individuals from engaging in behaviors that they consider integral to their fundamental sense of self (Eccles & Wigfield, 2020). Attainment value encompasses the elevation of self-confidence, cultivating a growth mindset, and acknowledging one's strengths (Rosenzweig et al., 2022).

> *"I would say because just getting to participate in something … new and getting to take on a new challenge. And just something completely different from what we're usually used to and getting to create something and collaborate with different people. And just something in getting to put it out and letting others see it and hopefully you some concrete out of it."* (Female, Hispanic, Undergraduate Information Technology/Cyber Security)

Costs

Every activity has costs in addition to its benefits, and individuals avoid those that cost too much relative to their benefits, particularly when compared to alternative tasks with

higher benefit-to-cost ratios (Eccles & Wigfield, 2020). These costs can be de-motivators for students to participate in ICPs. There are different types of costs conceptualized in the SEVT as described in the literature review section: (i) effort cost, (ii) opportunity cost, and (iii) psychological cost. Regarding the effort cost, students continuously evaluate whether the involvement in ICPs justifies the exerted effort through a constant mental calculation.

> "*Even though there are some benefits…it was like a lot of effort for just like a slim chance at having like the prize area making it to the next round. It … felt like you were taking a chance... but it also took a lot of time where like we could have been doing other things to like work on our project further.*" (Female, White, Undergraduate Engineering)

For opportunity cost, students are confronted with the reality that time is a limited resource, and they must navigate a balance to fulfill tasks required by their coursework and other responsibilities.

> "My schedule… considering I lost track (of it and) it's pretty hectic. Lately… my experiments are picking up, I do have to be in clinic for the next couple of days too. Yes, I do a lot of things."

With regard to psychological cost, some students referred to it as experiencing "social anxiety," particularly in the context of ICPs being competitive in nature.

> *"I don't know. But for me it would kind of be like a social anxiety…What I'm picturing in my head is, right, you go to compete and it's kind of like a social event where you're there with other people and you're like, you know, kind of face-to-face with the people that you're competing against."* (Male, White, Undergraduate Medical)

Nevertheless, teamwork cost has emerged as another important cost dimension among students (Reeves et al., 2019). Students highlighted the challenges they faced in forming teams.

> *"It's hard to... make a big enough group because we didn't have that many people that wanted to do like interests…because they have a different priority for the weekend."* (Female, White, Undergraduate Engineering)

Furthermore, students expressed concerns about the free riders within their teams, as they perceived limited control over the collaborative process and an inability to compel team members to actively engage in ICPs.

> *"We were in a group and maybe everyone in the group didn't participate at the full extent in which they should have."* (Female, Black, Graduate Science)

Barriers

Identified barriers were categorized into two sub-themes: institutional and individual. Institutional-level barriers include "low program awareness" and "lack of diversity and inclusiveness." Individual barriers, on the other hand, include "not matching self-identity," "low expectancy of success," "confirming subjective norms," "lack of financial resources," and "limited discretionary time.", which are related to the constructs of TPB.

Institutional- Low Program Awareness. Many students are unaware of the benefits and availability of ICPs, hindering their participation and engagement. One of the possible reasons for low awareness is suboptimal communication strategies to break through the information clutter faced by students. Students are constantly bombarded with flyers, emails, social media, newsletters, etc., but most promotional materials go unnoticed.

> "*Basically lack of information, since I know there's just so many things going on around campus, different things to do. You can get kind of lost in all of it.*" (Female, Black, Undergraduate Agriculture)

Institutional- Lack of Diversity and Inclusiveness. Underrepresented students may have personal and academic issues associated with demonstrating grit and overcoming institutional racism throughout their lives (Kundu, 2019). When the campus environment lacks social and cultural support for underrepresented students, they may not feel comfortable, visible, or represented in student life as they are not included in the conversations and decisions that affect them (McCabe, 2016).

> *"I am a woman of color. It was obvious sometimes where my ideas would be cut short or undermined..."* (Female, Black, Undergraduate Engineering)

Individual- Not Matching Self-Identity. As students progress in their academic journeys, their self-identities develop and manifest differently. Students attribute varying degrees of importance to different tasks and activities that are connected to their identities (e.g., gender-role identity, professional identity) (Eccles & Wigfield, 2020). Some students who perceived ICPs as irrelevant to their self-identity formation are not motivated to engage in them.

> *"I think (ICPs) are for engineering students, that are constantly being bombarded by the flyers, everything that's around that…"* (Female, Hispanic, Undergraduate Science)

Individual- Low Expectancy of Success. Behavioral choices, such as education and occupation, are influenced by students' expectancy of success and the perceived importance the students attach to the various available options. When individuals harbor low expectations of success, reflecting a lack of confidence in their skills, traits, and

capabilities to achieve success, they tend to be less motivated to participate in related activities (Eccles, 2009).

> *"I think maybe it's like lack of competence or lack of a specific idea that could gear me towards like…having a feeling like I have a fair shot… And if I knew that wasn't going to be as fruitful… because I don't have the necessary skills, talents, or whatever in order to succeed in that endeavor. Like I just haven't really wanted to pursue that or invest time in that."* (Female, Hispanic, Undergraduate Science)

Individual- Confirming Subjective Norms. Subjective norm reflects an individual's perception of the expectations held by influential people in their social circle, indicating whether these individuals believe the person should or should not engage in a particular behavior (Fishbein & Ajzen, 2009). When students perceive that their social circle does not support their participation, they may become less motivated to be involved in ICPs.

> *"No one really ever encouraged me to go into it, or really related to any of my studies."* (Female, Black, Undergraduate Agriculture)

Individual- Lack of Financial Resources. Students who did not participate expressed concerns about the financial requirements associated with attending the event, including not only the cost of attendance but also the cost of living if they were to engage in ICPs during the summer.

> *"A lot of like financial difficulties. Like, for example, if I wanted summer one, I'd have to find housing and be able to afford that."* (Female, Black, Undergraduate Science)

Individual- Limited Discretionary Time. Many non-participating students expressed concerns about the time commitment required for involvement in ICPs. They perceived their schedules as already packed with coursework, part-time employment, and various co-curricular activities, making it difficult to accommodate additional events.

> *"I would say during school … (it may) interfere with my studies. I'm already a procrastinator. I don't need (to spend) that extra time, I'm not being able to do my studies."* (Female, Black, Undergraduate Human Development)

Theoretical Implications

Regarding theoretical implications, the findings summarized in Table 2 are parallel to the predictions of the SEVT (Eccles & Wigfield, 2020), which suggest that students are more likely to engage in an activity if their expectancy of success is high, the activity is perceived to align with their personal goals, and the knowledge and skills acquired from ICPs are advantageous for their career development. Notably, our interview data revealed that participating students overwhelmingly emphasized the values they gained

from ICPs. In contrast, 76% of non-participating students expressed concerns about opportunity costs, a sentiment not echoed by any participating students. Interestingly, both groups mentioned teamwork-related costs at comparable frequencies, while students who engaged in ICPs cited effort costs due to their direct experience. These insights suggest that a comprehensive cost-benefit analysis played a pivotal role in shaping students' decisions regarding participation in ICPs. Additionally, the disparity in perceived expectancy of success between the two student groups, with 43% of non-participating students expressing "low expectancy of success," further corroborated the predictions of the SEVT. By establishing a strong correlation between the SEVT and our interview findings, we are able to not only validate our observed data but also support the applicability of the proposed interventions and implications discussed in the following section. This will make them more relevant to a broader range of student populations.

Comparison Across Sub-Groups

In this section, we present the results of additional sub-group comparisons, aiming to discern the shared perspectives and divergent viewpoints within distinct student cohorts, thereby illuminating the potential formation of participation barriers across various groups (RQ3). We utilized crosstab queries to investigate how the themes differed among various sub-groups. These queries provided the frequency of each theme for gender, White/Asian and underrepresented groups, and professional and art/sciences/humanities majors. Table 3 summarizes the results of these comparisons.

Drawing from the interview data, the most frequently cited barriers to participation were "limited discretionary time," "not matching self-identity," and "low expectancy of success." Notably, female students were more inclined to express concerns about "limited discretionary time" and the notion of "not matching self-identity" as hindrances to their engagement. Conversely, in the context of cost-related considerations, "opportunity cost" and "teamwork cost" emerged as the most commonly referenced dimensions. In particular, female students are more likely to associate "opportunity cost" with participation in ICPs.

> *"I just don't have a lot of time... I'm doing my class work, my lab work, so I don't have time to do other things that might also be interesting."* (Female, Black, Graduate, Science Education)

When we compared Whites/Asians (who are overrepresented in ICPs) and other races/ethnicities (who are underrepresented), an interesting pattern was observed. Overrepresented students were more likely to mention the values of ICPs compared to underrepresented students. In contrast, the underrepresented students mentioned "opportunity cost," "teamwork cost," and "limited discretionary time" more frequently than the overrepresented group. Overrepresented students tend to come from higher-income families; it is plausible that their families possess greater

Table 3. Similarities and Differences in the Responses of Various Student Groups (*Freq. and Ref. indicate the percent and number of interviewees mentioning a code related to a theme, respectively*).

	Gender				Race/Ethnicity				Major			
	Female (n = 25)		Male (n = 13)		White/Asian (n = 13)		Underrepresented (n = 25)		Professional (n = 18)		Art/Sciences/ Humanities (n = 20)	
Category/Theme	Freq. (%)	Ref	Freq. (%)	Ref	Freq. (%)	Ref	Freq. (%)	Ref	Freq (%)	Ref	Freq (%)	Ref
Values												
Intrinsic value	36.0	9	38.5	5	53.8	7	28.0	7	55.6	10	20.0	4
Utility value	56.0	14	53.8	7	61.5	8	52.0	13	72.2	13	40.0	8
Attainment value	28.0	7	23.1	3	38.5	5	20.0	5	33.3	6	20.0	4
Cost												
Effort cost	16.0	4	15.4	2	15.4	2	16.0	4	16.7	3	15.0	3
Opportunity cost	48.0	12	30.8	4	15.4	2	56.0	14	33.3	6	50.0	10
Psychological cost	0.0	0	7.7	1	7.7	1	0.0	0	0.0	0	5.0	1
Teamwork cost	28.0	7	23.1	3	7.7	1	36.0	9	33.3	6	20.0	4
Barriers												
Low program awareness	20.0	5	15.4	2	15.4	2	20.0	5	22.2	4	15.0	3
Lack of diversity or inclusiveness	8.0	2	7.7	1	7.7	1	8.0	2	11.1	2	5.0	1
Not matching self-identity	40.0	10	23.1	3	30.8	4	36.0	9	22.2	4	45.0	9
Low expectancy of success	24.0	6	23.1	3	15.4	2	28.0	7	16.7	3	30.0	6
Confirming subjective norms	8.0	2	0.0	0	0.0	0	8.0	2	0.0	0	10.0	2
Lack of financial resources	12.0	3	0.0	0	0.0	0	12.0	3	0.0	0	15.0	3
Limited discretionary time	56.0	14	38.5	5	38.5	5	56.0	14	50.0	9	50.0	10

resources to support co-curricular activities. The different levels of emphasis placed on co-curricular activities and core academics by different groups may also explain the observed differences. For example, Latino families consider education a pathway to economic stability and strongly emphasize academic achievement in college (Gándara, 2015). Similarly, Black students often face significant pressure from family members to excel academically and obtain a college degree (Rowley et al., 2012). Consequently, many underrepresented students might regard time and resource-intensive activities like ICPs as secondary pursuits. This observed pattern in our data demands further studies to design effective interventions to increase the participation of underrepresented students in broader entrepreneurial ecosystems.

The notion of "not matching self-identity" emerged as a notable barrier for art/science students, who often regarded ICPs as activities more suited to engineering and business students, as previously discussed. Traditionally, student competitions have centered on technology and entrepreneurial concepts, fostering a strong association with engineering and business disciplines. Nevertheless, there is a growing movement toward integrating more entrepreneurship opportunities and teaching innovation skills within science and humanities programs (Carey et al., 2020). Universities, including the one where we conducted the study, have established interdisciplinary entrepreneurship centers that offer training and resources to students across academic fields (Pittaway et al., 2020; Welsh, 2014). Despite these endeavors, the persistence of the "not matching self-identity" barrier poses a significant challenge to the success of such interdisciplinary entrepreneurship initiatives. The perception that entrepreneurship is not pertinent can impede the engagement of humanities and science students, inhibiting their active participation in ICPs and related entrepreneurial endeavors.

Practical Implications of the Research

In this section, we cover strategies and interventions suggested by previous studies to overcome the identified barriers using the same theories that helped us understand our results. The noticeable similarities between our findings and the predictions of the SEVT and TPB, as well as SDT to some degree, underscore the relevance of these motivational theories in the context of ICPs. Additionally, they serve to validate the generalizability of our findings. Particularly, we observed a pattern of perceived values and costs consistent with the predictions of the SEVT. Our findings suggest that the SEVT can help educators understand and explain students' motivation and decision-making about participating in ICPs. Consequently, the SEVT can be used to design strategies and interventions to address students' real-world challenges, support them throughout ICPs, and reduce barriers to their engagement with ICPs. As we will discuss further, these interventions should increase the values and reduce the costs of ICPs to encourage a broader group of students to participate in ICPs.

Identified barriers, namely "lack of financial resources" and "limited discretionary time," can be explained by the TPB's perceived behavioral control construct, which postulates that a person's perception of the ease or difficulty of performing an activity is

a factor for performing the activity. In our study, students who did not participate in ICPs referred to these barriers more frequently than those who participated. The barriers of "not matching personal identity" and "conforming subjective norms" relate to the normative beliefs construct (social factors indicating which behaviors are deemed acceptable) and the subjective norms construct (how significant others perceive the behaviors as acceptable) within the TPB framework. Finally, we observed a significant effect of intrinsic motivation on student decisions according to the SDT.

Our theoretical insights summarized above have important practical implications in terms of lowering the barriers to participation in ICPs. Our findings indicated that the limited discretionary time was the most frequently mentioned barrier by the interviewees. Earlier research (Kulturel-Konak et al., 2023b; Rui et al., 2015) identified time demand as a significant barrier. Reducing the time demand of ICPs can help make them more accessible and appealing to all students. ICP organizers also have other options for intervention. For example, providing clear guidelines and expectations at the beginning can reduce uncertainty surrounding the time and effort requirements of ICPs. According to ICP organizers (Konak et al., 2023), it is critical to make expectations, judging criteria, and rules up front for running a successful program with the precaution that too rigid guidelines may negatively affect students' creativity. Another feasible intervention involves streamlining the required time and diversifying the scope of ICPs. Furthermore, offering comprehensive support, mentorship, workshops, and training can help reduce the time students spend acquiring the skills and knowledge essential for ICPs, thereby alleviating any perception of time wastage. The opportunity cost was another frequently mentioned theme, closely tied to the time demand. Our study revealed that female students expressed slightly more concern about opportunity costs than their male counterparts, while underrepresented students also identified opportunity costs as a significant concern. Implementing interventions to alleviate opportunity costs for students could involve integrating ICPs with students' academic obligations more effectively, introducing flexible scheduling (Rui et al., 2015), and providing students with financial and other resources.

The perception of low expectancy of success was mentioned by 43% of interviewees who did not participate in ICPs. Therefore, it was identified as an important barrier in this study. ICP organizers can address this barrier by sharing success stories of previous ICP participants, especially students who overcame challenges to thrive, involving role models who can inspire students and reframe the definition of success in ICPs, and emphasizing collaborative and networking aspects. For example, although ICP organizers consider cultivating students' personal growth and development as one of their objectives in their events (Konak et al., 2023), this aspect of ICPs is not always adequately emphasized. Students might be more motivated if ICPs' promotional materials explicitly outline the available training opportunities and resources designed to assist students in developing the requisite skills. Integrating collaboration into ICPs can alleviate student anxiety (Almeida & de Souza, 2022) and enhance student outcomes (Nag et al., 2013). Role models, especially peer-to-peer role models (Komulainen et al., 2020), can help students realize their true potential in ICPs.

The interconnected barriers of "not matching self-identity" and "lack of diversity and inclusiveness" pose notable challenges for ICP organizers. As discussed in the background section, lack of diversity has been a significant concern in ICPs, particularly for hackathons. A lack of diversity can make certain student groups feel excluded or unwelcome, deterring them from participating in these programs. For example, a large-scale empirical study on computing hackathons (Gan et al., 2022) found that participants from underrepresented student groups were less likely to continue coding than participants in well-presented groups. In this study, "not matching self-identity" was more frequently cited by non-participating students and those majoring in the arts and sciences. Similarly, previous research (Kulturel-Konak et al., 2023b) highlights how students in liberal arts, humanities, and science fields tend to hold more negative perceptions of ICPs compared to students in business and engineering disciplines. Gedeon (2020) suggests adopting an inclusive definition of entrepreneurship, which encompasses intrapreneurship, social innovation, personal growth, transformation, and agency, to increase the acceptance of entrepreneurship programs at higher education institutions. Research has indicated that social and situational support, which refers to individuals' perceptions of how much others provide resources, encouragement, and support for them to succeed, positively impacts students' college engagement (Kundu, 2019; Tani et al., 2021), particularly if faculty and peers encourage students to engage (Wang & Eccles, 2012). Providing social support to students through information sessions, intentional advising/mentoring (Prince et al., 2022) and success stories can help change negative perceptions about ICPs among some student groups.

To address these issues, it is also important to develop marketing materials, websites, and branding that communicate an inclusive message that appeals to diverse student groups. Punjwani (2018) notes that outreach to diverse student populations becomes challenging when event organizers do not represent those student groups. Therefore, it is essential to have ICP organizing, selection, and judging committee members who represent various disciplines and groups (Konak et al., 2023). Furthermore, persuasive messages regarding social norms, commonly referred to as social norm messaging, have demonstrated promise as an effective approach to fostering inclusion in higher education (Murrar et al., 2020). Social norm messaging can change students' perceptions of ICPs by correcting their misconceptions about their peers' actions. This approach can be instrumental in promoting inclusivity, as students frequently turn to each other for cues on appropriate behavior (Rhodes et al., 2020).

Limitations of the Research

It is essential to acknowledge some limitations of the research methodology and precautions that we took to limit their effect. Firstly, it is important to note that all interviewees were drawn from various geographically dispersed campuses of the same institution, and the interviews were conducted within a year after the institution fully resumed face-to-face instruction following the COVID-19 pandemic. While only a small number of interviewees explicitly discussed the negative impacts of the

pandemic, it's possible that students' perceptions were subtly influenced. To enhance the generalizability of the findings to other populations, we made efforts to recruit interviewees from different campuses. Furthermore, particular attention was given to recruiting students underrepresented in ICPs. These factors should be considered when interpreting the research outcomes.

As is the case with any qualitative research, the analysis of the interview transcripts might be influenced by the research team's subjectivity and bias. Two different research teams conducted and analyzed the interviews to reduce researcher bias. The coding and thematic extraction processes were carried out using a collaborative consensus-building approach, and an independent group of researchers was engaged to verify the reliability of the coding. During the pilot interviews, it became evident that some interviewees faced challenges articulating their perspectives. As a result, probing questions were developed to enhance the depth and quality of the responses. However, it should be noted that responses that were too brief were excluded from the analyses.

Repeating the study in other institutions and comparing the results will evaluate the generalizability of the findings in this paper. In addition, interviewing program organizers or mentors can provide an additional perspective to interpreting student perceptions about values, costs, and barriers of ICPs. Such a multi-perspective approach can better inform targeted interventions to increase the diversity and inclusiveness of ICPs. In this study, we also observed differences between underrepresented and overrepresented students' perceptions of the values and costs of ICPs. Further studying the cause of this observed pattern can lead to more targeted interventions to increase underrepresented students' participation in broader entrepreneurial ecosystems.

Conclusions

Innovation competitions and programs (ICPs) play important roles as a recruitment ground for many other co-curricular programs and expose students to entrepreneurship and innovation. Through the analysis of student interview data, the study has identified three major themes: values, costs, and barriers to participating in student ICPs. Within this framework, two distinct levels of barriers have been recognized: institutional and individual. Institutional-level barriers encompass challenges such as "low program awareness" and "lack of diversity and inclusiveness," while individual barriers revolve around factors like "not matching self-identity" and "low expectancy of success." Furthermore, the study has emphasized the significant influence of "opportunity cost" and "teamwork cost" on students' engagement levels within ICPs. The dissemination of findings from this research will provide STEM educators and ICP organizers with valuable insights into the specific barriers and costs associated with student participation, thereby enabling stakeholders to better understand and address these challenges. This knowledge can serve as a basis for creating and executing targeted interventions to tackle these inclusivity challenges.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was supported by National Science Foundation (DUE 2120936) and Penn State Social Science Research Institution.

Ethical Statement

Ethical Approval

This research project was determined to be exempt from review by the Pennsylvania State University Institutional Review Board (IRB No: STUDY00017590) as it posed minimal risk to participants.

Informed Consent

Informed consents was given written before participating in this research.

Disclaimer

Any opinions and findings expressed in this manuscript are of the authors and do not necessarily reflect the views of the funding institutions.

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References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-t

Ajzen, I. (2001). Nature and operation of attitudes. *Annual Review of Psychology*, *52*(1), 27–58. https://doi.org/10.1146/annurev.psych.52.1.27

Al-Jubari, I., Hassan, A., & Liñán, F. (2019). Entrepreneurial intention among university students in Malaysia: Integrating self-determination theory and the theory of planned behavior. *The International Entrepreneurship and Management Journal*, *15*(4), 1323–1342. https://doi.org/10.1007/s11365-018-0529-0

Almeida, L. A., & de Souza, C. R. (2022). A social-cognitive analysis of a female-focused hackathon. In Proceedings of the third workshop on gender equality, diversity, and inclusion in software engineering, Pittsburgh, PA, 20 May 2022.

Alves, A. C., Kahlen, F.-J., Flumerfelt, S., & Siriban-Manalang, A. B. (2019). *Lean engineering for global development*. Springer.

Baluku, M. M., Leonsio, M., Bantu, E., & Otto, K. (2019). The impact of autonomy on the relationship between mentoring and entrepreneurial intentions among youth in Germany, Kenya, and Uganda. *International Journal of Entrepreneurial Behavior & Research*, *25*(2), 170–192. https://doi.org/10.1108/ijebr-10-2017-0373

Bandura, A. (1982). The assessment and predictive generality of self-percepts of efficacy. *Journal of Behavior Therapy and Experimental Psychiatry*, *13*(3), 195–199. https://doi.org/10.1016/0005-7916(82)90004-0

Barron, K. E., & Hulleman, C. S. (2015). Expectancy-value-cost model of motivation. In J. D. Wright (Ed.), *International encyclopedia of the social & behavioral sciences* (2nd ed., Vol. 8, pp. 503–509). Elsevier Ltd.

Bodolica, V., & Spraggon, M. (2021). Incubating innovation in university settings: Building entrepreneurial mindsets in the future generation of innovative emerging market leaders. *Education + Training*, *63*(4), 613–631. https://doi.org/10.1108/et-06-2020-0145

Bridgestock, L. (2022, 22-January). *Six reasons to participate in student competitions*. QS Top Universities. https://www.topuniversities.com/blog/six-reasons-participate-student-competitions

Bryant, P. C., Fabian, F., Kinnamon, E., & Wright, P. (2012). Tailoring entrepreneurship education: Exploring components of entrepreneurship education for underrepresented groups. *Journal of Business and Entrepreneurship*, *23*(2), 1–24. https://www.researchgate.net/publication/258703461.

Byers, T., Seelig, T., Sheppard, S., & Weilerstein, P. (2013). Its role in engineering education. *The Bridge*, *43*(2), 35–40. https://www.nae.edu/81235/Entrepreneurship-Its-Role-in-Engineering-Education.

Carey, J. C., Beitelspacher, L. S., Tosti-Kharas, J., & Swanson, E. (2020). A resource-efficient modular course design for co-teaching integrated sustainability in higher education: Developing the next generation of entrepreneurial leaders. *Entrepreneurship Education and Pedagogy*, *4*(2), 169–193. https://doi.org/10.1177/2515127420969967

Creswell, J. W. (2006). *Qualitative inquiry and research design: Choosing among five approaches*. Sage.

Dang, H. P., & Nguyen Viet, B. (2021). Inside the intention to join extracurricular activities: Integrating the theory of planned behavior and signaling theory. *Cogent Education*, *8*(1), 1888672. https://doi.org/10.1080/2331186X.2021.1888672

Da Silva, G. B., Costa, H. G., & De Barros, M. D. (2015). Entrepreneurship in engineering education: A literature review. *International Journal of Engineering Education*, *31*(6), 1701–1710. https://www.researchgate.net/publication/284174304.

Eccles, J. (2009). Who am I and what am I going to do with my life? Personal and collective identities as motivators of action. *Educational Psychologist*, *44*(2), 78–89. https://doi.org/10.1080/00461520902832368

Eccles, J. S., Adler, T. F., Futterman, R., Goff, S. B., Kaczala, C. M., & Meece, J. L. (1983). Achievement and achievement motivation. In J. T. Spence (Ed.), *Expectations, values, and academic behaviors*. W. H. Freeman.

Eccles, J. S., & Wigfield, A. (2020). From expectancy-value theory to situated expectancy-value theory: A developmental, social cognitive, and sociocultural perspective on motivation.

Contemporary Educational Psychology, *61*(3), 101859. https://doi.org/10.1016/j.cedpsych.2020.101859

Falk, J., Kannabiran, G., & Hansen, N. B. (2021). What do hackathons do? Understanding participation in hackathons through program theory analysis. In Proceedings of the 2021 CHI conference on human factors in computing systems, New York, NY, 8–13 May, 2021.

Fishbein, M., & Ajzen, I. (2009). *Predicting and changing behavior: The reasoned action approach*. Taylor & Francis Group.

Flake, J. K., Barron, K. E., Hulleman, C., McCoach, B. D., & Welsh, M. E. (2015). Measuring cost: The forgotten component of expectancy-value theory. *Contemporary Educational Psychology*, *41*(April), 232–244. https://doi.org/10.1016/j.cedpsych.2015.03.002

Gan, E., Menezes, T., & Hill, B. M. (2022). How gender, ethnicity, and public presentation shape coding perseverance after hackathons. In Proceedings of the 22nd Koli calling international conference on computing education research, Koli, Finland, 17–20 November, 2022. https://doi.org/10.1145/3564721.3564727

Gándara, P. (2015). With the future on the line: Why studying Latino education is so urgent. *American Journal of Education*, *121*(3), 451–463. https://doi.org/10.1086/680411

Garcia, M. B. (2022). Hackathons as extracurricular activities: Unraveling the motivational orientation behind student participation. *Computer Applications in Engineering Education*, *30*(6), 1903–1918. https://doi.org/10.1002/cae.22564

Gedeon, S. A. (2020). Theory-based design of an entrepreneurship microcredentialing and modularization system within a large university ecosystem. *Entrepreneurship Education and Pedagogy*, *3*(2), 107–128. https://doi.org/10.1177/2515127419856612

Hsu, D. K., Shinnar, R. S., & Powell, B. C. (2014). Expectancy theory and entrepreneurial motivation: A longitudinal examination of the role of entrepreneurship education. *Journal of Business and Entrepreneurship*, *26*(1), 121–140. https://www.proquest.com/scholarly-journals/expectancy-theory-entrepreneurial-motivation/docview/1635000526/se-2.

Htun, M. (2019). Promoting diversity and inclusion through engagement: The apsa 2018 hackathon. *PS: Political Science & Politics*, *52*(4), 677–683. https://doi.org/10.1017/s1049096519000593

Huang-Saad, A. Y., Morton, C. S., & Libarkin, J. C. (2018). Entrepreneurship assessment in higher education: A research review for engineering education researchers. *Journal of Engineering Education*, *107*(2), 263–290. https://doi.org/10.1002/jee.20197

James, A., & Brookfield, S. D. (2014). *Engaging imagination: Helping students become creative and reflective thinkers*. John Wiley & Sons.

Karim, M. S. A. (2016). Entrepreneurship education in an engineering curriculum. *Procedia Economics and Finance*, *35*, 379–387. https://doi.org/10.1016/s2212-5671(16)00047-2

Kayastha, C. (2017). Enabling innovation through community and competition. In 2017 IEEE Women in Engineering (WIE) Forum USA East, Baltimore, MD, 30 November–02 December 2017.

Komulainen, K., Siivonen, P., Kasanen, K., & Räty, H. (2020). "How to give a killer pitch?" Performances of entrepreneurial narratives as identity models in higher education. *Entrepreneurship Education and Pedagogy*, *3*(3), 214–235. https://doi.org/10.1177/2515127420908039

Konak, A., Kulturel-Konak, S., Schneider, D. R., & Mehta, K. (2023, October 18-21). Best practices for cultivating innovative thinking skills in innovation competitions and programs. In 2023 IEEE frontiers in education conference (FIE), College Station, TX, 18–21 October 2023.

Kos, B. A. (2018). The collegiate hackathon experience. In Proceedings of the 2018 ACM conference on international computing education research, New York, NY, 13–15 August, 2018.

Kosovich, J. J., Hulleman, C. S., Barron, K. E., & Getty, S. (2014). A practical measure of student motivation: Establishing validity evidence for the expectancy-value-cost scale in middle school. *The Journal of Early Adolescence*, *35*(5-6), 790–816. https://doi.org/10.1177/0272431614556890

Kulturel-Konak, S., Konak, A., Schneider, D. R., & Mehta, K. (2023a, March 30-April 1). Fostering innovation mindset through student innovation competitions and programs. In ASEE zone 1 conference-spring 2023, State College, PA.

Kulturel-Konak, S., Konak, A., Webster, N., & Murphy, P. K. (2023b, January 3-6). Building inclusive student innovation competitions, exhibitions, and training programs. In Hawaii international conference on system sciences (HICSS), Maui, Hawaii.

Kulturel-Konak, S., Leung, A., & Konak, A. (2023c). Perceived barriers and costs associated with participation in student innovation competitions. In 2023 IEEE frontiers in education conference (FIE). College Station, TX, USA.

Kundu, A. (2019). Understanding college "burnout" from a social perspective: Reigniting the agency of low-income racial minority strivers towards achievement. *The Urban Review*, *51*(5), 677–698. https://doi.org/10.1007/s11256-019-00501-w

Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics*, *33*(1), 159–174. https://doi.org/10.2307/2529310

Liu, H., Kulturel-Konak, S., & Konak, A. (2021). Key elements and their roles in entrepreneurship education ecosystem: Comparative review and suggestions for sustainability. *Sustainability*, *13*(19), 10648. https://doi.org/10.3390/su131910648

McCabe, J. M. (2016). *Connecting in college: How friendship networks matter for academic and social success*. University of Chicago Press.

Mikesell, D. R., Sawyers, D. R., & Marquart, J. E. (2012). External engineering competitions as undergraduate educational experiences. In 2012 ASEE annual conference & exposition, San Antonio, TX.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). Sage Publications, Inc.

Murphy, M. C., Steele, C. M., & Gross, J. J. (2007). Signaling threat: how situational cues affect women in Math, science, and engineering settings. *Psychological Science*, *18*(10), 879–885. https://doi.org/10.1111/j.1467-9280.2007.01995.x

Murrar, S., Campbell, M. R., & Brauer, M. (2020). Exposure to peers' pro-diversity attitudes increases inclusion and reduces the achievement gap. *Nature Human Behaviour*, *4*(9), 889–897. https://doi.org/10.1038/s41562-020-0899-5

Nag, S., Katz, J. G., & Saenz-Otero, A. (2013). Collaborative gaming and competition for Cs-stem education using spheres zero robotics. *Acta Astronautica*, *83*(February-March), 145–174. https://doi.org/10.1016/j.actaastro.2012.09.006

Olewnik, A., Chang, Y., & Su, M. (2023). Co-curricular engagement among engineering undergrads: Do they have the time and motivation? *International Journal of STEM Education*, *10*(1), 27. https://doi.org/10.1186/s40594-023-00410-1

Paganini, L., Ferraz, C., Gama, K., & Alves, C. (2021). Promoting game jams and hackathons as more women-inclusive environments for informal learning. In 2021 IEEE frontiers in education conference (FIE), Lincoln, NE, 13–16 October 2021.

Paganini, L., & Gama, K. (2020a). Engaging women's participation in hackathons: A qualitative study with participants of a female-focused hackathon. In International conference on game jams, hackathons and game creation events 2020, Osaka.

Paganini, L., & Gama, K. (2020b). Female participation in hackathons: A case study about gender issues in application development marathons. *IEEE Revista Iberoamericana de Tecnologias del Aprendizaje*, *15*(4), 326–335. https://doi.org/10.1109/rita.2020.3033209

Parra, C. A., & Knobloch, N. (2022). Exploring the barriers, opportunities, and motivation for agricultural entrepreneurship of rural Colombian students who participated in dual-credit programs. *Journal of International Agricultural and Extension Education*, *29*(4), 93–108. https://doi.org/10.4148/2831-5960.1039

Pittaway, L., Aissaoui, R., Ferrier, M., & Mass, P. (2019). University spaces for entrepreneurship: A process model. *International Journal of Entrepreneurial Behavior & Research*, *26*(5), 911–936. https://doi.org/10.1108/ijebr-09-2018-0584

Prince, A. J., Kulturel-Konak, S., Konak, A., Schneider, D. R., & Mehta, K. (2022, Nov. 11-12, 2022). The role of mentors in student innovation competitions and programs. In ASEE middle Atlantic 2022 fall conference, Harrisburg, PA.

Punjwani, F. (2018). *Organizing for radical inclusion: Reflections from hackathons*. Massachusetts Institute of Technology.

Putwain, D. W., Nicholson, L. J., Pekrun, R., Becker, S., & Symes, W. (2019). Expectancy of success, attainment value, engagement, and achievement: A moderated mediation analysis. *Learning and Instruction*, *60*(April), 117–125. https://doi.org/10.1016/j.learninstruc.2018.11.005

Reeves, P. M., Zappe, S. E., & Follmer, D. J. (2019). A comparison of the types of problems encountered by entrepreneurial students and successful professional entrepreneurs. *Entrepreneurship Education and Pedagogy*, *2*(3), 214–244. https://doi.org/10.1177/2515127419829396

Rhodes, N., Shulman, H. C., & McClaran, N. (2020). Changing norms: A meta-analytic integration of research on social norms appeals. *Human Communication Research*, *46*(2-3), 161–191. https://doi.org/10.1093/hcr/hqz023

Richard, G. T., Kafai, Y. B., Adleberg, B., & Telhan, O. (2015). Stitchfest: Diversifying a college hackathon to broaden participation and perceptions in computing. In Proceedings of the 46th ACM technical symposium on computer science education, New York, NY, 4–7 March, 2015.

Richterich, A. (2019). Hacking events: Project development practices and technology use at hackathons. *Convergence: The International Journal of Research Into New Media Technologies*, *25*(5-6), 1000–1026. https://doi.org/10.1177/1354856517709405

Rosenzweig, E. Q., Wigfield, A., & Eccles, J. S. (2022). Beyond utility value interventions: The why, when, and how for next steps in expectancy-value intervention research. *Educational Psychologist*, *57*(1), 11–30. https://doi.org/10.1080/00461520.2021.1984242

Rowley, S. J., Varner, F., Ross, L. L., Williams, A. D., & Banerjee, M. (2012). Toward a model of racial identity and parenting in African Americans. In *African American identity: Racial and cultural dimensions of the Black experience* (pp. 273–288).

Rui, P., Randa, L. S., Cindy, E. F., Deborah, A. T., & Susan, E. W. (2015, 2015/06/14). Building diversity in engineering competition teams by modeling industry best-practice. In ASEE Annual Conference And Exposition, Seattle, Washington.

Ryan, R., & Deci, E. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. Guilford Publications.

Ryan, R. M., & Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology*, *25*(1), 54–67. https://doi.org/10.1006/ceps.1999.1020

Samson, K. (2010). Nervecenter: Mit competition a catalyst for student innovation. *Annals of Neurology*, *68*(6), A13–A14. https://doi.org/10.1002/ana.22326

Schmitt, F., Sundermeier, J., & Mikkelsen, K. (2023). Hello diversity! Digital ideation hackathon: Fostering gender equality in digital innovation. *Communications of the Association for Information Systems*, *53*(1), 877–902. https://doi.org/10.17705/1cais.05336

Schuster, P., Davol, A., & Mello, J. (2006, June 18-21). *Student competitions-the benefits and challenges*. American Society of Engineering Education Annual Conference & Exposition.

Shekhar, P. (2023). Engineering entrepreneurship program participation: Differences across men and women. *IEEE Transactions on Education*, *66*(2), 188–196. https://doi.org/10.1109/te.2022.3208524

Shekhar, P., & Huang-Saad, A. (2021). Examining engineering students' participation in entrepreneurship education programs: Implications for practice. *International Journal of STEM Education*, *8*(40), 1–15. https://doi.org/10.1186/s40594-021-00298-9

Shi, L., Yao, X., & Wu, W. (2019). Perceived university support, entrepreneurial self-efficacy, heterogeneous entrepreneurial intentions in entrepreneurship education: The moderating role of the Chinese sense of face. *Journal of Entrepreneurship in Emerging Economies*, *12*(2), 205–230. https://doi.org/10.1108/jeee-04-2019-0040

Shulruf, B. (2010). Do extra-curricular activities in schools improve educational outcomes? A critical review and meta-analysis of the literature. *International Review of Education*, *56*(5-6), 591–612. https://doi.org/10.1007/s11159-010-9180-x

Tani, M., Gheith, M. H., & Papaluca, O. (2021). Drivers of student engagement in higher education: A behavioral reasoning theory perspective. *Higher Education*, *82*(3), 499–518. https://doi.org/10.1007/s10734-020-00647-7

Taylor, N., & Clarke, L. (2018). Everybody's hacking: Participation and the mainstreaming of hackathons. In CHI Conference on Human Factors in Computing Systems, CHI 2018, Montreal, QC, 21–26 April, 2018.

Timmermans, S., & Tavory, I. (2012). Theory construction in qualitative research: From grounded theory to abductive analysis. *Sociological Theory*, *30*(3), 167–186. https://doi.org/10.1177/0735275112457914

Walden, S. E., Foor, C., Pan, R., Shehab, R., & Trytten, D. (2015). Leadership, management, and diversity: Missed opportunities within student design competition teams. In 2015 ASEE annual conference and exposition, Seattle, Washington.

Walden, S. E., Foor, C. E., Pan, R., Shehab, R. L., & Trytten, D. A. (2016). Advisor perspectives on diversity in student design competition teams. In American society for engineering education annual conference. New Orleans, LA.

Wang, M. T., & Eccles, J. S. (2012). Social support matters: Longitudinal effects of social support on three dimensions of school engagement from middle to high school. *Child Development*, *83*(3), 877–895. https://doi.org/10.1111/j.1467-8624.2012.01745.x

Warner, J., & Guo, P. J. (2017). Hack.Edu: Examining how college hackathons are perceived by student attendees and non-attendees. In Proceedings of the 2017 ACM conference on international computing education research, Tacoma, Washington. https://doi.org/10.1145/3105726.3106174

Welsh, D. (2014). *Creative cross-disciplinary entrepreneurship: A practical guide for a campus-wide program*. Springer.

Wilson, A. W., & Patón-Romero, J. D. (2022). Gender equality in tech entrepreneurship: A systematic mapping study. In 2022 IEEE/ACM 3rd international workshop on gender equality, diversity and inclusion in software engineering (GEICSE), Pittsburgh, PA, 20 May 2022.

Wilson, F., Kickul, J., & Marlino, D. (2007). Gender, entrepreneurial self–efficacy, and entrepreneurial career intentions: Implications for entrepreneurship education. *Entrepreneurship Theory and Practice*, *31*(3), 387–406. https://doi.org/10.1111/j.1540-6520.2007.00179.x

Zappe, S. E., Cutler, S. L., & Gase, L. (2021). A systematic review of the impacts of entrepreneurial support programs in science, technology, engineering, and math fields. *Entrepreneurship Education and Pedagogy*, *6*(1), 3–31. https://doi.org/10.1177/25151274211040422