

Exploring interactions between short-term academic-industry engagement moments and professional identity development in undergraduate construction students: A grounded theory study

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Work-In-Progress: Exploring interactions between short-term academia-industry engagement moments and professional identity development in undergraduate construction students: A grounded theory study

Abstract

To better prepare undergraduates for the STEM industry which struggles with workforce shortages, academia-industry collaboration offerings and engagements are facilitated by professors. Professional identity development (PID) theories link well-designed engagements with increments in undergraduates' thinking, feeling, and performing as professionals. However, existing PID studies focus on long-term engagements such as internships and disregard short-term engagements such as guest lectures. As a preliminary effort to bridge this gap, the purpose of this study is to explore how short-term academia-industry guest lecture engagement moments (SAIs) interact with self-definitions to influence PID in construction undergraduates. Our constructivist grounded theory methodology engaged 10 construction undergraduates in semi-structured interviews regarding their SAI-driven professional identity development (SAI-PID). We utilize constant comparative analysis for coding, categorization and theory development.

Preliminary findings from this work-in-progress indicate that guest lectures facilitate PID in construction undergraduates. The novelty of our work lies in our introduction of the first multi-dimensional and multi-phase SAI-PID grounded theory. Our SAI-PID framework utilizes four sequential phases of important guest lecture moments and three personality types to explain how varied student-GL psychological distance perceptions are associated with varied types and levels of attentiveness, responsiveness, PID, and regulation of professional aspirations. SAI-PID is characterized by increments in cognition and affection towards professional aspirations. However, increments in performance are not as prevalent. This signals a key difference between short- and long-term engagements as short engagements provide sparse opportunities for professional practice and socialization.

We bridge critical gaps in literature by positioning SAIs and self-definitions as viable for PID in undergraduates. To enhance SAI contributions to PID, student-GL psychological distance perceptions can be reduced by increasing the practical and interactive components of SAIs to include hands on engagements and personal stories. Furthermore, inviting alumni guest lecturers or a panel of guest lecturers with diverse attributes will ensure that more students perceive similarities with GLs to reduce psychological distance perceptions. Institutions should provide opportunities for undergraduates to strengthen their self-regulation skills as this would give them more control over psychological distance perceptions to facilitate PID. The diverse identity content, process, and context variables in our framework inform future dialogues, investigations and interventions to improve SAI-PID. In the long term, stronger professional identities will strengthen transitions into the workforce and reduce persistent STEM workforce shortages.

Introduction

Current STEM workforce shortages are concerning as jobs requiring substantial STEM expertise in the U.S. has grown [1]. The construction industry is a high-demand STEM sector that employs about 8% of the global workforce [2] with an estimated 9% growth projection by 2034 [3].

However, persistent workforce shortages may worsen due to challenges in attracting, developing, and retaining the workforce [4]. In part, low participation is attributed to weak construction professional identity development (PID) and challenging transitions into construction professions [5]. To compound this, little is known about PID in construction undergraduates. Within the broader STEM undergraduate domain, PID studies focus on long-term academia-industry engagements like internships [6]. These engagements are full or part-time employment for two or more months. While these long-term engagements impact PID, [7] noted that professors rely heavily on short term academia-industry engagements like guest lectures, which are understudied.

Short-term academia-industry guest lecture engagements

Guest lectures (GLs) are delivered by industry partners to students on campuses. They are utilized frequently because they require less time, paperwork, and logistics [7]. Scholars report that GLs are beneficial to students [8][9][10]. Pre-recorded sessions in nursing [11], videoconferencing in construction management [12], and online sessions in social work [13] strengthen networks, confidence, and employment preparation [10]. Also, GLs broaden pharmacy students' career goals [14] and accounting students' career choices. While few GL studies capture students' perspectives, many draw from literature reviews, expert opinions, and assessments [9][16][17][18]. Also, GLs are mostly studied as a single homogenous event which limits understanding of the varied moments within GLs that influence student outcomes such as PID [19][20].

Little is empirically known about GL interactions with PID outcomes despite frequent utilization to provide practical insights to construction undergraduates [21]. As industry experts, guest lecturers share the realities of professional practice. Only one empirical GL study was found in the construction education domain [22]. In this study, construction students (82%) reported that GL content aligns with theoretical aspects [22]. No study was found to assess GL interactions with PID. The paucity of studies is concerning and demands empirical studies to increase understanding of GL interactions with undergraduates' sense of becoming professionals [19 - 21][23].

Professional Identity Development

PID is important for understanding undergraduates due to its association with persistence into the STEM workforce [24][25]. PID studies are founded in psychology and sociology frameworks which conceptualize professional identities as the constellation of attributes by which individuals define themselves in professional roles [26-29]. Developing professional identities involves individuals internalizing the beliefs, values and interests of a specific profession and seeing themselves as professionals through socialization [30]. Therefore, undergraduate education is one of the avenues by which students become professional members [6]. As they proceed through the education continuum, they undergo dynamic internal processes that advance their thinking, feeling, and performing as professionals [31]. PID processes are unique and driven by personal identities, relevant engagements, and persistent aspirations [29][31]. Therefore, scholars utilize identity content dimensions to understand individual and group attributes in PID [32 - 34]. They utilize identity process dimensions to understand how PID evolves over time [35 - 37]. While a strong match between personal and professional attributes strengthens PID and persistence into the workforce, a mismatch causes tensions in PID and disrupts persistence [38]. Therefore, [36]

calls for competency-based educational programs to integrate interventions that focus on meanings and interconnectedness that support PID.

Despite findings that short catalyst moments shift PID [39], short-term academia-industry engagements remain understudied. The few short-term studies that exist position engagements as a single homogenous event that impact undergraduate learning and perspectives. These studies do not capture how important moments and processes evolve within short-term engagements to influence PID. Furthermore, they position undergraduates as a homogenous group and do not explain how variations in self-definitions influence PID processes.

As a preliminary effort to bridge this gap in PID literature, the purpose of this ongoing empirical study is to explore how short-term academia-industry guest lecture engagement moments (SAIs) interact with self-definitions to influence PID in construction undergraduates. Due to the frequent utilization of GLs in undergraduate construction education, we select GLs as a context for understanding PID processes in SAIs. Thus, we ask: How do important GL engagement moments and salient self-definitions interact and evolve to influence PID in construction undergraduates?

Methods

We utilize an institutional review board approved constructivist grounded theory methodology [40][41] to understand SAI-driven PID processes in construction undergraduates. This methodology permits the simultaneous collection, analysis, and interpretation of data for the construction of theory [40]. We co-construct an explanatory SAI-PID framework by drawing from the diverse experiences and subjective meanings of both researchers and research participants [41]. Research participants (RPs) are recruited from undergraduate construction science, engineering, and management programs in two U.S. institutions. A digital Qualtrics-based recruitment form is distributed to undergraduate communities for self-nomination. We implemented maximum variation purposeful sampling to enroll RPs with varied characteristics and experiences to strengthen the robustness of our findings [42]. To date, 10 out of the targeted 30 RPs have been interviewed. Population demographics are tracked by gender (50% male; 50% female), institution (50% HBCU; 50% PWI), classification (30% underclassmen; 70% upperclassmen), and race (60% African-American; 30% White Caucasian; 10% White Hispanic).

Adopting a critical incident interviewing technique, we elicit details about GL moments and self-definitions that contribute to SAI-PID. RPs are engaged in 60-to-90-minute semi-structured interviews utilizing the zoom communication platform. Our interviews have open-ended questions that permit follow-up questions. This technique allows us to go beyond surface conversations to better understand individualized and shared meanings and experiences [40]. The questions focus on the *whats*, *whys*, *hows*, and *whens* associated with shifts in SAI-driven PID. As an example, Question 1 is, *describe any guest lecture that has impacted your sense of becoming a construction professional*. This GL becomes the reference point for each RP's interview. Questions capture professional identities prior to and after the referenced GL to understand any PID changes attributed to the referenced GL. Notes are taken during interviews to preserve context, track linkages, and inform subsequent questions. Interviews are recorded and transcribed verbatim within the zoom software. Research assistants cleaned transcripts for further analysis.

A bottom-up, inductive, and interpretivist approach is utilized to systematically understand the trends and patterns within the data [43]. Interview transcripts are uploaded into the NVivo 12 qualitative analysis software for constant comparative analysis. This allows the detection of analytical distinctions by comparing statements across RPs. We adopt a three-coding stage approach which involves open/focused, axial, and selective coding [43].

Open coding involved the breaking down of data into smaller units that captured concepts that characterize and explain how important GL moments interact with self-definitions to influence PID. Process coding is utilized to track time dynamics and PID transitions [44]. Coding reveals the properties and dimensions of emerging concepts. Successive focused coding permit the synthesis of the most frequent and relevant open codes to explain larger data segments and facilitate the clustering of codes into categories [45].

Subsequent axial coding permits the clustering of categories into one of four sequential phases. These phases capture the key categorical concepts that link prior self and GL definitions with present GL engagement moments to influence PID. Each category is then assigned to one of six grounded theory components - context, causal conditions, phenomenon, strategies, intervening conditions, and outcome as summarized in Table 1 [45].

Table 1. Components of Emerging SAI-PID Grounded Theory Components

Standard Grounded Theory Components	Definition	SAI-PID Theory Components
Context	The environment in which the core phenomenon occurs	Guest lectures in undergraduate construction educational contexts
Core Phenomenon	The central occurrence or process which is being investigated	Developing professional identities through important GL engagement moments.
Causal Conditions	The cause or source of the core phenomenon	Prior GL and self-definitions Important GL moments
Intervening Conditions	Situations that influence strategies	Student-GL psychological distance perceptions
Strategies	Responses or actions taken because of the core phenomenon	Stabilizing attentiveness during introductory phase Directing responsiveness during instructional phase Regulating construction aspirations during closing phase
Outcome	Consequences or end results from the implementation of strategies	Committing to construction professions

Final selective coding refines the emerging theory and links theoretical categories around the core category, *Developing professional identities through important GL engagement moments*. This core category characterizes RPs' thinking, feeling, and performing like construction professionals. It is abstract enough to explain this SAI-PID process and relates to all other categories. By encountering negative cases, codes are revised to accommodate diversity. Theoretical sampling and categorization are still in progress to increase the robustness of the emerging theory [40].

Results

Our preliminary findings show that GLs drive PID in construction undergraduates. Our emergent SAI-PID framework (Figure 1) utilizes four sequential phases of important GL moments and three personality types to illuminate how salient self-definitions and important GL moments interact to influence PID. In subsequent paragraphs, we utilize four phases to report our results and substantiate key findings with RP quotations.

Phase 1: Pre-GL Phase

This pre-GL phase captures the previous and important self and GL-defining moments that influence salient self-definitions and feelings about GLs. Through personal, educational, and industrial engagements, RPs become more aware of their personalities to include open (N=6), homophilic (N=3), and conscientious (N=1). These personalities influence RPs' attitudes and feelings during previous GL engagements in pre-college and undergraduate educational contexts.

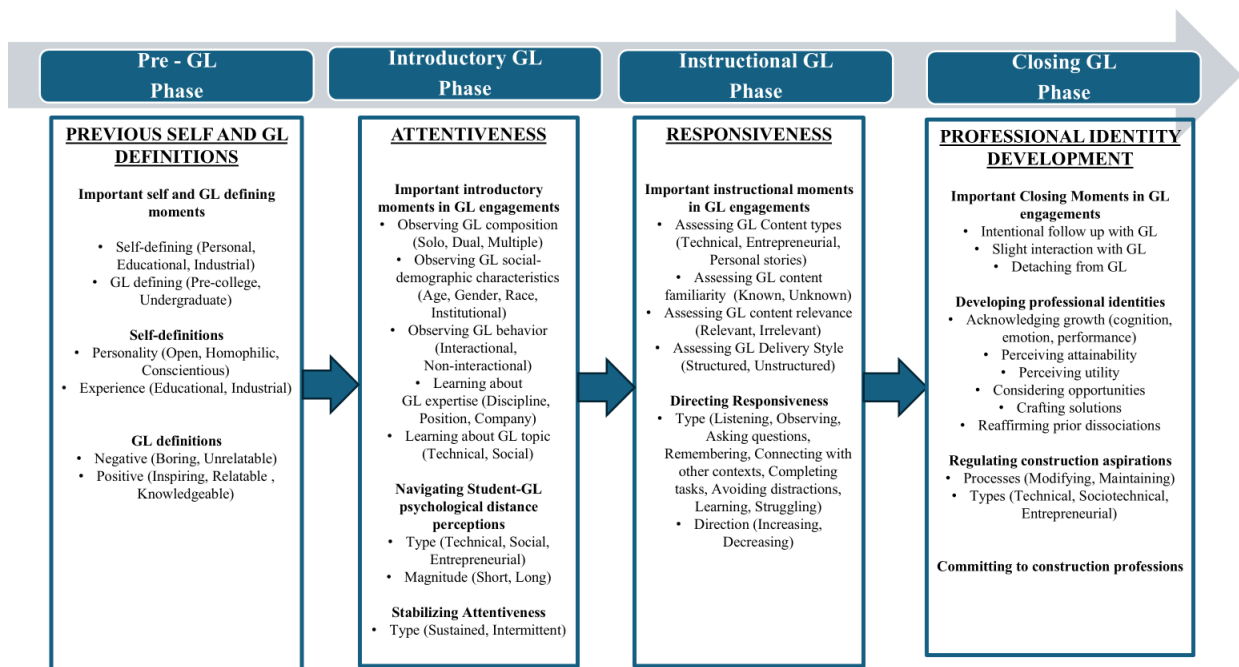


Fig. 1. SAI-PID Framework

RPs like Vida are characterized as possessing open personalities because they describe themselves as open-minded, curious, and receptive. Therefore, they were willing to explore new opportunities and receive different information during previous GLs as explained by Vida:

I feel like being open-minded ... being receptive to whatever the person, whatever the other side of the picture is... another guest lecturer who worked at [Organization Name] when I was in engineering and the insight that he gave... I think going in the lecture with an open mind and not leading with judging them based off the surface... they (Guest

Lecturers) have some type of knowledge to provide... I'm going to have confidence that it's something that I should listen to, even though I don't want to.

Like Vida, RPs with open personalities tended to describe previous GL experiences as either boring or inspiring and often maintained both negative and positive feelings. Nevertheless, they restrained themselves from distractions and focused on new experiences, regardless of GL attributes.

Paul is characterized as possessing a conscientious personality because he described himself as determined, goal-oriented, and persistent as explained:

My sole purpose was going to school...making my own company...I would describe myself...determined to get with my goal...if I set myself up like either at the gym or at something else and I tell myself to stay on it for a certain time, I won't get off until then.

Also, he utilized personal stories of persevering in the gym and through a hike despite health risks to place emphasis on how focused he is. Paul's use of *sole purpose* shows how his conscientious personality makes him focused on education and entrepreneurial aspirations. Therefore, he focuses on GL expertise and describes prior GL experiences as inspiring. Paul maintained positive feelings about GLs because they aligned with his aspirations as explained:

... essentially, there was one guy who helped improve my, impacted my sense of becoming a construction professional as he told me about his ways of business ... they [Guest lecturers] are an inspiration.

RPs like Stacy are characterized as homophilic because they elevate relatability and prioritize interactions with others who possess similar attributes, particularly demographic attributes such as age, gender, and race. Therefore, they valued interactions with professors, peers, and alumni with similar demographic and institutional attributes. They tended to characterize prior GLs as unrelatable when guest lecturers possessed dissimilar characteristics as explained by Stacy:

Well, I would say part of it for me is being able to see more of myself in my professors than in the industry professors that we have coming. Like I have one professor, [Professor name], she's a woman. So, I feel like she has the understanding of what it's like being an industry professional as a woman ... Normally, in my experience, when we have a guest lecture, it's someone who I don't really relate to.

Our analysis reveals that these three different personalities shape previous RPs' experiences and feelings about GLs; and, therefore their mindsets going into subsequent guest lecture engagements.

Phase 2: Introductory GL Phase

This introductory GL phase captures how prior salient self and GL definitions interact with important introductory GL moments to influence student-GL psychological distance perceptions and attentiveness during new GLs. While few RPs have prior positive feelings about GLs and are excited about upcoming GLs, most RPs have prior negative GL experiences and express uncertainty and mixed feelings about subsequent GLs.

During these introductory moments, guest lecturers introduce themselves to students. Students observe and form initial perceptions of the guest lecture. Earliest observations include the number of lecturers in any GL. While RPs value single guest lecturers, they express preference for dual or multiple lecturers to enhance diversity in GL attributes and behaviors. RPs also observe guest lecturers' demographic (age, gender, race) characteristics and interactional behaviors. They also learn about GL expertise (discipline, position, company) and topics (technical, entrepreneurial, social). These new observations and knowledge result in internal comparisons as RPs note similarities and differences between their salient attributes and the attributes of GLs. Although present in the same learning space as GLs, together these similarities and differences result in RPs perceptions of a psychological distance between themselves and GLs. We characterize this as the student-GL psychological distance perception. We found the magnitude (short, long) and type (technical, social, entrepreneurial) of psychological distance perception to be mostly related to the personality and aspirations of the RP, as well as the attributes of the GLs.

Due to their willingness to explore new experiences, RPs with open personality describe fewer and less intense technical, social, and entrepreneurial differences. They are less likely to describe demographic characteristics of guest lecturers. Therefore, regardless of GL attributes, these RPs express shorter psychological distances and sustain attentiveness as explained by Mariam:

So, I definitely, kind of go on that mindset, with like guest lectures, where I might not connect with it...but, kind of go with the open mind...his whole lecture was about essentially like general contracting... I wasn't too excited...I was like, okay, well, hopefully I'm able to get some information ... But then when he started presenting, I kind of got a little more excited about it just because I was able to connect with it.

We characterize Mariam's distance perception as technical because she is initially unexcited about general contracting content related to construction technology. Furthermore, her distance perception is characterized as short because Mariam remains open and connects with the GL. Therefore, Mariam sustains attentiveness during the introductory moments of the GL.

RPs with homophilic personality tend to pay close attention to the demographic and interactional attributes of guest lecturers. Where the lecturer has different demographic attributes, homophilic RPs express a long and social psychological distance with the GL as explained by Stacy:

I would really get more from a guest lecturer who is like ... freshly out of college, but it's like five to ten years removed... just to kind of get someone who is more in my age range that I can identify with, even a [Institution Name] alum. A lot of them haven't been [Institution Name] alums... It was two guys ... They were both like kind of in their 40s or 50s ... I value somebody who I can almost see part of myself in... In my years in college, I haven't experienced a guest lecture that has lightened the place... and then, some people I just can't lock in with... Like my attention, it was not sticking with the lecture.

Stacy's psychological distance perception is coded as social because she elevates age and institutional differences. Her distance perception is also coded as long because these differences are intense enough to cause her intermittent attentiveness during the GL.

With a conscientious personality, Paul comes to the GL prepared and remains attentive with little regard for demographic and personal attributes of GLs as stated:

I was kind of prepared to like, listen in, ask questions when needed to, to take their experience as my own...they were both like building construction...They were both alumni of [University], and then I heard like their backgrounds in the field and I was pretty impressed...I get really appreciative when like people of like a higher position than you ... They're already in the field, so, they can pass on that knowledge to you.

Paul elevates the guest lecturers because they possess more technical construction field knowledge so we characterized this psychological distance as technical. Also, the distance is characterized as short because he expresses appreciation for their field expertise and positions himself close to these alumni and expert GLs because he can learn from them. He sustains attentiveness during this introductory phase and is prepared to listen and ask questions.

Phase 3: Instructional Phase

This instructional phase captures how salient self-definitions and important instructional GL moments interacted to influence student responsiveness during GLs.

During these instructional moments, guest lecturers teach students. RPs learn and respond to GL teachings. They assess the type of GL content and delivery style, as well as the GL familiarity and relevance. Generally, RPs tend to respond better to new content which is relevant to their courses and aspirations, as well as delivered in an informal and interactional manner. RPs respond by listening, asking questions, completing tasks, avoiding distractions, and connecting content with other contexts. While open and conscientious RPs tend to respond better to technical and entrepreneurial GL content, homophilic students respond better to personal GL stories.

Like RPs with open personalities, Debbie remains open to the GL and demonstrates responsiveness by listening and learning how to utilize the Bluebeam software. She completes tasks and develops skills for practicing as a construction professional as explained:

We downloaded Bluebeam and then he taught us how to use it... I had to go back and find how to use the software...I could use a couple more skills under my belt before I went into the industry... So, I was like, okay, now, I have this in my back pocket.

With his conscientious personality, Paul remains focused on how the technical content in the GL was relevant and aligned with his Revit class which had similar requirements. He demonstrates responsiveness by observing and learning about building frames through structured slides and a video as explained:

They [Guest Lecturers] showed us the slides and there was even a video... I was kind of excited because I was like ... this is really the field I'm going into ... So, essentially in the video, it was a frame or work of a house ... I was impressed ... because I'm taking a Revit class where I'm required to do such things.

Like other RPs with homophilic personalities, Rahab elevated personal stories and connections over technical content as explained:

Typically, they're [Guest Lectures] more in-depth about how every day goes ... like scheduling, cost analysis... The ones that have been most impactful to me are the ones that explain their day-to-day life and kind of how they go about work as an individual rather than a company... I do remember them going more in-depth about like day-to-day life and personal experiences. I felt that was really important... It's easier to relate to people that way, and I can then see myself in the future and connect my life to these other people's lives in a way of like, 'oh, maybe this is something that I want to do.'

Rahab prefers personal stories as they are more relational and facilitate connections with her future. Therefore, personal stories make her relate better and strengthen her responsiveness during GLs.

Phase 4: Closing phase

This closing phase captures how salient self-definitions and important professional identity development GL moments interact to influence PID and regulation of construction aspirations.

During these closing moments, guest lecturers summarize and conclude lectures. RPs detach or intentionally network with guest lecturers. A few RPs desire to network but are unable to due to competing demands. Overall, RPs note that GLs improve professional identities by increasing professional cognition, emotions, and performance. Therefore, most RPs reconsider and regulate professional aspirations to better align with new understanding, feelings, and capabilities.

With new understanding about licensing, Mariam with her open personality, explores the potential of expanding her technical aspirations to include entrepreneurial aspirations as explained:

I would say it [GL] definitely improved it [PID]. Like, it's kept me still in the same mindset of, I want to go into the general contracting space, even if it isn't like out of college, doing my own and having my own GC, but just knowing that there is opportunities to like switch over and have your own company... I've ultimately realized, OK, yeah, maybe this just isn't for me. But I still showed that determination of let me at least explore, let me at least try... Every guest lecture I walked out of, it's just made me want to stay in the industry more because I either learned like a new application or a new technology.

With her heightened understanding of the importance of minimizing student-GL psychological distance by reducing demographic differences between GLs and students, Stacy became interested in becoming a guest lecturer. However, not just any guest lecturer. She generated a new aspiration to become an alumni guest lecturer herself as explained:

... let's say less of the actual technical stuff about being in construction, but more about the social stuff about being in construction... A lot of them haven't been [Name of University] alums... I hope that I'm able to come back to universities and make guest lectures, like make students take away more from guest lectures outside of what they would possibly learn in

class, speak to them on things that their professors might not cover or like what it's like going from being an intern or student to a new hire... I hope to improve guest lectures.

Stacy's alumni guest lecturer aspiration is characterized as a socio-technical aspiration because she wants to elevate social over technical content in GLs to connect with students who would have similar demographic and institutional characteristics. Stacy has already started reaching out to lowerclassmen as she appreciated receiving from upperclassmen when she was in lower class.

With a conscientious personality, Paul increases in understanding and further develops his technical skills. This increases his confidence in becoming a construction entrepreneur as explained:

Towards the end [of the guest lecture], ... I was satisfied with the outcome, satisfied with the information I learned... Essentially what I've been doing is for that Revit class, I've been looking at some models and I've been looking at like the harder parts of it... It [GL] has driven my self-esteem up, my confidence. Yeah. To essentially become to that level where I can work on something by myself to perfection.

While other RPs broadened or narrowed their aspirations, with a conscientious and focused personality, Paul remained focused on his original aspiration but went deeper into his aspirations.

Discussion

We present an emerging SAI-PID grounded theory that explains how important short-term academic-industry GL engagement moments and self-definitions interact to strengthen PID in construction undergraduates.

Theoretical contributions

Existing PID theories are mostly drawn from STEM undergraduate interactions in long-term academia-industry collaborative engagements and disregard SAI engagements [6]. Therefore, this empirical study extends PID theories by establishing the viability of SAIs in facilitating undergraduates' PID and subsequent commitment to STEM professions [39]. By demonstrating how SAI moments impact PID and subsequent regulation of professional aspirations, it is evident that PID is not limited to long-term engagements [6].

Rather than existing literature portraying GLs as one homogenous short-term event, our novel four-phased framework highlights heterogeneity and sequential progression of moments within GL engagements to support PID. Also, while previous studies highlight the impact of GLs on student outcomes, our grounded theory framework utilizes four phases to explain the processes by which GL moments interact with undergraduates' attributes to influence PID [30]. Also, rather than positioning all undergraduates as one homogenous group participating in GLs, we demonstrate that the varied personalities and experiences of undergraduates drive their subjective GL preferences and PID. Lastly, we extend existing GL literature by explaining GL interactions with PID in a new STEM undergraduate population – construction undergraduates.

The novelty of our work lies in our introduction of the first multi-dimensional and multi-phase SAI-PID grounded theory. Our SAI-PID framework highlights key relationships among diverse identity content, process, and contextual variables that contribute to PID in undergraduates [25][36].

The core phenomenon of this grounded theory highlights PID through important SAI moments. SAI-PID is evident as undergraduates acknowledge growth in professional cognition, emotion, and performance. Nevertheless, compared to performance, SAIs are more effective in increasing professional cognition and emotions [31]. This signifies a key difference between SAIs and long-term engagements. This is because SAIs provided scant opportunities and time for professional practice and socialization.

The causal conditions of this grounded theory include personalities, prior feelings about GLs, and important GL moments in undergraduate contexts. These are fundamental to the origination of the SAI-PID phenomenon. Our three different personalities are associated with variations in values, attitudes, and situational meanings. Therefore, personalities are the lens through which undergraduates interpret and adapt to different situations that emerge during GLs [46]. This is because personalities capture inclinations to think, feel, and behave in specific ways in various contexts, to include undergraduate GL contents. Furthermore, our findings revealed that experiences during previous GL engagements are stored in undergraduates' minds and influence the mindsets and feelings expressed when approaching new GLs. The categorization of prior self-definitions and GL feelings in the pre-GL phase of the framework establishes that even before the GL begins, most undergraduates have a heightened sense of uncertainty about the GL. These prior conditions influence students' expectations of GLs, as well as their initial observations of GLs and the meanings that they make of those observations. Adopting the constructivist underpinnings, our theory highlights the critical agentic role played by prior and varied student and GL definitions in the SAI-PID process. Beyond the important pre-GL moments, important introductory, instructional, and closing moments are connected by time and sequentially contribute to SAI-PID [30].

The intervening conditions of this grounded theory highlight situational factors that influence strategies that undergraduates take in response to the core phenomenon. With increasing observation and knowledge of GL attributes, the personalities of students influenced the meanings construed from important GL moments. Together, similarities and differences between self and GL attributes shaped the magnitude and types of internalized psychological distance between students and GLs [37]. Undergraduates with open and conscientious personalities tend to express short psychological distances that were mostly focused on GL expertise. Undergraduates with homophilic personalities tend to express longer psychological distance between themselves and GLs with dissimilar demographic and institutional attributes. While increased similarities between student and GL attributes shortened psychological distance perceptions and sustained attentiveness and responsiveness, increased differences lengthened distance perceptions and resulted in intermittent attentiveness. Nevertheless, although not always successful, undergraduates put in effort to minimize this psychological distance when possible.

The strategy categories of this grounded theory highlight actions taken by undergraduates because of the core phenomenon. They include stabilizing attentiveness, directing responsiveness, and

regulating construction aspirations. Attentiveness and responsiveness are key mediating variables. Attentiveness involves being alert and concentrating on GL content. This is an important step and allows undergraduates to minimize distractions and stay focused on key GL content. Responsiveness involves participating and following directions to solidify knowledge, understanding, and application. With new understandings from GL, undergraduates modified or maintained their original aspirations. While open students tended to consider expanding, switching, or narrowing technical and entrepreneurial aspirations, homophilic students tended to expand or generate new sociotechnical aspirations [46]. Their homophilic personality gives them a heightened awareness of social needs and values which they incorporate into their future professional aspirations. With a focused attitude, the conscientious undergraduate gained increased confidence to maintain current technical aspirations. This student wants to grow deeper into his specialization aspiration, rather than broader to consider other specialization options.

We identified one unique outcome which was the consequence and result from the implementation of strategies to support the phenomenon. To date, all undergraduates noted an increase in their commitment to construction professions.

This framework introduces linked and varied identity content, process, and context variables to inform future investigations on PID, GLs, and other short-term academia-industry collaborative engagements [32]. Lastly, we introduce a key intervening variable, student-GL psychological distance perceptions, that captures internal negotiations within undergraduates during GLs.

Research contributions

We demonstrate that the constructivist grounded theory methodology is beneficial for studying the agentic processes within short-term academia-industry engagement moments that contribute to PID in undergraduate STEM students [41].

Practical contributions

This emergent SAI-PID theory informs the proactive selection, design, and implementation of short-term academia-industry collaborations that influence PID in STEM undergraduates [36]. The sequentially phased SAI-PID framework can be utilized to plan different phases of new GLs to facilitate PID and increase undergraduates' commitment to construction aspirations. To reduce undergraduates' levels of uncertainty and negative feelings about GLs, it is important that professors give undergraduates the opportunity to learn about the guest lecturer(s) prior to the day of the GL. Furthermore, to reduce student-GL psychological distance perceptions, professors should endeavor to select guest lecturers who have attributes that match salient undergraduate attributes, aspirations, and expectations. This implies that professors should observe and understand students bearing in mind that each cohort of students is likely to have different attributes. Also, alumni guest lecturers are preferred by undergraduates because they tend to have similar disciplinary, demographic, and institutional attributes as undergraduates. It is recommended that GLs have a minimum of two guest lecturers. This will facilitate diversity in the attributes, behaviors, and content of guest lecturers to assure more connection points and reduce psychological distance perceptions of all undergraduates within a guest lecture. Furthermore, guest lecturers should be made aware of undergraduates' attributes and preferences to inform their

preparation and delivery of GLs. Guest lecturers should consider incorporating more practical and interactional activities in GLs to strengthen students' capacity to act as professionals – a critical component of PID that was lacking in undergraduates SAI-PID [10]. Lastly, undergraduates should be provided with self-regulation options and tools to enhance their capacity to remain attentive and responsive, regardless of GL attributes.

Limitations

A key limitation of this study is that it is a work-in-progress with a small sample size of 10 construction engineering and management RPs. Therefore, the emergent SAI-PID framework is still evolving, and findings are limited to undergraduate construction students in the United States.

Assumptions

We assumed that RPs are objective and truthful. Also, their narrations draw from accurate memories while future aspirations narrations are based on rational speculations.

Conclusion

Our findings establish that SAIs like GLs are viable sources for strengthening PID in undergraduate students. This work-in-progress study is the first multi-dimensional and multi-phase grounded theory that sheds light into the complexities of PID processes in undergraduate students during SAI. We contribute to the design of SAIs by highlighting that an understanding of undergraduates' personalities, pre-SAI experiences, SAI preferences, and professional aspirations are critical for the design and implementation of SAIs. Minimizing the differences between student and GL attributes is essential to maximizing attentiveness, responsiveness, and PID. Therefore, alumni guest lecturers tend to be preferred by undergraduates due to disciplinary, institutional, and demographic similarities. Diverse identity content, process, and context variables are highlighted to inform future dialogues, investigations and interventions to improve short-term STEM industry-academia workforce development collaborations and strengthen PID and students' commitment to construction professions. Future work should focus on validating theoretical linkages among key variables utilizing quantitative methodologies and other STEM undergraduate populations to strengthen the generalization of findings. In the long term, improved PID could contribute to reducing persistent STEM workforce shortages.

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