

Board 102: Exploring Professional Identity Formation in Undergraduate Civil Engineering Students Who Experience Disabilities: Establishing Definitions of Self

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Abstract

The ways in which students encounter school can markedly shape how they form professional identities and continue into the engineering workforce. This is particularly true for those students who experience a variety of disabilities, as they must simultaneously manage and navigate disability-related cultural, academic, physical, and bureaucratic university structures and form professional identities. In this paper, we describe the evolution of an ongoing NSF-sponsored project exploring professional identity formation in undergraduate civil engineering students with disabilities as they experience their undergraduate careers and move into the workforce. To provide context for this ongoing work, we summarize the background, sensitizing concepts, and updated research procedures underpinning this study. We then focus our discussion on our emergent findings to-date, which include the identification of a sub-process referred to as *Establishing Definitions of Self*. Overall, these findings begin to highlight the nuance and fluidity of disability identity as students form professional identities as civil engineers.

Study Background

Recent research estimates that approximately 13% of U.S. college students identify as individuals with disabilities [1], with 4.3% of those students enrolled in engineering programs [2]. However, disability studies scholars speculate that these numbers are inaccurate. Due to the personal and self-reported nature of disability status, the use of systemic procedures that rely on medical definitions and official diagnoses of disability, and the stigmatization of disability in U.S. culture [3], the number of students with disabilities within higher education and engineering education is likely greater than current estimates, although this number is difficult to accurately capture and track.

The underrepresentation and marginalization of students with disabilities in secondary and higher education, particularly within engineering, reflects the lack of student support within the K-12 space [1], [4] as well as the lack of scholarly attention in leading higher education journals [1] and engineering education research [5], [6]. Prior work has shown that the ways in which engineering students with disabilities encounter school can significantly shape the ways in which they form professional identities and continue into the engineering workforce [1], [7]. More specifically, these students must manage and navigate specific disability-related academic, cultural, physical, and bureaucratic university structures and form professional identities differently from nondisabled students [1], [8]. Despite these unique challenges, there is little identity research with this demographic [5] within engineering education. At the same time, the field also lacks research that considers disciplinary influences on identity formation [5]; the majority of this work has been dedicated to generalizing professional identity formation to all or multiple engineering majors [9], [10].

In this ongoing study, we address this paucity of research by utilizing grounded theory approaches to understand how engineering students with disabilities in U.S. universities develop,

or fail to develop, professional identities. Because practices and experiences can vary widely across fields, we scope our exploration to a single engineering discipline: civil engineering. We choose civil engineering as the disciplinary focus to provide some level of continuity across participant experiences and a meaningful point of comparison across institutions. Further, as the second oldest engineering discipline and one of the largest [11], civil engineering provides a broad starting population for recruitment and plays a central and pervasive role in the development of national infrastructure and society [5]. Moreover, civil engineering has also codified a clear and distinct body of knowledge (BOK) [13] for the profession that supports consistency across programs nationally.

The overarching questions to be addressed in this study include: 1) How do students with cognitive, developmental, or physical disabilities form identities as civil engineers during their undergraduate programs? and 2) How do students with cognitive, developmental, or physical disabilities form identities as civil engineers during their first year at work? In this paper we focus on data collection and analysis to-date.

Sensitizing Concepts

To expand on the Advancing from Outsider to Insider (AOI) Model developed by Groen with McNair, Simmons, and Paretto [12], three frameworks served as sensitizing concepts for this study: social identity theory [14], [15], intersectionality [16], [17], and identity salience [18]. Social identity theory posits that individuals partially define who they are through member comparisons and self-categorization based on valued meanings and regulatory influences to which particular groups ascribe [19], [20]. Intersectionality [16], [17] serves as a lens for examining interrelations among various dimensions that constitute a single individual's identity [18]. Identity salience and multiple dimensions of identity suggest that a core sense of self is influenced by a variety of identity dimensions that become more or less salient as individuals interpret and make meaning of the contexts and interactions around them [18]. Within the context of this study, we recognize disability as both a social construct or categorization [1] to which individuals are socially assigned or ascribed and a dimension of one's concept of self.

Research Methods: A Brief Overview

To gain a deeper understanding of the ways in which students understand and experience disability as they form identities as civil engineers, we are conducting a longitudinal grounded theory study to explore professional identity formation for this population. Aligning with prior research that examines nuanced experiences and access requirements of students with disabilities in higher education (see [21] - [23]), the utilization of grounded theory methods allows us to dive into student experience to gain rich insights into why and how they form professional identities as they encounter perceived engineering-related activities and events during their undergraduate and early-career experiences. An in-depth discussion of the grounded theory methods employed within the larger study, including participant recruitment approaches, are presented in [5] and further highlighted in [24]. Here, we describe the initial grounded theory data collection and analysis phases completed to-date.

While participant recruitment remains open, a series of semi-structured interviews were conducted once per semester with participants. As of April 2019, we have conducted interviews with 23 participants, though the data collection and analysis described in this paper – completed in early Spring 2019 – includes only the first 17 participants (16 undergraduate civil engineering students and 1 recent graduate transitioning into the civil engineering workforce). Students eligible for participation were those who identified as experiencing any form of cognitive, developmental, physical, or mental health disability (for a complete list of recruitment and sampling criteria, please see [5], [24]. Each interview lasted approximately 60-90 minutes and was conducted using a combination of intensive and constructivist interviewing approaches [25] and critical incident technique [26]. The total number of interviews conducted with each participant varied based on the student’s enrollment within the study and their general availability. As shown in Figure 1, semesters in which the first 17 students actively participated in the study (i.e., conducted an interview) are shaded in gray.

Semester	FA2017	E																
	SP2018		E	E	E	E	E	E	E	E	E							
	FA2018												E	E	E	E	E	
	SP2019																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		Participant ID Number																
		<i>E indicates semester of study enrollment</i>																

Figure 1: Student enrollment and active participation to-date for first 17 participants

Conducting multiple interviews over time allows us to tailor each interview to participants’ unique responses and intentionally explore their experiences relevant to professional identity and disability [24]. To ensure that the interview process was accessible to our participants, we used a variety of media, including Zoom online video calls, phone, and, for one participant who preferred to type rather than talk, Google Chat. Interviews were audio-recorded and transcribed, and field notes were recorded to preserve the context and subtle implications of topics discussed by participants. As outlined in the constant comparative procedures of grounded theory [25], initial coding was conducted line-by-line and incident-by-incident for each interview to identify incidents related to professional identity formation and disability. Incidents were then clustered into themes according to concept (i.e., a translation of data that considers context, language, and speech acts)[12], [25], [27]. Researcher insights were captured as memos and discussed during bi-weekly team meetings. The findings discussed in the following sections represent the initial formation of a grounded theory and will further evolve as data collection and analysis continue.

Results: A Sub-Process of Establishing Definitions of Self

The constant comparative data collection and analyses conducted to-date resulted in the identification of a sub-process in which students establish and negotiate definitions of self. This sub-process within the larger AOI Model demonstrates the evolving and ever-changing nature of student definitions of self. As described in [12], and [5], [28], the AOI Model captures the

dynamic and iterative process in which civil engineering students employ a series of identity negotiations to advance from an outsider (i.e., an individual not belonging to a civil engineering group) to an insider (i.e., an individual belonging to a civil engineering group). Throughout this iterative process of identity negotiation, students' definitions of self-evolve as different identity dimensions become more or less salient within different contexts [18], [22], [30], [31]. This sub-process, in its current form, consists of the six grounded theory components as outlined by Charmaz [25]. Each grounded theory component and its associated representation, contextualized within the identified sub-process of Establishing Definitions of Self, is shown in Table 1.

Table 1: Current grounded theory model of the sub-process, Establishing Definitions of Self, based on components outlined by Charmaz [25]

GT COMPONENT/THEME	DESCRIPTION
Context: The research context in which the study takes place	
<ul style="list-style-type: none"> ● Civil Engineering Education & Early-Career 	This study takes place within the undergraduate civil engineering experience and the early-career workplace.
Core Phenomenon: The central concept or phenomenon on which the process under study is based	
<ul style="list-style-type: none"> ● Disability Identity Saliency 	The participant considers disability identity as integrated with or separate from their core sense of self.
Causal Condition: Factors that cause the phenomenon	
<ul style="list-style-type: none"> ● Experiencing or Discussing a Barrier or Difference 	A causal condition in which the participant experiences a barrier or identifies a difference that promotes the saliency of disability identity; can also include the identification of past experienced barriers.
Intervening Conditions: Broad and specific situational factors that influence strategies	
<ul style="list-style-type: none"> ● Requesting & Managing Accommodations ● Assessing Disclosure 	<p>An experience related to students' processes or requesting, managing, and implementing accommodations within the university setting.</p> <p>An evaluation process in which the student decides whether or not to disclose a salient yet non-apparent disability identity to an individual.</p>
Strategies: Actions taken in response to the core phenomenon that influence the outcome	
<ul style="list-style-type: none"> ● Navigating Sociocultural Expectations ● Managing Expectations of Engineering Career 	<p>Strategies that the participant employs to either align with or challenge the socially-constructed definitions, norms, and expectations of individuals with disabilities.</p> <p>Strategies employed by the participant to manage navigational expectations of their engineering education or career.</p>
Outcomes: Consequences of the employed strategies	
<ul style="list-style-type: none"> ● Defining & Identifying with Disability 	A process in which the individual determines the saliency of their disability identity.

While this identified sub-process generally captures the overall experiences of study participants, we note that students experience this process in nuanced ways that differ based on a variety of contextual and environmental factors (e.g., setting, people, characteristics of the experienced disability, etc.), resulting in differing levels of disability identity saliency [24]. To illustrate this sub-process, we present a cohesive narrative from a single participant that captures the each of the components.

Johnny is a recent graduate who was diagnosed with Attention Deficit Disorder (ADD) during elementary school. The first difference, or barrier, he recounted occurred during high school when he was required to take special education courses:

I didn't notice anything really in elementary or middle school. No, I was just a regular kid. I started noticing in high school probably a little bit more [...] I just thought I felt different when I was in those classes. That was in high school. I wasn't bullied, I just felt different. I didn't feel like a normal student. *(coded as experiencing or discussing a barrier or difference)*

His feeling of difference was further reinforced by reactions from his teammates, which prompted him to postulate the makeup of their academic course schedules as compared to his own:

I was on sports teams, and a lot of the kids were like, "Oh, man. That kid's in special ed," because all the people in sports team were in these advanced classes. They usually are in high school, I would assume. At least that's how it was for all the sports people at my school and they were, "Oh that kid's in special ed, he must be really dumb or something." *(coded as experiencing or discussing a barrier or difference)*

Johnny became interested in civil engineering throughout his high school career, which he attributed to his participation in his special education chemistry and physics courses as well as a weekend math and science program co-sponsored by his high school and local university. Upon entering his undergraduate civil engineering program, Johnny was required to request accommodations from his university student services office. Below, he describes this process of requesting his accommodations and assessing the implications of disclosing his disability to his instructors:

[...] except for three professors, everyone was really rude about [my accommodations]. [...] They would always ask me more questions than were necessary. That was about it. When I first requested [my accommodations], people were really, really rude. Like, "Really. Do you really want that?" They would bring up a really, I don't know, micro-aggressive tone, I would say. It wasn't until that I actually got to the resource center, then everyone was really nice. *(coded as requesting and managing accommodations)*

You have to tell [your professors] within the first week [of classes], that's essentially your first interaction usually. [...] It was uncomfortable, because I always thought they might not be cool with [my accommodations]. For a lot of them, honestly, [it] was the first time they ever had to do something. It was uncomfortable, and it made me feel like, "If I can't get [my accommodation] am I going to fail the class?" Because for a lot of those classes, 60% is exams. It was very intense. Sometimes [the professors] would actually send me back to the resource center to get extra verification that I wasn't trying to cheat or something. It was really weird. *(coded as assessing disclosure)*

In these segments, Johnny describes the variety of reactions he experienced as he requests accommodations within his courses. He then moves into a process of assessing disclosure where he considers the implications of not receiving his testing accommodation (i.e., failing an exam-intensive course without testing accommodations) and the potential assumptions that faculty may make about his character (i.e., being a cheater). Throughout his undergraduate experience, Johnny often had to advocate for himself and repetitively explain his disability to justify his accommodation. He experienced similar reactions from his peers:

. . . more often than not, they are like, “Did you drop the class? Why weren’t you in the exam? Why weren’t you in the room taking the exam with us?” People would always question. I explained that to them, and then people wouldn’t believe me in school. “I have a learning disability.” “Johnny, you’re right [on homework], why do you have to do that?” [...] The hard part was explaining it to my peers. A lot of my peers would never really accept that, really. [...] They didn’t believe me. (*coded as navigating sociocultural expectations*)

Johnny’s descriptions of his interactions with faculty and peers highlight broader societal expectations and interpretations often ascribed to individuals with learning disabilities. Despite his repeated explanations, it was difficult for Johnny’s professors and peers to comprehend and accept that one can have a learning disability and need accommodations while performing well in school. Despite these challenges, Johnny still remained identified with the civil engineering profession and often spoke about his learning disability as an advantage in conducting civil engineering-related work, particularly when reviewing legal documents while working as a transportation engineering intern in the government sector:

I’ll be reading something, let’s say a legal document, and I’ll forget, when I’m reading, where I’m actually reading. So let’s say if I’m reading a sentence, I’ll just forget in the middle of the sentence, and I’ll be like two or three sentences away. Or I won’t retain the knowledge that I read. In order for me to read something, I’ve got to read it multiple times. Which is actually good for me because I’ve caught a lot of errors at my internship with legal documents. It’s actually a positive thing. (*coded as identifying with disability; sub-coded as aligning disability with profession*)

From this perspective, Johnny highly identifies with his disability and positions it as an advantage that improves the overall quality of his civil engineering work. At the time in which this interview was conducted during the Spring 2018 semester, Johnny anticipated going to back to work for the same government entity as a full-time employee and continuing the work he had begun during his internship.

While Johnny’s sub-process of establishing definitions of self and its integration with his professional civil engineering identity led to professional success, this experience is not necessarily shared by all study participants. Notably, students encounter and navigate each identified grounded theory component differently. For example, Darren, a sophomore with a traumatic brain injury, does not formally request accommodations through his university; rather, he has developed and manages his own accommodation techniques such as bringing a recorder to

lectures when he is experiencing a “bad brain days” (i.e., days in which he knows he will have difficulty retaining course material).

These findings have been identified as a result of analyzing 17 participant interviews. Continued data collection, with a goal of recruiting 40 students, and analysis is necessary to expand on these themes and further glean out the nuance of each student’s experience of this sub-process. For more information on the evolution of these themes to-date, see [24].

Conclusions and Future Work

Within this paper, we describe the identification of a sub-process of *Establishing Definitions of Self*, resulting from initial analyses of interviews conducted with 16 undergraduate civil engineering students and 1 early-career professional who experience disability. While the overarching goal of this ongoing work is to create a theoretical model of identity development for undergraduate civil engineering students with cognitive, developmental, physical, and mental health disabilities, the sub-process identified herein begins to offer nuanced and contextual insights into why and how individual students identify with disability identity and community as they form professional identities as civil engineers. Methodologically, this sub-process advances our grounded theory data collection and analysis by providing a framework that will iteratively guide and expand future theory development. As previously mentioned, participant recruitment remains open-to-date with data collection and constant comparative analyses continuing throughout the remainder of the study. From this current and ongoing work, we are beginning to highlight the complexity and fluidity of disability identity as students form as professional engineers.

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