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Uncovering Forms of Wealth and Capital Using Asset Frameworks in Engineering Education

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Introduction

This work-in-progress paper presents the intermediate results from a qualitative research project for which we are seeking feedback from the engineering education community. The goal of our research is to elucidate the aspects of "capital," "wealth," and "knowledge" that are neither widely recognized nor valued by the engineering education community.

Critical scholars have described engineering education as an institution characterized as raced, gendered, and classed[1–5]. We agree with this assertion, particularly in that the current normative state of engineering education requires students to either adopt or adapt to a narrow range of assets and characteristics in order to pursue higher education. Our work aims to better understand the diverse experiences and perspectives of students and to dispel the myth of monoculture[6,7] in engineering education—that is, that there exists a single "normal" student experience. Our work is critical in that our study explores the potential for multiple, and perhaps unexpected, sources of capital, wealth and knowledge by investigating the experiences of recent engineering graduates using asset (rather than deficit) frameworks.

The intermediate results presented herein combine our "series of singular testimonies" method inspired by Peggy McIntosh's "serial testimony" technique[6,7] with two asset-based frameworks: Community Cultural Wealth (CCW) and Funds of Knowledge (FoK). In our research group's previously published 2015 ASEE paper[8] we describe the development of the singular testimony method in which we demonstrate the method's efficacy to elicit powerful testimonies. We also characterized how our participants interpreted their "unearned advantages" and "unearned disadvantages" with respect to their engineering education. We have since collected additional testimonies from early-career engineers and developed *a priori* and emergent codes during thematic analysis according to the CCW and FoK frameworks. We have also uncovered evidence of other forms of capital (such as spiritual capital) that are not currently included in the CCW framework. Thus, we believe that our work has the potential to extend these frameworks.

Theoretical Frameworks

We employed two established theoretical frameworks, Community Cultural Wealth (CCW)[9] and Funds of Knowledge (FoK) for this research[10-14]. The CCW framework asserts that underrepresented communities possess aspirational, familial, social, navigational, linguistic, cultural, and resistant capital—all of which are extrinsic to educational institutions. The FoK framework acknowledges that regardless of what society views as useful, students have skills and resources that can and should be used by the educational institution.

The following definitions of the tenets of CCW are taken directly from Yosso's work[9].

- *Aspirational capital:* The ability to maintain hopes and dreams for the future, especially when managing such aspirations against both substantive and perceived barriers.
- *Linguistic capital:* The intellectual and social skills attained through communication in more than one language or style, and which emphasizes the connections between cultural or racial history and language.
- *Familial capital:* cultural knowledges nurtured among family that carry a sense of community, history, and cultural intuition; expands the concept of family to include kinship.
- *Social capital:* networks of people and the resources/skills garnered through relationships, and community resources.
- *Navigational capital:* the skills of maneuvering through social institutions that have not been historically created for the population in discussion.
- *Resistant capital:* knowledges and skills fostered through oppositional behavior that changes inequality.

Developed by several scholars, the FoK framework is based upon skills and knowledge derived through filial origins of the Mexican household and the knowledge acquired within. FoK has been expanded to resemble Yosso's familial capital in the sense that it includes skills gained through tight-knit communities and expanded kin[10–14].

Typically used by education scholars to investigate the experiences of students of color, we are theoretically expanding the use of CCW and FoK to also include others who are currently underrepresented or marginalized[1–4,15] in engineering education, such as: first generation college students, women, lower socioeconomic background students, students older than the traditional college age, students identifying as lesbian, gay, bisexual, transgender or queer, and students with non-linear pathways into engineering study.

Research Question

The purpose of this paper entails identifying those specific assets that students bring from their background, culture, and life experience to their undergraduate engineering education by exploring the following research question:

> In the varying experiences of engineering students who are underrepresented and/or socially marginalized, what forms of capital, wealth, and knowledge are identified as significant?

Participants

Our participants are individuals who have earned a bachelor's degree in engineering within the last 10 years, and who are either currently employed or are continuing their studies as graduate students. We identify participants via chain and snowball sampling[16], utilizing our own professional and personal networks, as well those of our project advisory board members. Due to our focus on the participants' personal testimonies of their unearned advantages and disadvantages, we chose not to select or reject any participant based on our perception of their race, gender, sexual orientation or any other demographic characteristic. In an effort to be open to the unseen dimensions of participants' experiences, we are not making assumptions about

their realities. To date, some participants revealed how they self-identify with traditional demographic characteristics during their testimony, while others did not.

Methods

Throughout our entire research process, we utilize the quality management framework developed by Walther, Sochacka, and Kellam as a guide for ensuring aspects of quality and validity in interpretive research in engineering education for capturing the social reality under study[17]. This framework serves as a guide for both "making the data" and "handling the data" in qualitative work, establishing measures for process reliability and theoretical, pragmatic, procedural, communicative, and ethical validation[17]. An in-depth examination of our quality considerations for "making the data" can be found in our previous paper[8]. We are also currently developing quality assurance steps for "handling the data," and will describe these steps in a future publication.

Our qualitative research utilizes a one-on-one, semi-structured interview method[8] derived from McIntosh's "serial testimony" technique[18,19]. We developed an interview technique that is based upon two questions for participants: we ask each participant to tell us about unearned advantages and unearned disadvantages they have experienced in life. The rest of the interview is structured around follow-up questions to their "testimonies" and how these unearned advantages and unearned disadvantages may relate to their engineering education. At the time this current paper was written, we had conducted interviews with eight participants. Since then, we have interviewed more than 20 additional participants. While we will not have analyzed the entire data set by the 2016 conference, we do anticipate being able to discuss additional data not presented in this paper.

Two members of our research team analyzed the transcripts concurrently, and regularly met to debrief, discuss thoughts, and share memos regarding that analysis. Our thematic analysis uses *a priori* and emergent codes to categorize participants' responses based on our chosen theoretical frameworks of CCW and FoK. Our *a priori* codes include the forms of capital that make up CCW: cultural capital, social capital, aspirational capital, linguistic capital, navigational capital, resistant capital, familial capital; as well as funds of knowledge. The two coders discussed emergent codes and then independently made recurring passes through the transcripts to uncover evidence and seek coherence of emergent themes in a constant comparative manner[20,21]. These researchers periodically meet with the lead author to debrief and discuss the next steps.

Results to Date

Our summary of intermediate results (n = 8) is presented in Table 1. Our presentation of quotes provides an example of how we mapped participants' words (raw data) to the *a priori* themes corresponding to the CCW framework. Additionally, we include an example of an emergent theme. The rightmost column in the table indicates whether the participant categorized their statement as an unearned advantage or disadvantage (or both).

Table 1: Forms of capital and wealth salient in testimony data.

Theme	Evidence	Unearned Advantage or Disadvantage
Aspirational capital	One participant's lower socioeconomic origins was the catalyst for his persistence in engineering study in order to obtain financial stability: "All of the things that I didn't have growing up, I said I'd never go without those things again so it was always motivational for me to be successful." –Participant 4	Unearned advantage
Linguistic capital	One participant expressed her familiarity with cultural slang and dialect, yet attributed some of her success with white peers, professors, and colleagues to "talking white": "I used to get teased as a kid because people said that I 'talk white' . . . it's like if you pronounce your words a certain way or you're not really speaking the slang and things like that then they called that talking white . . . so it's been an advantage in a sense where I'm able to prove myself, I'm able to articulate things that I'm thinking and feeling and things in the workplace and environment . . . I mean people might judge me but once I start talking and I show them what I can do, then it's okay, she knows what she's talking about, she knows what she's doing." –Participant 3	Unearned advantage
Familial capital	While one participant described his parents' lack of education as contributing to his academic struggles, he also conveyed that they were the source of his everyday knowledge: "I think my parents' educational background, it helped me a lot in the practical street-smarts sort of senses but when it came to a lot of school-related stuff . . . My father likes math, but he couldn't understand a lot of it . . . I was more or less teaching *them*." –Participant 7	Both Unearned Advantage and Unearned Disadvantage
Social capital	One participant's exposure to engineers in a high school classroom influenced his decision to become an engineer: "There was a week of [Calculus] class where we had ended up so far ahead in what he had planned for the curriculum, he's like, 'I've got a couple friends from different walks of life. We're gonna have	Unearned advantage

	one of them come in every, each day this week, and they're gonna talk about what they did' . . . An [electrical engineer] came in . . . talking about what he did, showing us some of the stuff he does at work . . . So, I think that's where I made that switch, like sophomore year of high school was when I really got behind engineering" –Participant 8	
Navigational capital	One participant's financial situation required him to earn money to pay for his education. He obtained a job working with the football team, which required him to manage his time carefully: "Being forced to have to manage your time. I mean, I think a lot of people would talk about it and it was the case with me, too, is that I would generally have better GPA's during the football season than I would in the off season and I think some of that had to do with you were forced to learn time management because you had no choice, you know." –Participant 5	Unearned disadvantage
Resistant capital	One participant described how his classmates labeled him with the "dumb athlete" stereotype due to race and natural physical build: "I had to show [my classmates] that I did the work and [it was] not just a fluke, I guess I had to explain the work in way, they was, okay, he know the material, opposed to explain[ing] that I got the answer from someone else . . . I had to go more in depth even to the point where they didn't know what I was saying, but they understand I knew what I was talking about." –Participant 1	Both Unearned Advantage and Unearned Disadvantage
Funds of Knowledge	One participant gained both a strong work ethic and hands-on skills through his relationship with his father: "[My father], I guess he was kind of tough on me growing up. He'd always had me doing work around the house, fixing the car, or helping him out on the car, welding things, but in retrospect … I like to think that the values that I have now, the work ethic, is a direct result that it, he taught me to have initiative. He put it as '*acatar*', which is basically . . . having the intelligence to not to wait to do something. If you see that	Unearned advantage

	there's something that needs to be done, you just do it." –Participant 6	
***Spiritual/ Religious Capital**	One participant strongly attributed much of his success in academics and life to God and his spirituality: "And at times you need to believe in a higher power when you're at your lowest point. I prayed before every test I took. In life actually. And it's just my belief that God will get me through, guide me through in a sense. There's no question that if I hadn't had faith behind me that I wouldn't have been as successful as I am now because I know that's what I depended on and it proved to be what I needed." -Participant 4	Unearned advantage

*Spiritual or religious capital is not included in the CCW framework, but has been suggested by Espino[22], and was emergent in our findings.

Conclusions to Date

Our work promotes the use of asset-based theories and language within the engineering education community[23]. The testimonies of our first eight participants demonstrate how *differences from,* as well as similarities to, the norms valued in engineering education contribute to student success. Findings to date reveal that our testimony technique elicits salient aspects of CCW and FoK in our participants' life experiences. We have also found evidence of other forms of capital that are not currently included in the CCW framework, such as spiritual capital. Thus, we believe that our work has the potential to extend these frameworks.

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