Where does the Personal Fit within Engineering Education? An Autoethnography of one Student's Exploration of Personal-Professional Identity Alignment

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I am a senior at Seattle University pursuing a major in civil engineering. I am deeply interested in structural engineering, and I aspire to use my technical skills gained through education to serve and improve society. As my education progresses, so does my desire to learn, both on a technical level and on a social level. Understanding how engineering relates to society has been fundamental to my undergraduate experience. I plan to continue on a path of lifelong learning as I hope to obtain a graduate-level education in the future. My engineering identity and career are underpinned by a hunger for knowledge and a desire to serve.

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Abstract

This paper presents an exploration of personal-professional identity alignment through the use of an autoethnography. To understand identity and identity formation, my research advisor and I drew from post-modernist perspectives of identity as being highly contextualized, co-created between the individual and their surroundings, and neither singular nor stagnant. I am a senior, male undergraduate engineering student who worked as a research assistant in a separate engineering education study on engineers' imaginaries of "the public." My exposure to documents and interviews associated with this work began to illuminate and sometimes even change my views of personal identity, my understanding of my engineering identity, my perception of core values within the engineering profession, and how those elements interacted. Analysis of three of my journal entries through a lens of identity formation showed evidence of misalignment between my personal and professional identity expectations and experiences. This misalignment brought into question for me my fit within "the system" – the way I was trained, what I was trained for, and the larger views of the engineering profession with respect to how I should contribute to society.

Introduction

One way to look at many of the challenges facing the engineering community is to focus on the ways in which engineering systems (educational or professional) relate to the individual. From K-12 outreach for encouraging interest in engineering, to first-year undergraduate programs for retaining incoming students through graduation, to transition work for understanding why some graduates pursue engineering careers and others do not – these efforts all involve discussions about how the individual fits or does not fit within "the system" and what the individual can do to help develop a better fit. For example, several studies have looked at the effects of a non-inclusive culture in engineering and how to make students, especially those from underrepresented groups, more resilient in this "chilly" environment [1-3]. Additionally, research suggests that the degree to which the individual's personality aligns with the dominant values of the environment they are in, such as an engineering program, the higher their likelihood for satisfaction and success in that environment[4].

Some recent studies have begun to look at the engineering culture itself to see if, instead of programs to help make students more resilient, there might be ways to make the engineering environment more malleable. However, there exists immense rigidity in educational systems that try, generally, to employ one-size-fits-all approaches to education, largely ignoring (or even never asking) how the system fits or does not fit within the individual and what the leaders of the system can do to foster a better personal-professional identity alignment, when such alignment does not already exist.

This paper explores the question of personal-professional identity alignment and, by extension, individual fit within "the system," through an autoethnography. Autoethnography is a qualitative research and writing technique that combines traditional autobiographical and ethnographic methods to examine personal experiences in order to gain insight into the larger

and multi-faceted culture in which these experiences take place[5]. This approach places value on the subjectivity of the researcher, acknowledging the inherent bi-directional influences between this individual and the culture they are studying. The autoethnography herein focuses on one student's experiences of identity formation and reflection spurred by his involvement in a research project about engineers' imaginaries of "the public." These experiences are discussed in three journal entries and analyzed with the lens of identity formation described below. Through this research, the student was able to gain a deeper understanding of experiences foundational to his personal and professional identities as well as throw into relief core cultural dimensions of engineering education. The process opened for the student a new set of questions concerning his fit within "the system."

Identity Formation

In this study, we draw from post-modernist perspectives of identity as being highly contextualized, co-created between the individual and their surroundings, and neither singular nor stagnant. One's identity, according to these perspectives, is informed within and by the social contexts in which one operates[6]. We use the model of "communities of practice," [7] which refers to learning that occurs in groups through participation and practice, to look at cultural and structural elements of engineering education that are taught informally and implicitly and how these elements might influence professional identity formation. This theoretical lens has been used in several studies examining the cultural production of engineering identities [8-10]. Related to "communities of practice" is the concept of "communitarianism", which also informs our analysis. "Communitarianism" focuses on traditions and social context of a learning community.

Looking at a broader range of professions, Reid et al.[11] used the concept of "communitarianism", which focuses on traditions and social context of a learning community, to explore the professional formation of college students, including some engineers. They found that the learning community itself contributes to students' "sense of being" in that students align their personal and professional identities with respect to the qualities they see or derive from their academic field. In this study, the autoethnography is an examination of the first author's position in the "community of practice" of engineering education. Through reflexive inquiry, the first author explores his evolving identity and relationship with the culture of the engineering profession, as this culture manifests itself in messages from engineering peers, faculty, and professional documents. Furthermore, he explores the multiple facets of his identity in varying contexts, all toward better understanding his "sense of being" within the engineering profession.

In his study of how professionals learn to fit in as they progress to new roles in their organizations, Ibarra [12] used the term "provisional selves" to talk about the experimental phases of identity formation as one adjusts to new expectations and sometimes even new organizational cultures. He witnessed several forms of experimentation that advancing professionals use, including imitation, efforts to remain true to one's self and ideals, and use of internal and external feedback mechanisms to evaluate their developing "provisional selves." Ibarra defined these strategies as "the degree of congruence between what one feels and what one communicate[s] in public behavior about one's character or competence"[12] (p.778). With its focus on personal-professional identity alignment, this autoethnography employs the second form of experimentation, "true-to-self strategies", to identify overlaps and gaps between his personal and professional identities. In other words, this autoethnography serves as a vehicle for the exploration of the first author's "provisional self" during the transitional period of senior year and, by extension, his fit within "the system" and "the system's" fit within himself.

Research Context

The larger study in which the first author served as an undergraduate research assistant focused on engineers' imaginaries of "the public." This work draws on a theoretical framework of social imaginaries[13] to see how engineers conceptualize "the public" and how these views may affect the ways in which they approach real-world problems with diverse stakeholders. A framework of social imaginaries focuses on "the ways in which people imagine their social existence, how they fit together with others, how things go on between them and their fellows, the expectations that are normally met, and the deeper normative notions and images that underlie these expectations"[13] (p.106). Examining engineers' social imaginaries of "the public" focuses on perceptions of "the public," formal and informal processes that shape these perceptions, and how these perceptions are expressed through interactions between engineers and diverse publics with which they interact.

The first step in this broader study was thematic analysis of 14 key engineering documents such as the National Academy of Engineering (NAE) report *Educating the Engineer of 2020* [14] and the American Society of Civil Engineer's *Body of Knowledge V.2* [15], for institutionally sanctioned characterizations of the public, definitions of the proper relationship between engineers and the public, and visions of the role of engineers/engineering in society see [16]. Coding these documents – which was carried out through a collaboration between this paper's three authors – was one of two experiences that the first author explored in his journal entries. The second experience was his transcription of interviews, conducted by the second and third authors, with engineering students and faculty concerning their conceptions of "the public" and views about the relationship between engineering and "the public." The first author was not present during these interviews. However, his transcription of the interviews was disclosed to all interviewees as part of the study's informed consent process.

Authorship

In light of the fact that this paper was written collaboratively and the coauthors had relatively distinct roles, we would like to clarify who authored which sections. The introduction, literature review, description of the research context and methods were largely written by the second author, an engineering professor who is a Principal Investigator (PI) on the broader study on social imaginaries and a research advisor to the first author. The journal entries, their development into more formal narratives, the short analysis that related the narratives back to the identity theories, and the overall discussion of personal-professional alignment and individual-system fit, were written by the first author, who is a senior civil engineering student. The third author is a medical anthropologist and is co-PI on the study examining engineers' conceptions of "the public." This author served as an advisor for the paper, to improve its analytical conceptualization, focus, and clarity.

Methods

This study used an autoethnography to examine formative experiences for the first author as a result of his engagement with the research by the second and third authors on engineers' social imaginaries of "the public." The goal of autoethnography is to "concentrate on ways of producing meaningful, accessible, and evocative research grounded in personal experience – research that would sensitize readers to issues of identity politics, to experiences shrouded in silence, and to forms of representation that deepens our capacity to empathize with people who are different from us" [5] (p.274). An autoethnography should draw the reader into the narrative and, ultimately, inspire them to critically examine their own life experiences, as well as cultural

contexts surrounding those experiences, in a similar fashion[17]. To achieve this, autoethnographies are written in narrative form (drawing from the biographical) and focus on moments of change for the researcher that are then used to develop insights into larger social systems. Recently, autoethnographies have been used in engineering education to study the preparation of engineering students for work on culturally taboo topics[18], experiences of misalignment between one student's personal history and dominant messages in the engineering profession[19], and experiences of first-year faculty in engineering education[20].

The notions of "reliability" and "validity" are different in autoethnography from traditional scientific research, due to the highly personalized experience as the base data source. In autoethnography, "reliability" refers to the narrator's credibility and is examined through the question of "could the narrator have had the experiences described, given available factual evidence?" [5] (p.282). For evidence of reliability in this study, we present a biographical sketch of the first author and his background as well as a discussion of traits and experiences that have shaped his perspectives.

"Validity" in autoethnography refers to the authenticity of the work and its ability to "evoke in readers a feeling that the experience described is lifelike, believable, and possible, a feeling that what has been represented could be true" [5] (p.282). The authors have attempted to be thorough and transparent in their description of context, data development, and analysis as evidence of validity for this study. A detailed discussion of how this study was conducted and how data were developed from broad journal entries into tightly structured narratives is provided below as further evidence of validity.

Study development process

This autoethnography began as the first two authors discussed interviews that the first author was transcribing, key documents from engineering societies he was coding, and his overall personal connection to the research by the second and third authors. The discussions were meaningful and frequent enough that the first author was encouraged to create audio journal entries reflecting on experiences he was having that provoked in him reactions or new thoughts, or that evidenced change or growth. Three of these journal entries were chosen to be iteratively developed between the first and second authors, with writing mechanic and story development assistance from the campus writing center into the narratives presented in this paper. After all three narratives were written, the first and second authors examined them collaboratively to form the basis for the analysis in this paper.

Narrative validity

Three narratives are provided below as part of the first author's autoethnography. The first is a recreation of a conversation between the first author and a civil engineering peer. For this narrative, the quotes are paraphrases written by the first author and subsequently discussed with the peer for accuracy. These approximated quotes were created to reflect the trajectory and theme of the conversation. The second narrative draws from an audio file of an interview that the first author transcribed. This interview, with an engineering professor, was carried out by the third author. Quotes used in this narrative are exact. Similarly, the third narrative draws from a professional document and also uses direct excerpts as the foundation for reflection. For the second and third narratives, the featured quotes were captured generally in the initial audio journal entries and presented with precision in the written narratives.

Biographical Context

The suburban hometown in which I grew up is situated near a large Boeing plant. Most residents in the area are employees of the plant, in well-paying jobs that place them in the middle to upper-middle class income bracket. Additionally, the demographics of the schools I attended were predominately white, with some Asian students but with very few African American or Latino students. In middle school, five black American kids from neighboring, less well-off cities transferred to my school through a permit process. Through sports like football, they became some of my closest friends. One of them, Gabriel, who is an African American born in Ethiopia, became my best friend.

My parents used to give me rides to these friends' homes, which were often located in what people from my town called "struggling neighborhoods." My parents may have noticed the all-too-frequent lack of stability in many of these friends' homes, which manifested itself in hardships like financial struggles, parental absence, and compromised neighborhood safety. Perhaps in response, they implemented a permanent "open door" and "full fridge" policy, which meant that if any of my friends needed a place to stay or a meal to eat, they were welcome to our home. My parents didn't formally disclose this to me until the beginning of high school, but I didn't need to hear their disclosure to notice the opening of our house even sooner: they remodeled our basement, purchased a couch large enough to sleep several people, and bought an extra refrigerator that was constantly stocked with drinks, snacks and leftovers.

Beginning our junior year of high school, Gabriel's mother found herself having to relocate across the country and, rather than forcing Gabriel to leave his school and friends, my parents allowed him to move in with my family and make our basement his home. Over the three years that Gabriel lived with us, we became like brothers. Ours was a unique "brotherhood," not only because of our racial difference, but also because Gabriel had experienced homelessness, racism, and paternal and maternal absence – quite opposite from my own experiences. In times of need, my other black American friends would also eat and temporarily stay with us. The presence of these friends in my life opened my eyes to my own privilege and helped me realize that having the same bed to sleep in every night and a constant supply of food weren't a given for everyone else around me. In high school, I found myself expanding this realization beyond basic accommodations to our society's essential infrastructure. In the engineering class I took at the time, which broadly introduced me to the material innovations of all types of engineers, I couldn't help but think about how I had taken basic forms of infrastructure for granted and how I had benefited from "simple" things like steady shelter and cars that other people, like Gabriel and my friends, had not. It was this awakening that nudged me to choose engineering as my major in college.

As a white, upper-middle class, male civil engineering student, in a private, urban, liberal arts university, I found myself fitting the stereotypical mold. One instance I recall when I recognized my comfortable upbringing as "the norm" was during a reflective exercise called a "privilege walk" that I participated in with my peers in a sophomore level engineering class. In this exercise my class responded to questions about experiences of "privilege" by taking a step forward or backward: steps forward signified a positive response, steps backward, a negative. The questions centered on experiences such as having parents that read to us before bed, if we have been discriminated against, and if we had to work to help support the family. While there was some diversity of responses among my peers, the majority of us took more steps forward than backward, resulting in our final positions being well ahead of the starting point which was

key for me in recognizing my similar privilege relative to my peers regarding things like race, gender and economic upbringing.

Like most of my civil engineering peers, I found myself on a predetermined track for achieving my major, beginning my freshman year. From then through senior year, my classes were meticulously planned out and varied little from my peers' due to constraints by the engineering program at my school. It seems to me that this "one-size-fits-all" approach allowed my program to achieve with precision and control synchronous learning among students. If there were critical moments within the engineering curriculum that were intended to be formative of our engineering identities, then we most likely experienced them together and simultaneously.

Though we are imbedded in the same curriculum, I have noticed that within classes my involvement and interest in the material has often been different from that of my peers. I frequently get carried away in conversation with professors during class because I get excited about the depth and breadth of the knowledge they possess. Conversely, I have felt that the majority of my peers have been there to achieve a grade about which they feel good. Upon reflection I have concluded that my ambitions in education come largely from my desire to learn rather than to secure satisfying grades. I think that it has been this ambition that has caused me to dig deeper into questioning some concepts that may not have been relevant to a test or homework, but that I saw as imbued with value. I have attributed my relationship to learning to my parents who never placed value on grades. In fact, elementary school was the last time they asked to see my grades. In short, I think that my academic "pulse" comes simply and solely from a heart of curiosity and desire for knowledge. In terms of identity development, I experienced the same curriculum as my peers but may have received them differently due to my differing motivations.

It is with this background and initial sense of self that I approached the writing of the three narratives that follow. Within each narrative there is analysis that comes from my immediate processing of the experience. After each narrative, I provide further analysis which helps to connect the narratives and place them in the larger context of personal-professional identity alignment. At the end of the paper, I present a final analysis of how my experiences might be useful in thinking more broadly about the question of individual-system fit in engineering education.

Narrative 1

I am with Brooke (pseudonym), a mechanical engineering student at my university, walking down a residential sidewalk in the city. We stride past a building that houses a small organization that is responsible for handing out food to homeless people. I pass this organization everyday on my way to campus so I recognize some of the homeless people receiving their meals, sharing a nod with them and receiving one back.

It pains me to walk past this group of people as, thinking about my friends from high school, I attempt to imagine myself in their shoes. I consider the daily trials they face and the physical and emotional toll that homelessness must take on one's life. I reflect on my three years of engineering education and feel like I have made no impact through engineering, especially on underserved communities like the one in front of me. I thought that my undergraduate training would not only connect me to organizations that work on a systemic level to fight social problems like homelessness, but also that it would equip me with tools to contribute similarly to systemic level solutions. I assumed that, even if these connections weren't made and tools

weren't provided, that I was strong and driven enough to bring this type of meaningful service work into my education. I thought that before my senior year I would have joined organizations like *Engineers for a Sustainable World*, or started a club, or inspired others to demand some direct connection between our learning and problems facing underserved communities around us even if my education hadn't. But in the end, I chose not to take such initiatives due to the time they would take, which would ultimately impact my studies. I feel that I have failed to apply my education in the ways I intended, and this causes me a tremor of anxiety.

Whatever Brooke and I are talking about is forgotten as I nervously consider sharing my disappointment with her. Prior to this interaction, I often sat in my thoughts alone but this time I see a door of opportunity to vent. Though I experience a strong desire to share my feelings, I notice that I also feel resistance, fearing that I might be judged. In my engineering training, conversations about underserved communities are rare and when they are brought up they are often treated like an unwanted deviation from the lessons being covered in class. I fret that Brooke won't understand my empathy for the homeless. Three blocks later, I gather my thoughts enough to open up to Brooke. "Honestly… (I clear my throat), I hate myself for not having done more by now. I've seen homeless and hungry people all year and still haven't done anything to help through engineering, ya know? Like buyin' them a meal or handin' them a dollar is cool and all, but what have I done to systematically help? It just makes me feel like I'm failing in what I think my life calling is."

My fears are relieved as Brooke looks at me with an expression of understanding and support. She waits a moment and then responds, "I feel the same way. I know I am supposed to do great things in life and make a difference somehow but it has been hard to do within engineering. I didn't even want to necessarily be an engineer, but I knew it could enable me to make a bigger impact but I'm struggling to actually do that." We continue with this conversation, going back and forth, discussing specific frustrations about our inability to make a difference. The conversation leads us to reflect on our experiences at a regional student engineering conference we had both attended. A new thought is inspired in me that I share with Brooke: "If small groups of engineering students like us are able to put in the energy needed to do competitions like steel bridge and concrete canoe with limited resources, that make little impact on others, then we should also be able to put similar energy into projects that actually produce at least a minor societal impact while in college. Does it just take the extra time and camaraderie of a team to motivate students to make a change?"

Brooke can't respond as we are forced to walk in different directions to our classes. I leave the conversation elevated, reflecting on it while feeling simultaneously dissatisfied by the lack of resolution. Seeing another future engineer identify with my feelings brings me some emotional solidarity as it reveals that I'm not alone in my frustration and confusion. For the first time, I question whether the problem I have been struggling with lies beyond just myself.

Narrative 1 Analysis

This conversation functions as a "discovery of self" where a peer, serving as an external feedback mechanism, assists me in reflecting on my dissatisfaction with my performance as an engineer who makes a difference in society. My exchange with Brooke destabilizes my original assumptions that my failure to serve as I had intended was purely my fault, by providing an example of another student who, like myself, entered engineering to make an impact, but is also dissatisfied with her contributions. Brooke helps me see that the application of engineering to

address social problems could have been integrated into my education, so that I didn't have to choose between my studies and my personal goals of service. Thus my frustration shifts from myself as the sole focus, to myself and my education. I note that, besides one instance where my class assisted an organization that provides meals and childcare to underprivileged people, my four years of undergraduate engineering education failed to train me on how to use what we are taught in the classroom to serve society.

I view Brooke's effect on me, along with my own internal reflections, as evidence of my use of external and internal feedback mechanisms to employ "true-to-self" strategies in the development of my "provisional self." Perhaps in a "true-to-self" manner, I chose to prioritize my academics – succeed in my classes and complete my degree – over opportunities to engage in service. Through this reflection, I recognized that my desire to serve others had been overshadowed by my focus on my professional development. I also realized that my initial apprehensiveness to share my thoughts with Brooke was informed by the absence of conversations within my formal education about my personal goals and how my professional development as an engineer aligned with those goals. Naturally, I then wondered, why my engineering training had not asked about my personal ambitions and how these ambitions might relate to engineering. I asked myself, did other students, beyond Brooke and I, have thoughts similar to ours?

Narrative 2

Transcribing faculty interviews is more interesting than I initially anticipated. It is unusual to hear engineering professors respond in depth to questions about social issues. In my engineering classes, instructors stay removed from such topics. In my non-engineering classes, they often serve as "facilitators," but even in those cases they are neutrally seated in their views, only leaning one way or another to demonstrate broader perspectives. In this context, listening to engineering faculty share personal positions on matters beyond the technical offers me a unique and intriguing array of perspectives on subjects like global warming, unethical engineering practices and education.

As I open this one faculty interview audio file, I feel inherent trust, and notice my readiness to believe what is said due to the classroom power dynamic I'm accustomed to with faculty – they speak, I listen and learn. The interview starts as most do with introductions and backgrounds, and then the conversation flows towards Prof. Wilcox's (pseudonym) conception of "the public" and experiences that shaped his views. In this phase of the interview, Prof. Wilcox reflects on an interaction he had with a retired engineer who doesn't believe global warming is occurring:

> **Prof. Wilcox**: And this guy is an *engineer* and I…, and so when you look at these other people who don't have any… training, or whatever you wanna call it, into bringing in a bunch of facts and making a logical decision about what's happening, not an emotional one... They just… they just let… they just get swayed so much that… I look at the U.S. and I just say, if I could… if I could move out, I would move just because I think we've hit the peak, I think we're on our way down.
>
> **Interviewer**: Peak of what?
>
> **Prof. Wilcox**: Peak of the "good life" or whatever you want to call it…, "society" in the U.S. because we're just… we're getting dumber and dumber and dumber as we go…

I notice that I am taken aback by this stance. Prof. Wilcox gets straight to the point, juxtaposing logic and emotion and saying that "the public" is so "emotional" that they think without "facts" and as a result our society has "hit the peak" and "we're on our way down." He then connects this decline with how "dumb" Americans are becoming. From my perspective, I see an implicit transitive property that is being made where Americans are thought of as dumb because they are too emotional and, by extension, increasingly unable to distinguish "fact" from "fiction." Although his narrative begins with the views of one engineer, it quickly transitions to a broader assault on "the public," making me feel offended on behalf of "the public." I feel it is not okay to lump all of society into the stereotype he is speaking of since many non-engineers believe in global warming and, as Prof. Wilcox's own story illustrates, some engineers do not. Also, I have never heard "the public" characterized as "dumb" because of their emotions. I respond by journaling my reactions, which eventually served as the foundation for this narrative.

As the interview progresses, the interviewer asks another question that provokes a second response that surprises me:

> **Interviewer**: How would you say that your education as an engineer has shaped your views of "the public"? If at all?
>
> **Prof. Wilcox**: Oh I think it's mainly this whole idea of approaching things logically and that the public just doesn't. They approach everything from an emotional standpoint and, you know, it's hard to… it's hard to argue once someone's emotionally charged and it doesn't matter what you say, you know?

What Prof. Wilcox describes is not only a difference in knowledge and understanding between those who are trained in engineering and those who are not, but also a difference in the two groups' thought process. Essentially, Prof. Wilcox attributes to engineers the capacity to think logically and contrasts that with "the public's" deficient tendency to think emotionally. This distinction was surprising to me because I have always seen "quality" decision making as involving both emotional and logical elements; where sound logic is guided by emotions, such as a sense of doing the right thing.

Through listening, writing, and editing, I have had many opportunities to reflect on Prof. Wilcox's perspectives and what these perspectives mean to me as an engineering student and potentially a future engineer. Prof. Wilcox's views were new to me, and my strong disagreement with them reinforced in me a desire to become a well-rounded engineer who has a solid appreciation for the inextricable interconnections between the technical and the non-technical, and recognizes the value of both. They also made me question, might his views be more common among engineers than I realized? Might they lie at the "heart" of the engineering profession? And if so, is this the right profession for me?

Narrative 2 Analysis

Prof. Wilcox's comments seem to me to echo the culture of education I have experienced at my school, in the sense that this culture focuses primarily on the technical aspects of problem solving. In my training, we are taught to solve "engineering" problems (which, when you think about it, are rarely only "engineering" problems) by using logic to apply scientific principles and carrying out standardized procedures. This approach employs a narrow focus that neglects the complexity of real-world problems by overlooking their social elements and repercussions. From the "engineering" point of view described by Prof. Wilcox, these types of social concerns

fall into the realm of the "emotional." But since engineering aims to serve society by solving problems, it seems to me that to do this adequately, one must design not only for technical efficiency, which is covered in my engineering education, but also for desirable social, economic and political impacts. To my frustration, this aspect of engineering design is not only not covered in my training but also seems to be looked down upon as irrelevant or a distraction.

For me, Prof. Wilcox represents the face of the engineering profession in my professional formation. If Prof. Wilcox is the role model that my "provisional self" is intended to emulate, then my reaction to his worldview could be considered a rejection of a core element of the very profession I am preparing to join. I now cannot help but wonder if the privileging of technical over non-technical knowledge in my education is doing me a disservice by placing exclusive value on the implementation and means of "service" rather than the intent or impact of "service." This reflection highlights misalignment between my personal goals and the professional identity I might be expected to assume, as represented by Prof. Wilcox, an authority figure in my education, and my experience through my almost four-year now journey in engineering education.

Narrative 3

As I sit in my new apartment, I can see a half dozen cranes that serve as flagpoles marking some of the engineering projects taking place in my city. As of late, I've been spending my time on my walk to campus contemplating my career. I am in the beginning of my final year of my undergraduate education, meaning that I only have nine months until I enter the "real world." I have many questions and worries relating to my professional future but lately I have been struggling with an important responsibility within engineering: How will I apply the technical knowledge gained from an undergraduate education to serve society?

I am sipping coffee on my living room couch as I begin content analysis of the National Academy of Engineering's (NAE) *Educating the Engineer of 2020*. I, along with two professors, have the challenge of meticulously combing through key engineering documents in search of language that describes "the public" or the relationship between engineers and "the public". Before even opening the document, I can tell by the title that this will be more interesting than the other engineering reports that I've read. I value my own education greatly so seeing "education" highlighted attracts my attention. Indeed, early into the document I recognize statements related to the concerns I've been having as I traverse my senior year:

> "The steady integration of technology in our public infrastructures and lives will call for more involvement by engineers in the setting of public policy and in participation in the civic arena" (pg. 4).

I can tell that NAE is describing engineers as possessing technical knowledge that is becoming increasingly intertwined with society. This seems logical and is somewhat on track with my current perceptions of technological growth. As technology makes its way into more facets of daily life, engineers should naturally be expected to engage deeper with society because they have the knowledge and responsibility to create and implement technological solutions.

Then my thoughts shift to a place of self-reflection: As of now, I have completed three of the four years of my undergraduate education and don't feel I have the technical expertise to be trusted with technological innovation, nor the necessary skills or experience to advocate for specific technological interventions through public policy. This lack of preparedness scares me

because even though I identify as one of the "engineers of 2020," I don't believe I have acquired the competence necessary for the role NAE is calling me to play.

Suddenly, I notice that the questions I am asking myself have shifted from "how will I apply the technical knowledge gained from an undergraduate education to serve society?" to "do I even have the most basic technical knowledge that I need to serve society?"

As I read another couple pages, I stumble upon further discussion about engineers and public policy:

> "The business competitiveness, military strength, health, and standard of living of a nation are integrally connected to engineering. As technology becomes increasingly ingrained into every facet of our lives, the convergence between engineering and public policy will also increase. This new level of interrelatedness necessitates that engineering, and engineers, develop a stronger sense of how technology and public policy interact" (pg. 11).

Statements like this make me more aware of my potential future impact on society. It is curious because the opportunity that an engineer has to impact and serve society, through the means of technology and infrastructure, was what initially inspired me to be an engineer. And yet now, as I am inching closer towards being an engineer myself, the very aspiration that attracted me to engineering is making me feel unprepared and fearful about my career.

Narrative 3 Analysis

My reading of the NAE report was memorable in that it made me feel for the first time that my aspirations as a future engineer were aligned with an official message from the engineering profession. Up until this point I had only an inkling that engineering was the right vehicle to help me realize my goals, but it took the NAE, a lofty engineering society that sets the standards for the engineering profession, to confirm that my dedication to public service aligns with the intent of engineering. As reassuring as the feeling was, the experience left me concerned that had it not been for my serendipitous involvement in a research project about engineers' imaginaries of "the public," I may have never come across the NAE's document and, therefore, never experienced this sense of personal-professional alignment. I now wonder why these messages have not been more prominent in my education.

Since I have received an education that focuses on decontextualized technical knowledge, I feel ill-prepared to enter a profession that envisions itself as so connected with society. This, as well as the natural feeling of cold feet, contributes to a fear that I am unequipped to realize my personal goal of social service. I interpret this dissonance as a double misalignment: between my education and the core of my personal identity, but also between my education and official declarations by the leaders of my profession about the role of engineering in society.

Discussion

I view the three narratives as capturing critical developmental moments of my identity and sense of being. Through them, I explore and evaluate the development of my "provisional self" informed by Brooke, Prof. Wilcox, and the NAE by relating the emerging messages from each narrative to my own personal goals, which led to three realizations about misalignments in my personal and professional engineering identity development. The first being that my education did not recognize or support my aspirations as an engineer to serve others and thus has

failed to meet the needs that I expected from my training. Perhaps there are many other students experiencing similar disconnect between their personal, deep-seated goals and the education that they hoped would help them materialize these goals. I believe that engineering education would be enriched if students' ambitions were elicited, valued, and supported through classroom discussions, and if the instructions offered reached beyond the classroom to mentor students on how to realize their goals through the application of engineering knowledge and practice.

The second realization is that there seem to be implicit messages in engineering education that promote an artificial dichotomy between "technical" and "non-technical" aspects in engineering and that elevate the former while ignoring or even dismissing the importance of the latter. This separation of technical from non-technical prescribes an education that strikes me as "patchy" at best, ill-preparing students for real engineering decisions that require contextualized, systematic considerations and that can only be achieved through careful study and consideration of non-technical perspectives. Engineering education could be made more "complete" by teaching comprehensive applications of technical knowledge that disclose the limitations of the "technical" and demand robust incorporation of knowledge from non-technical fields and the communities that engineers aims to serve. A way of doing this would be by challenging students with engineering problems that are similar to professional engineer problems in that they require the students to balance technical and social dimensions in their design solutions.

Lastly, my education seems to promote messages about engineers' relationship with "the public" that differ from the official visions of the profession which leaves me confused about the true "essence" of engineering and how it relates to my "sense of self." To alleviate this dissonance and create continuity, I believe that engineering education must function as an "extension" of professional engineering societies, teaching their vision and equipping students with the tools to realize it. Incorporation of these realizations would lead to deeper convergence between students' personal identities, their educations, and the needs of the profession.

Study Limitations

As with any autoethnography, this discussion and analysis is not intended to be generalizable to any engineering study or any context as it represents a highly personalized experience, within a specific context. My motivations for going into engineering may not be the motivations of other engineering students, and my experiences of engineering education may be unique or unusual. Therefore, my personal-professional misalignment may not be representative of other students' identity experiences. Additionally, my experience of Prof. Wilcox's words were taken from an informal context – the interview for the research on social imaginaries – and may not represent language or ideas that Prof. Wilcox would share in a more formal environment such as a classroom. Therefore, this encounter may not be representative of formal projections of the profession's views that most students would see.

Conclusion

For me, my experiences as a student demonstrate a misalignment in personal and professional identity development that has occurred because internal identity factors are ignored by the formal systems responsible for early professional training. Additionally, these experiences seem to highlight a larger misalignment between the official vision of engineering and what in fact is being taught in engineering school and fostered in engineering professions. A lesson from this study could be that engineering educators and practitioners alike might benefit from a

systematic examination of students' personal-professional alignment to gain further insight into the effectiveness of our curricula and potential ways to improve them. Questions I am left with for example include the following: Are there opportunities to share professional society documents in class discussions about engineering, beyond simply exposing students to the codes of ethics? Could contextualized problems or project-based service-learning be ways to highlight the social ramifications and significance of engineering work while also teaching technical skills? It is essential that these factors converge if students are to experience an education that progresses them in ways that are true to themselves and to the profession, especially as the engineering community reaches out to diverse groups of students who bring myriad motivations and backgrounds with them into their personal and professional development?

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