Comparing First- and Fourth-Year Undergraduate Engineering Experiences of First-Generation Students Using Narrative Analysis

Emily Nicole Fitzpatrick, University of Nebraska, Lincoln

Emily is an undergraduate student researcher focused on engineering education in the Mechanical & Materials Engineering department at the University of Nebraska-Lincoln.

Nosakhare Iyobosa Idiaghe, University of Nebraska, Lincoln

Idiaghe Nosakhare is a PhD Student of Engineering Education Research at University of Nebraska, Lincoln. He holds a Masters degree in Industrial Engineering and a Bachelors degree in Petroleum Engineering.

Chloe Faith Mann, University of Nebraska, Lincoln

Chloe is an undergraduate student researcher on engineering education in the Civil Engineering department at the University of Nebraska-Lincoln

Dr. Jessica R Deters, University of Nebraska, Lincoln

Dr. Jessica Deters is an Assistant Professor of Mechanical and Materials Engineering and Discipline Based Education Researcher at the University of Nebraska - Lincoln. She holds her Ph.D. in Engineering Education and M.S. in Systems Engineering from Virginia Tech.

©American Society for Engineering Education, 2024

Comparing First- and Fourth-Year Undergraduate Engineering Experiences of First-Generation Students Using Narrative Analysis

Abstract

The field of engineering, traditionally dominated by homogenous groups, is undergoing a transformative shift towards embracing diversity and inclusion. As institutions aim to diversify their student bodies, it is imperative to understand the multifaceted experiences of students from underrepresented backgrounds, particularly those students who are the first in their family to pursue a college degree. Moreover, examining the experiences of students at different academic stages provides a nuanced understanding of the evolving challenges and opportunities faced by first-generation students in engineering. Comparing and contrasting these viewpoints can empower institutions to foster an environment that is truly inclusive from start to finish.
This paper is a subset of a project focused on investigating minoritized engineering undergraduate students at a large, public, land-grant university in the Midwest. Through detailed, hour-long, semi-structured interviews, participants shared their experiences as minoritized engineering students, especially as their experiences relate to their own mental health. This paper specifically explores the narratives of two participants, illustrating the contrast in perspectives of a first-year and fourth-year first-generation student. This paper underscores the importance of continual dialogue with first-generation students, emphasizing that true inclusivity in engineering education extends beyond mere integration; it demands sustained understanding and unwavering support.

Introduction and Background

First-generation college students face many challenges compared to their continuing-generation peers when pursuing an undergraduate engineering education [1]. First-generation students often face additional barriers to success in engineering, like inadequate academic preparation [2], [3], a lack of family support [4], and difficulty transitioning to postsecondary education [5], which can lead them to struggle academically [6]. First-generation students must overcome these unique challenges in addition to the challenges that are common in the broader population. The transition from high school to college not only represents a shift in academic rigor but also a significant change in the learning environment and culture. In engineering, the coursework is demanding, and the pace of teaching accelerates quickly, meaning students need to adapt swiftly [7], [8]. Without proper support systems to aid in this acclimation, many students are left grappling with the demands of their degree, which can lead them to reconsider their decision to major in engineering [8]. Students must overcome the common challenges that lead to attrition, including lack of readiness, poor advising, faculty approachability, and peer support [8], [9]. As students progress through their engineering degree, they overcome or persist through these challenges. By their fourth-year, engineering students are in a much different position, in possession of a distinct perspective as a result of years of experience and growth. Their journey is likely full of overcoming the challenges of their own first year and beyond, along with the vast experiences that have shaped them to be who they are today. These experiences, of both challenges and successes, provide them with insights that may differ from their own perceptions at the beginning of their engineering journey.

The present study investigates this difference in perspective between the first-year and fourth-year for first-generation students. We meet a student who is at the beginning of their journey, looking up at the challenges ahead, and a student who is at the end of their journey, looking back at the terrain they navigated in order to get to where they are. This research responds to calls for an asset-based approach to research on first-generation students, reflecting a focus on what these students can add to engineering rather than focusing on what they lack [10]. We pose the following research question:

> How do two first-generation students, one a first-year and one a fourth-year, describe their journeys through engineering?

By comparing the perspectives of a first-year and fourth-year student, we can identify opportunities for better supporting our first-year, first-generation students. Identifying the specific challenges endured by both students in their first years, and the stories of how those challenges were navigated, allows educators to adjust existing practices to be more supportive and inclusive of first-generation students.

Methods

In order to answer the research question, we draw on narrative analysis to construct narratives of two first-generation participants in a broader study. We employ narrative analysis because of its focus on the study of stories, narratives, or a description of a series of occurrences and events about individual's lived and told experiences [11], [12]. Narrative analysis allows us to explore our participants' stories and delve into the meaning of their experiences through their narratives [13], [14]. Therefore, adopting a narrative approach for this study enables us to capture a nuanced understanding of the evolving challenges and opportunities faced by first-generation students in engineering through their unique stories and lived experiences.

We draw on qualitative semi-structured interviews with two participants, each at a single point in time, to construct each participant's narrative. This small sample size is consistent with narrative analysis [15]; previous narrative analysis studies published at ASEE and CoNECD have ranged from including one to three participants [16], [17], [18] to eight participants [19]. These interviews were approximately one hour and were conducted via Zoom or in-person, depending on the choice of the participants. The study was approved by the institution's IRB, and participants provided informed consent. Both participants were students at a large, public, land-grant university in the Midwest at the time of data collection.

The participants in this study are two first-generation undergraduate students. The first-year student, Wyatt (pseudonym), is a White man majoring in Civil Engineering who comes from a low-income background. The fourth-year student, Parker (pseudonym), is a Native American and White man majoring in Mechanical Engineering. Based on the available data and demographics of participants in the larger study, these two participants offered the best comparison of a first-year and fourth-year first generation student experience. We acknowledge that both participants come from different backgrounds, which may impact the experiences they shared in their respective interviews. We were unable to match two participants in the same discipline, however, the first year in engineering at this university is common across majors.

To analyze the data, we began by constructing narratives. Deters reviewed the transcripts, identified initial themes, and developed narratives of both participants experiences in a chronological order [12]. The author team each reviewed the narratives independently and identified themes that they noticed in the narratives, and then met to discuss. Mann, who is a first-generation student herself, returned to smooth each narrative, removing redundancy and organizing around the themes [20]. The narratives presented in this paper reflect the participant's original words and have been smoothed for readability and alignment with the research question. In establishing trustworthiness of the results, each author reviewed each narrative, refined codes, and established consensus on the themes generated from the narratives.

Findings

To answer the first research question, we share the narratives of the two participants. Then, we discuss themes and implications of the findings in order to advance understanding on supporting first-generation students in engineering.

Wyatt – First-Year Mechanical Engineering Student

Coming to Engineering

Choosing Engineering as a Major: I knew that I wanted to do something with roads and maps, and I knew it was some type of engineering, but I didn't know exactly what it was called. [...] I don't think I found out what my major was, like civil engineering, until I was about a sophomore in high school. And then, you know, sophomore, junior, and senior year, I was kind of like researching it. And I was like, yeah, I know, I really want to do this. I've not really thought about changing my major. [...] I do like horticulture, which deals a lot with how infrastructure impacts the environment. I think it's interesting, but I'm not in love with it. If I were to change, or if I had a different spark at some point in my life, I would change to that.

Motivation and Challenges

Academic Challenges: I knew math was going to be hard going into it. And failing this Calc III class really made me think it's time to start a back-up plan, even though I really don't want to. I'm taking it again this summer, but if I fail it twice, maybe it's a sign that I should switch majors. Someone I know told me to switch professors. So, I have the top professor for math this summer – everyone I've ever met says that he's the best. But then, someone told me, if you fail with Dr. [name], you maybe should not be in engineering. So, I was like, what if I do fail? What's going to happen?

I remember in Calculus II, when I first saw the disk and washer formula, I was like, this is the end. This is the end. I hated it. I didn't understand it. Then, when we finished all the integrals and limits, I thought that was so easy. I wish I could do that all the time. So, I hope that now that I understand what the entire course is and what kind of questions they were asking, that it will go better.

Motivation: I feel like the only reason why I'm an engineering major is because I have such a huge passion for roads and maps. So, in Calc III, I thought it was so stupid. Then we did a problem where we found how fast something can move at a curve, and I realized, oh, that's how

you find the speed limit of a curve. I got really excited and got that little dopamine rush of, oh my gosh, I love this. Like I understand how this is going to help me when I get a job, and I feel like that impacts your mental health and makes it a lot better.

Balancing Work and School: Another challenge is that we have tutoring on campus, but it's other college students. So, there's not really somebody that's higher up in math and completed everything, that's like a tutor. [...] So, I've gone to tutoring, and I struggle to talk with somebody because they can only help so much. Also, the hours are really difficult. The hours are usually from 8 am to 5 pm, and sometimes I work during those hours. I wish they had night or weekend hours.

Sense of Belonging

Searching: So, for me personally, being a man and also white, I see a lot of people that look like me. But I feel like a lot of them don't have the same personality. When I go to class, there are a lot of guys that are more introverted and that keep to themselves or spend all of their time studying. For me, the only way I can survive is social interaction. There's a lot of guys that I wish I could ask for help or do things with, but they're just really quiet and awkward socially. I did, however, find some friends that are a little bit more outgoing. But overall, it's very rare to find.

Results: I'm involved on campus with a couple of student organizations and student government, which I really like. It makes me happy; I feel like I have a purpose in college, and it helps my mental health. I feel like the bonding that you have between other students has been rewarding, especially in calculus. Calculus is so hard, so when you're struggling with somebody, you get trauma-bonded. I met some of my best friends through calculus, so I really enjoy that. Sometimes, I feel a lot more in touch with the community because I'm so passionate about roads and transit. [...] And so, in those little things, it's like, oh my gosh, that's my career, it's in my community. I get so excited, and I dig really deep into it.

What Comes Next

Future Plans: I want to travel abroad or travel domestically. I want to be like a foreign exchange student or a domestic exchange student […] I want an internship out of state. I want to go to like TxDOT or Florida or somewhere where it's booming and there's a lot of work that needs to be done on roads. [...] I want to connect San Francisco to New York with a high-speed train. I want to do something bigger [...] I'm going to get an internship and experience with different state laws. So, it would be fun to work out of state and then come back and settle down back in [college state] and start a family. But yet, then I would get all that experience, and then it transfers and then I can't bring a lot of experience that I have back home. So, it's a lot of yeas but nays. [...] I can live wherever I want. There's a lot of engineering everywhere.

Parker – Fourth-Year Civil Engineering Student

Coming to Engineering

Choosing Engineering as a Major: In high school, it was really hard to settle on engineering. I really wasn't sure if that's the way I wanted to go because I didn't know what engineering really was like. Sometimes, I still feel like I don't, but I do have a better picture. The teachers in my

high school were very good people. They pushed me on a life trajectory that was positive, and it makes me want to give back. I really thought teaching was the way I could do it. They impacted my life; maybe I can impact someone else's life the way they did. I thought I would teach math because I loved math. So, I'm in engineering, and that stuck. For my work study for the past three years, I've gone to [name] elementary school, and I worked with the fifth-grade teachers, and I formed relationships with the fifth-grade students. And then I went to the after-school program, and I helped kids with homework and all of elementary. It was very rewarding. At the time, when I was really struggling with engineering, I was looking at this different side of what I was doing at the elementary school, and it was really fulfilling; I really thought about changing majors.

Every teacher will tell you that there are good days and bad days and why they do it. I thought, why wouldn't I transfer over [to education]? But I've been in the classroom on some of their bad days, and those kids can be a force of nature. There were a lot of things that I am not equipped to handle, and I don't think I want to be equipped to handle. So, it was being honest with myself and saying, yeah, those are great moments, but I can't just be working for those great moments. I have to enjoy every piece of it. And for engineering, I do enjoy every piece of it.

Motivation and Challenges

Academic Challenges: It's engineering. It's hard. It's very much theoretical applications put into reality. You take the implicit and make it explicit. It's that in itself is kind of a difficult task sometimes. As a student, it's hard in other ways because I don't know how to study. In high school, I didn't have to study, I just knew what was going on. So that was difficult. It's difficult figuring out how to balance a course load on top of a work schedule. It's difficult finding internships and figuring out what I want to do for my career. I wouldn't say like there's any specific aspect that's more difficult than another; it's just things that pop up. [...] It's not that difficult. It's just that there's so many difficult things that makes it in relation to other difficult things not difficult. There's not like a single source of what's difficult. It's just how it is.

Motivation: One of the most rewarding things I've found is when I really understand something. It's putting in the long hours, like looking over your notes and really committing it to memory and fully understanding a concept or topic. And really getting a good grade on an exam or quiz because you studied and then even going a step further is like showing other people like how you connected those dots and seeing them understand as well. That's pretty rewarding.

Balancing Work and School: I'm a fourth-year student, so like I've kind of figured out how to navigate the challenges over the years. But one of the things that I keep kind of coming back to as kind of a point of contention for a lot of it is working. I don't have any other choice, I need to work, I have rent, I have XYZ bill that I have to pay that I am responsible for. I work about 24 hours a week. And so, as much as I want to say, "education comes first," I mean, it does, but it can't be my sole priority because I have to live. I have to figure out what I'm eating tonight. And so I can't spend like six, seven hours on homework like you see some people do when they valiantly claim, that's what they're doing. It's just not feasible.

A Hard Semester: It was the fall semester when I came back during my sophomore year. Again, I worked 24 to 30 hours, then on top of a 17-credit hour course load. I found myself not having time to do homework. Those were some really foundational classes, and I couldn't pick apart these nebulous concepts. That was the first time I was really academically challenged, and I saw it as a kind of a failure on myself. Because for the first time in my life, I was met with something that I didn't instantly understand. Being whatever age it was, 19 at the time, I didn't know how to sit down and break it apart. I was met with that challenge, and I just wanted to face it, but I ran away. And that hurts. It hurt inside because I just didn't know. So, every waking moment was ignoring homework because I wanted some time to unwind. And I couldn't unwind because I had to go to work. [...] I found myself working long hours. I would get off at two or three in the morning, some nights. You can't just go home from that and just fall directly asleep. And so, I would just kind of like sit outside on the patio for a bit, and I would smoke weed, just trying to unwind. At first, I thought it was like helping me sleep, but like, no, it was just a crutch. I'm fully aware of that now, but at the time, I thought that's what I needed.

Sense of Belonging

Searching: As a freshman, not having others who had a similar background to me was kind of a big sticking point. I remember my freshman year, they were really pushing a narrative for students at the university. It was like, [motto], or something like something like that. They were really talking about the notion that everybody's story matters. As a freshman that just graduated high school, I didn't know my story; I was still trying to figure out what my story was. The more I looked, the more I felt so isolated from everybody else. The more I tried to find myself, the more I found myself sticking out like a sore thumb. [...] And so, it was trying to live up to all these expectations of not only who I thought I was, but who I thought other people thought I was. And it's, it's difficult to go through a transitionary period like that.

Looking back, I really wanted a support network. But at the same time, I feel like there were support networks in place that I just didn't really capitalize on. I'm one of the [program name] scholars. Some of my best friends are [program name] kids. We've kind of grown through college together. But at the time, I really pulled back from those connections, because I thought I had to do it all on my own. And so like, I was drowning, because I was, I didn't want to grab onto the support networks, because I thought I had to do it by myself. I needed them. I wanted them. But I just couldn't grab them. [...] Recently, I've been kind of looking more to some of my friends and asking them for help.

Results: My best friends are engineering students. I wouldn't have met them without engineering. We take the majority of our classes together, so when we do sit down and do homework, we do it together. You know, the late nights here at [the engineering building] are some of my favorite times. Just shooting the shit, working on homework problems, but not really working you know. Challenging each other. Seeing what we really thought of each other, you know, and it's, as much as, like, homework is just a really good bonding thing. And so, some of the greatest times I've had are working on homework.

But the more I've progressed, the more I see myself in other people. Like, I have friends now in the College of Engineering that are like me in a lot of ways. I no longer feel so secluded and isolated. Because I can relate to other people and see their struggles. You know, they're not the

same, but I can empathize. I think it's when I stopped trying to find myself that I started feeling like I belonged. I just kind of started being who I wanted to be. I always thought there was a kind of stigma of who I was meant to be. Like, if I failed this test, I'd let people down. If I did this instead of that, people will look at me differently. I stopped caring.

What Comes Next

Future Plans: Well, it's funny because like, every time I have a goal, every time I have an idea of what I want, it changes. It's something I'm really trying to focus on now, being a fourth-year engineering student. I'm taking five years, so it's okay. I have some time. But right now, my biggest goal besides graduating is getting my FE license. I want to be distinguished. I want a bigger sense of accomplishment than just getting my degree. You know, I've been looking at what kind of industry I want to go to. I thought design was for me. In my current internship, I don't think design is quite the avenue I want to go. Neither is continuous improvement. I have another internship over the summer for a test engineer, and that looks promising. That really interests me, and I think that's what I want to go towards, but it's too early to give any definitive answers on sorts. I want to get my license. And above all, I just want to be happy.

I want a community; I want a tribe of people; I want people around me, who I want to improve upon and have them improve and you know, we can be better than ever, you know, together. When I see my ideal life, I see me going to a job I like. After the job, I see me going home, tinkering in the garage, building a really cool project. I see little, I usually call them "Little [participant's name]" running around. I want kids. I want them to grow up feeling they're loved, and they're appreciated, and I want to teach them the life lessons that I have learned by myself. I want to teach that to them. I want a partner through it all. You know, and so I wouldn't say that's just a goal, but I want to work towards that. It's something that I know is going to happen. It's just going to be a matter of when. The way engineering fits is it just adds to the picture. I'm happy working through problems. It makes me feel fulfilled. And I want to like a job in engineering that will make me feel fulfilled. I want the stability that having a career in engineering will provide.

Comparing Narratives of a First- and Fourth-Year Student

We draw out three themes that accentuate the differences between Wyatt's narrative of his first-year in engineering and Parker's narrative as a fourth-year student. At a high level, we can compare Wyatt and Parker's journey through engineering to climbing a mountain. Wyatt is early on in the climb. The obstacles he encounters are new and sometimes unexpected, and at times, he's uncertain if he'll make it to the top of the mountain, or if he'll choose another mountain to climb. His vision of life after the summit is still fuzzy; there's a few things he knows he wants to do, but it's still a way off in the distance. Parker, on the other hand, is almost to the summit. He's learned how to navigate the obstacles that Wyatt is facing, and he's made the decision to stick with climbing this mountain. He can see the finish line, and his vision of life after the summit revolves around the kind of life he wants to have.

Navigating the "Hard": Learning How to Do Engineering

Engineering has a reputation as a challenging degree program [21]. Engineering students often spend long hours taking complicated classes and managing extensive workload [22]. Wyatt, the

first-year student, described the challenge of failing his first class. Even though he expected his Calculus III course to be hard, the level of difficulty he experienced made him reconsider whether he should stay in engineering. He, like Parker, has to work, and often works during business hours, which makes getting help from campus tutoring "really difficult."

Parker describes difficulty as a cumulative effect. Early on in his degree program, he had to learn how to study, balance his course load, and find internships. He accepts the difficulty as the status quo – "it's just how it is." Parker reflects that as a fourth-year student, he's "figured out how to navigate the challenges over the years." He reflects on feeling very challenged in his second-year courses coupled with work-responsibilities and coping with that challenge through avoidance. Though he learned how to manage the academic challenge, he still says that working is a point of contention. Parker works about 24 hours a week, so he's not able to spend the same amount of time on homework as his peers.

While Wyatt is still stuck in the "hard," Parker has faced really challenging semesters and learned how to overcome them. Parker has learned to let go of seeing failure on an assignment or in a class as a personal failure. Wyatt is still trying to overcome the challenge, but Parker's narrative promises that navigating engineering can get easier and just takes time. As first-generation students, Wyatt and Parker do not have the same familial access to knowledge about how to be successful in an engineering degree as their continuing-generation peers. Moreover, both students have financial needs to meet through working, and juggling these work obligations with their education remains challenging.

Feelings of Belonging Grow Over Time

Establishing a sense of belonging in engineering is an integral component of success in engineering education [23]. This feeling of belonging, often associated with inclusion, community, and well-being, was represented to varying degrees in the narratives. Since Parker has been integrated in the engineering education experience for a longer time, it is likely that he has more deeply rooted connections on campus than Wyatt; however, since retention of first-year engineering students may be negatively impacted by a lack of a sense of belonging [23], this comparison emphasizes the need to establish sense of belonging early on in a students' degree program.

Both participants shared their experiences and perceptions of belonging during their freshman year. Parker shared that he felt very isolated from everyone else as a freshman. He found himself putting pressure on his own identity in order to live by the expectations of others and lost himself while doing so. Parker felt like he "stuck out like a sore thumb" the more he tried to find himself freshman year. Alternatively, Wyatt shared a different experience with 'fitting in.' Wyatt is a white male, so a lot of people in his classes look like him; however, he doesn't feel like the people around him share similarities with him personality-wise. He finds it difficult to connect with other students since they are often very introverted and lack shared interests. These two students share unique experiences with belonging that demonstrate the varying components that contribute to a sense of belonging in a community. Although Wyatt looks like many of the other students on the outside, he still feels isolated—as does Parker, who instead finds himself differing from their peers on the outside more.

Parker also shared that looking back on his freshman year, he needed support networks and failed to seek them out. He recalls the feeling of drowning and seeing help right in front of him; he could see it but he just couldn't reach for it. He explained: "I was drowning, because I was, I didn't want to grab onto the support networks, because I thought I had to do it by myself. I needed them. I wanted them. But I just couldn't grab them." While navigating through multiple years of school, Parker did finally manage to reach those support groups. He was pointed in the right direction by many clubs on campus that he was a part of and ended up utilizing the free counseling that the university offered. As Parker progressed through his experience, he shared that he began to see himself more in other people and was able to build lasting friendships. In fact, Parker shared that many of their closest friends are engineering students. Wyatt has found friends as well; he mentions "trauma bonding" with people in his Calculus class that were also struggling. While Wyatt mentioned finding friends, Parker emphasized that he had found his "best" friends. The key differences in these friendship journeys show the difference in experience. Parker, having a majority of the same struggles as Wyatt when it came to "fitting in," over time, found his best friends. Parker explains that the best times are doing homework with his friends: "Homework is just a really good bonding thing. And so, some of the greatest times I've had are working on homework." Working with other people is a common thread between building relationships for both participants, but finding a level of belonging goes beyond just "trauma bonding."

The groups that were utilized on campus by Parker show that it takes grow belonging, especially in a challenging major like engineering. This also demonstrates that freshmen need to be encouraged and supported to get involved early: an action that could benefit their mental health and level of belonging. Parker and Wyatt have both found some level of belonging. The more Parker has progressed, the more he sees himself in other people. After a certain amount of experience and time, he has found the people he most relates to and even found a sense of belonging with groups. This has led him to feel like he has a purpose and has developed a sense of belonging as well.

These narratives show the different ways that students can feel "at home" while at school, even if it is just temporary. The fourth-year student has found belonging by fitting into the engineering aspect of campus. As time progresses, students feel more at home with the people they spend most of their time with, which includes people who are a part of the same major. This level of belonging can spark a bigger passion for engineering than was previously held. The first-year student found his place in a broader part of campus. As the circle of people that a student interacts with narrows, they can build more powerful, meaningful, and deep relationships with the people surrounding them. This connection goes beyond just "trauma bonding," but sharing a passion for the field of engineering.

Clarity and Scope of Career Goals

Prior studies have shown that first-generation students in engineering are often persuaded to pursue careers that promise a good salary and often see connections between a manual job their parents may hold and an engineering career [24]. One quantitative study found that first-generation students reported a higher interest in having an easy job when compared to their continuing-generation peers [24]. We see the theme of economic stability emerge in our participants' narratives, and also see participants imagining their lives in addition to their careers.

Wyatt's career plans center around his interests – roads and infrastructure – and his desire to travel, either domestically or internationally, before settling back down in his home state. He recognizes that there is engineering everywhere, which gives him the freedom to travel; however, he worries that he may not be able to translate the experience that he would have in more densely populated areas with more intricate infrastructure systems to his majority-rural home state.

Parker's career goals have continuously changed, and now, his top goal is to be happy. Through internship experiences, he has narrowed down what kinds of engineering interest him, but he describes his goals in terms of the life he wants to have. He describes wanting a "tribe of people" around him; he wants to have hobbies; he wants to have kids that he can love, appreciate, and teach; and he wants a partner. He describes engineering as adding to the picture. He wants to feel fulfilled by his job, and he wants the stability that an engineering career can provide.

Both Wyatt and Parker are envisioning what their life looks like after graduation. Wyatt wants to travel; Parker wants to be happy. Parker's story is akin to our metaphor of climbing a mountain – he has overcome so many challenges on his climb. While he does want the distinction of passing the FE exam (one more hill to climb), he really wants to sit at the peak and enjoy the fruits of his labor. At the same time, we see both participants wanting to strive for more. For Wyatt, that striving looks like travel – getting to explore the world outside of his home state. For Parker, that striving looks like building a community and a family and dedicating himself to raising his children well.

Conclusions, Implications, and Future Work

We found that the first-year narrative and fourth-year narrative contrasted in the following ways: (1) Navigating the "hard": learning how to do engineering; (2) Feelings of belonging grow over time; and (3) Clarity and scope of career goals. We build on the implications of previous studies [24] that call for more nuanced mentorship of first-generation students who are considering engineering careers. These students may need more guidance around what engineering careers look like and what it takes to be successful in engineering. These findings also support the need for bridge programs and student success programs that can help students develop necessary survival skills, like asking for help, learning how to study, and time management. Programming should also be realistic, acknowledging that students may be juggling significant work schedules and thus be limited in how much time they can spend working on homework.

Future work can use an expanded sample size and focus specifically on how motivation or sense of belonging in engineering changes from the first- to fourth-year for first-generation students. Studies could also compare first- and fourth-year student narratives for first- and continuing-generation students. Lastly, studies could narrow in on one discipline to make this comparison between first- and fourth-year first-generation students.

Acknowledgements

This material is based upon work supported by the University of Nebraska – Lincoln Interdisciplinary Research Grant and the John C. and Nettie V. David Memorial Trust Fund. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the funders.

References

[1] J. E. Aspelmeier, M. M. Love, L. A. McGill, A. N. Elliott, and T. W. Pierce, "Self-esteem, locus of control, college adjustment, and GPA among first- and continuing-generation students: A moderator model of generational status," *Res. High. Educ.*, vol. 53, no. 7, pp. 755–781, 2012, doi: 10.1007/s11162-011-9252-1.

[2] P. T. Terenzini, L. Springer, P. M. Yaeger, T. Pascarella, and A. Nora, "First-generation college students: Characteristics, experiences, and cognitive development," *Res. High. Educ.*, vol. 37, no. 1, pp. 1–22, 1996.

[3] J. Engle, "Postsecondary access and success for first-generation college students," in *American Academic*, vol. 3, 1 vols., 2007, pp. 25–48.

[4] D. C. York-Anderson and S. L. Bowman, "Assessing the college knowledge of first-generation and second-generation college students," *J. Coll. Stud. Dev.*, vol. 32, no. 2, pp. 116–122.

[5] P. Terenzini *et al.*, "The transition to college: Diverse students, diverse stories," *Res. High. Educ.*, vol. 30, pp. 301–315, 1994.

[6] N. M. Stephens, S. A. Fryberg, H. R. Markus, C. S. Johnson, and R. Covarrubias, "Unseen disadvantage: How American universities' focus on independence undermines the academic performance of first-generation college students," *J. Pers. Soc. Psychol.*, vol. 102, no. 6, pp. 1178–1197, 2012, doi: 10.1037/a0027143.

[7] K. Meyers *et al.*, "Perspectives on First-Year Engineering Education," in *ASEE Annual Conference and Exposition, Conference Proceedings*, Pittsburgh, PA, 2008. [Online]. Available: https://peer.asee.org/3740

[8] M. L. Morris, R. A. M. Hensel, and J. Dygert, "Why do students leave? An investigation into why well-supported students leave a first-year engineering program," in *ASEE Annual Conference and Exposition, Conference Proceedings*, Tampa, FL, 2019.

[9] S. Haag, N. Hubele, A. Garcia, and K. McBeath, "Engineering undergraduate attrition and contributing factors," *Int. J. Eng. Educ.*, vol. 23, no. 5, pp. 929–940, 2007.

[10] D. Verdin, A. Godwin, A. Kirn, L. Benson, and G. Potvin, "Understanding how engineering identity and belonging predict grit for first-generation college students," in *Proceedings of CoNECD - The Collaborative Network for Engineering and Computing Diversity Conference*, Crystal City, VA, 2018.

[11] D. J. Clandinin and F. M. Connelly, *Narrative Inquiry: Experience and Story in Qualitative Research*. San Francisco, CA: Wiley, 2000.

[12] J. W. Creswell and C. N. Poth, *Qualitative Inquiry and Research Design: Choosing Among Five Approaches*. SAGE Publications, 2018.

[13] S. B. Merriam and E. J. Tisdell, *Qualitative Research: A Guide to Design and Implementation*. Jossey-Bass, 2016.

[14] C. K. Riessman and L. Quinney, “Narrative in social work: A critical review,” *Qual. Soc. Work*, vol. 4, no. 4, pp. 391–412, Dec. 2005, doi: 10.1177/1473325005058643.
[15] J. W. Creswell, *Qualitative Inquiry and Research Design: Choosing Among Five Approaches*. SAGE Publications, 2012.
[16] T. D. Ennis, “‘She’s Walking into Like Systems Dynamics. What Is She Doing Here?’ A Narrative Analysis of a Latina Engineer,” in *Proceedings of the Collaborative Network for Engineering and Computing Diversity (CoNECD) Conference*, Virtual, 2021. Accessed: Jan. 31, 2024. [Online]. Available: https://peer.asee.org/she-s-walking-into-like-systems-dynamics-what-is-she-doing-here-a-narrative-analysis-of-a-latina-engineer
[17] N. N. Kellam, T. Costantino, J. Walther, and N. W. Sochacka, “Uncovering the Role of Emotion in Engineering Education within an Integrated Curricular Experience,” presented at the 2011 ASEE Annual Conference & Exposition, Vancouver, BC, 2011, p. 22.1560.1-22.1560.11. Accessed: Jan. 31, 2024. [Online]. Available: https://peer.asee.org/uncovering-the-role-of-emotion-in-engineering-education-within-an-integrated-curricular-experience
[18] T. Lightner, S. Roy, M. Edwards, and J. S. London, “‘Racing the Sun’: A Narrative Analysis of Engineering graduate students’ journeys navigating public-inspired science work,” presented at the 2021 ASEE Virtual Annual Conference Content Access, Virtual, 2021. Accessed: Jan. 31, 2024. [Online]. Available: https://peer.asee.org/racing-the-sun-a-narrative-analysis-of-engineering-graduate-students-journeys-navigating-public-inspired-science-work
[19] J. R. Deters, A. R. Taylor, T. K. Holloman, D. M. Grote, and D. B. Knight, “Exploring the experiences of prospective transfer students in a global engineering program,” presented at the 2019 CoNECD - The Collaborative Network for Engineering and Computing Diversity, Crystal City, VA, 2019. Accessed: Jan. 31, 2024. [Online]. Available: https://peer.asee.org/exploring-the-experiences-of-prospective-transfer-students-in-a-global-engineering-program
[20] K. Shanachilubwa and C. G. P. Berdanier, “Synthesizing indicators of quality across traditions of narrative research methods,” in *ASEE Annual Conference and Exposition, Conference Proceedings*, Baltimore, MD, 2023.
[21] E. Godfrey, “Understanding disciplinary cultures: The first step to cultural change,” in *Cambridge Handbook of Engineering Education Research*, A. Johri and B. M. Olds, Eds., Cambridge University Press, 2015, pp. 437–455. [Online]. Available: https://doi.org/10.1017/CBO9781139013451.021
[22] J. R. Deters, “Investigating Student Experiences of Engineering Culture During COVID-19: A Comparative Case Study,” Apr. 2022, Accessed: Jul. 08, 2022. [Online]. Available: https://vtechworks.lib.vt.edu/handle/10919/109720
[23] J. B. Buckley, B. S. Robinson, T. R. Tretter, C. Biesecker, A. N. Hammond, and A. K. Thompson, “Belonging as a gateway for learning: First-year engineering students’ characterizations of factors that promote and detract from sense of belonging in a pandemic,” *J. Eng. Educ.*, vol. 112, no. 3, pp. 816–839, 2023, doi: 10.1002/jee.20529.
[24] D. Verdín and A. Godwin, “First in the family: A comparison of first-generation and non-first-generation engineering college students,” in *2015 IEEE Frontiers in Education Conference (FIE)*, 2015, pp. 1–8. doi: 10.1109/FIE.2015.7344359.