It's the End of the World as We Know It, and I Need a Job: A Qualitative Exploration of Mid-Year Engineering Students' Future Possible Careers

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Abstract

This research paper on students' future possible careers is situated in a larger mixed methods study exploring mid-year engineering students' motivations related to their future possible careers. Previous work has demonstrated the importance of motivation in engineering for improved academic performance and retention. Our work is situated in the future-oriented motivation frameworks of future time perspectives (FTP) and future possible selves (FPS). In this study we further qualitatively explore the perception of a group of students who have been quantitatively identified as having shortened future time perspectives and unattainable ideal future possible selves, in terms of their future careers.

Using an exploratory qualitative approach, we interviewed eight mid-year engineering students who quantitatively demonstrated a focus on short-term goals and a belief that they will not achieve their ideal future career. Those interview transcripts were analyzed using directed content analysis (DCA), an a priori coding based on a previously developed codebook, while also allowing for new qualitative codes to emerge.

Participants primarily described a focus on the near-future, general lack of future-oriented motivation and lack of connection between the present and future. The short extension into the future was described by students as being affected by their basic wellbeing and a sense of feeling overwhelmed by their current workload. Participants also described a fear of or feelings of being stuck in engineering. When considering inclusivity in our course or policy decisions, we can also consider different student motivations and perceptions of the future. By allowing for some flexibility in engineering curricula, we can provide safe opportunities for each student to find the career path that is the best fit for their future goals, and potentially reduce the fear, discomfort, or feelings of being stuck they might associate with thinking about the future.

Introduction

> *"We all know that there is going to come a time when our planet isn't going to last for us. Because we're getting...were not ruining it but we are using it. Eventually we are going to have to leave and when that time comes, we need to be ready. Otherwise, a lot of bad things are going to happen…. I think that is where I want to study the most, propulsion, and life-sustaining on another planet."* Parker, mid-year engineering student

Students' perceptions of their future affect them in the present in terms of their beliefs and how they set goals [1]. These perceptions of the future affect students' educational experiences, which we strive to improve , particularly for mid-year, or sophomore and junior, engineering students who are at a crucial point in their academic paths, whose motivations may be hardest to get to know in their large-enrollment engineering courses, and are most likely to leave engineering [2]. In this study we explore mid-year engineering students' perceptions of the future, drawing from the theoretical frameworks of future time perspectives [1] and future possible selves [3].

Theoretical Frameworks

Future Time Perspectives

All students are motivated by their different future goals [4], [5]. These future goals, how they are integrated into the present, and how they affect actions in the present are a student's future time perspective (FTP) [1]. FTP has several constructs, including extension [6], [7], future time attitude [1], connectedness [8], and perceived instrumentality [9].

Extension refers to how far into the future a person is setting goals [4], and can also be thought of more generally as how far into the future a person is thinking [6]. Extension can be short (only the very near future is considered) or long (perception of time extends into the distant future) [10]. Future time attitude is attitude about the future, and can be positive or negative [6]. Connectedness is the extent to which a person believes they have control over the future, and how connected the future is to the present [1]. As one of the cognitive aspects of FTP [11], connectedness is highly related to perceived instrumentality [12]. Perceived Instrumentality, how useful a task is perceived to be with respect to future goals, is a cognitive [1] and more task specific dimension of FTP [4].

Future Possible Selves

When thinking about the future, a person creates future possible selves, or a cognitive manifestation of their hopes, dreams, and fears for the future [3]. Future possible selves are the cognitive conceptions of who they believe they can become (realistic or achievable selves), who they want to become (ideal or hoped-for selves), and who they do not want to become in the future (avoided or feared selves) [3], [13], [14]. Future possible selves link future goals and self-concept, where future possible selves can serve as a roadmap for attaining future goals [3], [15].

In this work, we explore future possible careers, which are aspects of one's future possible selves that describes their cognitive manifestations of who they can become, want to become, and do not want to become in terms of their careers [16].

Previous Work

This study is situated in a larger mixed methods study focused on identifying the different ways mid-year engineering students perceive their future possible careers [17]. In an initial phenomenographic study (interviews with 18 mid-year engineering students from a public U.S. institution), we identified three different ways of thinking about the future [18]. Students' perceptions of the future were defined by their different extensions of their future time perspectives, their ideal and realistic future possible careers, and their perceived instrumentality. Based on these findings, we created a survey to identify these different ways of thinking about the future [19]. We then distributed this survey to five primarily undergraduate research institutions in the U.S. (n=746). A fourth way of thinking about future possible careers was identified through the quantitative analysis of that survey data [17], specifically in terms of students' clarity of their future possible careers, and alignment of their future possible careers. Clarity refers to how well-defined and how far into the future students perceive their future possible careers [16]. Alignment refers to how closely related a student's realistic and ideal future possible careers are. Students with conflicting ideal and realistic future possible careers believe that they cannot achieve their ideal career [16].

Research Objective

The purpose of this study is to answer the research question, "What are the characteristics of FTPs of students who were identified (through quantitative results) as having lower clarity of FTP and mismatched ideal and realistic future possible careers?" We took a pragmatic exploratory qualitative approach, meaning that our research is not drawing from one main qualitative method but rather takes the most appropriate approach for meeting our research objective.

Methods

Participant Selection and Data Collection

We identified potential participants based on their low survey scores for their alignment of ideal and realistic future possible careers and low clarity of future possible careers [16]. One to two weeks after students completed the survey, we identified 31 students who fit into the target population [16]and invited them via email to participate in follow-up interviews. We sent two reminder emails and offered a $20 incentive for completing a two-hour interview. Eight students, from four of the five universities in our survey population, volunteered to participate and were interviewed. A description of the participants' pseudonyms, majors, and year in school is shown in Table 1. We interviewed these participants using a semi-structured interview protocol piloted in previous studies [18], [20]. Interviews ranged from 45 minutes to 90 minutes in length. The same researcher led each interview; a second interviewer sat in to ensure consistency in the questions asked and to ask clarifying questions when necessary. The researchers' experience with the protocol from previous interviews also provided consistency in interview prompts, and the semi-structured prompts provided consistency that helped reduce any bias introduced from knowledge of the participants' quantitative survey scores. The lead interviewer also memoed before and after the interviews for each participant to help prepare for the interview and acknowledge any bias or initial impressions with the participants prior to data analysis. Each of the interviews were audio recorded and professionally transcribed.

Data Analysis

Directed content analysis was used to code all the interviews following the codebook created in our previous studies [18]. Directed content analysis uses a pre-defined set of codes and code definitions to drive analysis and allows for codes to emerge from the data [21]. Directed content analysis was appropriate for this study because it allowed for an authentic description of how these participants experienced a phenomenon while also allowing for parallel descriptions to the previous findings, which fits with the philosophy of phenomenography [22] and can add to the previous phenomenographic findings [18]. The resulting codebook used in this study is provided in the Appendix.

The lead researcher read through the transcripts while listening to the audio twice for each participant. The first round allowed for checking for inconsistencies in the transcriptions and format the transcripts appropriately. During the second listen, the lead researcher focused on being immersed in the data so they could understand each participant's tone throughout the interview and be able to read the transcript without listening to the audio while still being able to recall what the participant sounded like at that point. After listening the second time, the lead

researcher read through each participants' transcript and memoed initial interpretations of what the participant was describing. Memos included extended phrases and paragraphs and interpretations beside those sections to continue our immersion in the data.

Using qualitative coding software, RQDA [23], and the codebook, the lead researcher started coding the interviews one at a time, with coding segments of about one sentence. They identified if the meanings in that coding segment fit with any identified codes; if the coding segment seemed significant to the research question but did not fit with any existing codes, it was marked with an initial "?" code. Towards the end of the first cycle, the lead researcher started noticing patterns in the "?" codes and brought them to the research team. At the end of the first cycle of coding, the team looked at the "?" codes, grouped them in similar meanings, named the code, and added an entry to the codebook with a description and example for consistent coding in the future. The lead researcher continued with a second round of coding to consistently code each of the interviews using the original codebook with the additional codes. At the end of this round of coding, the lead researcher read through each coded transcript and created a summary sheet for each participant. Themes were mapped out on participant sheets, such as extension in time and connections the students described, along with additional descriptions of the themes.

The research team then talked through the summary sheets and identified significant themes. These conversations also held the researchers accountable for consistent coding and offered alternative and fresh perspectives of interpretation.

Results

Participant Descriptions

Of the eight participants, four self-identified as male and four as female (including one cis-female). Four participants self-identified as White, one as Hispanic, two as Asian, one as Asian and White. One participant identified as bisexual, and one participant identified as not being born in the U.S. Descriptions of the participants and their perceptions of the future are included in Table 1. The Year 2 students are second-semester sophomores; Year 3 students are first- or second-semester juniors.

Table 1 Description of Participants: Participants are described using their pseudonym (Name), major, year in school (Year), and a brief description of their perceptions of their future careers.

Name	Major	Year	Perceptions of Future Careers
Amy	Electrical Engineering	2	• Aware of career options with an EE degree • Wants to use her degree to help people
Bill	Mechanical Engineering	3	• Interested in roller coaster construction • Pursuing internship in two manufacturing companies
Derek	Biomedical Engineering	2	• Wants to work in a lab space • Realizes BME may not provide lab opportunities he expected
Grace	Electrical Engineering and Dance	3	• Seeks a future with both EE and Dance • Is defining the best way to reach that future

Hannah	Cyber Engineering	3	• Intentionally avoids thinking about the future • Wants to save the country
Parker	Mechanical and Aerospace Engineering	2	• Focused on studying abroad in Germany • Wants to help society colonize in space
Ryan	Textile Engineering	3	• Wants to coach or teach • Also wants to use his degree and make money
Selyne	Electrical Engineering	3	• Enjoys gaining a variety of experiences • Always wants to work on something new

Themes

The results in this section include themes that emerged across the participants with quotes and examples from the interviews to support the themes. The discussion further combines these themes to holistically describe the ways these participants are thinking about their future possible careers.

Future Possible Careers Described as Characteristics and Pragmatic Outcomes

When asked about the future, participants described broad characteristics of their future possible careers, such as being on a team, innovating, and working in a lab space. Selyne described desired characteristics of her future possible career: "I want to be constantly intelligently stimulated in a creative environment."

In general, participants' descriptions of the future beyond graduation were undefined, although nearly all participants described their future career goals in terms of desired *outcomes* of their future possible careers. These outcomes were related to contributing to society or more personal objectives such as being financially stable. Hannah, who was majoring in cyber engineering, did not describe any characteristics of her future possible careers but did describe a desired outcome from her major and eventual career as saving the country. Parker described an even broader future career outcome of addressing large societal problems.

> Information warfare is getting to be a pretty big thing, and I'm not that into politics, but I would definitely like to maybe save the country, just not ... Without moving across the country or anything. Just from my computer wherever I am. (Hannah)

> Research helps innovate and it helps people and I think that's where my passion comes in is because that's the one thing that I have always wanted to do is help people and make sure that they are the best they can be because [of] what I have done. (Parker)

The desired outcomes were often described as a balance between something the participants will enjoy, something that contributes to society, and something more practical such as earning a living.

> To either get a job, or something, to help sustain the lifestyle that I want. Like, if it pays ... The goal is to ... I don't care how much money I get, as long as it's

> enough for me to live, and do things that I find entertaining. Or things that I enjoy doing. (Ryan)
>
> My goals are kind of just to find something I enjoy that helps me earn enough money to just not have to really worry about financials and that stuff. (Amy)

Participants demonstrated a strong connection to wanting to use their degree to contribute to society but also struggle with finding a career that will also be beneficial to themselves by providing enjoyment and financial stability:

> Well, also like doing something that kind of contributes to like, I want to work with solar because climate change is an issue and like creating sustainable renewable energy sources is like something that has a huge benefit on the future. So, like I want to do something that is beneficial to other people and also to me. (Amy)

Discomfort with or Fear of the Future

Most participants showed a discomfort with having undefined future possible careers or experienced anxiety or fear when thinking about the future. Amy's initial reaction to being asked about her goals for 10 years in the future was, "I'll be thirty, that's scary. I don't really know, like yeah, just having a decent job." Participants such as Selyne described using the present to gain an idea of their many future possible careers. Selyne also demonstrated having a fear of narrowing down those future possible careers:

> Definitely [gaining a variety of experiences now] to help me narrow down because I am very good at generating a bunch of different paths because that's how my brain works. Picking one, oh my God. It's horrible. It's terrifying. (Selyne)

While Selyne had many ideas for her future, but was stifled by her fear of choosing one career to pursue, Hannah expressed not wanting to plan for the future to avoid being disappointed:

> I'm going to be working, but I don't want to plan too specifically, I guess, and have plans change or something. …I just ... I don't want to be disappointed, I don't want to have ... I don't want to go in with a preconception that's going to affect how I make my decisions and things. I don't want to say oh, I thought I was going to be here, so I'm going to say no to this. (Hannah)

Even participants who have a defined career path show discomfort with the *perception* of their future possible careers as undefined. For example, when asked "What are your goals for the future?" Grace responded, "Mine are kind of undefined at the moment." Then she continued to describe a well-defined future career path:

> Ideally, after college I will go and work in industry for a few years. I'm thinking about working ... I kind of want to focus on like MEMS and microsystems and circuits and stuff like that. Yeah, so I'll work in industry there for a while, and hopefully, I will also get to dance while I do that. Then after working in industry for a few years I think I will probably go back to grad school. Then after that I'm not really sure. … [In] 10 years, hopefully, I'll be

> working my way up through a company because I'd like to get to more higher-level positions. Probably I think I would probably be living in a bigger city like New York City or something like that. Yeah. (Grace)

Although we interpreted her description of her future career path as well-defined, Grace expressed a discomfort with the breadth of her future possible careers, partly because she had only recently started thinking about it: "Yeah, just so that hopefully by the time I graduate my idea of what I want to do won't be so vague and it'll be more specific."

Extension to the Future Stunted at Near-Future

This fear or discomfort with the future for other participants seemed to result in the stunting of their extension into the future. In general, these participants' future goals did not extend beyond graduation. For example, when asked about 10 years into the future, Bill responded with ambiguity:

> In general. I see myself with a family, with a career. I don't know. Hadn't really thought that far ahead. (Bill)

Hannah simply responded that her goals for the future are "to end up with a job." This short extension was also demonstrated by the participants' focus on the present or near-future.

Often when asked about the future, participants described goals for the near-future, within that week or semester as opposed to jobs or careers after graduation. These goals were often focused on academics. Parker and Ryan described wanting to focus on being a good student:

> That is a good question. I think that...what I think I can be is I hope that I can be a good student. That's really all I have for the future right now is getting through school right now. (Parker)

> I guess, for the near future, kind of get back to my good study habits, because lately I've been feeling a lack of motivation. And that's hurt my grades a little bit. And in the far future, I guess, graduate college, with a good GPA, get a job, all that good stuff. And still be enjoying the process. Because now I'm starting to not enjoy it, so, I'm trying to find out ways to enjoy it again. (Ryan)

Note that Ryan's description demonstrates the extent of his extension into the future where the far future is graduation and a general idea of a job. Ryan described wanting to try to find a way to enjoy the present. Similarly, Parker described how important it is to be happy and enjoy the present: "Yeah, I think in my eyes, the journey is better than the destination." Often participants described their future goals as graduating or getting through the nearer future.

> So those are my goals. It used to be get done with school and move away from here. Now it's just get done with school and then take it from there. (Derek)

> Right now, my main thing is graduating and finding a job right after I graduate. I guess I haven't really thought this far into the future. (Hannah)

Derek and Hannah both demonstrated being conscious of their short extension into the future, even demonstrating an intentional effort to not think beyond graduation. Participants described the workload in engineering as consuming their thoughts and motivations:

> I have just sort of...I haven't really gone much more into it [thinking about the future] because this semester I've been getting...the courses have been really...they're not technically hard, just the amount of time that I have to put in them because I am working full-time and trying to keep grades up is kind of keeping my full attention at the moment. Between that and studying abroad it is kind of difficult to think much further than that. (Parker)

> I think it's just the repetitive nature of the school. Because you wake up, go to class, do homework, and then finish the rest of your day. So, yeah. It's kind of like ... I just have to get motivated again. (Ryan)

Amy described her overall experience in engineering as "good but stressful." She also echoed the coursework being time consuming:

> The amount of coursework we have, like projects and homeworks and that stuff. And it is a fairly difficult subject, especially now, like junior year is intimidating. So yeah, like I tend to spend a lot of time worrying about when things are going to get done and when I'm actually going to have free time. Yeah, but I do enjoy it, like I don't want to, I don't know. (Amy)

The participants' descriptions of workload were often accompanied by a desire to focus on the present and often wanting to focus on present well-being. Ryan described struggling with finding the motivation to do the work in his courses; he was currently trying to improve his grades by attending and being prepared for class:

> I've been losing motivation this semester, so I'm trying to work on ways to get that back up…I'm trying to wake up ... On Mondays, and Wednesdays, I have late class, but I'm trying to wake up when I'd normally wake up ... Like today, and Thursday, I have morning classes. So, wake up at the same time ... Or maybe just a little bit later, and start doing homework, or study, before I have the classes, and then go to class. It's hard to do, but "do it as soon as it's assigned" kind of mentality. Because right now, I kind of do it the day before, and it works out because the assignments aren't that long. But also, if I did the day before, then I'd have more time to just in case something changed. (Ryan)

Feelings of or Fear of Being Stuck in Engineering

These descriptions of the workload were also accompanied by feelings of being stuck in engineering. These feelings of being stuck were based on financial reasons, or family pressures, but primarily driven by the time already spent in engineering:

> That's my main goal, just to finish hopefully within the next three years, give myself an extra year. Even if it takes longer, I'll just keep going. I wanted to switch majors for a long time, but now I feel like I've got too far into it to… switch…yeah. (Derek)

> I'm kind of thinking, because I'm already this far in, I've got to get that degree. Because it's from there, that opens up more doors than just not getting a degree. And so, yeah. My goal right now is to stay focused and get that degree. Because from there, if I do want to switch, it's much easier to switch than it would be to completely stop now, and then not get that. (Ryan)

Ryan continues to explain this feeling of being stuck in the context of the expectations of and his financial dependence on his family:

> He [a brother] was kind of like someone who was very encouraging…He helped me get more independent. Even though you do have people to help you out, in the end, it's all up to you. And he switched out of engineering, and my parents weren't happy with it, at first. But he said he didn't care. Because he wasn't enjoying it at all. Now he said he's much happier in his new major. And so I kinda feel like, I wish I had done that. Then I maybe would have found something that I was more interested in. Because if I switch too, my parents may have been real upset, and I didn't know exactly what I wanted to switch into yet. The only thing that I was told was engineering kind of thing. (Ryan)

This description of being stuck extended beyond feeling currently stuck to a fear of being stuck in the future.

> My fear is that I get an engineering degree, and something happens, and I am stuck in a job that I don't really care for and that's something that I am not really...I don't ideally want in life. (Parker)

Discussion of Future Possible Careers Without Agency

When describing future possible careers, participants could name many future possible careers that were possible because of their degree. These ideas of future possible careers came from conversations with peers, career fairs, or seminars. When asked about what careers Amy could achieve, she began to list careers using her fingers as if she was trying to recall a list. When asked about the listing, she said, “Yeah, I think we had like a presentation, and it was like, these are the three like major areas [for careers in EE].” Hannah also described three options related to her major:

> I don't know [where I’ll be working in 10 years]. Maybe working for the government, maybe a private cybersecurity firm, maybe an insurance company if I do the actuarial science route. Honestly, I don't know. (Hannah)

As she described this list, Hannah made no connection to these careers or expressed any judgement on them; these careers were simply ones that she knew were options based on her major. There was an awareness of the possible future careers and again a focus on using the degree that they were currently pursuing.

Also demonstrating a lack of choice or ownership, participants describe their future possible careers in terms of what will be most practical. Participants described these future possible careers in broad practical terms. The future possible career wasn’t necessarily a goal in itself, but rather the most practical option to find a job they enjoy that also uses their degree. Parker

described wanting to go to graduate school and ideally become a professor, because it is "the best way to go in the current state of the government and funding and everything that's one of the better ways to go." Seylne also demonstrated a very practical approach to her future possible career options:

> Figuring that out, one option was the academic option that is kind of get really into my research lab, get publications in, go down the PhD track and having to deal with that like, going and teaching and kind of build my own research lab or to be one of the four P.I.'s of a research lab. Another option is after, on a graduate level, probably I join a small business just because I know that's more my working style. Working on something interesting that I can contribute to. Probably start somewhere and move somewhere else just knowing how industry kind of works a little bit. You're not usually set in stone at one place but as I go through and figure out who I work really well with and then branch off, kind of, figure out the important people and where I work best and go from there to build that ideal team and do something awesome. (Selyne)

Selyne showed some idea of preference of her many options, but generally echoed her concern about choosing one path. Participants including Seylne described using academic experiences (seminars, career fairs, internships, and undergraduate research) to help them determine what their many options are.

Misalignment of Ideal, Realistic, and Avoided Future Possible Careers

When describing avoided future possible careers, participants described a career unrelated or that does not use their degree, such as working in a coffee shop (Grace). Hannah again listed a wide range of careers that she did not want to pursue, including being in charge of a large group of people, a public figure, a public speaker, involved with politics, a lawyer, a judge, a doctor, a nurse, a physical therapist, an architect, an artist, or an actress.

Parker describes his avoided career as being one where he doesn't use his degree:

> The thing that I want is having…to use my degree so I don't want to be in a profession that doesn't use the degree that I have attained if that makes sense. (Parker)

Not only did they describe their avoided future possible careers as those that don't use their degrees, these participants struggled with finding an ideal career that uses their degree:

> Long term, I would have to say [my goals are] to just find a job that I would actually enjoy in engineering. (Parker)

> Right now, I'm in textile engineering, so find something ... A career path in textiles that I enjoy. Because I'm getting into the more specific classes, but I still would like to learn more about it, just so I know what I'm getting into. So, yeah. (Ryan)

Ryan went on to describe his ideal career as being a coach or a teacher, and his avoided future as not being (financially) independent and not making enough money to support himself. He

acknowledged that his ideal career, although it is realistic, would not allow him to make enough money, and would thus lead him to his avoided future:

> [My ideal future career is] probably a coach, or a teacher, something like that. But ... I don't know, teaching now, it sounds bad, but I know it's not going to pay enough for what I want to do. Because teachers are very undervalued here. (Ryan)

When describing realistic future possible careers, participants described their future possible careers as attainable given certain conditions: "I definitely can be an engineer. I just have to get motivated again to do it." (Ryan) Given a change in behavior or a change in their current path, their broad conceptions of the future were perceived as being possible. However, some participants described being past the point of the conditional statement, resulting in more of an impossible future possible career.

A Focus on The Past or Impossible Future Possible Careers

Participants' undefined or absent future goals may be related to having a time orientation mainly focused on the past. For example, Ryan described what his responses to these questions would have been a year ago:

> So, yeah. Usually, if you asked me that question last semester, it would have been 100%, oh, yeah, my future goals are to graduate, so I want to work hard, and enjoy it while I'm doing it. But right now, it's kinda like, I want to work hard, but it's just not fun. So I'm not doing as well as I should. (Ryan)

This focus on the past also seems to be related to participants' feelings of being stuck in engineering. When asked about his goals for the future, Derek described what his future possible careers used to be, why he wanted to be a BME major, and how he now believed he had a misconception of BME:

> They have a biochemistry degree at the school I'm at. I'm in biomedical engineering and I guess when I got into it I thought it was more like that laboratory track where you work under somebody helping them do their research or whatever. But I think now that I've seen about half of it, I can tell its hardcore engineering which I was not expecting it to be. (Derek)

Derek now faced the conflict of having an ideal future possible career that was no longer connected to his present tasks. He described the curriculum as being a major factor in his choice and his feelings of being stuck in engineering:

> I really wanted to switch to chemistry about a year ago or something and I just didn't pull the trigger, I've taken a bunch more engineering classes that don't transfer over to that major. Some anatomy classes, things like that that aren't in that other curriculum. I was trying to do both, never taking anything that was too ... Never tried to pick a side but then last year I guess I just kind of picked one. (Derek)

Once again, the participants' coursework was impacting their perceptions of the future; in the case of Derek, the lack of flexibility in the engineering coursework caused a loss of autonomy in career choice. The present no longer connected to his future possible careers.

Discussion

This group of participants is characterized primarily by their short extension into the future and general lack of connectedness and future-oriented motivation. The connection between the present and the future is primarily pragmatic with a focus on using their degree. These participants, through some combination of these factors, demonstrated discomfort with the future.

Short Extension into the Future

The short extension into the future was often accompanied by a focus on the near-future, present well-being, or the past. There seemed to be multiple possible factors related to this stunted perception of the future including a heavy workload.

> [Classes are] not technically hard, just the amount of time that I have to put in them … is kind of keeping my full attention at the moment. Between that and studying abroad it is kind of difficult to think much further than that. (Parker)

Previous studies have identified workload, particularly when the value of the tasks is questioned as being a major stressor and source for psychological distress for students in higher education [24]. Although the Deasy et. al [24] study was conducted with non-engineering majors, studies on the culture of engineering indicate that working hard is embedded in the cultural norms of engineering [25], [26].

Lack of Connectedness

This heavy workload may be a contributor to the lack of connectedness for students. This may be because students are struggling to find value in the tasks they are completing, or are overwhelmed with the present, as Parker's quote above demonstrates. Ryan also showed a discouragement from the daily grind, or repetitive nature, of college, and Amy described the stress that comes from the amount of coursework in engineering. These feelings of being overwhelmed by the present are likely due to the speed with which the participants perceive the future approaching [1]. Speed is a future time orientation construct described as the perceived ability to manage upcoming events or deadlines [7]. Some of our participants perceived deadlines in the future as rapidly approaching, causing their perceived lack of ability to manage those events.

Participants described many possible future careers as being the practical option or having little ownership of those careers beyond them being related to their degree. Derek discussed the lack of flexibility in the curriculum in engineering. Derek also demonstrated a lack of connectedness due to perceiving his future possible careers as no longer being possible on his current career path. In fact, this is echoed by several participants facing a future *im*possible careers [27] unless their current paths change: "I definitely can be an engineer. I just have to get motivated again to do it." (Ryan)

Lack of Future-Oriented Motivation

Participants demonstrated a narrowed perceived instrumentality of present tasks caused by their lack of future-oriented career goals. However, they did demonstrate some perceived instrumentality of their engineering courses in a broader sense driven by their desire to use their engineering degree.

When participants' perceptions of their possible future extended into the far-future, they described a breadth of possible careers based on their degree without ownership or contingent paths connecting those careers to the present. Some participants showed discomfort with having to make a choice and some showed discomfort with not already having made a choice.

> I am very good at generating a bunch of different paths because that's how my brain works. Picking one, oh my God. It's horrible. It's terrifying. (Selyne)

Although these participants described discomfort with the future and narrowing the future, generally they believed that they would be able to find something they would enjoy in the future. They did not necessarily demonstrate a negative time attitude, or a negative outlook towards the future [1]; they showed general optimism for their future possibilities, particularly in terms of their ability to achieve a future possible career that they could enjoy.

The End of *My* World as I Know It

There were current political events taking place that pervaded the interviews, indicating a desired to be prepared for the end of the world:

> We all know that there is going to come a time when our planet isn't going to last for us. Because we're getting...were not ruining it but we are using it. Eventually we are going to have to leave and when that time comes, we need to be ready. Otherwise, a lot of bad things are going to happen…. I think that is where I want to study the most, propulsion, and life-sustaining on another planet. I hope [the world won't end in my lifetime], I hope not. I hope that's a thing that we have to prepare for that I won't live to see. (Parker)

Parker goes on to explain that although he is interested in researching this topic, his course load is keeping him from thinking about his future goals, including what his first job after graduation will be.

This analogy of the end of the world can be carried through to students' cognitive or psychological experiences, the shifts in students' worlds, or specifically their future possible careers. Many of these students have experienced a realization that their ideal future possible career, previously thought to be achievable, is not achievable in connection to an engineering degree. With the heavy course load in the mid-year engineering curriculum, participants were not able to address the disconnect. Their focus remained on the present and near-future rather than thinking about their careers after graduation. From that realization and lack of focus on future possible careers, feelings of being stuck in engineering emerged.

Conclusions

In summary, participants in this study had a short extension into the future with a wide breadth or number of future possible careers, which they were not connecting to the present. They described being overwhelmed by or losing motivation in their present engineering coursework, which narrowed their perceived instrumentality for that coursework. Participants still demonstrated perceived instrumentality in terms of using their current degree.

Implications and Future Work

In motivation literature, an important way to motivate students in the classroom is to connect the present to the future and show the relevance of the material being taught in class [28]. However, many of the techniques that have been discussed in the literature, such as speaking about the future in terms that make it seem nearer and more important, could contribute to the factors negatively affecting students with these short extension into the future and lack of connectedness. Participants in this study already experienced feelings of being overwhelmed even by the near-future, and bringing the far-future to their attention may only cause additional distress and lack of motivation. In future research directions, we will assess how engineering programs can consider all of these different ways of thinking about the future to create an inclusive and supportive environment for all types of student motivations.

Further, this research has also prompted a discussion for how we are considering the students in our policy decisions. It is important to consider how the flexibility of engineering curricula or the course load for those crucial middle years for engineering students impact students' motivations. By allowing for some flexibility in engineering curricula, we would be providing a safe opportunity for students to find the career path that is the best fit for their future goals, and potentially reduce the fear, discomfort, or feelings of being stuck associated with thinking about the future. When considering inclusivity in our course or policy decisions, we can also consider different motivations and perceptions of the future.

Along with the importance of coursework on student motivation, the data in this study demonstrates the importance of considering the past. The past and present are clearly interconnected, and as demonstrated in our analysis of these interviews, students' present actions and perceptions of the future are often difficult to describe without the context of the past. A study exploring this connection between the past, present and future in more depth may provide some interesting insights into these characteristic ways of thinking about future possible careers.

Finally, now that these different ways of thinking about the future have been identified, and some implications of those ways of thinking about the future have been identified, the question remains of how mid-year engineering students can be best supported in their engineering programs. Exploring the engineering culture in different programs could help further the results of this work for creating an engineering culture that is more inclusive to different types of perceptions of the future and motivations. A future study could explore the culture of engineering programs and what aspects of those programs best support engineering students' motivations and well-being.

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Appendix: Codebook Used for Qualitative Analysis

Category	Code	Name	Definition	Example
Affective (A)	Enjoy	Expression of Enjoyment	The student expresses any type of enjoyment, including wanting to enjoy their career in the future	"Long term, I would have to say [my goal is] to just finding a job that I would actually enjoy in engineering." -Parker
	Fear	Expression of Fear	The student expresses any type of fear, including fear influencing what they are doing now or fear of a future.	"Picking one [future career], oh my God. It's horrible. It's terrifying." -Selyne
	Stuck	Feelings of Being Stuck	The student expresses feeling stuck in the present or in terms of their future.	"[I] wanted to switch majors for a long time, but now I feel like I've got too far into it to … switch…yea." -Derek
	Wellness	Focus on Wellness	The student describes wanting to focus on well-being, mental health, or wellness.	"Some people try to call that selfish, but I think that it's better for mental health and mind. I don't want to wake up and just dread going somewhere for the rest of my life."
Future Possible Careers (FPC)	Alternative	Alternative Future Possible Career	The student describes a future that could have been possible in the past.	"It used to be get done with school and move away from here. Now it's just get done with school and then take it from there."
	Avoided	Avoided Future Possible Career	The student describes what they do not want to be in the future.	"An automotive engineer. I don't not want to go into automotive. It just doesn't interest me. "
	Conditional	Conditional Future Possible Career	The student describes the future using a conditional statement--a future that is not necessarily possible given their current behavior.	"I definitely can be an engineer. I just have to get motivated again to do it." -Ryan
	Desired	Desired Future Possible Career	The student describes what they do want to be in the future.	"[I want] to be in an environment where...I always have that opportunity to learn."
	Ideal	Ideal Future Possible Career	The student describes what they ideally want to do in the future.	"Honestly, my ideal future would be being able to travel without restraint and not having to worry about working."
	Backup	Backup Future Possible Career	The student describes having future possible careers that they will pursue if their realistic future possible career fails.	"Because I want to do engineering, but if engineering doesn't work out, then I think I might switch to Physics."

	General	General Future Possible Career	The student lists options for jobs based on their major, without making a judgement of the job or identifying it.	"I know there's like three categories. There's research and development, I guess like design, and something else." -Amy
	Realistic	Realistic Future Possible Career	The student describes what they can realistically do in the future.	"Probably realistically, if I didn't get up to being a pilot, then working at a company like Boeing"
Clarity (C)	Well Defined	Well-Defined Future	Having a defined future goal that one wants to attain. The goal should be clearly defined by the student.	“I really see myself in the bioengineering field doing R&D for a company, orthopedics, possibly implants, whatever they have to offer, and I could get excited about.”
	Ill Defined	Ill-Defined Future	The student describes a future goal using ambiguous terms. The goal is not clearly defined by the student.	“What do you mean? I mean, manufacturing, but that's about as much ... I mean, I hadn't really thought of something very specific.”
	Extension	Deep Extension of Future Goals	The student describes future goals deep in the future.	“And in the far future, I guess, graduate college, with a good GPA, get a job, all that good stuff. And still be enjoying the process.”
	Present Goals	Goals in the Present	The student describes goals for the present or very near future (i.e. tomorrow)	"I guess, for the near future, get back to my good study habits, because lately I've been feeling a lack of motivation." -Ryan
	Steps	Steps to Reach Future Goals	The student describes a series of steps or paths needed to reach a distant future goal.	“I'd like to go to med school and study cardio thoracic surgery, eventually, so... bioengineer branching into med school after I graduate hopefully.”
Future Career Descriptions (FC)	Description	Description of Future Career	The student describes attributes or characteristics of their future career.	“But like, yeah job-wise, something where I feel like I'm doing something every day, I'm not just sitting at a desk.”
	Outcomes	Outcomes of Future Career	The student describes outcomes of their future career.	“So that would be my ultimate goal is to help people.”
	Skills	Skills Needed for Future Career	The student describes skills needed for their future possible careers.	“I guess getting a lot of experience working with people and working on teams of people is really important. Those are some skills I need to build.”
Present (_)	FoP	Effects of Future on Present	The student describes how their future goals are influencing what they do in the present.	“As far as keeping my grades up so that my applications look good and also just understanding the material as opposed to just memorizing it so that I know when I'm in a job, I won't be stuck or look bad.”
	Past	Past Experiences and Perceptions	The student describes an experience that occurred in the past or a	“Yes, that also because to begin with engineering wasn't my first choice as a profession. I was set on

			perception of the present or future that was formed in the past.	being a teacher. I just didn't want to even be a professor, I just wanted to help kids and students help figure out who they were"
	PI	Perceived Instrumentality	The student describes how relevant they view certain tasks.	"I'll be able to properly configure my machines, my inventions so that they work as I want them to, and without Statics and Dynamics, I would not be able to even come close to that."
	PoF	Past/Present Actions Influence on Future	The student describes how what they do in the present influences what they will do in the future or what their future goals are.	"I think this summer I'm going to do an internship to figure out if I'm actually interested in industry or if I should stick with research."
	Engineering Problems	Perceptions of Engineering Problems	The student describes their perceptions of engineering problems.	"I think most problems can be approached in like through an engineering way."