Engineering Students’ Perceptions of the Future: Implications for Student Performance

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Abstract

This work seeks to understand how engineering students’ long-term motivations influence their present actions, such as course work. Future Time Perspective (FTP) and possible selves provided models for how student perceptions of the future can guide their actions in the present. Previously, FTP has been applied in engineering quantitatively to study differences among engineering majors and retention of engineering students; this study extends previous work to include rich descriptions of engineering students’ FTPs through qualitative methods. Students were interviewed about their long-term goals and actions taken in the present. Students interviewed (n=9) were at the end of their second year or beginning of their third year of an engineering program. Using themes from the data, motivational profiles of students’ future goals were characterized in terms of their possible selves and FTP. Results presented here describe FTPs with goals defined far into the future and the interactions of these goals with present tasks such as problem solving. This research furthers the understanding of the connection between multiple levels of student motivation and how these levels influence students’ actions and performance.

Keywords: Future time perspective; problem solving; motivation
Introduction

Student motivation in engineering is often studied at one of two time scales: short-term task-specific motivation and motivation towards long-term goals. Task-specific motivation seeks to understand student motivation for performing and completing a specific task such as problem solving or design. Specifically, students with higher problem solving self-efficacy (a task-specific motivation construct) have been shown to have improved learning and understanding in introductory engineering courses. Students’ long-term motivation focuses on goals such as graduating with an engineering degree or having a specific career path. Work in Expectancy x Value theory has shown that students who have higher expectancies for their courses are significantly more likely to have higher grade point averages (GPAs). The importance of both scales in the literature has been highlighted in a number of studies (e.g.,). It has been proposed that these two scales of motivation are connected and influence one another. Attempts to connect these scales of motivation have had limited documentation in the engineering education literature. The purpose of our research is to understand the connection between multiple levels of student motivation and how these levels influence students’ actions and performance.

For this work, we sought to richly describe student experiences with future-oriented long-term goals (e.g., careers) and present tasks, to understand how student perceptions of their futures interact with tasks they perform in the present (task-specific motivation). By addressing this research objective through exploratory qualitative methods, we can further the body of knowledge about the complexities of engineering student motivation and its influence on performance and learning in the present.

Theoretical Foundations

Literature on student perceptions of the future informs our study and aids in interpretation of our data. Aspects of engineering student future perspectives provide insights into how students’ motivation toward long-term goals may be connected to motivation and action related to short-term tasks. We first turn to literature that conceptualizes how students’ perceptions of the future may influence their present motivation. Additionally, we utilize literature that explains how students use multiple perceptions of the future to refine their future goals and influence their present actions.

Future Time Perspective

Future time perspective has been used to understand how varying perspectives of the future can influence present actions. There are three dimensions to one’s future time perspective. The first dimension is time orientation, which can range from being past oriented to being future oriented. Students who are future oriented have goals and are primarily focused on the future, and what is yet to come. In establishing these future goals, students incorporate their future desires into the present through motivational goal setting. Students without established future goals have shown greater difficulty anticipating the implications of present tasks for their futures. Additionally, students with more detailed (further into the future) future perspectives will place more value on future tasks than those with limited or shorter future time perspectives. It has been shown that students who place
more value on the future are more likely to possess a mastery orientation. Possession of mastery orientations has been associated with the use of processes that promote learning and retention.

The second dimension of future time perspective is that of endogenous versus exogenous instrumentality. Students will view current tasks based on their established future goals, and determine the value of a task for both the present and their future goals. Perceived instrumentality is task-specific, and highly dependent on an individual's future time perspective. Instrumentality is similar to utility value in the Expectancy x Value literature. Students who see the usefulness or instrumentality of a task have shown increased performance in academic settings. A task may be perceived as endogenous or exogenous instrumentality by students. A task that is endogenously instrumental is one that a student views as essential for their desired future, while a task that is exogenously instrumental is one that a student must complete to reach their desired goal but does not help them make gains relative to that goal.

The third dimension is based on students’ perceptions of time. Some students perceive time as having the ability to help make things better. These students possess a positive view of time. Others who possess a negative view of time do not see the future as a place where things will get better. For students with a positive view of time, helping them make connections to the future will assist in their ability to see the value in present tasks. When possessing a negative view of time, students will not connect items to the future, and will often fail to see the value or have decreased motivation in the tasks they are currently performing.

When combined, these three dimensions of a student’s future time perspective can be conceptualized as forming three axes. Referring to Figure 1, a student’s perspective of time rests on the x-axis, and this perspective can range from focused on the past to focused on the future, with the origin representing the present. On the z-axis is the instrumentality of the current task. Because a majority of tasks contain multiple subcomponents in engineering, we hypothesize that students’ motivations fall into an area that is both endogenous and exogenous depending on the specifics of the task and how they are perceived relative to a student’s future goals. On the y-axis is a student’s view of time as either positive or negative.

Possible Selves

Work in future time perspective has indicated that students’ time perspectives and their perceived instrumentality are not enough to sustain academic motivation and interest. The theory of future possible selves rests on the conceptualization that someone can envision themselves in the future. Possible selves is the cognitive manifestation of goals, hopes, fears, and threats. These manifestations by students may aid in sustaining academic motivation and interest. Specifically, three types of possible selves have been found to be important to individuals’ motivations in the present. The first is an ideal possible self; this is the self that can exist if the individual could choose everything that happened to one’s self. An example of an ideal self would be becoming the first astronaut to land on Mars and return. The second is the attainable self; this version of the future is shaped by who an individual thinks they can become given the life experiences that they have had. For the same person with the ideal self of becoming an astronaut, their attainable self could be becoming someone who designs materials for the shuttle because they are too tall to fit inside the spacecraft.
The third is the avoid or feared self; this is the self that individuals know they do not want to become. In the possible selves literature, the avoided self is often depicted as someone suffering from drug addiction or remaining in the same difficult living conditions. Students who possess ideal or attainable possible selves have something to strive for and something to work towards\textsuperscript{18}. The combination of a student’s future time perspective and possible selves can create what our research team has termed a ‘future cone’, as shown in Figure 1.

![Figure 1: A theoretical students’ future time perspective is represented in this figure. This student is future oriented with a positive time perception, and sees both endogenous and exogenous instrumentality in the current task he or she is undertaking.](image)

Much like students with detailed future perspectives, students with ideal selves are more likely to persist when faced with challenges or difficulties in their lives\textsuperscript{19}. It has been found that balanced possible selves, having both desired and feared possible selves, within a given area are motivationally more effective than unbalanced possible selves\textsuperscript{20,21}. Additionally, thinking about the future or working to develop future possible selves has been shown to increase interest and efficacy to succeed in school\textsuperscript{21}. While possible selves have been shown to influence self-regulatory action\textsuperscript{20}, it like future time perspective has been shown to fall short at sustaining motivation when in conflict with other self-concepts\textsuperscript{22}. Kerpelman and colleagues proposed a model for adolescents’ identity formation through the exploration of possible selves\textsuperscript{23}. This model demonstrated that environmental feedback leads to varied student responses based on the quality of prior exploration of these selves.

For our work, we adapt the ideas of future time perspective\textsuperscript{11}, possible self exploration\textsuperscript{18}, and environmental feedback\textsuperscript{23} to understand how engineering students, who are in a feedback intensive environment, use possible selves to clarify their future time perspectives and subsequently how these future time perspectives lead to refinement of their possible selves and present actions.
Methods

For this work, students were interviewed during the spring and fall of 2013 about their desired future careers, problem solving methods, and the interaction between their desired futures and present tasks (e.g. problem solving). Students were recruited from second year mechanical and bioengineering major specific courses through in-class announcements and emails for a period of three weeks. A second round of recruiting was conducted during the following fall semester in a third year bioengineering course for a period of three weeks using in-class announcements and emails. Bioengineering and mechanical engineering courses were selected for this work to represent a range of differences in post-graduation norms (e.g. medical school vs. industry, respectively). Students were given a twenty-dollar gift card for participation in the interviews.

Nine students were interviewed, which included five students who had just completed their second year of engineering courses and four students who were beginning their third year. Those ending their second year were interviewed during the end of the spring semester (two male mechanical engineers, a female mechanical engineer, a female materials science and engineering major, and a female bioengineer), while those in their third year were interviewed during the beginning of the fall semester (all bioengineers). Eight of the nine students were Caucasian, one student was of African descent. Additionally, two students were of international origin. Racial and ethnic status is not attached to specific students in order to protect the identities of participants. All names used for participants are pseudonyms.

The semi-structured interviews, detailed elsewhere, were broken into three parts; student desired futures, student perceptions of problem solving, and student beliefs about how these two categories influence one another. Interviews ranged from 39 to 95 minutes in length. Student responses to a pre-determined set of prompts were used by the research team to guide conversation during the interviews. Additional questions were posed by the interviewers as needed for clarification and further descriptions within student responses.

A phenomenological lens was adopted to collect and analyze the data. Phenomenology’s rich history creating powerful understandings of participants motivations and actions facilitates our ability to establish connections between students’ future-oriented motivations and present actions, through the students’ eyes. The phenomenon of interest for this study, connections between students’ future-oriented motivations and present actions, is longitudinal in nature and differs from traditional examples of phenomena, such as experiences related to September 11th, 2001, that are more instantaneous. The phenomenological lens was selected because we wanted an in-depth understanding of the specific ways students experience a phenomenon from their perspective. Initially, interview transcripts were analyzed to create units of relevant meaning. These units of relevant meaning were established and refined through peer review by the authors. Next, units of relevant meaning were clustered for each participant resulting in a set of themes. Another pass was conducted to further cluster units of relevant meaning based on themes and patterns across respondents. Four common themes emerged across participants: ‘Future Career’, ‘Characteristics of Future Career’, ‘Future Career’s Influence on Present Action’, and ‘Past/Present Perceptions Influence on Future’.

Bracketing was used to limit subjectivity of the researcher during the writing of interview ques-
tions and data collection. An interpretive phenomenological approach was taken to foster student connections between future-oriented motivations and present tasks. Interpretive phenomenology looks for deeper meaning and connections in the data that participants may not make on their own. Additionally, the interpretive approach to phenomenology relies on the use of advanced theoretical knowledge and posits that the subjectivity of the researcher cannot be removed from analysis. Analysis of the data was conducted in its entirety by the first author in the R Qualitative Data Analysis package in R statistical software.

Overview of Findings

Following phenomenological tradition, the results of this paper will be presented first in an overview, followed by supporting information for the claims made in the overview. Next, implications and limitations of this work for engineering educators will be discussed. We avoid the word conclusion as it implies a level of finality that cannot be drawn from this approach.

From interview transcripts and themes developed from analysis of clustered units of relevant meaning, we described engineering student experiences with their future-oriented motivations and present tasks. Using the theoretical foundations of future time perspective, possible selves, and environmental feedback, we established connections between these constructs that can further our understanding of student learning and performance. We conceptualized students’ future time perspectives as future ‘cones’ (Figure 1). Students establish the depth of their future cones through descriptions of future possible selves. All students expressed possible selves for the future, but those who defined these selves with high clarity project deeper into the future. The positioning of the cone base is defined by the instrumentality of tasks that students are presented with in the present. Instrumentality judgments are based on students’ perceptions of the future, and how present tasks connect to their futures. Finally, the external boundaries of the cone are generated when students evaluate the instrumentality of a task and connect this task from the present to the future. Student actions with respect to these tasks, drive environmental feedback and self evaluation leading to student refinement of the future desires. In this paper we will fully describe one future cone encountered during analysis. Two other future cone types were encountered and a full description of these is ongoing.

The ‘Sugar Cone’ experience represents students who defined their future possible selves with a high level of granularity. Students in this group distinguished between minute differences in their fields of interest. Additionally, students in this group had ideal and attainable selves that were the same. The lack of difference between these selves allows students to express outcomes that may result from their participation in their future career. Being able to project outcomes of their career assists students in defining future time perspectives further into the future than students with other cones. Established future time perspectives of Sugar Cone students, creates a foundation on which students evaluate present tasks. These value judgments narrow the number of tasks that are relevant to students’ desired futures. By narrowing tasks, students in the sugar cone group will encounter more tasks with exogenous instrumentality. While the specific tasks students are encountered with may be viewed as exogenous, higher order skills that can be gained from a task are seen as relevant to Sugar Cone students’ future goals. Higher order skills include working in teams, problem solving, critical thinking, and creativity. These higher order skills are used by...
students to further refine the perceptions of the future. Through acquisition of skills in the present for the future and value judgments established through future goals, Sugar Cone students have created a feedback loop between the present and future. This feedback loop is used to further define the future, and evaluate the usefulness of present tasks.

**Detailed Description and Discussion of Findings**

**Sugar Cones: Ideal Careers that are Attainable**

Figure 2 is a detailed depiction of the future cone or future time perspective of students (n=5) in the Sugar Cone group. All of the participants with this future cone possess a positive view of the future (y-axis) as noted by their creation of future possible selves. The creation of highly detailed possible selves has led to the development of detailed perceptions of the future (x-axis). Students in this group possess both endogenous and exogenous instrumentality for present tasks, and use their views of the future to limit the number of exogenous tasks. The exact placement of the present section of the future cone on the instrumentality axis (z-axis) depends on the value judgment of a specific task undertaken by a student.

![Diagram of Future Cone](image)

Figure 2: Sugar Cone represents those students who have a defined future career that is both ideal and realistic. Students were able to express the desired traits of this career and what the outcomes of this career would be. Students used this highly detailed future to narrow down relevant tasks in the present through value or instrumentality judgments. Additionally, these students were able to make direct connections from the tasks they are completing in their daily lives to their desired futures.
In characterizing their future time perspectives, Sugar Cone students defined their futures with a high level of clarity, deep into the future. When discussing future goals, Sugar Cone students generated detailed descriptions of their future possible selves and the steps needed to achieve these selves:

I’m going to stick with the undergraduate Bioengineering program, pursue a Master’s and then, my goal is to ultimately work for a medical device company in research and design so, yeah, that’ll be the ultimate goal. Probably a Ph.D. also after I start working too. (Jeremy, male bioengineer junior)

I plan to do the five year Master’s program here. And then, I’m thinking about med school. I’ve taken the practice MCAT a couple of times, but I’m not sure that’s really something I want to do, but I know that I’m very interested in the imaging, bioimaging type things. I really want to work with the equipment but also people. Which is why I thought that it would be, if I was going to be a doctor I would be a radiologist. (Katherine, female bioengineer sophomore)

These students demonstrate highly developed future time perspectives that consist a series of steps or paths to reach a distant future goal. These paths contain goals that are dependent on one another. The contingency of these goals on one another leads to increased valuing or endogenous instrumentality of a task in the present due to the implications for future goals. Tasks that are not viewed as part of the contingent path will be viewed as less valuable or exogenous.

In order to construct contingent paths, students narrow down the infinite number of possible future goals. The conceptualization of future possible selves is one way that these engineering students have narrowed their perceptions of the future. Throughout the course of Katherine’s interview she establishes that both her ideal and attainable career selves are that of a radiologist working with Doctors Without Borders. Limited differentiation between ideal and attainable career selves serves students by creating a focal point of their future time perspective. Career goals, directed by students’ possible selves, allow a student to further clarify and define the future and direct present actions. Through creation of detailed time perspectives around future possible selves, students may be more likely to determine which present tasks possess endogenous instrumentality and fall onto their contingent paths.

To further refine their future time perspectives, students create possible selves they wish to avoid alongside ideal and attainable selves. All nine of the study participants were able to name a self they wished to avoid. Unlike other participants, Sugar Cone students described avoid selves that were closely related to their ideal selves. Silas, a male bioengineering junior, expressed, “Ideally I think the anesthesiologist assistant or any sort of person in, you know, a hospital setting would be a goal. I’ve never really wanted to be like a surgeon or a doctor.” This trend is also echoed by Bonnie, a female bioengineering junior, who despite wanting to be a doctor, wants to
avoid becoming a surgeon. Students’ expressing possible selves to avoid that seem in contrast to their ideal selves speaks to their highly developed future time perspectives, or depth of their time orientation axis. The level of detail in descriptions of career aspirations allows students to distinguish minute details within professional fields that many outside observers might consider insignificant for undergraduate students. This level of distinction by students gives them the ability to have balanced possible selves (a positive hoped for self and a negative avoid self). The establishment of balanced possible selves has been correlated to increased motivational strategies on present tasks\textsuperscript{18}.

*Future career characteristics*

As students established the balanced details of their future perceptions, they also expressed desired outcomes for their future careers. All students possessing the Sugar Cone future perspective expressed a desire to help people as a result of their jobs:

I just want to, want to help cure people but I feel like if I come up with a cure, let’s say for a new drug delivery method, that will cure so many more people than I could being a doctor, like let’s say you saved three lives a week even if you’re really lucky, but if you find a way to deliver [therapeutic] drugs you can save thousands of people a day if you, if you were lucky enough. (Katerina, female material science and engineering sophomore)

[I want to own my own business because] I kind of have dreams of helping people abroad too, so being able to reach out in that aspect, even providing services for people overseas or being able to send implants or whatever is needed over there. (Jeremy, male bioengineer sophomore)

Sugar Cone students have differentiated themselves from students who possess other future cones by moving beyond the desired traits of their future careers to the results of their productivity in future careers.

In addition to the outcomes of their career Sugar Cone students expressed the desired traits of their future careers. Silas expressed, “I don’t want to sit at a desk all day”, and Katherine noted, “I don’t think I would be happy reading about what other people have done and not be doing it myself”. While Bonnie and Katerina were the only two members of this group to not explicitly express a desire for hands on work, they both mentioned being mentally challenged and interested in the work they were doing. Additionally, all of the students in the Sugar Cone group expressed a desire to work with others to develop or provide a solution. Bonnie provided the following description of how she views working with others:

I have always been a leader, Type A personality, and I think in order for me to have a good sense of fulfillment I’m going to need to be in a leadership role in my career. (Bonnie)
In this role Bonnie views herself as the lead member of the team. She goes on to elaborate about her desires to be in a position of authority either as a department head at a hospital or an owner of a medical practice. In contrast, Silas expresses his desire to work with people as:

I just want to be involved with both coworkers and people that you’re working on or working with things. In research or a lab area you have a few people but it’s mostly sort of working together for awhile delegating a bunch of work and then maybe coming back, and I like to work through things as a group or have that communication. (Silas)

Silas’s desire to work in a team based environment, shows that while he and Bonnie both have extremely well developed future time perspectives, they have different desired futures that have been shaped through their experiences. Student development of personal agency has led to their expression of goals of their future careers. The differences expressed in students’ future career goals may be a result of experiences that have led to the production of differing views of personal agency or differing manifestations of students’ goal setting processes.

**Influence of future on present**

As practicing educators we are concerned with how students’ future cones influence their present actions. In this study, Sugar Cone students noted that their future perspectives gave them an intrinsic reason to work harder, focus more, and strive for learning over memorization, if the tasks were viewed as relevant (endogenous instrumentality). Students who view a task as useful, or having endogenous instrumentality by the student (e.g. the statics and dynamics of a car engine for mechanical engineers), are more likely to use strategies that are adaptive for learning. In this study, if a task was defined as having exogenous instrumentality (e.g. an engineer having to pass a leisure skills class for their degree), students reported that they were more likely to memorize and forget it, or just do what they had to so that they could proceed forward. When solving problems students with well-defined future perceptions students stated that they were more likely to pursue and persist with endogenous tasks:

Um, just kind of give it a little more, um, if I encounter an issue I’ll push through it a little more than, if I look at it, if I’m looking at calculus, calculus is specific, I hate calculus. I’m looking at an issue like this and I have to solve a calculus problem and I run into an issue, I have no clue what to do. I’ll probably get frustrated, come back to it in like ten minutes. Whereas if I’m working on a problem where I know that this is something that I’m going to do, like it is directly, like I can tell, I know that I’m going to have to do this, if I, do the work and get to a problem point where I’m like damn, I did this wrong, I’ll work it out and do it again. I’d just say I don’t give up as easy. Put a little more effort in. (Matt, male bioengineering junior)

I definitely do judge things based on if I think this will apply later on in life, do I need to actually understand it or is it just something I need to get done, in which case I just
get it done and not put as much time into trying to understand it if it doesn’t click right away. So probably just like how much effort and focus into understanding the current problem I put into and depending on if I see it applicable later on in life. (Katerina)

In making value judgments of what is and is not useful based on future goals, students with the Sugar Cone future perspective perceived which present tasks must be completed and understood that reaching near future goals enables them to obtain their future possible selves. The valuing of a task and subsequent techniques used by students begins to explain how students with similar levels of preparation may reach different levels of understanding in the same course33,34.

**Effects of present actions on the future**

Sugar Cone students create an instrumentality system that allows them to examine tasks beyond the surface details. This system allows Sugar Cone students to limit the number of tasks that are of exogenous instrumentality. Students in this group define this system using their well defined future perceptions:

I think working in groups [is relevant to my ideal self], that would be a good example of one, because it’s not my preferred thing to do and I always find that I like different ways of thinking about things than other people, but basically every class forces you to do at least one group project throughout the semester. And I realize that both as an engineer and as someone in the medical field, you’re going to have to work in groups on projects and with people. (Bonnie)

In a research or lab area you have a few people but it’s mostly sort of working together for a while delegating a bunch of work and then maybe coming back and I like to sort of work through things as a group or have that communication. (Silas)

Through defining their own value system students may overcome the traditional values outlined by the dominant cultures in field of engineering. This may explain why some members of non-traditional backgrounds flourish while others take their skills to other domains in the university system. We support this claim with Katerina who despite being a high performing student in Bioengineering, switched majors to materials science and engineering due to a perceived ability to provide a greater impact on the world. Additionally, students in engineering who value social skills such as group work go against perceived cultural norms within engineering that place value on the technical over the social35,27.

In addition to teaming skills, Sugar Cone students are using their problem solving tasks to develop skills for their future career:

I think it’s just being able to analyze a problem which is, when you’re working or when you’re doing any kind of job, you’ll run into problems and basically the same
steps apply for when you run into those problems at work because you have to analyze the problem...so I feel like the basic process of solving an engineering problem applies to [my desired future] work. (Jeremy)

The broad spectrum of things given to you and solving the problem with that information yourself and applying the right techniques to it, that’s something you don’t necessarily get in all types of majors. Obviously there’s knowledge to know and some people are good at memorizing, but actually working through a task and problem solving, I think is something that you best learn within engineering classes, and that’s something that is involved in most careers. (Silas)

The process of Sugar Cone students developing skills to prepare themselves for future tasks and goals creates a feedback loop wherein students refine their perceptions of the future, and use these refined perceptions to determine the value of present tasks. By accomplishing tasks in the present, students are able to generate more defined future time perspectives or future cones. Student connections between future goals and present actions through perceived instrumentality allows students to leverage dispositional and situational traits which has been shown lead to increased performance\textsuperscript{33,34}.

Implications

For a course level context, discussions of students’ futures should be more than a one-off seminar or lecture. Students in this population discussed evaluating a number of different present tasks based on their future-oriented motivations. This continual evaluation by students indicates that discussions of careers and tasks performed by engineers should be revisited throughout the course of students’ experiences while pursuing an engineering degree. All students in this study had a positive view of the future. Providing students with a future-oriented engineering education may help them better shape their future time perspectives. Discussions of the future may be able to assist students with the cones presented in this work develop increased future-oriented and task-specific motivations\textsuperscript{36}.

Many of the students in this population have future goals that go beyond the boundaries of engineering. Engineering educators may view the migration of these students away from engineering as a loss\textsuperscript{37}. Based on students’ discussions of their future time perspectives we choose to view this as a gain for society. Students often discussed the problem solving skills, critical thinking skills, and general knowledge they are gaining from their engineering courses, and how they can apply these skills to an outside field. The migration of these students to fields not traditionally accessed by engineers may help advance the understanding of engineering and its role in benefiting society.

Finally, this work extends the theoretical understanding of future time perspective with engineering students. Creating an understanding of future time perspective for engineers has been outlined as a need for furthering the future-oriented motivation work\textsuperscript{38}. We have also established an understanding of how students’ dispositional (or stable) future-oriented traits interact with situational motivations. Specifically, we are able to demonstrate that students are creating a feedback
loop between present tasks and future goals. This idea allows motivational researchers to better understand how and why situational and dispositional traits are correlated, and what correlations are driving engineering students.\textsuperscript{36,39}

**Limitations and Future Work**

The phenomena of connecting future oriented motivations to present tasks is one that is longitudinal in nature. For this work we have only taken a cross-sectional view of students' interaction with this phenomena and cannot speak to the ways in which students’ future time perspectives, or cones, developed. We can only speak to the descriptions of student cones in the moment. In her interview, Katerina described a process by which she worked to develop her perceptions of the future:

> Everyday I kind of think of something else that will be cool or not cool and I try to fit that into what I think I want to do in the future and I guess eventually it keeps evolving into a different future based on stuff that I add to it. And how concrete any of that is depends on how well all these pieces fit together and hopefully they actually end up being some form of research that I want to do. (Katerina)

This description necessitates the need for future work exploring the longitudinal nature of future cone development and the ways in which these cones drive student action. Additionally, other future cones were encountered during analysis of student descriptions. These additional cones need to be fully described and compared to other cones to better understand the range of experiences students have with the future-oriented motivations, motivations toward short-term tasks, and actions taken toward obtaining a career in engineering.

**Summary of Findings**

This study examined nine engineering students' experiences with their future oriented motivations and actions taken toward present tasks. The goal of this work was to better understand how student future-oriented and task-oriented motivations interact and influence actions taken in the present. Future Time Perspective and possible selves were used as theoretical lenses to examine this goal. Sugar Cone students displayed highly defined futures that interacted highly with present actions, and these present actions were used to define the future. Centering teaching practices around the future instrumentality of tasks may help students better develop their future cones and have increased motivational strategies in the present. This work supports and extends the theoretical understanding of future time perspective literature through understanding the ways in which engineering students experience this phenomena.

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