The Motivation of Low-Income Engineering Transfer Students that Influences Choosing and Pursuing a Baccalaureate Degree Attainment in Engineering

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Abstract

The transfer pathway in engineering disciplines, especially for low-income students, is often seen as an opportunity to expand the science and engineering workforce, particularly when transferring from a two-year community college to a four-year institution. This study focused on low-income transfer students' motivational factors that led them to choose and continue to pursue an engineering baccalaureate degree(s).

This studied used Eccles's (1983) expectancy-value theory of motivation as the guiding theoretical framework to show the relationship between competence and value beliefs as the motivated actions towards earning an engineering degree. It relates competence to, "Can I earn an engineering degree?" and task value beliefs to, "Do I want to earn an engineering degree?" Twenty students (12 first-year and 8 second-year low-income engineering transfer students) were interviewed about their experiences in engineering. Additionally, these twenty students completed a survey collecting data on their demographics, recognition, social belongingness, performance, and value beliefs. A qualitative analysis showed that students mainly chose to pursue a baccalaureate degree in engineering due to the financial reward, family influences, faculty support, and early childhood interest. Furthermore, students' motivation to continue to pursue an engineering degree was attributed to prestige, engineering experiences acquired, financial and academic support, faculty and peer support, and gain of engineering knowledge throughout their academic journey.

Implications of the study were: a) a set of small samples of data was analyzed, and b) examination of students belonging to a specific cohort. This cohort was provided with financial and academic support to navigate through their studies. Future studies could consist of various topics. For example, a longitudinal research study is required to track students' motivation and how it transitions over time. Also, a study that compares two-year community college students transferring to a four-year institution who received financial support by applying for it versus students that were provided with a full financial tuition package. Furthermore, a research study about low-income engineering transfer students who do not belong to a cohort and are not receiving financial support. Overall, the study intended to further explore low-income engineering transfer student's experiences, in terms of motivation, which led them to choose and continue to pursue engineering.

Introduction

In recent reports, the United States continues to fall behind other countries in the adequate supply of STEM professionals [1], [2]. In the American Affairs report named America's STEM Crisis Threatens Our National Security (2019), it highlights the fact that "Americans' basic STEM skills have modestly improved over the past two decades" but the country "continue(s) to lag behind many other countries" [2]. Furthermore, India and China are producing almost half of the total science and engineering degrees (S&E) globally, while the United States in only producing one-tenth. This shows the disparity among STEM professionals [2]. According to a report published by the National Science Board in 2019, the United States conferred S&E 40% lower

than China, South Korea, and several European nations. Additionally, United States universities awarded approximately 800,000 S&E first degrees. However, China awarded 1.7 million S&E first university degrees in 2015 [3]. Comparing the global percentages of engineering degrees awarded among other countries, the United States awarded the lowest percentage (7%). China accounted for nearly 70% of the awarded engineering degrees [3]. With the need to increase STEM professionals in the United States, community colleges can help fill the demand. It has been noted that community colleges play a significant role in undergraduate education in the United States. Furthermore, community colleges attract students from various groups; first-generation college students, minority and underrepresented, continuing students, and students from different social-economic status. Community colleges accept students from diverse groups as well as provide a pathway for students to earn advanced degrees, as students can transition to a four-year institution [3].

Among transfer students, focusing on those who matriculated into an engineering program, 50% of the total students who chose an engineering major graduated with an engineering degree [4]. A subset group, are those who come from a disadvantaged social-economic status, individuals that come from a low-income family of which post-secondary U.S. institutions have continuously seen growing numbers in enrollment over the past decades [5]–[10]. Despite the increase in the number of student enrollment, disparity among graduation rates still exist. For example, 10% of low-income students graduate with a four-year degree, compared to 76% of high-income students [10], [11]. In a study of 50 undergraduate participants majoring in physical sciences or engineering, ninety-two percent were first-generation or low-income students [6].

This study focused on low-income engineering transfer students' motivation to choose and pursue an engineering degree at a four-year institution. This study focused on students from a lower socioeconomic status (SES) who tend to be underrepresented [12]. Additionally, this group of students who are considered to be at a socioeconomic disadvantage are less likely to major in or be drawn to physical sciences or engineering or persist a bachelor's degree or have graduate degree aspirations [5], [6], [12].

Literature Review

To support this study and provide a meaningful understanding of its context, a review of the literature around three scholarly topics was conducted. Those topics included: 1) motivation, 2) engineering identity, and 3) a sense of belonging at the undergraduate level. These topics were selected to understand what motivates low-income engineering transfer students to choose and pursue engineering degrees. Additionally, to increase retention, it is vital to understand students' goals, objectives, and the decision-making process.

To understand the decision-making process, the need to explore the driven mechanism that pushes students to choose and pursue engineering with a motivational model must be defined. According to the Management Study Guide (MSG), motivation is defined as the needs, desires, wants, or drives within the individuals. Motivation is considering a process consisting of three stages: 1) a felt need or drive; 2) a stimulus in that needs have been aroused; 3) when needs are satisfied, the satisfaction or accomplishment of goals. It is considered a psychological phenomenon that can be influenced by success, recognition, desires, and satisfaction. Motivation can be categorized differently depending on the area that is being analyzed. For example, Maslow (1943) expressed it based on "fundamental human needs" in terms of physiological,

safety, love, esteem, and self-actualization (Latta & Patten, 1978; Leggett & Dweck, 1988; Maslow, 1943, pp. 1–21). In the context of engineering students in higher education, motivation is defined as the means to "move", as a form of action and is measured as the time spent on a task, assessment of personality traits, and capture of various cognitive-based processes (Jacquelynne S Eccles & Wigfield, 2002; Latta & Patten, 1978; Leggett & Dweck, 1988; Stachowsky & Milne, 2018). The interpretation of motivation itself could vary among individuals, therefore research on motivation has led to the development of several motivational theories. The development of such theories shows the importance of trying to understand the factors or driven mechanism(s) behind individuals' motivation that leads to their decision-making process or engaging in a task. Modern theories of motivation have been developed based on beliefs, engagement, control, attribution, values, interest, goal-driven, and achievement-related choices [13]. Such theories have taken various approaches to understanding individuals' motivation.

Expectancy-value theory of achievement motivation

Currently, the expectancy-value theory of motivation is one of the most used motivational models to study students' career choices in engineering [14]. Expectancy-value theory (Eccles et al., 1983) is considered the most influential theory for explaining students' learning behavior and achievement-related choices [15]. The theory indicates that the students' task choice and level of engagement are driven by two subjective task-specific beliefs: (a) the expectancy that an individual can succeed in a task and (b) the value individuals attach to the task. The theory is composed of two fundamental questions "Can I do this?" and "Do I want to do this?", which provides the framework to understand achievement-related choices, a) why students choose engineering as a major but most importantly b) why students continue to pursue engineering. Such theory, from the students' perspective, consists of a set of values and beliefs that provide a deeper understanding of the influential factors that students take into consideration of their expectancy to succeed and the value they see in the decision of choosing and pursuing engineering. In the context of engineering, competence and value beliefs are shaped by many contributing factors such as: past experiences, the influences of socializers (e.g., parents, teachers and peers), personal identity beliefs (uniqueness of ourselves), and collective identity beliefs (the aspects of ourselves that tie us to others) [16], [17]. Eccles and colleagues proposed that students' expectancies for success and their subjective task values are directly related to their educational and behavioral choices [16], [18], [19]. Expectancy for success is defined as the individuals' beliefs as to how well they will do in the task [13]. The value of a task it's influenced by four components: (a) Intrinsic value (interest- defined as the enjoyment a person derives from engaging in an activity), (b) attainment value (competence-indicates the personal importance of doing well on a given task), (c) utility value (refers to the perceived usefulness of engaging in a task) and (d) cost (describes all the perceived negative consequences of engaging in a task, including effort, negative emotions, and opportunity cost) [13], [20]. Overall, students are more inclined to engage in an activity in which they expect to succeed and foresee value in it.

Engineering identity

A study, where identity is defined in a particular context, conducted by Verdin and colleagues (2018), defined identity as "being recognized as a certain 'kind of person,' in a given context," [21]. Within the context of engineering, the authoring of oneself was categorized by; interest, recognition, and performance/competence [21], [22]. The three constructs are defined as, (a) a

form of being recognized by others (b) interest is defined as a key role and the attraction towards engineering as well as a formal understanding of it, and (c) performance/competence is defined as the individuals' belief of being competent and be able to perform effectively in engineering [21], [23]. In a previous study at a post-secondary institution, these three constructs were used engineering identity to identify different levels of influence when it comes to choosing engineering as a major. Results from the study identified pre-cursors, factors, and moderators of engineering identity [21]. The precursors of engineering identified were noticeable due to the strong connection between the developments of multiple identities for students entering college. Factors consist of physics, math, and general sciences which are important to engineering identity development. Moderators are based on beliefs about performance/competence, recognition, and interest that influence subject-specific identities. Engineering identity can be considered a motivational factor that influences students to choose and pursue engineering. It has been noted that based on students' level of commitment and participation in a discipline, students identify themselves with the discipline and at the same time leads into further development of an identity within the community they are mostly associated with, hence engineering identity [21].

Sense of belongingness

A study about first-generation college students' engineering identity and belongingness concluded the direct effect of engineering identity to students' persistence of effort. An important factor was the indirect effect of engineering identity to student's consistency of interest, attributed to engineering belongingness [21]. Furthermore, their results highlight how underrepresented engineering students often find themselves struggling to identify themselves or seeing themselves as engineers. This is a correlation within engineering identity, as it provides the opportunity of fostering interest, recognition, and performance/competence beliefs in engineering that can influence students' sense of belonging in engineering. Additionally, it creates a passion to persist in engineering, especially for first-generation college students [21]. A study conducted among underrepresented students during their first quarter of college focus on identifying the effects that ENGR 101 had on an engineering identity and sense of belonging. It was noted that students' engineering identities were influenced by certain engineering assignments and overall the course had a positive impact on their sense of belonging [24]. It is important to highlight that a certain level of involvement or exposure influences the students' engineering identity and sense of belonging.

To better understand why transfer students, choose and pursue engineering with the intent to graduate with a baccalaureate degree, this study adopted the expectancy-value theory as the main framework, Godwin's (2016) engineering identity model and sense of belonging. However, the expectancy-value theory of achievement motivation model was used as the framework because it provided the ability to examine students' values and beliefs about the importance of choosing engineering and academic achievement [25]. Additionally, this study used a simplified version of the expectancy-value of achievement motivation model. The study did include the cost construct, as it relates to the negative aspect of motivation. According to Wigfield & Eccles (2000), the cost is defined as the perceived effort, loss of valued alternatives, and the psychological cost of failure [20].

Framework

This study used a simplified version of Eccles's expectancy-value theory (EVT) model which suggests that choices to engage in certain tasks or activities are shaped by competence and value beliefs. Students' decision to choose and purse engineering is attributed to competence beliefs, which addresses the questions of ability, "Can I do this task?" and task beliefs address the personal importance of a task, "Do I want to do this task?" Individuals needed to answer both questions before deciding to enroll in an engineering program to achieve academic success. One of the reasons this model was being used was because it allowed the exploration of student's beliefs and a wide array of values that students assign to earning an engineering degree [25]. Furthermore, an important aspect of EVT's attainment value relationship as to how students identify themselves as engineers and related goals to their engineering major illustrates the connection to engineering identity and a sense of belonging within the engineering community.

In addition to the simplified EVT model, we adopted the engineering identity model consisting of interest, recognition, and performance/competence, previously validated [23]. To support this study, such models previously adopted by researchers to understand the effects of students' physics and math identities and engineering career outcomes [26]–[30]. Hence, this model enabled the researcher to capture the process of students becoming engineers, seeing themselves or feeling like an engineer, and doing engineering.

A sense of belonging was an additional influential factor for the motivation and engineering identity development of students in this study. Additionally, a sense of belonging was a determinant factor of students' success, especially for underrepresented engineering students [31]–[34]. Incorporating it into the research model for this study, showed that sense of belonging influenced motivation through EVT and EI. This was a clear representation of "the human need to belong is the most powerful motivators of social behavior" [35], [36]. Within both frameworks, an overarching question is asked: What motivates academically talented, low-income engineering transfer students to succeed in engineering?

Research Questions

This study is part of a broader, five-year, National Science Foundation (NSF)-funded research project that seeks to examine low-income engineering transfer student's motivation to choose and pursue an engineering degree. To better understand the motivational factors that lead students to choose and continue to pursue engineering, three fundamentals research questions were asked:

- RQ1: Why do academically talented low-income transfer students choose engineering as a major?
- RQ2: Why do academically talented low-income transfer students continue to pursue engineering?
- RQ3: When do academically talented low-income transfer students believe that they are engineers?

The first two questions were developed to help explore students' values and beliefs for choosing and pursuing an engineering degree. Question number three was developed to explore students' engineering identity. Overall, information obtained from these questions can reduce the gap in the research literature about low-income engineering transfer students and help increase enrollment and retention. The findings can also enable programs to better understand the: needs,

desires, interests, expectations, and misconceptions of low-income engineering transfer students transferring into four-year institutions. Furthermore, the study can guide faculty, counselors, mentors, and staff on how to best support and motivate low-income engineering transfer students.

Methodology

A systematic approach was used in this study to categorize data into themes and codes that represented key terms related to motivation, engineering identity, and sense of belonging. The study used a qualitative research method, a grounded theory approach, and an exploratory analysis as the design method. Using a qualitative method to gather the data, a semi-structured interview was conducted at the end of the students' first quarter (fall 2019). The interview included open-ended questions about motivation as to why students chose engineering, continued to pursue engineering, recognition, and a sense of belonging. Open-ended questions provided the flexibility to explore participants' experiences. This also, included follow-up questions to be asked when there was a need to explore an answer or clarify an inconclusive response. Students' experiences enabled the study to explore students' beliefs, values, engineering identity, and sense of belonging as the influential factors that potentially led them to choose and pursue engineering. Furthermore, this created an open environment for the interviewees to share information beyond what the study was asking. That information opens new research topics to be explored. The interviews followed a written outline that guided to conduct the recorded interviews. The recordings were heard for clarity which was later transcribed verbatim. Each case was analyzed separately while being heard for clarity and after being transcribed for keywords and phrases before looking across cases for themes and patterns. Content analysis was performed via the DEDOOSE Software. The software is a cross-platform app use for analyzing qualitative and mixed methods research with text and audio.

Data Analysis & Results

Demographics of Participants

All twenty participants in this study were classified as low-income socioeconomic status by the Office of Financial Aid and Scholarships. Additionally, all participants were engineering transfer students and part of a cohort. In this study, both male and female participants were interviewed. However, most of the participants were male (see Table 1). Additionally, the participants' age range was from 20 to 25 years old. The average age of a participant was approximately 22 years old. Most of the participants identified their race/ethnicity as being white (see Table 2). Out of the twenty participants, only twelve were first-year and the other eight were second-year transfer students. Participants self-reported their demographics, as well as their engineering major. Participants declared the following majors: Biomedical, Chemical, Electrical Mechanical, and Mechanical & Aerospace. All students were enrolled and considered full-time students.

Table 1: Summary of Participants (N = 20)

Description	N	%
Male	14	70
Female	6	30

Table 2:Participant's Race/Ethnicity (N=20)

Description	N	%
Asian	6	30
Hispanic or Latina(o)	4	20
Hispanic or Latina(o), White	2	10
White	8	40

Themes and Codes

The twenty interviews were analyzed using content analysis for the entries [37]. A priori and deductive coding scheme were used to explore the data. The constructs were used as the first domain area and also served as the initial codes. During the analysis, a new set of themes emerged and a second domain area was developed (see Table 3).

Table 3: Domain Areas (EVT, EI, & Sense of Belonging)

Model	1st Domain Area (Initial code)	2nd Domain Area
Expectancy-Value Theory	Competence Belief	Intellectual Development
Engineering Identity	Attainment Value	Social Persuasion
Sense of Belonging	Interest (EVT)	Mastery Experience
	Utility Value	Attention to Human Ethical values
	Recognition	Personal Integrity
	Interest (EI)	Achieving Inner Satisfaction
	Performance	
	Sense of Belonging	

The second domain area was categorized. The first category was intellectual development and it was described to solve problems, create, gain analytical skills, and gain engineering knowledge. Social persuasion was the second category and it evolved around role models, faculty interaction, tutors, and peer-influenced. The third category was mastery experience that dealt with hands-on experience, research, and internship participation. The fourth category was the attention to human and ethical values which emphasized caring for others, family influences, and giving back to the community. The fifth category was personal integrity which associated with hard work, and persistence. The last category was achieving inner satisfaction, which highlighted personal goals and achievement.

Key terms were initially sub-coded based on which theme emerged from the text. Sub-codes were categorized by excerpts under the participants' experiences that influenced the students' motivation to choose and pursue an engineering degree. Such key terms included: career choice, mentoring, academic and financial support, engineering experiences, role models, family, future potential income, collaboration, study spaces, early-childhood interest, prestige, career opportunities, job security, career development, and the realization that engineering had a real-life application. These themes were identified as motivational factors for low-income engineering transfer student's motivation as it related to choosing and pursuing an engineering degree.

The content analysis consisted of a previously used three category strategy. The strategy included: a) case-oriented, b) variable-oriented, variables across cases, c) mixed strategies, using a combination of both [25], [38]. The study examined each case separately for unique words or

phrases, then compared some of the key terms that were found among participants. Mixed strategies were implemented when a theme arose but explained differently. Additionally, the study examined phrases to compare and reassess the classification of its code. The three category strategy was used to identify trends in messages and explore content in which the messages varied. To analyze the data and code development, the study implemented a mixed strategy, where the twenty individual cases were given the same level of importance. Further, results were presented with variable-oriented assertions that evolved around the three categories of EVT and EI and sense of belonging.

The coding process started with a case-based approach. Additionally, interviews were heard several times and key terms that were repeated or unique were written down. After being transcribed, each interview was read and then coded. Coding was done using a cross-platform app named DEDOOSE. This app was used to analyze qualitative and mixed methods research with text and audio. Initially, a list of codes and themes were developed before inputting them into the software. The codes were developed inductively from the data and the codes referenced the constructs of EVT, EI, and sense of belonging. The initial set of codes were categorized by its uniqueness, resemblance to the constructs, and others were developed by their repetition. After inputting the transcribed documents into the software, new themes emerged and were added to the list. Code overlapping was addressed when creating excerpts. They were identified by writing memos and linked them to the appropriate codes. To keep consistency across all cases, the finalized list of codes was applied to all twenty interviews.

Analysis of Motivation

Students' motivation to choose and pursue an engineering degree originated from an early interest (early childhood, during high school or at an early stage of community college), faculty-to-student interaction, faculty or family influence, engineering usefulness, or exposure to the engineering field. Furthermore, upon attending a university one-week summer program, students reported that it increased their level of confidence and university exposure. Students stated that through the program, “we were able to build friendships and create some bonding”, which in terms when the academic year started, they “felt that they already knew each other” and were “familiar with some of the resources and had a study room where they were able to study.” Additionally, they were able to discuss “which courses they were going to be taking” and “possibly share class notes and were planning to work together on group projects”. Students had acquired a sense of belonging and were more motivated to continue to be enrolled in engineering courses. One key aspect was that students were highly interested in conducting research which in turn they had already contacted some of the faculty members by the beginning of week one of the fall quarter. One student stated, “he allowed me to join his research even though I wasn't officially settled into school yet”. It appeared that their motivation level had seen an increase from when they initially attended the one-week program in comparison to their first week of being enrolled at a four-year university in an undergraduate engineering program.

Domain Areas

Intellectual development: Participants reflected on the fact that gaining knowledge motivated them to choose and pursue engineering. Knowledge in engineering was found to be crucial as

engineering is learned. Additionally, knowledge was an intricate process that required discipline and understanding of its essence with real-life applications.

Table 4: Intellectual Development Shared Experiences

Description	Expression
Intellectual Development	"No one's born knowing how to do engineering or any of these difficult courses, but one has to have discipline to sit down and learn everything and this isn't very easy stuff. It's very easy to just give up on it or just learn half of it or learn as much as you need to pass. To actually understand the subjects and apply it in the real world you have to really have the discipline to understand and how to apply to understand how everything's implemented together"
	"I am really big fan of knowledge and knowing science and how to apply technology in the field."
	I chose engineering because I figured that with the technological advances that we're experiencing and stuff like that, I just feel like it's just a booming field and there's just a lot of opportunities there."

Social persuasion: Faculty and peer interaction were among the most common themes of motivation to choose and pursue engineering. Faculty interaction was described as a supportive and inspiring aspect. Students expressed their interest based on how professors provided support, answered questions, and showed passion about the subject. Additionally, peer influence played an important role when students felt depressed, experienced a lack of confidence, needed assistance with course material, and provided a sense of inclusion. Faculty and teaching assistant support were acknowledged to be a motivational factor, especially when students were seeking support and were able to get questions answered regarding the material being taught. Table 5 illustrates the social persuasion of students' shared experiences.

Table 5: Social Persuasion Shared Experiences

Domain	Expression
Intellectual Development	"the professor, even though he had 30 to 40 students in his office hours, he made sure to stay like eight, 10 hours every time we had a midterm. The day before the midterm, he would always stay eight to ten hours, which I thought was really… said a lot about how much he cares about his students. The teaching assistants (Tas) were really, for the class specially, they were really supportive and always made sure that we understood the problem before going ahead."
	"I would love to take their master classes, but at this point, I already have enough on my plate. But I am really considering retaking some of the professors, they are really good. Some of them are really inspiring"
	"The people I am surrounded by, they're always pushing me when I feel down. They're always reassuring me that I'm actually smart and that I would make a good engineer"
	"My motivation I think mainly comes from the people before me, such as Elon Musk and Leonardo da Vinci and the people with great minds, because they've pursued this path and they did great things, and that motivates me to become like them."

Mastery experience: Participants recognized that by obtaining research or internship experiences as well as real-world applications would help them thrive in engineering. It was a key component to incorporate theory into practice. Having hands-on experience consisted of course projects, conducting research, and internship opportunities within the field of engineering. It would enable them to build confidence and slowly progress into becoming an engineer. Many described that they were engineers in progress and that it would take some sort of engineering experience or participation in a real-world project to be fully considered an engineer. Table 6 illustrates the students' shared mastery of experiences.

Table 6: Mastery of Experience Shared Experiences

Domain	Expression
Intellectual Development	***"I was able to work along with a professor who worked in the industry before and also I worked along Ph.D. students who also worked in the industry before… So, I basically worked with engineers, and I was able to get their response that I was successful in my work"***
	"Yeah, you gain a lot of things by meeting a lot of people, because engineering requires a lot of group work and teamwork. You are going to go through a lot of obstacles and that's going to require a lot of patience, so you are going to definitely develop a lot of patience and critical thinking along the way."
	"But I am a work in progress obviously, we're not engineer yet, we don't have a degree. But I definitely consider myself to be a thinker in the way of engineering"

Personal integrity: Motivation in engineering was most commonly identified in personal or financial gain. Participants expressed their motivation towards engineering in a form that related to honesty, personal integrity, possible failure, hard work, or were destined to be engineers. Table 7 illustrates students shared experiences regarding personal integrity.

Table 7: Personal Integrity Shared Experiences

Domain	Expression
Intellectual Development	***"Honesty and integrity are probably the biggest one because even though I did poorly, I think I'm still proud of what I did and how far I've come, and I'm never embarrassed to say that I failed, and a lot of engineers do fail while they're in school."***
	"I felt like it fit with me, for sure. Like I said, I like to work with my hands. I like to create things, solve problems, this felt like it was for me."
	"Hardworking, just dedication, mentally strong too. A lot of these tests are stressful, to say the least. If you break under stress or pressure very easily, I don't think you will end up getting through the school"

Achieving inner satisfaction: Most of the students in this study identified a desire to be an engineer during their childhood, high school, or while in community college. Interest in engineering range from tinkering, recognition, personal goals, prestige, career goals, or enjoying a challenge. This sort of satisfaction was based on what students originally experienced and how they saw themselves acquiring inner satisfaction in reaching their goal. Table 8 illustrates students shared experiences in achieving inner satisfaction.

Table 8: Achieving Inner Satisfaction Shared Experiences

Domain	Expression
Intellectual Development	***"When I was a kid, I would see the TV remoter, and just break it apart and see what's inside and just put it back in. So that is an engineer to me"***
	"Well, when I was growing up, I was surrounded by a lot of friends. My family didn't really have any engineers, but friends of family had engineers that I grew up with. And I was wanting to like to be like them, and you're always attracted by the money, but having the prestige and being able to call yourself an engineer is one of the things that really set aside and made me want to pursue the career"
	"I felt like every time I overcome the challenge, I felt more accomplished when I accomplished something in, let's say, chemistry".

Attention to human and ethical values: Family influence was the most important motivator among participants. The motivation was highlighted when students felt needed to support their families by providing a better living situation. Besides keeping a tradition, students felt a family

obligation, due to the limited financial resources that were put towards their education. Some students mentioned a sense of failure to not thrive in their academic journey. In addition to family influence, other students found diversity and lack of participation of underrepresented groups to be a motivator. This was especially true for the women participants in the study. Table 9 illustrates the participants shared experiences related to human and ethical values.

Table 9: Attention to Human and Ethical Values Shared Experiences

Domain	Expression
Intellectual Development	***"I will say for sure is my family because I know they put a lot of effort and they have been supporting me a long time."***
	"I primarily believe my motivation to pursue engineering is just how fun it is to create something new. It's been a big part of my family and I want to continue the tradition of engineering, and it's been more of a cultural thing in my case within my family."
	"I think one the reasons that I really, really wanted to do it, obviously after all that I told you was that when I figured out there's not many girls in engineering, it makes me even more motivated to become an engineer. Because I think there shouldn't' be any difference. Because I think there shouldn't be any difference. No matter if you're men or women you can do all do the same thing. It doesn't matter. So, that was one of the reasons."
	"I guess the financial aspect really helps. Also, being able to support a family. Since especially coming from low income with a mother that works a lot, it definitely adds a lot of motivation to my dreams and aspirations to become an engineer."
	"I want to become an engineer a very long time ago when I was a little girl when my. The town with the very dirty river is because manufactory. So, I want to become an engineer to solve that problem, and help people have a better health."

Results

Results from the qualitative analysis showed that students mainly chose to pursue a baccalaureate degree in engineering due to the financial reward, family influence, faculty support, and early childhood interest. Furthermore, students' motivation to continue to pursue an engineering degree was attributed to prestige, engineering experiences acquired, financial and academic support, faculty and peer support, and gain of engineering knowledge throughout their academic journey.

Discussion

Findings from this study provided detailed information about what type of experiences can motivate low-income engineering transfer students to choose and pursue a baccalaureate degree Across domain areas in this study, mentoring, family influence, hands-on experiences, and financial support were critical factors that emerged as a positive influence on the participants' decision to choose and pursue engineering. Upon transferring to the university, transfer students indicated that they were more interested in finding research and internship opportunities because they felt that they needed to find a good job after graduation. Students highlighted that such opportunities are competitive and hard to come by. A certain level of persistence was attributed to having participated in the one-week summer program which provided comfort and the opportunity to get acclimated to the university community. They were able to familiarize themselves with a classroom environment and became aware of resources. Additionally, as members of the cohort, they were assigned a peer and faculty mentor that met with the participants individually.

Results from this study document motivational factors of low-income transfer students that led to choosing and pursuing an engineering degree. Such motivation can be traced to their early childhood, family, role models, faculty members, or personal achievement and goals. Such levels of motivation can be improved over time with consistent support, guidance, and opportunities where students can participate throughout their academic journey. Participation enhanced their skills and level of engineering knowledge and provided an engineering toolbox. The participants faced numerous challenges and barriers while transitioning from a community college to a four-year university. However, with a supportive environment, students felt that they gained the necessary engineering knowledge and experience to be confident in the field of engineering.

It should be noted that participants self-selected to participate in this program and were already admitted to an undergraduate engineering program. The process of choosing an engineering degree was already pre-determined. Additionally, academic and financial support was already in place, which could have influenced the decision to choose and pursue engineering.

Despite some limitations, this study produced important results related to motivational factors of low-income engineering transfer students. Findings identified, financial support, family, research or internship opportunities, hands-on experience, faculty, and peer support, mentor support, long-term goals, passion, and social integration as influential factors of motivation to choose and continue to pursue an engineering degree.

Overall, this study provided a valuable contribution to the knowledge base and provided a better understanding of what experiences can positively influence the decision of choosing and pursuing a baccalaureate degree attainment in the field of engineering. Additionally, the research indicated that continuous academic and financial support helped improve students' level of academic engagement by allowing students to stay focused on their academics instead of the financial cost of their education.

Conclusion

The study used the expectancy-value theory framework, engineering identity model, and a sense of belonging to capture the participants' experiences to identify the motivational factors that led low-income engineering transfer students to choose and pursue engineering. This study consisted of a small sample that provided reliable information to answer the three research questions.

Qualitative results identified that participants initially (Q1) choose engineering because of an earlier interest (EI - exposure to the field or tinkering) and its usefulness (utility value – financial reward, ability to care for others, job opportunity, real-world application). As participants continued to pursue engineering, (Q2) participants move from choosing engineering to enjoying engineering. This change consisted of engineering interest (interest-EVT), the gain of engineering knowledge, hands-on experience (research and internship opportunities, group projects), exploring opportunities, and faculty-to-student interaction.

Furthermore, degree attainment was the key to the participant's goal completion. Many participants (Q3) identified themselves as being engineers in progress and that a degree would make them engineers. On the contrary, other participants expressed that more than a degree was needed to be recognized as an engineer. These participants felt that it would require work experience, higher education, or possibly more, to feel like an engineer.

Lastly, the expectancy-value theory of motivation achievement framework used in this study was based on two questions; a) "Can I Do It?" and b) "Do I want to Do It?" Participants answered the

question (a) by expressing confidence (competence), and hard work and dedication (from the participants' perspective, attention to human and ethical values). Question (b), wanting to do it was not fully expressed or answered for the low-income engineering transfer participants in this study. The choice to pursue an engineering degree for most participants was based on the family living situation. Furthermore, those participants indicated that choosing and pursuing engineering was to find a stable well-paying job, support, and alleviate parental hard working conditions or care for others. For those participants, studying engineering was considered a need and not a choice. Engineering was considered a well "paying job" that would provide "job opportunities" and "stability". Passion to pursue an engineering degree was not a significant topic for academically talented low-income engineering transfer students. However, for engineering transfer students that are not considered low-income, passion is considered the leading motivational factor that led them to choose and pursue an engineering degree. Additionally, research shows that 50% of the total number of engineering transfer students will graduate with an engineering degree (Anderson-Rowland & Rodriguez, 2015). Ultimately, low-income engineering transfer students can fill the need for STEM professions in the United States, but these students need to be fully supported to increase their motivation to choose and pursue baccalaureate degree attainment.

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