Received: 18 February 2023 | Revised: 22 December 2023 | Accepted: 4 January 2024

DOI: 10.1002/jee.20584

RESEARCH ARTICLE

Investigating engineering undergraduates' agentic and communal career values in writing responses

Hye Rin Lee[1,2] | **Nayssan Safavian**[2] | **Anna-Lena Dicke**[2] | **Jacquelynne S. Eccles**[2]

[1]College of Education & Human Development, University of Delaware, Newark, Delaware, USA

[2]School of Education, University of California, Irvine, Irvine, California, USA

Correspondence
Hye Rin Lee, College of Education & Human Development, 106 Alison Hall West Newark, DE 19716, USA.
Email: hyerin@udel.edu

Funding information
National Science Foundation, Grant/Award Numbers: DGE-1839285, 1742627; Institute of Education Sciences, Grant/Award Number: R305A170160

Abstract

Background: A perceived fit between personal values and what a career offers is critical for college students pursuing and persisting in that career.

Purpose/Hypothesis(es): We, therefore, investigated the career values of engineering undergraduates through language in two different studies. Study 1 ($N = 35$) examined students' written postgraduation plans for agentic and communal career value themes. Drawing on Study 1 themes, Study 2 ($N = 918$) examined the association of achievement-related and interpersonal word categories in written narratives to surveyed career values.

Design/Method: In Study 1, inductive and deductive approaches were used to identify agentic and communal career values. In Study 2, regressions were conducted using achievement-related and interpersonal words as outcomes.

Results: Study 1 found agentic and communal value themes. Agentic value themes included career, personal development, and financial gains. Communal value themes included helping others and being family-oriented. Results from Study 2 showed that students' language use in the discussion of their careers was associated with surveyed career values.

Conclusion: Although engineering students hold more agentic than communal values, they hold both career values, which may have implications for supporting students from diverse backgrounds.

KEYWORDS

agentic career values, communal career values, engineering college students, language

1 | INTRODUCTION

Despite the need for engineers, the engineering field in the United States neither attracts nor retains enough engineering majors in college—the next generation of engineers (Beering, 2007; Chen & Weko, 2009; National Science Foundation, 2021). Therefore, understanding college students' reasons for choosing and persisting in engineering is important for researchers and practitioners. One effective approach to increase college students' participation and persistence is to help them perceive a fit between what a career offers and what they value (Diekman et al., 2010; Eccles, 1994, 2009; Holland, 1985; LaMeres et al., 2019; Moss & Frieze, 1993; Super, 1957, 1990). Nevertheless, there is little research on the career values of engineering students, and more research is needed to better understand how their perceptions of the opportunities that engineering careers offer them and their values align. Research from

psycholinguistics suggests that language can be a useful and important tool to understand students' in-the-moment beliefs (Pennebaker et al., 2015; Tausczik & Pennebaker, 2010) and, thus, presumably also their career values and stereotypes. For instance, the language a teacher uses with students in the classroom, a mentor uses with mentees, or a career counselor uses with students can all influence how interested, engaged, and successful college students are in a given major (Harackiewicz et al., 2012; Yeager et al., 2016). To be able to best support college students' choices and persistence in engineering, we conducted two studies on language usage in the context of career values. The first study explored career value themes that engineering college students discussed and the frequency of those endorsed themes. Using a larger convenience sample, the second study examined the extent to which engineering college students' career values (measured by surveys) are associated with the language they use (measured by word use) to describe their career values. The results of the first study's examination of the themes of agentic and communal career values guided the selection of word categories. Both studies focused on engineering college students' writing responses about their career plans.

2 | LITERATURE REVIEW

2.1 | Conceptual framework

We frame our work within various psychological theories, such as situated expectancy–value theory (SEVT; Eccles & Wigfield, 2020) and goal congruity theory (GCT; Diekman et al., 2020). SEVT, previously known as expectancy–value theory (EVT; Eccles et al., 1983), posits that individuals are more likely to engage and persist in activities they perceive as valuable and relevant to their personal goals. Values are defined as a set of stable beliefs that are important and desirable to an individual (Rokeach, 1979), whereas goals are defined as tasks that an individual wants to achieve (Eccles & Wigfield, 2002). A value that is particularly vital in the context of engineering attraction and persistence is attainment value, a component of SEVT that refers to how central a task is to one's personal and collective identities (Eccles, 2009). It is important because individuals who choose a career that aligns with their values and goals are more likely to be motivated (Eccles et al., 1983; Eccles & Wigfield, 2020). If an individual values their identity as a woman (i.e., attainment value), which can come with placing importance on helping others, then their goal typically aligns with choosing a career that allows them to fulfill this value.

In the context of GCT, Diekman et al. (2020) postulate that individuals seek congruency between their personal values and goals and the values and goals connected with their chosen careers. GCT emphasizes the importance of two broad, but different, categories of values and goals that students hold when deciding to pick or stay in a career: agentic and communal (Bakan, 1966; Judd et al., 2005; Pöhlmann, 2001). Agentic values and goals refer to the importance of and wanting to do something in service of the self, whereas communal values and goals refer to the importance of and wanting to do something in the service of others (Diekman & Steinberg, 2013).

Both SEVT (Eccles & Wigfield, 2020) and GCT (Diekman et al., 2020) highlight the importance of considering the fit between personal goals, values, and the characteristics of a career when making decisions related to career choice or persistence. In the context of engineering, students often view engineering careers as offering opportunities to fulfill agentic goals to a greater degree compared with communal goals because of engineering stereotypes like "engineers tend to work in isolation" as opposed to help others (Beardslee & O'Dowd, 1961; Boucher et al., 2017; Cech, 2014; Diekman et al., 2011). For example, they view engineers as having goals, such as to achieve or to gain wealth, status, or independence, instead of working, connecting, and helping others. This perception can hinder engineering college students from pursuing or completing their degrees, particularly if they hold communal values to a greater degree than agentic values. This is due to a misalignment between the perceived values and goals provided by engineering careers and the personal values and goals of the students (Diekman et al., 2010, 2011, 2017). To foster interest and sustain motivation for engineering careers, it is important to better understand the values that engineering college students hold. The current multi-methods exploratory study explored agentic and communal career values of engineering college students through language. Using a qualitative approach, the first study investigated the natural emergence of agentic and communal value characteristics and the extent to which they appear in engineering students' written narratives about their career plans after graduation. Then, using a quantitative approach, the second study examined whether the use of agentic and communal value language by engineering students in their career discussions was associated with the surveyed agentic and communal career values.

2.2 | Characteristics of agentic and communal values

Limited research has delved into the agentic and communal career values of engineering college students in a descriptive manner. Previous empirical work by McAdams et al. (1996) and more recent theoretical work by Diekman et al. (2020) have provided a foundation for this area. They identified mastery, achievement, status, power, etc., as characteristics of agentic values, and community, helping others, caring for others, etc., as characteristics of communal values. However, there remains a gap in knowledge regarding the specific agentic and communal values held by engineering students, as explored through qualitative methods.

Previous research on engineering students' careers has either focused on their personal identity development during the transition to the workplace (Huff et al., 2019) or the alignment of their values related to career intentions (Woodcock et al., 2012). Although Huff et al. (2019) did not explicitly investigate the agentic and communal values and goals of engineering students, their interviews suggested that engineering fulfilled their agentic values and goals more than communal ones. For instance, an engineer mentioned how their career allowed them to secure a job immediately after graduation, fulfilling their goal of financial independence (i.e., an agentic goal). Additionally, women engineers expressed a conflict between their professional and personal identities as they became physically distanced from their families. Although their agentic values and goals were met through their profession, they struggled to align their communal values and goals of developing relationships with their families. As a result, further research is needed to identify the prevalent characteristics of agentic and communal values and goals among engineering students. On the other hand, Woodcock et al. (2012) systematically investigated agentic and communal values and goals but did not qualitatively examine the discussions of engineering college students regarding these values and goals. Their findings indicated that women with a higher orientation toward agentic values and goals were more likely to pursue careers in engineering research. The perceived lack of affording communal goals in engineering contributes to low participation in engineering careers for women. Consequently, there is a pressing need to employ a qualitative approach to explore engineering students' values and goals in their own words. Such an approach may unveil new dimensions and characteristics of agentic and communal values and goals that have not been previously considered, particularly in the context of engineering students.

Moreover, prior work has mostly regarded students as either holding agentic or communal values (e.g., Allen et al., 2015; Bairaktarova & Pilotte, 2020; Diekman et al., 2011; Evans & Diekman, 2009; Smith et al., 2014), but in reality, students hold both agentic and communal values simultaneously (Fuesting et al., 2017; Yeager et al., 2012; Yeager & Bundick, 2009). Both SEVT (Eccles & Wigfield, 2020) and GCT (Diekman et al., 2020) contend that students maintain multiple identities, which can result in multiple values and goals. For instance, a student may value gaining new knowledge and have a goal of mastering specific engineering topics to get into graduate school (i.e., an agentic value and goal), but also value family and have a goal of making a lot of money to repay the family to fulfill their responsibilities as a daughter or son (i.e., a communal value and goal). We propose that students simultaneously hold agentic and communal values in addition to multiple value characteristics. For example, a student may value achievement, status, and money (i.e., different characteristics of agentic value). More work is needed to examine whether and how engineering students discuss holding agentic and communal values simultaneously.

2.3 | An alternative way to measure career values

To date, scholars have either focused on career value orientation or the extent to which a career allows individuals, such as college students, to do what they value via surveys (Diekman et al., 2010; Johnson, 2002; Pöhlmann, 2001). Yet, the question that remains is whether these career values drive college students' choices. One novel way to assess this association is through language. Researchers and professionals can determine whether the values that engineering college students agree to in surveys are factors in their career considerations by examining the language that students use when discussing their career choices. Using language analysis will allow for an examination of the link between the content of students' written narratives about their career aspirations and their career values assessed by surveys.

Studying students' language is one viable strategy for assessing how career values influence their career choices (Hirsh & Peterson, 2009; Tausczik & Pennebaker, 2010). Technological developments have allowed scholars to develop language software to study the use of language in efficient ways. For example, the Linguistic Inquiry and Word Count (LIWC; Pennebaker et al., 2015), one of the most prominently used language software within psychology, classifies words into meaningful, theoretically predetermined categories. After the words from a text have been categorized,

psychologists can relate the use of certain word categories to various psychological outcomes. For instance, Robinson et al. (2016) found that college students who wrote more extrinsic reward words (e.g., get, career, etc.) were less likely to persist and complete the course than those who wrote more words about how the material of the course applies to their future career (e.g., engage, impact, etc.). Other scholars found that asking college students to write about the usefulness of their major or course to their daily life or future associates with more personal (e.g., I, them, etc.), social (e.g., friend, help, etc.), and cognitive (e.g., cause, know, etc.) word use, which, in turn, was connected to greater interest and persistence in the major or course (Canning et al., 2019; Harackiewicz et al., 2016; Priniski et al., 2019). However, there has been less attention on the extent to which certain words are associated with career values. Researchers and practitioners can better understand the subtleties of career values by analyzing the language used by engineering college students.

2.4 | Purpose and justification of the two-study format

This article employs a two-study format to investigate the agentic and communal career values of engineering undergraduates. The two studies, taken separately and together, advance our knowledge of engineering students' career values. Study 1 employs a qualitative approach to examine the distinctive features of agentic and communal career values among engineering students. To better understand career values as a complex and multifaceted construct, Study 1 aims to (a) understand the unique characteristics of agentic and communal values among engineering students, and (b) ascertain whether survey-based methods of measuring these values capture the full range of value characteristics. We focus on themes related to agentic and communal values drawn from the written accounts of engineering community college students on their postgraduation job plans. We employed two strategies to promote high research quality (Walther et al., 2017). First, we used not only the perspectives of engineering students to comprehend the distinct characteristics of agentic and communal values but also referenced existing literature, including works by Bakan (1966), Diekman et al. (2020), Judd et al. (2005), and Pöhlmann (2001), to define agentic and communal values. We investigate the frequency with which agentic and communal value themes are expressed in career plan narratives and how frequently they co-occur. Second, we handled data with multiple coders to enhance the reliability of our data analysis. To document the process, coders communicated closely and made detailed notes when encountering discrepancies. Using a community college sample of sociodemographically diverse students, we aim to capture a broad spectrum of themes in Study 1. In other words, we implemented a research design that allowed us to gather data from a diverse group, as community colleges typically have a more varied student population (Cohen et al., 2013), with the aim of ensuring high research quality.

Building on the findings of Study 1, Study 2 employs a quantitative methodology to investigate the link between the agentic and communal career values reflected in the self-narrative writing responses of engineering college students and those values as measured by survey responses. Study 2 aims to extend the work in Study 1 using the agentic and communal value themes to guide the selection of relevant word categories from the LIWC program for the language content analysis. This investigation is essential because, relying solely on their writing responses, we cannot assert that students consciously hold particular career values. Study 2 aims to triangulate the results of the survey-based agentic and communal values (traditional measures) with the nontraditional measures of students' written language use as an indicator of their agentic and communal values. To promote high research quality (Walther et al., 2017), we include both agentic and communal values as factors in our estimation models because we want to take into consideration the likelihood that students can hold an assortment of agentic and communal beliefs. Using an undergraduate sample from a four-year university with a notably sociodemographically diverse student population, we aim to extend findings from Study 1.

Study 1 and Study 2 build upon previous research on career values and goals (Diekman et al., 2010, 2011; Eccles, 1994, 2009; Holland, 1985; Klussman et al., 2021; LaMeres et al., 2019; Moss & Frieze, 1993; Super, 1957, 1990; Yang & Barth, 2015) to enhance college students' choice, interest, and long-term motivation in engineering by exploring career values through written responses. This two-study format allows for a broader exploration of engineering college students' agentic and communal career values using traditional and nontraditional data sources and methodologies. Together, these studies adopt a measured approach in recognizing that students can simultaneously hold agentic and communal beliefs. Further, they attempt to validate agentic and communal values by comparing the values expressed in the students' written responses to the survey-based measures of career values.

2.5 | Positionality statement

We approach our work as academic researchers grounded in the theories of STEM education, particularly motivation for STEM, in order to understand the experiences and perspectives of students in the field of engineering. We acknowledge that, as authors, none of us possess a degree in engineering, which may limit our direct lived experiences within the discipline. This recognition underscores the importance of being aware of potential biases and limitations in our understanding of engineering students' career values. To address this gap in our experiential knowledge, we employ research methodologies that are validated standards of practice within the field and draw on established theories and frameworks in STEM education and motivation, such as GCT (Diekman et al., 2020). A core aspect of our research approach is to center the voices and narratives of students themselves. By prioritizing students' own words and experiences, we aim to foster an authentic and nuanced understanding of their career values, which will thereby guide implications and recommendations on how to cultivate greater interest, engagement, and persistence in the engineering major. Although we recognize the significance of lived experiences and the potential limitations resulting from our own backgrounds, we actively seek to bridge this gap through close collaboration with engineering students and faculty through ongoing projects. Our positionality as researchers investigating engineering career values is characterized by a commitment to high-quality research methodologies, a recognition of our own limitations in terms of lived experiences, and a focus on amplifying the voices and perspectives of engineering students themselves.

3 | STUDY 1

3.1 | Research questions and hypotheses

In Study 1, we examined the following research questions:

1. How do engineering community college students discuss their agentic and communal values in written narratives about their career plans after graduation?

Drawing on prior studies (Diekman et al., 2010; Pöhlmann, 2001) of agentic and communal values and goals using self-reported survey measures, we expected that agentic values in engineering would be characterized by themes of mastery, personal and career success, status, and financial rewards. We expected that communal values in engineering would be characterized by themes of connecting with others, helping others, and serving the community.

2. Do engineering community college students express multiple agentic and communal value themes in their post-graduation career plan narrative? If so, to what extent?

We expected multiple agentic and communal values to be portrayed through (a) holding both agentic and communal values simultaneously, and (b) holding more than one agentic and communal value characteristic. The examination of the extent to which community college engineering students reported multiple values was exploratory.

4 | METHOD

4.1 | Participants

Participants were 44 community college students (29 men and 15 women) enrolled in lower division engineering courses in Southern California. Engineering community college students are important to examine, especially as they have often been neglected in higher education despite being a diverse student population (Bryant, 2001; Seymour & Hunter, 2019). Relative to traditional four-year undergraduates, community college students are more likely to be older, parents, full-time employees, women, and low-income and racial/ethnic minorities (Bryant, 2001; Kim, 2002; Smith et al., 2022). With these demographic and contextual differences, this study examines engineering community college students' agentic and communal career values. Nine students did not complete the writing prompt, which was a key variable to examine agentic and communal values for the current study. Those students were excluded. Thus, the final

sample included 35 community college students (25 men and 10 women), which comprised of 31% Other (i.e., multiracial backgrounds, such as White and Hispanic/Latino, White and Asian, and etc.; $n = 11$), 29% White ($n = 10$), 17% Asian ($n = 6$), 17% Hispanic/Latino ($n = 6$), and 2 students who did not report demographics.

4.2 | Procedure

Community college students were asked to respond to online survey questionnaires about their engineering career goals as part of a larger study (see Lee, Ramirez, et al., 2023 and Lee, Rutherford, et al., 2023 for more information). Over the course of the semester in 2019, students watched four YouTube videos from Tim, a Latino male engineering graduate student, in which he talks about his engineering experience. Students were asked to write a brief response to a specific prompt after each video. Study 1 focused on the prompt assigned after the fourth video. This fourth video was selected due to its emphasis on career goals. The first three videos centered around the topics of study groups and tutoring as well as the process of transferring and adjusting to a four-year university. The chosen video tackled the crucial career decision-making process after obtaining a bachelor's degree in engineering. This particular video proved optimal for the current study as it aligned with a writing prompt that prompted engineering students to discuss their personal career values. Students were asked about their postgraduation career goals and how those goals connect to who they are as individuals or personal values. Students provided informed consent to participate in the study and received extra credit. The study was approved by the university's Institutional Review Board. Pseudonyms were used for confidentiality purposes.

4.3 | Writing prompt measure

Students watched Tim's video discussing his career pathway after graduating with an engineering bachelor's degree. In the video, Tim discussed his career pathways and the decision to pursue graduate school. He compared his situation as a transfer student to his friends who started their undergraduate studies as freshmen and landed job opportunities at large companies, such as Boeing and NASA. Tim felt that as a transfer student, he had limited time for research opportunities and internships, which made him feel unprepared for joining the workforce. He shared his experience of attending career fairs and finding limited job positions available. Tim explained that he did not feel ready to enter the workforce due to a lack of experience and the high competition for engineering positions. Reflecting on his options, Tim considered graduate school as a pathway to gain more experience and specialization in his field. He discussed the challenges of applying for graduate studies, including the need for a strong personal statement and research focus. Ultimately, Tim chose to continue his education by pursuing graduate studies, which provided him the necessary tools and hands-on experience to be more prepared for a career in engineering. He highlighted the advantages of specialization and the knowledge he will acquire as a graduate student. In conclusion, Tim shared his readiness and confidence in completing his master's degree and his belief that he now possesses the necessary tools for a successful career in engineering. He ultimately described how he now had a clearer concept of the type of career he wanted to pursue.

After watching the video, engineering community college students were asked to respond in writing to the following prompt with regard to their personal goals after graduation:

> Write about what you would like to do after graduation (e.g., either a potential job or attending graduate school in engineering). How can you gain the necessary experience or tools for your future goal? How might this job or graduate school be relevant to your personal values? To whom you are as a person? Include as much detail as possible.

4.4 | Coding and analysis

Using Braun and Clarke's (2006) process for thematic analysis, we used both inductive and deductive approaches to identify thematic patterns in the data in an iterative two-step process. An inductive or bottom-up strategy is characterized as generating codes based on the data itself, whereas a deductive or top-down strategy is defined as generating codes based on existing literature or theory (Saldaña, 2013).

First, an inductive approach was used to code for career values. Coders reviewed and identified statements that explained why community college students want to do *X* (i.e., get a job, attend graduate school, or any other career-

related goals) after graduation. Using in vivo techniques (i.e., codes that are literal or verbatim), each career value statement was identified within the transcript document and assigned the first round of codes. The second iteration of coding consolidated related codes into similar categories.

Second, a deductive approach was employed to group the emergent inductively coded career value statements into agentic or communal career values. To group the themes into either agentic or communal career values, we used definitions from prior literature (Bakan, 1966; Diekman et al., 2020; Judd et al., 2005; Pöhlmann, 2001). Emergent themes that alluded to engineering college students placing the importance of doing something in the service of the self in their careers were classified as agentic career values. Emergent themes that alluded to engineering college students placing the importance of doing something in the service of others in their careers were classified as communal career values.

Three coders met weekly for three weeks to discuss issues, such as differentiating enough between codes and discrepancies in codes among coders. Reliability was calculated by first dividing the number of discrepancies with the total number of career value themes and then averaging by the number of coders.

5 | RESULTS

Engineering community college students' ($N = 35$) written responses contained an average of 205 words in describing their postgraduation goals. Two students (6%) did not provide any references to career value themes in their responses. Ten students (28%) mentioned only one career value theme, 13 students (37%) mentioned two career value themes, eight students (23%) mentioned three career value themes, and two students (6%) mentioned four career value themes. One student (3%) solely indicated communal career values and 21 students (60%) solely discussed agentic career values.

Overall, three predominant themes were identified as representative of engineering community college students' agentic career values: *career development*, *personal development*, and *financial gains*. Agentic career values appeared 75 times over the three agentic career value themes (refer to Table 1 for details on the number of occurrences for each theme). Two predominant themes emerged representing engineering community college students' communal values: *helping others* and *family-oriented*. Communal career values appeared 14 times across both of the two communal career value themes (refer to Table 1 for details on the number of occurrences for each theme). We introduce each theme that corresponds to either agentic or communal career values and then present an instance in which a student mentioned multiple career values.

5.1 | Agentic career value themes

Three themes were classified as exhibiting agentic career values: *career development*, *personal development*, and *financial gains*. These subthemes were identified as having agentic career values because students expressed the importance of their own selves in their postgraduation plans.

5.1.1 | Career development

This theme is characterized by students valuing specific career goals, such as expanding their professional networks to acquire a job or acceptance into a graduate school program, as well as developing their expertise to advance toward their next career goals (Table 1). *Career development* was grouped as an agentic career value because students discussed improving their careers for themselves rather than others. Of the 75 times agentic career values were addressed, *career development* themes were mentioned 51% ($n = 38$) of the time.

5.1.2 | Personal development

This theme is characterized by students valuing their individual ambitions, such as matching their interests, self-exploration, doing what works best for them in their current situation, and wanting to gain knowledge for the sake of learning further (Table 1). Of the 75 times agentic career values were addressed, *personal development* themes were mentioned 33% ($n = 25$) of the time.

TABLE 1 Study 1: Agentic and communal career value themes.

Theme	Number of occurrences	Example quote
Agentic value		
Career development	38	Jude: After graduating from undergraduate studies, I would like to join the workforce in the defensive sector of the aerospace industry. After experience gained from those companies, I would be having [sic] more engineering experience and could help lead to a career with a well-known defensive, such as Lockheed Martin or Northrop Grumman. Greer: I also plan on taking internship opportunities during the summers where [sic] I am attending law school to also establish more connections and get hands-on opportunities. Stevie: After graduating, I would like to be able to take a year off from school and gain experience from being able to work for an actual company ... After a year of working, I would like to be able to go back to school—this time attending graduate school. By working for a year, I will gain a lot of experience that I will not only be able to apply for the rest of my professional career, but also to graduate school.
Personal development	25	Casey: Being able to join the workforce out of college is relevant to my personal values because I have always excelled the most when working in real-life situations. I believe that work experience would benefit me more than further studies although as I continue through my bachelor's degree, I am keeping all opportunities open to consideration to find my best fit. Kirby: Upon graduating with a master's degree in Aerospace Engineering, I want to get a job within [sic] the space industry ... My entire extended family worked for private Aerospace companies during the space race, which upon hearing their stories, heavily influenced me from a young age. For as long as I can remember, I have loved tinkering with toys and taking them apart to understand the internal mechanisms that allowed the toy to operate. This continuously grew as I got older and made its way to cars and planes as an adult. I have always gone by the ideology to [sic] doing what you love because if you do not, it is only you who you are cheating out of experiences. Jackie: I always want to complete tasks to the best of my ability, so if I feel underprepared then I always make sure to take a step back to reevaluate my goals. If more school will help me with being [sic] a better engineer in the workforce, then I would gladly continue with school.
Financial gains	12	Jodie: Now, why do I think it is so important to get a job straight out of college? Less debt and money stress. Frankie: I'd like to take my degree into my father's business or business, in general ... I want to use my own knowledge and my own talents to buy my own Ferrari.
	Total = 75	
Communal value		
Helping others	12	Robbie: Ultimately, I want to be able to open up a STEM school that targets underprivileged kids everywhere and exposes them to STEM fields and the many possibilities that they can achieve with a STEM degree. This is particularly close to me because I once was an underprivileged kid, and sometimes all it takes is one person believing in you to push you the extra mile. Channing: I have always wanted to contribute everything I can towards driving our world forward. The way I plan to do just that is by pursuing a career in sustainable energy transportation. This career path would enable me to contribute to helping the world reduce the strain on our resources and environment caused by the transportation industry, as well as work towards making vehicles safer.
Family-oriented	2	Finley: I want to go to graduate school for engineering ... I come from a family that is very education-oriented so going to graduate school aligns with the values that my family instilled in me. Jaylin: After graduation, I would like to work at a big engineering firm ... This job is relevant to my personal values because the better job I have, the more I can repay my parents back for what they have done and sacrificed for me.
	Total = 14	

5.1.3 | Financial gains

This theme is characterized by students valuing a high income or being able to purchase material goods (Table 1). *Financial gains* were grouped as an agentic career value because students wanted to make money for themselves. Of the 75 times agentic career values were addressed, *financial gains* themes were mentioned 16% ($n = 12$) of the time.

5.2 | Communal career value themes

Two themes aligned with communal career values: *helping others* and *family-oriented*. These subthemes were identified as having communal career values because students expressed the importance of someone else in their postgraduation plans.

5.2.1 | Helping others

This theme is characterized by students valuing benefiting society, industry, or helping others, in general (Table 1). *Helping others* was coded as a communal career value because students positioned the discussion of their career values in reference to others rather than themselves. Of the 14 times communal career values were addressed, *helping others* themes were mentioned 86% ($n = 12$) of the time.

5.2.2 | Family-oriented

This theme is characterized by students valuing their family, such as wanting to attend graduate school because their family values education or wanting to repay and honor parents for what they have done for them (Table 1). *Family-oriented* was coded as a communal career value because students are focused on their family members rather than themselves. Of the 14 times communal career values were addressed, *family-oriented* themes were mentioned 14% ($n = 2$) of the time.

5.3 | Multiple career values

When examining the subthemes, the findings revealed that students would express many career values at the same time. In their written responses, 66% ($n = 23$) of community college students mentioned multiple characteristics of career values, and 31% ($n = 11$) mentioned both agentic and communal career values. Asa, for example, mentions three unique career values that include elements of both agentic and communal values:

> If I feel like I need more experience or time, then I would follow according to that. But, if I feel ready or have a fortunate or solid opportunity at that moment, I will most likely take that offer and grow more.
>
> (personal development, agentic career value theme)

> Getting a specific job or choosing a more defined path in the engineering degree in graduate school would be reflected in my values ... which is helping people or inventing/innovating tools to better the quality of life.
>
> (helping others, communal career value theme)

> One of my ultimate goals is to become a successful engineer.
>
> (career development, agentic career value theme)

This example highlights the subtle nuances of career value, which may have gone undetected if a flexible and exploratory analytic approach had not been applied. These findings imply that community college students can be endorsing multiple career value characteristics at the same time.

6 | DISCUSSION

We explored students' career values using written narratives about their postgraduation career plans, a strategy infrequently employed in studies. We identified several subthemes in community college engineering students' career plans that correspond to agentic and communal career values. The findings also expand the discussion over whether these students hold agentic, communal, or both agentic and communal career values at the same time.

We found that *career development*, *personal development*, and *financial gains* subthemes aligned with commonly referenced operationalizations of agentic career values and *helping others* and *family-oriented* subthemes aligned with commonly referenced operationalizations of communal career values. These subthemes are specifically aligned with Diekman et al.'s (2020) agentic and communal characteristics. For example, the theme of *financial gains* (comprising students' mentions of tangible rewards) aligned with Diekman et al.'s (2020) observed agentic career values and *helping others* aligned with communal career values. Our findings on career value characteristics were broader. The *career development* subtheme is closely aligned with Diekman et al.'s (2020) characteristics of agentic career values to include success, self-promotion, and status. The *personal development* subtheme is closely aligned with Diekman et al.'s (2020) focus on the self and self-direction agentic career value characteristics. However, through our approach, we drew attention to the breadth of students' self-oriented reasons, which include self-exploration, doing what is perceived as optimal for oneself, and wanting to study for the sake of learning. Finally, our findings revealed a *family-oriented* subtheme of communal career values that Diekman et al. (2020) do not explicitly identify. One explanation for this finding is that many community college students tend to be the first in their families to pursue higher education, contributing to their family-oriented aspirations. Diekman et al.'s (2020) characteristics of agentic and communal career values were based on studies involving mostly White/European American students, whereas two thirds of our community college student sample were non-White or multiracial.

Most engineering students had agentic career values or self-oriented focused career values in their writing. This trend is consistent with stereotypic perceptions of what engineering careers afford and congruent with what cultures in the field promote (Boucher et al., 2017). A culture cycle perspective points out that an individual's motivation is influenced by a broader cyclical system of institutional contexts, interactions with others, and individual-level behaviors, cognitions, and motives (Cheryan & Markus, 2020; Markus & Kitayama, 2010). That is, engineering students' perceived affordances and values often align with what is signaled in the environment. Joshi et al. (2022) found that institutional context and daily practices shaped students' behaviors, motives, and cognitions related to their STEM engagement. There was a greater emphasis on agency in the engineering/physical sciences' surrounding environment compared with the life sciences' surrounding environment, which impacted their own agentic values over time. Therefore, more research is needed to disentangle whether engineering students are more inclined to be agentically driven or merely reproducing stereotypes of engineers due to their environment. For example, one possibility would be to examine implicit messages that may convey stereotypes in textbooks, lectures, and conversations with educators and career counselors who only afford agentic goals and values, rather than both agentic and communal goals and values in engineering. Another important next step would be to understand for whom and in what contexts some of these subthemes would be most relevant. Moreover, educators should think about how to promote engineering careers as affording communal goals for students who have communal or multiple values.

Our findings suggest that engineering students likely have varying levels of agentic and communal career values and hold agentic and communal career values simultaneously. One third of the students reported both agentic and communal career values, and more than half of the students shared various characteristics of career values. Our findings suggest that engineering students can have complex profiles of career values, similar to those found in the literature on multiple goal orientation (Pintrich, 2000) and work goals (Yeager et al., 2012; Yeager & Bundick, 2009).

6.1 | Limitations and future directions

Although our study provided valuable insights, it is also important to acknowledge certain limitations. First, the expression of agentic career values may have been influenced by Tim, who identified as a man. Future research should examine the degree to which hearing from multiple and diverse (e.g., women) students' goals can influence the expression of career values among engineering students. Second, considering the influence of cultural and social factors on

students' expressions of career values, future research should delve deeper into the specific contexts in which engineering students are situated. Understanding how these contexts shape students' perceptions and goals will contribute to a more comprehensive understanding of engineering students' career values, especially among diverse student populations. Third, we could not ascertain with certainty whether students genuinely believed and consciously held the career values expressed in their written narratives. Although the narratives provided insights into students' career aspirations, there is a possibility that some responses were influenced by social desirability or other external factors. Therefore, in Study 2, we tackle this issue by analyzing the link between language choice in students' written postgraduation goals and their self-reported support of career values. To better understand the scope of the career value subthemes that emerged from the written narratives of Study 1 students, we explore the written narratives of engineering students in more detail. Study 2 used a different and convenient dataset that includes engineering students' writing narratives from a four-year university.

7 | STUDY 2

7.1 | Research questions and hypotheses

Study 2 builds on the themes identified in Study 1 via the following research questions:

1. To what extent do engineering college students' financial agentic career values associate with their interpersonal and achievement-related language use in their writing about their career plan?

Engineering college students' written responses when discussing postgraduation plans from Study 1 suggest that words like money and agency should be associated with financial agentic career values. Therefore, we hypothesized that engineering college students with higher financial agentic career values should employ achievement-related words.

2. To what extent do engineering students' communal career values associate with their interpersonal and achievement-related language use in their writing about their career plan?

Engineering college students' written responses when discussing postgraduation plans from Study 1 would suggest that words like family and communion should be associated with communal career values. Therefore, we hypothesized that engineering college students with higher communal career values should employ interpersonal words.

8 | METHOD

8.1 | Participants

Participants were 934 undergraduates (643 men, 276 women, and 15 unreported demographics) enrolled in an introductory engineering course at a large, public university in Southern California. The university is designated as a Hispanic- and Asian-American-serving institution. Sixteen students were missing relevant variables examined for the current study (15 students missing demographics and 1 student not answering the writing prompt). The final sample included 918 engineering undergraduates (643 men, 275 women), which was comprised of 61% Asian (e.g., Chinese, Korean, Japanese, Thai, Vietnamese; $n = 563$), 19% Hispanic/Latino ($n = 173$), 15% White ($n = 134$), and 5% Other (e.g., American Indian, Black/Declined to Respond; $n = 48$). Of the 918 college students, 2% were Undeclared of specific major in the School of Engineering ($n = 19$), 9% were Aerospace Engineering majors ($n = 84$), 17% were Biomedical Engineering majors ($n = 157$), 5% were Chemical Engineering majors ($n = 48$), 9% were Civil Engineering majors ($n = 81$), 25% were Computer Engineering majors ($n = 231$), 7% were Electrical Engineering majors ($n = 60$), 3% were Environmental Engineering majors ($n = 27$), 2% were Material Science Engineering majors ($n = 21$), and 21% were Mechanical Engineering majors ($n = 190$). Twenty-three percent ($n = 207$) of the students were from low socioeconomic backgrounds and 33% ($n = 303$) were first-generation college students.

8.2 | Procedure

This study made use of a readily available dataset that was initially created to evaluate the efficacy of a psychological intervention within their courses. Engineering college students' career values and plans were surveyed at the beginning of the term and prior to the implementation of the intervention.

8.3 | Measures

8.3.1 | Career values

Career values assess what students believe to be important in their careers. They were assessed using classic survey measures.

Financial agentic career value: Financial agentic career value was adapted to be specific to physical and engineering sciences from Harackiewicz et al. (2016) using a single item on a seven-point Likert scale ranging from 1 (*not at all*) to 7 (*very much*). The item asked, "I want to study physical and engineering sciences because I want a job that makes a lot of money" ($M = 5.08$, SD = 1.56).

Communal career values: Communal career values were adapted to be specific to physical and engineering sciences from Harackiewicz et al. (2016) using a three-item measure on a seven-point Likert scale ranging from 1 (*not at all*) to 7 (*very much*). The following items were used: "I want to study physical and engineering sciences because I want to make a contribution to society," "I want to study physical and engineering sciences because I want to give back to my community," and "I want to study physical and engineering sciences because I want to learn things that will help me make a positive impact on the world." The three items were averaged to form a scale ($M = 4.90$, SD = 1.37, $\alpha = .86$).

8.3.2 | Writing prompt

As college major has been shown to be strongly linked to career aspirations (Brown & Strange, 1981; Harren, 1966; Osipow et al., 1976), an open-ended item of "Why did you choose this major" was used to assess career plans. Engineering college students' responses also reflected similarly to those from the first study that asked about career plans. Examples of responses included: "I wanted to learn more about the biomedical field and how I can help others through engineering." and "I am interested in learning circuit design and generally how electronics work. I am also interested in learning a bit of software programming languages that will be useful in the future."

8.3.3 | Word usage

We used the Linguistic Inquiry and Word Count program (LIWC 2015; Pennebaker et al., 2015), a computer-assisted text analysis tool, to assess students' word usage. LIWC identifies and categorizes psychological, emotional, cognitive, and other linguistic features in the text. We used the LIWC internal dictionary, a previously validated dictionary that compared ratings from human judges to that of the computer program (Pennebaker et al., 2015). The LIWC internal dictionary is a comprehensive compilation of words, phases, and patterns carefully categorized and labeled to represent various psychological dimensions. For example, words like "happy," "angry," and "sad" would be tagged into the emotion category, allowing LIWC to detect and quantify emotional expressions in text. That is, the internal dictionary serves as a reference guide for LIWC, enabling the software to automatically scan and analyze text by matching words in the text to categories in the dictionary (Pennebaker et al., 2015). Based on our findings from Study 1, the career value themes "career development," "personal development," and "financial gains" corresponded with the *reward* and *money* word categories in the LIWC internal dictionary because these word categories indicated doing something in the service of self. The career value theme, "helping others," corresponded with the *affiliation* word category and the career value theme "family-oriented" corresponded with the word category *family* in the LIWC internal dictionary as these word categories indicated doing something in the service of others. Thus, achievement-related words were captured by *reward words* and *money words*, and interpersonal words were captured by *family words* and *affiliation words*. Further dictionaries used were an agentic and communal dictionary developed and validated by Pietraszkiewicz et al. (2019). From

the agentic and communal dictionary, achievement-related words were captured by *agency words* and interpersonal words were captured by *communion words*. For more information on the list of words in the internal LIWC dictionary and agentic and communal dictionary, refer to Pennebaker et al. (2015) and Pietraszkiewicz et al. (2019), respectively.

Achievement-related word categories: *Agency words* refer to any words that relate to self-oriented values and goals (e.g., accomplish, mastery, expert, etc.). *Reward words* refer to any words that relate to how people are driven by accolades (e.g., take, benefit, award, etc.). *Money words* refer to any words that relate to personal concerns over money (e.g., cash, finance, payment, etc.).

Interpersonal word categories: *Communion words* refer to any words that relate to other-oriented values and goals (e.g., aid, cares, help, etc.). *Family words* refer to any words that relate to family members (e.g., daughter, dad, mom, etc.). *Affiliation words* refer to any words that relate to how people are goal-driven by others (e.g., friend, social, ally, etc.).

8.3.4 | Control variables

We used three control variables to account for variations in students' career values in their written narratives: gender, race/ethnicity, and prior achievement. As women use more communal words than agentic words compared with men (e.g., Madera et al., 2009), gender was included as a control variable. Research also suggests that word usage might differ by race/ethnicity (Soto & Deemer, 2018). Thus, race/ethnicity was included as a control variable. Prior achievement was used as a control variable due to its association with writing skills (Pajares, 2003). Prior achievement was measured using the average Scholastic Assessment Test (SAT) score on critical reading and mathematics.

8.4 | Data analysis

To examine word usage in engineering college students' writing responses, we used the computer language software, LIWC (Pennebaker et al., 2015). As mentioned above, LIWC analyzes text by searching for words that match the theoretically created dictionary file and then categorizes them into the appropriate category. To assess the frequency of word usage in a specific category, LIWC computes the percentage of words within the unit of analysis (a sentence or a passage) that have been ascribed to a specified category within the dictionary. More specifically, the number of used words that have been identified within a dictionary category (e.g., *agency*, *reward*, *money*, *communion*, *family*, and *affiliation words*) is divided by the absolute number of words used within the narrative being analyzed (i.e., the percentage of words within the passage of analysis that can be identified as *agency*, *reward*, *money*, *communion*, *family*, and *affiliation words* are calculated). The percentage of words is used to control for the variability in word usage because the more or fewer words someone uses overall can influence the number of certain words in a category.

To examine the associations between financial agentic and communal career values and each of the LIWC categories, hypothesis testing involved conducting a series of logistic regression models using R-Studio 3.5.2 (R Core Team, 2018). Major R-packages included *stats* for running the logistic regressions (R Core Team, 2018) and *tidyverse* for wrangling data (Wickham et al., 2019). The model regressed the presence or absence of each LIWC category on surveyed financial agentic and communal career values controlling for gender, race/ethnicity, and prior achievement. Both financial agentic and communal career values were entered as predictors in the same regression equation because the first study found that engineering college students held these values simultaneously.

9 | RESULTS

Table 2 presents descriptive statistics and intercorrelations between all variables for this study. Building on the idea that students can hold agentic and communal values simultaneously from Study 1, there was a statistically significant positive association between surveyed financial agentic career value and communal career value ($r = .20$, $p < .001$). As expected, surveyed financial agentic career values were generally positively correlated with achievement-related words. Surveyed financial agentic career values were positively correlated with *money words* ($r = .17$, $p < .001$), but not *agency* and *reward words*. Also, as expected surveyed communal career values were generally positively correlated with interpersonal words. Surveyed communal career values were positively correlated with *communion* ($r = .10$, $p < .01$) and *affiliation* ($r = .13$, $p < .001$) *words*, but not *family words*.

TABLE 2 Study 2: Descriptive statistics.

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Financial agentic value													
2. Communal value	.20***												
3. Women	−.05	<.01											
4. Asian	.01	.01	−.03										
5. Hispanic	−.01	.05	.03	−.61***									
6. Other	.05	<.01	<.01	−.30***	−.11***								
7. SAT score	−.06	−.10**	−.05	.20***	−.34***	.01							
8. Communion words	−.02	.10**	.16***	−.02	.06	−.03	−.05						
9. Family words	.02	−.03	.09**	.02	.01	−.01	−.01	.11***					
10. Affiliation words	−.02	.13***	.14***	−.02	.05	−.03	−.05	.71***	.23***				
11. Agency words	−.01	−.01	.03	.02	<.01	.04	.05	.21***	.01	.16***			
12. Reward Words	.02	−.03	.01	−.07*	.04	.08*	.02	.12***	<.01	.09**	.26***		
13. Money Words	.17***	−.05	.02	.04	−.04	.04	.02	.01	.11***	.07*	.11***	.15***	–
Mean	5.08	4.91	0.30	0.61	0.19	0.05	647.76	0.31	0.05	0.22	0.31	0.20	0.06
SD	1.56	1.37	0.46	0.49	0.39	0.22	66.25	0.46	0.21	0.42	0.46	0.40	0.24
Min	1	1	0	0	0	0	456.67	0	0	0	0	0	0
Max	7	7	1	1	1	1	800	1	1	1	1	1	1

Note: Word categories (i.e., communion, family, affiliation, agency, reward, and money words) capture the presence or absence of the word within a given category.

*$p < .05$. **$p < .01$. ***$p < .001$.

Table 3 presents the logistic regression models with surveyed financial agentic and communal career values as predictors of word usage. As hypothesized, engineering college students who reported having higher financial agentic career values were 2.78 times more the odds to use *money words* (OR = 2.78, 99% CI[1.91, 4.21]). However, engineering college students who reported holding higher communal career values were 0.72 less the odds to use *money words* (OR = 0.72, 99% CI[0.56, 0.94]). Findings did not show statistically significant greater than one odds ratio for the use of *agency* (OR = 0.99, 99% CI[0.86, 1.14]) and *reward words* (OR = 1.07, 99% CI[0.90, 1.26]) for engineering college students reporting higher financial agentic career values. Moreover, there were no statistically significant less than one odds ratios for *agency* (OR = 0.99, 99% CI[0.86, 1.15]) and *reward words* (OR = 0.92, 99% CI[0.78, 1.08]).

As hypothesized, engineering college students who reported holding higher communal career values were 1.28 times more the odds to use *communion words* (OR = 1.28, 99% CI[1.10, 1.49]). Those who had higher communal career values also were 1.42 more the odds to use *affiliation words* (OR = 1.42, 99% CI[1.20, 1.70]). Interestingly, there was no statistically significant greater than one odds ratio for the use of *family words* (OR = 0.83, 99% CI[0.62, 1.13]) for engineering college students holding higher communal career values. There also were no statistically significant odds ratios for the use of *communion* (OR = 0.92, 99% CI[0.79, 1.06]), *family* (OR = 1.17, 99% CI[0.85, 1.63]), and *affiliation words* (OR = 0.91, 99% CI[0.77, 1.07]) for engineering college students reporting higher financial agentic career values.

Finally, findings showed that women engineering college students were 2.04 times more the odds to use *communion words* than not (OR = 2.04, 99% CI[1.51, 2.76]), 2.28 times more the odds to use *family words* than not (OR = 2.28, 99% CI[1.23, 4.22]), and 2.02 times more the odds to use *affiliation words* than not (OR = 2.02, 99% CI [1.45, 2.80]) compared with men. There were no statistically significant associations between word usage and race/ethnicity or SAT score.

TABLE 3 Study 2: Financial agentic and communal career values from a survey predicting word usage.

	Achievement-related words			Interpersonal words		
	Agency words	**Reward words**	**Money words**	**Communion words**	**Family words**	**Affiliation words**
Financial agentic value	0.99	1.07	2.78***	0.92	1.17	0.91
	[0.86, 1.14]	[0.90, 1.26]	[1.91, 4.21]	[0.79, 1.06]	[0.85, 1.63]	[0.77, 1.07]
Communal value	0.99	0.92	0.72*	1.28***	0.83	1.42***
	[0.86, 1.15]	[0.78, 1.08]	[0.56, 0.94]	[1.10, 1.49]	[0.62, 1.13]	[1.20, 1.70]
Women	1.19	1.06	1.37	2.04***	2.28**	2.02***
	[0.88, 1.61]	[0.74, 1.50]	[0.75, 2.45]	[1.51, 2.76]	[1.23, 4.22]	[1.45, 2.80]
Asian	1.33	0.91	2.08	1.09	1.88	0.98
	[0.87, 2.06]	[0.57, 1.50]	[0.85, 6.25]	[0.72, 1.68]	[0.72, 6.44]	[0.62, 1.59]
Hispanic/Latino	1.40	1.39	1.23	1.31	1.83	1.13
	[0.83, 2.38]	[0.78, 2.51]	[0.36, 4.47]	[0.78, 2.21]	[0.56, 7.13]	[0.64, 2.00]
Other	1.91	2.11*	2.65	0.83	1.43	0.70
	[0.94, 3.85]	[1.00, 4.42]	[0.68, 10.4]	[0.37, 1.76]	[0.19, 7.67]	[0.27, 1.62]
SAT score	1.13	1.10	1.04	0.96	0.98	0.94
	[0.97, 1.31]	[0.92, 1.31]	[0.78, 1.39]	[0.82, 1.12]	[0.71, 1.36]	[0.79, 1.11]

Note: The reference group for gender was men; the reference group for race/ethnicity was White. Financial agentic value and communal value are measured via self-reported surveys. For each predictor variable, the reported coefficients are as follows (from top to bottom): odds ratio and confidence interval.
*$p < .05$. **$p < .01$. ***$p < .001$.

10 | DISCUSSION

Consistent with our hypotheses, there were indications that engineering college students' writing responses about their career plans corresponded to their career values. For example, results showed that surveyed financial agentic career values and *money words* were positively associated. Additionally, surveyed communal career values were positively associated with *communion* and *affiliation words*. These findings are consistent with how agentic and communal career values are defined (Diekman et al., 2011, 2017; Diekman & Steinberg, 2013). But we also extended Diekman et al.'s findings to non-White student populations (80% of our sample is non-White) and first-generation college-going students (33% of our sample is first-generation college-going). Furthermore, these results empirically validated surveys, an explicit self-reported measure (i.e., when participants are directly asked the question at hand; Nosek, 2007), to word usage, an implicit self-reported measure (i.e., when participants are indirectly asked the question at hand; Gawronski & De Houwer, 2014). Participants are usually assessed by engaging in a task where they do not know what the researchers are measuring. But the researchers are able to derive inferences about participants' attitudes and beliefs from the task), which can open new avenues for scholars and educators to examine engineering college students' career values in more naturalistic settings, such as social media platforms, in addition to more classic survey assessments.

Moreover, we observed that financial agentic career values were only related to *money words* and no other achievement-related word categories. This finding is likely due to our narrow financial agentic career values scale, which focused solely on money. We also observed that communal career values were related to interpersonal word categories, *communion* and *affiliation words*, but not *family words*. Again, this finding is likely due to our communal career scale focusing on contributing to society or helping others rather than doing something for one's family.

Descriptively, we found that women engineering college students used more *communion*, *family*, and *affiliation words* compared with men engineering college students. Aligned with prior research, women are more likely than men to hold relatively stronger communal values as a product of their socialization experiences and stereotypes linked with gender roles (Madera et al., 2009).

10.1 | Limitations and future directions

Our study has several limitations to acknowledge. First, we used a single-item measure to assess financial agentic career value. While previous studies have utilized single-item measures and yielded similar results (Nagy, 2002), future research would benefit from employing measures with multiple items to capture the nuanced characteristics of agentic career values that engineering college students may hold. By including items that tap into specific aspects of agentic career values, such as social status, researchers can obtain a more comprehensive understanding of the different dimensions of agentic career values and their relevance to engineering students' aspirations. Second, it is important to recognize the potential influence of both internalized and external factors on students' expressions of values. Students' writing reflects their internalized values and the norms and expectations of their cultural and social context. For example, the greater frequency of communal words as captured in the communion dictionary observed among women students in this study may be indicative of their internalized communal values, but it could also be influenced by societal expectations that encourage women to emphasize their communality while imposing restrictions on men expressing similar values. Future research could combine these surveys with interviews or focus groups to further study the interaction between internalized values and external factors, resulting in a more nuanced knowledge of the factors influencing students' expressions of career values. Finally, it is important to study the complexity of students holding multiple career values concurrently in order to more accurately model how those values would naturally emerge. Although our study accounted for the coexistence of agentic and communal career values by including them both as predictors in the logistic regression model, future research could employ interactions with a wider range of survey measures. We could not do so due to the shorter writing prompt responses compared with Study 1. Such an analysis would provide a more nuanced understanding of the various ways in which engineering college students navigate and prioritize their career values. By addressing these limitations in future research, we can advance our understanding of engineering college students' career values and their implications for educational practices and interventions. Ultimately, this knowledge will inform the development of tailored strategies and initiatives to support students in their educational and career journeys, promoting their success and fulfillment in the field of engineering.

11 | GENERAL DISCUSSION

Decades of research from various traditions have been conducted to better understand career choices (e.g., Diekman et al., 2010; Eccles, 1994, 2009; Holland, 1985; Moss & Frieze, 1993; Super, 1957, 1990). One approach to understanding career choice is through the perceived fit or the extent to which a career affords what a person values. Our research increased the understanding of what engineering undergraduates desire from their careers in the following ways: (a) exploring the different characteristics of agentic and communal career values expressed by engineering college students in the consideration of their future career plans (Study 1); (b) understanding the extent to which surveyed financial agentic and communal career values corresponded to the way engineering college students talked about their careers plans (Study 2); (c) incorporating the value of engineering college students holding multiple career values in two different populations: at a community college and a four-year university (Study 1 and 2). Using students' written narratives about their career plans, the first study explored how engineering college students discuss their career values, which laid the groundwork for the second study. Study 2 examined how engineering college students' surveyed career values align with the way they write about their career plans. Study 2 was built on the agentic and communal career value themes from Study 1 in that the word categories we chose to investigate engineering college students' writing about their career plan associated with their surveyed financial agentic and communal career values.

Across both studies, engineering college students held more agentic compared with communal career values. This finding is consistent with the stereotypic perception that engineering undergraduates endorse a greater degree of agentic than communal career values because they perceive that an engineering career will afford them more opportunities to fulfill agentic goals (Boucher et al., 2017; Diekman et al., 2017). Furthermore, in alignment with SEVT and GCT, engineering college students might be more inclined to hold agentic rather than communal career values. This inclination may be due to their perception of engineering careers as aligning with agentic values, driven by the stereotype that engineers tend to work in isolation rather than helping others (Beardslee & O'Dowd, 1961; Boucher et al., 2017; Cech, 2014; Diekman et al., 2011). The present investigation also extends existing knowledge on engineering college students' career values because it found that *career development* and *personal development* themes

occurred the most frequently out of the characteristics of agentic career values. Engineering college students place a high priority (or value) on achieving goals linked to their personal ambitions, and also gaining and developing knowledge for their future employment. This finding suggests that educators and career counselors can help college students already majoring in engineering persist by asking them to affirm their agentic values (Tibbetts et al., 2016). These students can reflect on how an engineering career allows them to fulfill their career and personal development agentic values. On the other hand, educators and career counselors can help college students with communal values who are not yet majoring in engineering by showing them that engineering careers allow opportunities to fulfill other-oriented goals (Belanger et al., 2017; Brown et al., 2015; Clark et al., 2016; Diekman et al., 2011; Zambrano et al., 2020). In either scenario, educators and career counselors can leverage written reflections as a tool that offers opportunities for engineering college students to make their own connections between what engineering can offer and how they can find ways to self-actualize. They can also examine textbooks, lectures, and conversations with educators and career counselors to better disentangle the types of messages or stereotypes that are being relayed through these discourses. This examination of implicit messages can help practitioners reduce stereotypes surrounding engineering careers, such as them being able to only afford agentic goals and values, instead of communal goals and values.

We also find that engineering college students hold multiple career values. This highlights the need for curriculum design and pedagogy that integrate a variety of career value orientations to enhance student engagement and motivation. By incorporating real-world examples and projects that highlight both agentic and communal aspects of engineering, educators can create a more inclusive and well-rounded learning experience. This approach helps students understand the broader societal impact of their work while also addressing their personal growth and aspirations. Aligned with previous literature, Study 1 found that engineering college students' career values are often nuanced and complex as they simultaneously hold agentic and communal career values (Yeager et al., 2012; Yeager & Bundick, 2009). But engineering college students' career values can be nuanced and complex because they also hold multiple characteristics within and across agentic and communal career values (e.g., an engineering college student can have two different agentic career values characteristics and one communal career values). This finding contributes to GCT by revealing that students do not hold just one agentic or communal career value, but rather, there are multiple characteristics associated with both agentic and communal career values. Then, Study 2 found a statistically significant association between engineering college students' surveyed career values and language use when both financial agentic and communal career values were included in the logistic regression models to account for the nuances and complexities of holding multiple career values. Findings from both studies indicate that educators and career counselors should account for this complexity of beliefs when catering materials to college students. That is, educators and career counselors can cater to students depending on their pattern of career values to promote motivation. For example, they can discuss how engineers have the advantage of having a high income and helping others for students who hold both agentic and communal values. Or discuss how engineers have the advantage of furthering their careers and gaining more knowledge for students who hold personal and career development agentic values.

This current study also validated the link between surveyed agentic and communal career values and implicit written responses about their careers. We did not prime engineering college students to answer a certain way to the open-ended writing response measure, and yet the written articulation of their careers was complementary to their surveyed responses. This finding validated the survey measures of career values. However, as we found in Study 1 with broad themes and Study 2 with few associations with the limited agentic career value scale, it is important to be careful in how we (and other researchers) operationalize and measure career values and which implications we can draw based on those measures. These findings inform us that language can be used as an implicit tool to understand engineering college students' beliefs, widening our ability to assess their career values without directly enquiring them to fill out surveys for both engineering education researchers and educators. Language can also reduce predetermined item choices and social desirability bias (Elliott & Timulak, 2005; Krumpal, 2013; Lefever et al., 2007). With the increasing use of social media, researchers and educators might be able to use Twitter, Facebook, and any other type of media posts that use videos (e.g., YouTube, TikTok, etc.) to infer their career values in order to ultimately broaden participation and interest toward engineering careers. Not only does this finding open a new avenue for assessing engineering students' career values, but it also shows that language matters. This can be used as a tool to promote the field of engineering and reduce the number of students dropping out of engineering for the wrong reasons. For example, academic counselors or career consultants might consider framing their messaging and the language they use in conversing with students about their career options with respect to engineering.

Limitations and future directions

Our study is not without limitations and opportunities for future research. First, Study 1 and Study 2 differed in the type of writing assignments that were investigated. In Study 1, the writing prompt provided students the opportunity to write more because it was broader than Study 2's writing prompt. Future studies should aim to examine the interaction effect of holding agentic and communal career values simultaneously with a writing prompt that affords more detailed responses from students. Second, even though the two samples in Study 1 and Study 2 shared the characteristic of sociodemographic diversity, there was a difference in their educational backgrounds. Study 1 focused on engineering students at a community college, whereas Study 2 examined engineering students at a four-year university. Typically, four-year universities are less sociodemographically diverse than community colleges. However, it is important to note that our sample from the four-year university came from a Hispanic- and Asian-American-serving institution, allowing us to bridge these two studies together. Although our findings indicate that themes are present across these populations to a certain extent, there still could be differences in how engineering students talk about their future career values. Community college students may be less certain about their future career plans compared with those who attend a four-year university. Future research should consider looking into group differences in career articulation (e.g., by college type, gender, generational college-going status, etc.). Considering writing style and personal characteristics might influence how focused and concrete their career articulation is, and the topics engineering students focus on. Learning more about such differences will ultimately inform our understanding of diverse engineering students' career plans and will allow us to refine our use of language analysis to capture engineering college students' attitudes and beliefs. Third, our study only looked at engineering career values at one time point. Future studies should investigate the development of engineering career values over time. It would be useful to distinguish whether engineering college students are more inclined to embrace engineering stereotypes over time or whether students who are more self-oriented gravitate toward engineering careers. Fourth, our study did not examine how engineering students holding multiple career values relate to outcomes, such as career interest, performance, and persistence. Therefore, more such work should be done in the future to understand whether engineering students who simultaneously hold agentic and communal career values have greater engineering career interest, higher grades in engineering courses, and more persistence in obtaining their engineering degree compared with those who do not simultaneously hold agentic and communal career values. Lastly, our study did not explore the extent to which word usage might differ across various engineering majors because of the limited sample size. For example, a Biomedical Engineering student may hold more communal career values and use more words associated with these values compared with a Computer Engineering student. Future studies should explore group differences within engineering fields.

11.1 | Conclusion

A less common methodological approach was utilized in this study to explore what engineering college students value in their careers: written narratives about their career intentions. Detailed themes of agentic and communal career values were found within engineering college students' written responses about their careers. The use of language content analysis also extended previous studies on perceived fit between what a career offers and what they value (e.g., Bairaktarova & Pilotte, 2020; Diekman et al., 2010, 2011, 2017, 2020; Woodcock et al., 2012) using an implicit measure of open-ended written responses about their careers. The approach to exploring engineering students' multiple career value characteristics, as well as their simultaneous endorsement of agentic and communal career values, assisted us in better understanding the complex nature of career beliefs. This work encourages engineering education researchers and educators to consider the ways in which we can promote career interest, performance, and persistence in engineering by supporting students' varied career fit perceptions through language use.

ACKNOWLEDGMENTS

This work was supported by the National Science Foundation Graduate Research Fellowship to Hye Rin Lee (award number DGE-1839285), the National Science Foundation to Lorenzo Valdevit, Jacquelynne S. Eccles, and Sharnnia Artis (1742627), and the Institute of Education Sciences to Jacquelynne S. Eccles, Michael Dennin, Anna-Lena Dicke, and Nayssan Safavian (R305A170160).

ORCID

Hye Rin Lee https://orcid.org/0000-0001-9957-5522
Anna-Lena Dicke https://orcid.org/0000-0001-8816-455X

REFERENCES

Allen, J. M., Muragishi, G. A., Smith, J. L., Thoman, D. B., & Brown, E. R. (2015). To grab and to hold: Cultivating communal goals to overcome cultural and structural barriers in first-generation college students' science interest. *Translational Issues in Psychological Science*, *1*(4), 331–341. https://doi.org/10.1037/tps0000046

Bairaktarova, D. N., & Pilotte, M. K. (2020). Person or thing oriented: A comparative study of individual differences of first-year engineering students and practitioners. *Journal of Engineering Education*, *109*(2), 230–242. https://doi.org/10.1002/jee.20309

Bakan, D. (1966). *The duality of human existence: An essay on psychology and religion*. Rand Mcnally.

Beardslee, D. C., & O'Dowd, D. D. (1961). The college-student image of the scientist. *Science*, *133*(3457), 997–1001. https://doi.org/10.1126/science.133.3457.997

Beering, S. C. (2007). *Moving forward to improve engineering education*. National Science Foundation.

Belanger, A. L., Diekman, A. B., & Steinberg, M. (2017). Leveraging communal experiences in the curriculum: Increasing interest in pursuing engineering by changing stereotypic expectations. *Journal of Applied Social Psychology*, *47*(6), 305–319. https://doi.org/10.1111/jasp.12438

Boucher, K. L., Fuesting, M. A., Diekman, A. B., & Murphy, M. C. (2017). Can I work with and help others in this field? How communal goals influence interest and participation in STEM fields. *Frontiers in Psychology*, *8*, 1–12. https://doi.org/10.3389/fpsyg.2017.00901

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Brown, E. R., Thoman, D. B., Smith, J. L., & Diekman, A. B. (2015). Closing the communal gap: The importance of communal affordances in science career motivation. *Journal of Applied Social Psychology*, *45*, 662–673. https://doi.org/10.1111/jasp.12327

Brown, G. S., & Strange, C. (1981). The relationship of academic major and career choice status to anxiety among college freshmen. *Journal of Vocational Behavior*, *19*(3), 328–334. https://doi.org/10.1016/0001-8791(81)90067-1

Bryant, A. N. (2001). ERIC review: Community college students' recent findings and trends. *Community College Review*, *29*(3), 77–93.

Canning, E. A., Priniski, S. J., & Harackiewicz, J. M. (2019). Unintended consequences of framing a utility–value intervention in two-year colleges. *Learning and Instruction*, *62*, 37–48. https://doi.org/10.1016/j.learninstruc.2019.05.001

Cech, E. A. (2014). Culture of disengagement in engineering education? *Science, Technology, & Human Values*, *39*(1), 42–72.

Chen, X., & Weko, T. (2009). *Students who study science, technology, engineering, and mathematics (STEM) in postsecondary education*. U.S. Department of Education, National Center for Education Statistics.

Cheryan, S., & Markus, H. R. (2020). Masculine defaults: Identifying and mitigating hidden cultural biases. *Psychological Review*, *127*, 1022–1052. https://doi.org/10.1037/rev0000209

Clark, E. K., Fuesting, M. A., & Diekman, A. B. (2016). Enhancing interest in science: Exemplars as cues to communal affordances of science. *Journal of Applied Social Psychology*, *46*(11), 641–654. https://doi.org/10.1111/jasp.12392

Cohen, A. M., Brawer, F. B., & Kisker, C. B. (2013). The American community college. San Francisco, CA: Jossey-Bass.

Diekman, A. B., Brown, E. R., Johnston, A. M., & Clark, E. K. (2010). Seeking congruity between goals and roles: A new look at why women opt out of science, technology, engineering, and mathematics careers. *Psychological Science*, *21*(8), 1051–1057. https://doi.org/10.1177/0956797610377342

Diekman, A. B., Clark, E. K., Johnston, A. M., Brown, E. R., & Steinberg, M. (2011). Malleability in communal goals and beliefs influences attraction to stem careers: Evidence for a goal congruity perspective. *Journal of Personality and Social Psychology*, *101*, 902–918. https://doi.org/10.1037/a0025199

Diekman, A. B., Joshi, M. P., & Benson-Greenwald, T. M. (2020). Goal congruity theory: Navigating the social structure to fulfill goals. In *Advances in experimental social psychology* (Vol. 62, pp. 189–244). Academic Press. https://doi.org/10.1016/bs.aesp.2020.04.003

Diekman, A. B., & Steinberg, M. (2013). Navigating social roles in pursuit of important goals: A communal goal congruity account of STEM pursuits. *Social and Personality Psychology Compass*, *7*, 487–501. https://doi.org/10.1111/spc3.12042

Diekman, A. B., Steinberg, M., Brown, E. R., Belanger, A. L., & Clark, E. K. (2017). A goal congruity model of role entry, engagement, and exit: Understanding communal goal processes in STEM gender gaps. *Personality and Social Psychology Review*, *21*, 142–175. 10.1177%2F1088868316642141

Eccles, J. S. (1994). Understanding women's educational and occupational choices: Applying the Eccles et al. Model of achievement-related choices. *Psychology of Women Quarterly*, *18*(4), 585–609. https://doi.org/10.1111/j.1471-6402.1994.tb01049.x

Eccles, J. S. (2009). Who am I and what am I going to do with my life? Personal and collective identities as motivators of action. *Educational Psychologist*, *44*(2), 78–89. https://doi.org/10.1080/00461520902832368

Eccles, J. S., Adler, T. F., Futterman, R., Goff, S. B., Kaczala, C. M., Meece, J. L., & Midgley, C. (1983). Expectancies, values, and academic behaviors. In J. T. Spence (Ed.), *Achievement and achievement motives: Psychological and sociological approaches* (pp. 75–146). W. H. Freeman.

Eccles, J. S., & Wigfield, A. (2002). Motivational beliefs, values, and goals. *Annual Review of Psychology*, *53*(1), 109–132. https://doi.org/10.1146/annurev.psych.53.100901.135153

Eccles, J. S., & Wigfield, A. (2020). From expectancy-value theory to situated expectancy-value theory: A developmental, social cognitive, and sociocultural perspective on motivation. *Contemporary Educational Psychology*, 101859. https://doi.org/10.1016/j.cedpsych.2020.101859

Elliott, R., & Timulak, L. (2005). Descriptive and interpretive approaches to qualitative research. *A Handbook of Research Methods for Clinical and Health Psychology*, *1*(7), 147–159. https://doi.org/10.1093/med:psych/9780198527565.003.0011

Evans, C. D., & Diekman, A. B. (2009). On motivated role selection: Gender beliefs, distant goals, and career interest. *Psychology of Women Quarterly*, *33*(2), 235–249. https://doi.org/10.1111/j.1471-6402.2009.01493.x

Fuesting, M. A., Diekman, A. B., & Hudiburgh, L. (2017). From classroom to career: The unique role of communal processes in predicting interest in STEM careers. *Social Psychology of Education*, *20*(4), 875–896. https://doi.org/10.1007/s11218-017-9398-6

Gawronski, B., & De Houwer, J. (2014). Implicit measures in social and personality psychology. In H. T. Reis & C. M. Judd (Eds.), *Handbook of research methods in social and personality psychology* (pp. 283–310). Cambridge University Press.

Harackiewicz, J. M., Canning, E. A., Tibbetts, Y., Priniski, S. J., & Hyde, J. S. (2016). Closing achievement gaps with a utility-value intervention: Disentangling race and social class. *Journal of Personality and Social Psychology*, *111*(5), 745–765. https://doi.org/10.1037/pspp0000075

Harackiewicz, J. M., Rozek, C. S., Hulleman, C. S., & Hyde, J. S. (2012). Helping parents to motivate adolescents in mathematics and science: An experimental test of a utility-value intervention. *Psychological Science*, *23*(8), 899–906. https://doi.org/10.1177/0956797611435530

Harren, V. A. (1966). The vocational decision-making process among college males. *Journal of Counseling Psychology*, *13*(3), 271–277. https://doi.org/10.1037/h0023722

Hirsh, J. B., & Peterson, J. B. (2009). Personality and language use in self-narratives. *Journal of Research in Personality*, *43*, 524–527. https://doi.org/10.1016/j.jrp.2009.01.006

Holland, J. L. (1985). *Making vocational choices: A theory of vocational personalities and work environments* (2nd ed.). Prentice-Hall.

Huff, J. L., Smith, J. A., Jesiek, B. K., Zoltowski, C. B., & Oakes, W. C. (2019). Identity in engineering adulthood: An interpretative phenomenological analysis of early-career engineers in the United States as they transition to the workplace. *Emerging Adulthood*, *7*(6), 451–467.

Johnson, M. K. (2002). Social origins, adolescent experiences, and work value trajectories during the transition to adulthood. *Social Forces*, *80*, 1307–1341. https://doi.org/10.1353/sof.2002.0028

Joshi, M. P., Benson-Greenwald, T. M., & Diekman, A. B. (2022). Unpacking motivational culture: Diverging emphasis on communality and agency across STEM domains. *Motivation Science*, *8*(4), 316–329. https://doi.org/10.1037/mot0000276

Judd, C. M., James-Hawkins, L., Yzerbyt, V., & Kashima, Y. (2005). Fundamental dimensions of social judgment: Understanding the relations between judgments of competence and warmth. *Journal of Personality and Social Psychology*, *89*(6), 899–913. https://doi.org/10.1037/0022-3514.89.6.899

Kim, K. A. (2002). ERIC review: Exploring the meaning of "nontraditional" at the community college. *Community College Review*, *30*(1), 74–89. https://doi.org/10.1177/009155210203000104

Klussman, K., Lindeman, M. I. H., Nichols, A. L., & Langer, J. (2021). Goal congruence and positivity toward college major: The role of self-connection. *The Career Development Quarterly*, *69*(2), 172–179.

Krumpal, I. (2013). Determinants of social desirability bias in sensitive surveys: A literature review. *Quality & Quantity*, *47*, 2025–2047. https://doi.org/10.1007/s11135-011-9640-9

LaMeres, B. J., Burns, M. S., Thoman, D. B., & Smith, J. L. (2019). The role of prosocial goal congruity on student motivation in electrical engineering. *IEEE Transactions on Education*, *62*(4), 256–263. https://doi.org/10.1109/te.2019.2897265

Lee, H., Ramirez, K. F., Yang, K., Rutherford, T., & Eccles, J. S. (2023). *Expectancies and values discussed by transfer engineering students when providing advice to peers*. Paper presented at the Division C—Learning and Instruction at the Annual Meeting of the American Educational Research Association, Virtual Online.

Lee, H., Rutherford, T., Hanselman, P., Rodriguez, F., & Eccles, J. S. (2023). *Role models in action through YouTube videos for engineering community college students*. Poster presented at the American Psychological Association Conference, Washington, DC.

Lefever, S., Dal, M., & Matthíasdóttir, Á. (2007). Online data collection in academic research: Advantages and limitations. *British Journal of Educational Technology*, *38*(4), 574–582. https://doi.org/10.1111/j.1467-8535.2006.00638.x

Madera, J. M., Hebl, M. R., & Martin, R. C. (2009). Gender and letters of recommendation for academia: Agentic and communal differences. *Journal of Applied Psychology*, *94*, 1591–1599. https://doi.org/10.1037/a0016539

Markus, H. R., & Kitayama, S. (2010). Cultures and selves: A cycle of mutual constitution. *Perspectives on Psychological Science*, *5*(4), 420–430. https://doi.org/10.1177/1745691610375557

McAdams, D. P., Hoffman, B. J., Day, R., & Mansfield, E. D. (1996). Themes of agency and communion in significant autobiographical scenes. *Journal of Personality*, *64*(2), 339–377. https://doi.org/10.1111/j.1467-6494.1996.tb00514.x

Moss, M. K., & Frieze, I. H. (1993). Job preferences in the anticipatory socialization phase: A comparison of two matching models. *Journal of Vocational Behavior*, *42*(3), 282–297. https://doi.org/10.1006/jvbe.1993.1020

Nagy, M. S. (2002). Using a single-item approach to measure facet job satisfaction. *Journal of Occupational and Organizational Psychology*, *75*, 77–86. https://doi.org/10.1348/096317902167658

National Center for Science and Engineering Statistics. (2021). *Women, minorities, and persons with disabilities in science and engineering: 2021* (Special Report NSF 21-321). National Science Foundation. https://ncses.nsf.gov/wmpd

Nosek, B. A. (2007). Implicit–explicit relations. *Current Directions in Psychological Science*, *16*(2), 65–69.

Osipow, S. H., Carney, C. G., & Barak, A. (1976). A scale of educational-vocational undecidedness: A typological approach. *Journal of Vocational Behavior*, *9*(2), 233–243. https://doi.org/10.1016/0001-8791(76)90081-6

Pajares, F. (2003). Self-efficacy beliefs, motivation, and achievement in writing: A review of the literature. *Reading & Writing Quarterly*, *19*, 139–158. https://doi.org/10.1080/10573560308222

Pennebaker, J. W., Boyd, R. L., Jordan, K., & Blackburn, K. (2015). *The development and psychometric properties of LIWC2015*. University of Texas at Austin.

Pietraszkiewicz, A., Formanowicz, M., Gustafsson Sendén, M., Boyd, R. L., Sikström, S., & Sczesny, S. (2019). The big two dictionaries: Capturing agency and communion in natural language. *European Journal of Social Psychology*, *49*(5), 871–887. https://doi.org/10.1002/ejsp.2561

Pintrich, P. R. (2000). Multiple goals, multiple pathways: The role of goal orientation in learning and achievement. *Journal of Educational Psychology*, *92*(3), 544–555. https://doi.org/10.1037/0022-0663.92.3.544

Pöhlmann, K. (2001). Agency- and communion-orientation in life goals: Impacts on goal pursuit strategies and psychological well-being. In P. Schmuck & K. M. Sheldon (Eds.), *Life goals and well-being: Towards a positive psychology of human striving* (pp. 68–84). Hogrefe & Huber Publishers.

Priniski, S. J., Rosenzweig, E. Q., Canning, E. A., Hecht, C. A., Tibbetts, Y., Hyde, J. S., & Harackiewicz, J. M. (2019). The benefits of combining value for the self and others in utility–value interventions. *Journal of Educational Psychology*, *111*, 1478–1497. https://doi.org/10.1037/edu0000343

R Core Team. (2018). *R: a language and environment for statistical computing*. (3.5.2) [Computer software]. R Foundation for Statistical Computing.

Robinson, C., Yeomans, M., Reich, J., Hulleman, C., & Gehlbach, H. (2016). *Forecasting student achievement in MOOCs with natural language processing*. Paper presented at the Proceedings of the Sixth International Conference on Learning Analytics & Knowledge. https://doi.org/10.1145/2883851.2883932

Rokeach, M. (1979). From individual to institutional values: With special reference to the values of science. In M. Rokeach (Ed.), *Understanding human values* (pp. 47–70). Free Press.

Saldaña, J. (2013). *The coding manual for qualitative researchers* (2nd ed.). Sage Publications.

Seymour, E., & Hunter, A. (2019). *Talking about leaving revisited: Persistence, relocation, and loss in undergraduate STEM education*. Springer.

Smith, J. L., Cech, E., Metz, A., Huntoon, M., & Moyer, C. (2014). Giving back or giving up: Native American student experiences in science and engineering. *Cultural Diversity and Ethnic Minority Psychology*, *20*(3), 413–429. https://doi.org/10.1037/a0036945

Smith, N. L., Grohs, J. R., & Van Aken, E. M. (2022). Comparison of transfer shock and graduation rates across engineering transfer student populations. *Journal of Engineering Education*, *111*(1), 65–81. https://doi.org/10.1002/jee.20434

Soto, C., & Deemer, E. D. (2018). Communal goals, campus racial climate perceptions, and cultural differences in perceived academic satisfaction. *The Career Development Quarterly*, *66*(1), 35–48. https://doi.org/10.1002/cdq.12120

Super, D. E. (1957). *The psychology of careers*. Harper & Row.

Super, D. E. (1990). A life-span, life-space approach to career development. In D. Brown & L. Brooks (Eds.), *Career choice and development: Applying contemporary theories to practice* (2nd ed., pp. 197–261). Jossey-Bass.

Tausczik, Y. R., & Pennebaker, J. W. (2010). The psychological meaning of words: LIWC and computerized text analysis methods. *Journal of Language and Social Psychology*, *29*, 24–54. https://doi.org/10.1177/0261927X09351676

Tibbetts, Y., Harackiewicz, J. M., Canning, E. A., Boston, J. S., Priniski, S. J., & Hyde, J. S. (2016). Affirming independence: Exploring mechanisms underlying a values affirmation intervention for first-generation students. *Journal of Personality and Social Psychology*, *110*(5), 635–659. https://doi.org/10.1037/pspa0000049

Walther, J., Sochacka, N. W., Benson, L. C., Bumbaco, A. E., Kellam, N., Pawley, A. L., & Phillips, C. M. (2017). Qualitative research quality: A collaborative inquiry across multiple methodological perspectives. *Journal of Engineering Education*, *106*(3), 398–430. https://doi.org/10.1002/jee.20170

Wickham, H., Averick, M., Bryan, J., Chang, W., McGowan, L. D. A., François, R., ... Kuhn, M. (2019). Welcome to the Tidyverse. *Journal of Open Source Software*, *4*(43), 1686. https://doi.org/10.21105/joss.01686

Woodcock, A., Graziano, W. G., Branch, S. E., Ngambeki, I., & Evangelou, D. (2012). Engineering students' beliefs about research: Sex differences, personality, and career plans. *Journal of Engineering Education*, *101*(3), 495–511. https://doi.org/10.1002/j.2168-9830.2012.tb00059.x

Yang, Y., & Barth, J. M. (2015). Gender differences in STEM undergraduates' vocational interests: People–thing orientation and goal affordances. *Journal of Vocational Behavior*, *91*, 65–75. https://doi.org/10.1016/j.jvb.2015.09.007

Yeager, D. S., & Bundick, M. J. (2009). The role of purposeful work goals in promoting meaning in life and in schoolwork during adolescence. *Journal of Adolescent Research*, *24*(4), 423–452. https://doi.org/10.1177/0743558409336749

Yeager, D. S., Bundick, M. J., & Johnson, R. (2012). The role of future work goal motives in adolescent identity development: A longitudinal mixed-methods investigation. *Contemporary Educational Psychology*, *37*(3), 206–217. https://doi.org/10.1016/j.cedpsych.2012.01.004

Yeager, D. S., Walton, G. M., Brady, S. T., Akcinar, E. N., Paunesku, D., Keane, L., Kamentz, D., Ritter, G., Duckworth, A. L., Urstein, R., Gomez, E. M., Markus, H. R., Cohen, G. L., & Dweck, C. S. (2016). Teaching a lay theory before college narrows achievement gaps at scale. *Proceedings of the National Academy of Sciences*, *113*(24), E3341–E3348. https://doi.org/10.1073/pnas.1524360113

Zambrano, J., Lee, G. A., Leal, C. C., & Thoman, D. B. (2020). Highlighting prosocial affordances of science in textbooks to promote science interest. *CBE—Life Sciences Education*, *19*(3), ar24. https://doi.org/10.1187/cbe.19-09-0176

AUTHOR BIOGRAPHIES

Hye Rin Lee is a National Science Foundation STEM Education Postdoctoral Research Fellow in the College of Education and Human Development at the University of Delaware. Her research employs a comprehensive approach that combines developmental and learning analytic methods with an integrative theoretical framework from cognitive, educational, developmental, and social psychology, to investigate the intricate interplay between short- and long-term motivation and learning.

Nayssan Safavian is a Research Scientist in the School of Education at the University of California, Irvine. Her research applies the motivation lens of expectancy–value theory to approach issues of motivation and educational and occupational attainment in underrepresented communities.

Anna-Lena Dicke is a Research Scientist in the School of Education at the University of California, Irvine. Her research focuses on understanding the influence of the educational context on students' motivation, interests, and their career pathways.

Jacquelynne S. Eccles is a Distinguished Professor in the School of Education at the University of California, Irvine. Her research is focused on academic motivation and achievement, school and family influences on adolescent development, and gender and ethnicity in STEM fields.

How to cite this article: Lee, H. R., Safavian, N., Dicke, A.-L., & Eccles, J. S. (2024). Investigating engineering undergraduates' agentic and communal career values in writing responses. *Journal of Engineering Education*, *113*(2), 308–329. https://doi.org/10.1002/jee.20584