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Understanding Identity and Personality Authenticity of Engineering Students

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Understanding Identity and Personality Authenticity of Engineering Students

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ABSTRACT

Women are underrepresented in engineering, with 18-20% of engineering students being women[1]. We, therefore, used the framework of identity theory and self-concept differentiation to better understand female and male engineering student retention. An exploratory approach is used to measure freshman and senior engineering students' personality and authenticity of personality across engineering and non-engineering contexts. First, we found personality profiles among engineering freshmen and seniors in engineering settings, and then compared them to their personality in nonacademic settings for authenticity purposes. Big 5 Personality and Authenticity scale were methods used through a survey to determine personality and authenticity in engineering and non-engineering environments for participants collected of their academic level and gender. Our results found that engineering students described themselves as agreeable (i.e. trusting), conscientious (i.e. reliable), and open to experiences (i.e. curious). We also found that freshman female engineering students have higher extraversion levels than seniors, and that senior females had the greatest variation of personality and authenticity between engineering and non-engineering settings. Understanding the impact identity, personality, and authenticity has on engineering students will benefit how we perceive students in and out of engineering and how that affects their persistence.

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I. BACKGROUND

Despite many efforts and programs to increase the representation of female students in engineering, a persisting low percentage of 18-20% of engineering students are women and only 14% of U.S. engineers are women[1]. The recruitment rates of women engineering students are higher than retention rates, suggesting a fallout of female engineering students throughout their years studying engineering. Currently, 19.2% of these with a bachelor degree in engineering are women [2, 3]. This percentage is a slight 0.8% increase from 2010, when the percentage of women with bachelor degrees in engineering was 18.4% [3]. Gender aside, the total number of STEM degrees given have decreased though the number of total university degrees given have increased[1]. With increasing STEM job demands, it is necessary to increase recruitment and retention to improve the number of female engineering students and women with engineering degrees[1].

A. Theoretical Underpinnings

An area of research that has received attention over the years to help contribute to our understanding of why we lose women in engineering is identity theory. *Identity is thought to be a set of meanings that are applied to the self in different social roles or situations that serve as a defining reference of one's self* [4]. Further, strong identification with a group has been linked to reduced likelihood of group desertion[5], as well as increased organizational commitment[6]. An identity consists of both social and personal identity[7]. In this society, stereotypes lead women to feel incompatible with engineering and other STEM fields[8]. Women with conflicting individual and career identities are often forced to choose whether to stick to their own personal identity, or to sacrifice their personal identity in order to identify with engineering[9]. An engineering identity does not come with a formula for success; however, some factors do relate to forming an engineering identity, including professional persistence[10]. Promoting qualities of engineering that correspond to women's engineering identity could increase the likelihood that they believe engineering does fit their personality, and therefore persist in the field[11].

Accompanying studies of engineering and engineer identity, self-concept differentiation (SCD) is an important construct for understanding motivation, belonging, and persistence of all students

in engineering, particularly those that are underrepresented, like women. *SCD occurs when individuals perceive themselves as having different personality characteristics across diverse roles and results in a sense of disharmony in the self-concept*[12]. For example, an individual may feel much more extraverted in their home setting than they do their work setting. SCD has been positively linked to indices of maladjustment, depression, and anxiety[12, 13]. Thus, insights into understanding engineering students' SCD becomes critical in being able to improve recruitment and retention efforts.

In SCD theory, personality plays a key role. *Personality refers to individual differences in characteristic patterns of thinking, feeling and behaving*. One way to measure personality is the Big Five personality factor model, which has been well established in explaining individual differences across the five factors of Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness to Experience[14]. The model is the most-used psychological tool, offering a variety of dimensions of personality to measure individuals[14, 15]. The Big Five framework is also the most researched personality model and is supported as a valid measurement tool[15]. Studies have used the Big Five theory as a tool to measure parameters such as job satisfaction, authenticity, subjective well-being, and narrative identity[16, 17, 18]. We use the Big Five model in this study to measure students' personalities in their engineering and non-engineering environments.

Because people do behave differently in different roles and situations[19], when studying personality, it also becomes critical to study cross-situational or cross-role variability[18]. This points back to SCD theory. Authenticity of personality now becomes another critical facet to understanding identity and SCD. *Authenticity is the way one's behavior represents their authentic self, an "internally caused" phemonemon*[18]. Authenticity is determined through the culmination of the following factors: self-understanding, openness to recognize "desirable and undesirable self-aspects", behavior, and orientation towards interpersonal relationships[20]. Individuals with high authenticity are aware of their own feelings and desires, process their thoughts without bias and ignorance, act in the way that reflects themselves and also values genuine relationships[20]. In Big Five terms, reverse-neuroticism and extraversion can be relatable to authenticity through their similar quality of well-being[21]. High authenticity is most

comparable to traits like “truthfulness”, “positive values”, and “sincerity”, though, and results in integration and organization[21, 18]. Inauthentic behavior can lead to problems relating to anxiety and depression[22]. Just like not all roles allow for the same personality, not all roles allow for authentic behavior[18]. However, variation away from authenticity is more alarming than variation in personality or lack of consistency[18]. We use authenticity in this study for the purpose of better understanding participants’ personal stance on themselves in their engineering and non-engineering environments.

B. Purpose and Research Questions

The purpose of this study is to apply the interrelated concepts of identity, self concept differentiation, personality, and authenticity to engineering students. In this study we investigate differences across male and female students that are of the freshman and senior engineering cohorts to better understand the ways students’ personalities and authenticity vary between engineering and non-engineering settings. With this critical piece of the study, we also desire to better understand male and female engineering students’ persistence in engineering. Combining the concepts related to personality and authenticity with factors of persistence gives us data to better understand the types of personalities that persist in engineering, as well as if authenticity across environmental settings affects persistence. The research questions guiding this effort are:

(1) What personality profiles are engineering students displaying as freshmen and seniors in engineering environments?
(2) What variations in personality profiles are present among engineering students’ different roles in engineering and non-engineering environments?
(3) What variations in authenticity of personality are present among engineering students’ different roles in engineering and non-engineering environments?

II. METHODOLOGY

A. Research Design

This cross sectional study uses mixed methods to collect and analyze personality, authenticity, and identity data from engineering students at James Madison University. The study is a concurrent mixed-methods design (Figure 1), in which both qualitative and quantitative data were collected at the same time[23]. The combination of quantitative and qualitative testing is ideal as opposed to one approach or the other, as close-ended and open-ended information are results that better fit the purpose of this study. Quantitative testing alone is a rigid approach to seek human behaviors and personality, while their voices are not heard to the extent that they are in qualitative testing[23]. Likewise, qualitative data can result from "varying interpretations" of the researcher, resulting in biased data that is not a problem in quantitative data[23]. Therefore, the benefits of quantitative data can be reinforced by qualitative data and vice versa. Both the quantitative and qualitative data were collected from the source of an online survey administered via Qualtrics. Quantitative items/data were predominant in this study and the qualitative items/data played a secondary role and served the role of supplementing the quantitative data.

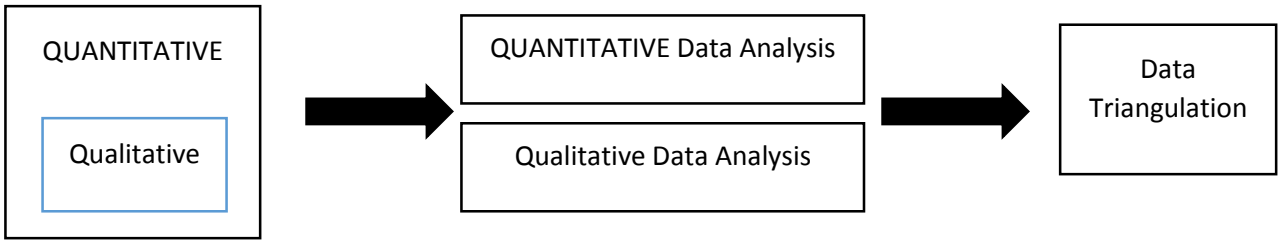

Figure 1: Concurrent mixed-methods design used in this study.

B. Survey Items

A survey consisting of 88 Big Five items and 11 authenticity items was developed to capture personality and authenticity, and the qualitative portions reflected on authenticity. In the survey administered, many of the items on measuring personality and identity were developed and validated from previous work of Pierrakos and her research team as part of a National Science Foundation award. Additional items were also added to the survey from the work of Sheldon et

al., which consisted of items to measure personality authenticity. Qualitative items in the form of open-ended questions were also included in the survey to allow for deeper insight to be gained in understanding personality and authenticity of personality across engineering and non-engineering contexts.

The Big Five model was the main framework used to measure personality in two settings: "non-academic settings" and "engineering academic settings". More specifically, the survey consisted of two sets of 44 items using the Big Five framework adjectives, one set for each setting. These items, an adjective checklist, were previously developed and used by Casto et al. and correspond to a Big Five personality factor, as shown in Table 1[11]. This approach uses personality traits, words, or phrases for self-description and is stated to be simple and be high in face validity[11]. The Personality Adjectives Check List and methods of Strack[24] were followed by Casto et al.[11] to generate a number of words and phrases that would describe a person. The list was then narrowed by removing sensory words and phrases, as well as examinations pertaining to "fundamental identity characteristics"[11].

Table 1: A list of all adjectives on the checklist for each corresponding personality factor (table borrowed from Casto et al.)[11]

Personality Factor	Description and Definition (Costa & McCrae, 1992)	List of Corresponding Adjectives (*Note*: R = reverse coded adjective)
Agreeableness	The tendency to be trusting, sympathetic, cooperative, and move toward rather than away from others.	compassionate, cooperative, individualistic, honest, optimistic, rude-R, agreeable, considerate, sympathetic, selfish-R, helpful, and stubborn-R
Conscientiousness	The tendency to be well-organized, diligent, self-controlled, and directed in actions.	ambitious, analytical, determined, efficient, lazy-R, meticulous, organized, precise, realistic, self-disciplined, studious, and systematic
Extroversion	The tendency to be social, active, interact with others, and experience positive emotions.	assertive, domineering, reserved-R, sociable, extroverted, adventurous, timid-R, energetic, passive, talkative, withdrawn-R, introverted-R

Neuroticism	The tendency to experience distress and emotional instability. A propensity to experience negative emotional states.	confident-R, emotional, envious, fragile, resilient-R, argumentative, impulsive, anxious, high-strung, unemotional-R, irritable, and stable-R
Openness to Experience	The tendency to be imaginative, open minded, sensitive to aesthetics, and have broad interests.	artistic, creative, curious, imaginative, inquisitive, intellectual, inventive, traditional-R, unique, industrious, simple-R, shallow-R

Each of the Big Five survey items require a response on a 1-5 scale, with 1 being "strongly disagree" and 5 being "strongly agree".

While Big 5 was measured in each environment, authenticity was also measured using Sheldon et al.'s Authenticity Scale[18]. The five authenticity-related items for each environment were given in the survey with a 1-9 scale, with 1 being "strongly disagree" and 9 being "strongly agree". The five items for measuring authenticity are shown below in Table 2. The first three items are in agreement to authenticity while items 4 and 5 are in disagreement to authenticity, or are items of reverse-authenticity.

Table 2: List of Sheldon et al. Authenticity Items[18]

Authenticity Items	
1	I experience this aspect of myself as an authentic part of who I am.
2	This aspect of myself is meaningful and valuable to me.
3	I have freely chose this way of being.
4	I am only this way because I have to be. (R)
5	I feel tense and pressured in this part of my life. (R)

The five authenticity questions used in Sheldon's work and shown above were validated using *the* Authenticity Scale, which consists of three subscales: authentic living, accepting external influence, and self-alienation[18, 21, 24]. Four questions are associated with each of the three subscales to make up the authenticity scale; however, Sheldon condensed the items in a reliable way from 12 items to five items, which will be used in Table 2[18].

The qualitative data in this study comes from one open-ended question included in the survey. The question asks "To what extent do you feel like you are the same person in engineering and in non-engineering settings?"

C. Data Collection

Participants for this study were freshman and senior engineering students at James Madison University. All students were identified through a class list provided by the department. The survey was administered to a total of 102 senior engineering students and 165 freshman engineering students, adding up to a total of 267 students. The data received was anonymous to protect the identity of the students who participated. An incentive, a voucher to be used at campus dining facilities, was provided to participants for completing the survey entirely. Participants selected a 4-digit code, which was used to determine survey completion and also used by a person external to the research team to hand off dining vouchers. Although 81 freshman students started the survey, only 41 students finished the survey. In terms of gender, 29 male freshmen completed the survey and 12 female freshmen completed it. While 55 senior students started the survey, also 41 students completed it, consisting of 27 male and 14 female. The response rates for the freshman and seniors were respectively 25% and 40%.

The survey overall took approximately 20 minutes to complete. Demographic information obtained from this survey was gender and academic level. Partial responses were not included in the quantitative data analysis, but were considered in the qualitative data analysis.

D. Quantitative Data Analysis

Descriptive statistics were calculated for the quantitative data collected from the survey, allowing comparisons between freshman and senior participants, as well as between male and female participants. Cohens d and effect size are the other methods of quantitative data analysis. Data from the Big Five personality items was based on the frequently endorsed adjective (FEA) approach. An item from the survey is determined an FEA when 65% or more of the population

endorsed them, as previously performed by Casto et al.[11] Data from the authenticity items was analyzed by totaling the average scores of each of the five authenticity item results.

To ensure both the Big Five and authenticity items are consistent with the data results, we performed reliability tests using Cronbach alpha. The Big Five reliability coefficient was measured at .78 total. Likewise, the authenticity reliability coefficient was measured at 0.78. We divided the items to ensure consistency between the different types, so we separated the reverse items, 4 and 5, from the first three items. The first three items, which are in agreement with authenticity, were measured to have a coefficient value of 0.89. However, the last two items which represent reverse authenticity were measured to have a coefficient of 0.63, which is below the 0.7 passing value. We do see this coefficient as an area to work on for future studies, but we continued with the study because the overall authenticity reliability coefficient was still measured to be above the passing value of 0.7.

E. Qualitative Data Analysis

Two content experts independently analyzed the qualitative data from the survey's open-ended questions. The first authenticity-related open-ended question, which asked "To what extent do you feel like you feel like you are the same person in engineering and in non-engineering settings?" was analyzed by blinding and profiling the responses. The responses were blinded from their associated identities to minimize bias in determining profiles. Reading through the responses, four profiles were clearly exhibited. Two forms of coding were developed in the process of profiling the responses: first with the response profile, and then open-coding themes. The profiles developed are: *I am the same in both settings, I am somewhat the same in both settings, I am not the same in both settings and feel more like myself in engineering settings*, and *I am not the same in both settings and feel more like myself in non-engineering settings.* The descriptions of these profiles are shown below in Table 3.

Table 3: Qualitative Authenticity Profiles between Engineering and Non-engineering Settings, with Descriptions

Profile	Description
I am the same in both settings.	The student depicted themselves to be the same person in engineering and non-engineering settings, and therefore say to be authentic between environments.
I am somewhat the same in both settings.	The student describes some ways they are similar in both engineering and non-engineering settings, but also points out that there are differences as well.
I am not the same in both settings and feel more like myself in engineering settings.	The student directly or indirectly states that they do not feel like they are the same individual in both settings, but seemed to favor their engineering self.
I am not the same in both settings and feel more like myself in non-engineering settings.	The student directly or indirectly states that they do not feel like they are the same individual in both settings, however depicted that they favor their non-engineering self.

A few responses indicated a fifth profile with the first half of the statement being "I am not the same in both settings", yet a second half that does not define the setting the respondent feels most like themselves in. We called this profile *I am not the same in both settings and (unknown).* The few students whose responses fit this profile did not go into depth relating to whether they felt most like themselves in engineering or non-engineering settings.

A major assumption in this portion of the study is assuming that individuals have a one-dimensional self. We did not further explore the "I am not the same in both settings but both are authentic" profile, which did arise in the responses.

Themes from the responses were then associated with each profile regarding the student responses given in each category and developed as a story. After these profiles and themes were created and responses were categorized, we unblinded the response identities to associate the profiles, themes, and individual responses with the identity of the participant (i.e. freshman female). We then tried to see if any responses have certain themes associated to them that aligned with their other responses.. Qualitative responses that fell into the *I am not the same in both settings and feel more like myself in non-engineering settings* were traced back to their quantitative authenticity results to see if their open-ended response correlates to their quantitative

authenticity between settings. This step is essential to connecting the quantitative data to the qualitative data.

III. RESULTS

All results are presented with the frequently endorsed adjectives (FEAs) regarding the Big 5 categories. The items were determined an FEA when 65% or more of the population endorsed them, as used in Casto et al[11]. The research questions are given below with associated results, given in forms of tables and charts for freshmen and senior engineering students. Other graphs differentiate between freshman female and senior female, as well as cross group differences between male and female.

A. Research Question One – Personality Profiles of Engineering Students

RQ1: What personality profiles are engineering students displaying as freshmen and seniors in engineering environments?

The data analyzed for this research question is entirely quantitative. Personality items relating to the Big 5 categories were first rated by the participants to describe themselves in engineering environments. Participants selected the items/adjectives that were descriptive of themselves in general in engineering academic contexts. Tables 4 and 5 show the participants' Frequently Endorsed Adjectives (FEAs) and the corresponding percentage of students endorsing each item/adjective. These *self* FEAs are organized up by gender and class level, as shown below (senior female, senior male, freshman female, freshman male). The Big 5 Factor is located on the left side column of each participant group. The number of FEAs for each Big 5 category is also displayed in Figure 2 for each participant group. Tables 4 and 5 and Figure 2 reveal that the majority of engineering students described themselves using Big 5 factors of agreeableness, conscientiousness, and openness. More specifically, *freshman females* predominantly described themselves as agreeable (i.e. considerate and kind to almost everyone, helpful and unselfish with others, trusting, cooperative), conscientious (i.e. reliable, thorough, persevering), extraverted (i.e. talkative, full of energy, assertive personality), and displaying openness (i.e. active imagination, curious, inventive, reflective). *Freshman males* has a similar profile to the freshman females (i.e. agreeable, conscientious, and displaying openness), but not describing themselves as extraverted. *Senior females* predominantly described themselves as agreeable (i.e. helpful, trusting, considerate), conscientious (i.e. thorough, reliable, follows through with plans), and

displaying openness (i.e. curious, inventive, deep thinker). *Senior males* described themselves as being agreeable, conscientious, and open to experience like the senior females with the exception that senior males also described themselves as reverse neurotic (i.e. relaxed, emotionally stable, remains calm in tense situations).

In comparing across the four groups (freshman females, freshman males, senior females, and senior males), the highest value of items in a certain Big 5 category was in openness, which came from the freshman females with 7 corresponding FEAs. Female freshmen also had the most FEAs in the whole study with 25, whereas the remaining participant groups ranged between a total of 14 and 18 FEAs. This shows more potential variation in personalities in freshman females than in other groups. In terms of gender, the senior male and senior female were very similar in number of FEAs across each category, as were senior males and freshman males. The only variance in senior male and freshman male was one reverse-neurotic FEA. Only the senior females and freshman females had items that were endorsed by 100% of the participants. 100% of the female senior participants recorded that they do a thorough job and like to cooperate with each other, whereas 100% of the freshman females recorded that they are reliable workers and are kind and considerate to almost everyone.

The most significant difference shown in these results is between freshman females and senior females. Freshman females scored 5 extraversion related FEAs whereas senior females actually scored a positive 1 in the reverse extraversion category. This data could infer that female students become more introverted as they continue in engineering, or extroverted females leave the major.

Table 4: Senior Students' Big 5 Categories and Frequently Endorsed Adjectives (FEAs) to Describe Selves in Engineering Environment.

SENIORS					
Big 5 Factor	**Female FEAs**, N=14	%	Big 5 Factor	**Male FEAs**, N=27	%
C	Does a thorough job	100%	C	Does a thorough job	93%
C	Is a reliable worker	86%	C	Does things efficiently	93%
C	Does things efficiently	86%	C	Makes plans and follows through with them	93%
C	Perseveres until the task is finished	79%	C	Is a reliable worker	93%
C	Makes plans and follows through with them	79%	C	Perseveres until the task is finished	85%
A	Likes to cooperate with others	100%	A	Is helpful and unselfish with others	96%
A	Is considerate and kind to almost everyone	93%	A	Is considerate and kind to almost everyone	93%
A	Is helpful and unselfish with others	71%	A	Is generally trusting	78%
A	Is generally trusting	71%	A	Has a forgiving nature	74%
E-R	Is sometimes shy, inhibited	71%	A	Likes to cooperate with others	70%
O	Is curious about many different things	86%	N-R	Is emotionally stable, not easily upset	85%
O	Is ingenious, a deep thinker	79%	N-R	Remains calm in tense situations	78%
O	Values artistic, aesthetic experiences	71%	N-R	Is relaxed, handles stress well	74%
O	Is inventive	71%	O	Likes to reflect, play with ideas	85%
			O	Is curious about many different things	74%
			O	Is original, comes up with new ideas	74%
			O	Is inventive	70%
			O	Has an active imagination	67%

Table 5: Freshman Students' Big 5 Categories and Frequently Endorsed Adjectives (FEAs) to Describe Selves in Engineering Environment.

		FRESHMEN			
Big 5 Factor	**Female FEAs**, N=12	%	Big 5 Factor	**Male FEAs**, N=29	%
C	Is a reliable worker	100%	C	Does a thorough job	79%
C	Does a thorough job	92%	C	Is a reliable worker	79%
C	Does things efficiently	83%	C	Makes plans and follows through with them	76%
C	Perseveres until the task is finished	83%	C	Does things efficiently	72%
A	Is considerate and kind to almost everyone	100%	C	Perseveres until the task is finished	69%
A	Is helpful and unselfish with others	92%	A	Is generally trusting	86%
A	Has a forgiving nature	92%	A	Is helpful and unselfish with others	79%
A	Is generally trusting	83%	A	Has a forgiving nature	79%
A	Likes to cooperate with others	83%	A	Is considerate and kind to almost everyone	79%
E	Is talkative	92%	A	Likes to cooperate with others	72%
E	Generates a lot of enthusiam	92%	N-R	Remains calm in tense situations	69%
E	Is full of energy	83%	N-R	Is relaxed, handles stress well	66%
E	Is outgoing, sociable	75%	O	Is curious about many different things	79%
E	Has an assertive personality	75%	O	Is ingenious, a deep thinker	76%
N-R	Is emotionally stable, not easily upset	83%	O	Is inventive	69%
N-R	Remains calm in tense situations	75%	O	Likes to reflect, play with ideas	69%
N-R	Is relaxed, handles stress well	67%	O	Has an active imagination	66%
O	Has an active imagination	92%			
O	Is curious about many different things	92%			
O	Is inventive	92%			
O	Is original, comes up with new ideas	83%			
O	Values artistic, aesthetic experiences	83%			
O	Likes to reflect, play with ideas	83%			
O	Is ingenious, a deep thinker	67%			
O-R	Prefers work that is routine	67%			

Note: A=Agreeableness, C=Conscientiousness, E=Extraversion, N=Neurotic, O=Openness, N-R= Reverse Neurotic, E-R=Reverse Extraversion, O-R=Reverse Openness

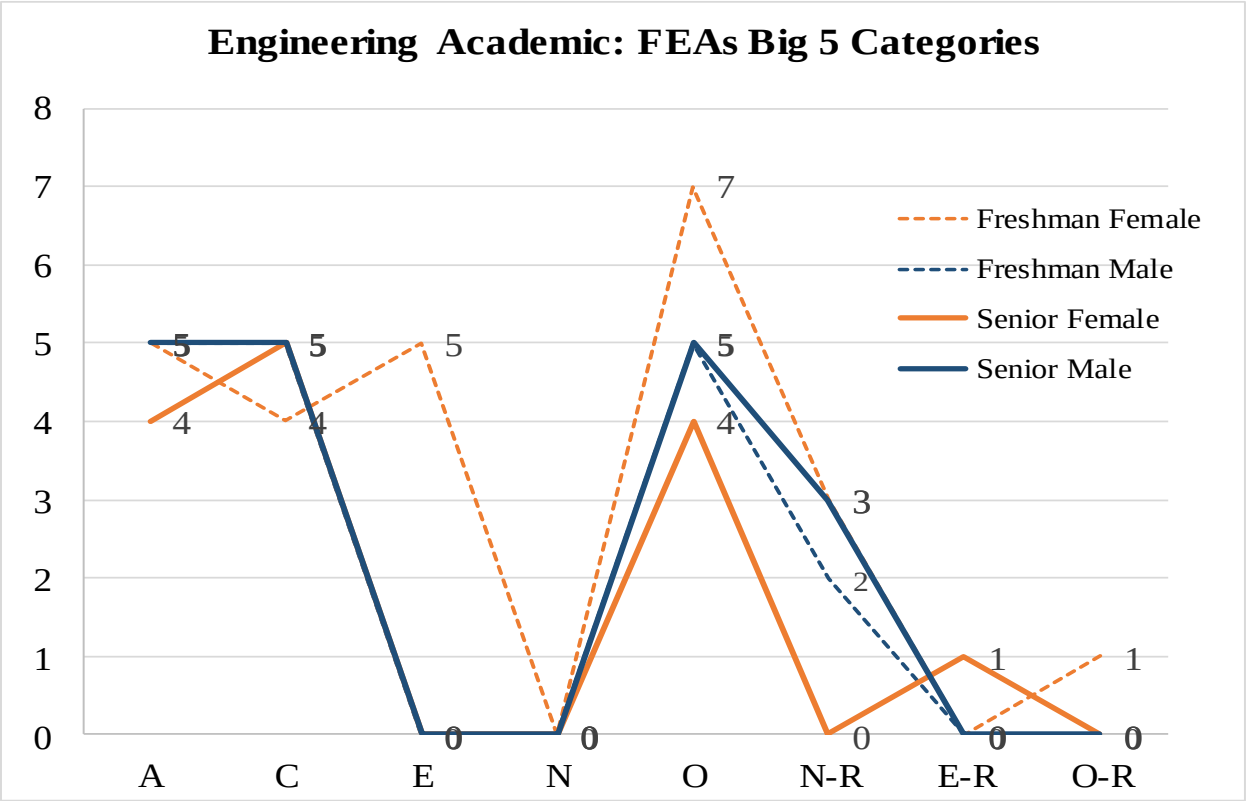

Figure 2: The number of Big 5 FEAs for students' description of *Self* in engineering academic settings. (*Note*: A=agreeableness, C=conscientiousness, E=extraversion, N=neurotic, O=openness, N-R=reverse neurotic, E-R=reverse extraversion, O-R=reverse openness)

B. Research Question Two – Variation in Personality Profiles Across Engineering and Non-Engineering Contexts

RQ2: What variations in personality profiles are present among engineering students' different roles in engineering and non-engineering environments?

Both quantitative and qualitative data were used to answer this research question and are therefore identified and separated in this analysis.

Quantitative Results. Engineering Students' ratings of self across engineering and non-engineering contexts. In addition to ratings of self during academic engineering contexts, participants also provided Big Five ratings of self in non-engineering contexts like social settings. The number of FEAs in non-academic settings were compared to the number of FEAs

selected in the engineering environment for each participant group, displayed in Figure 3 (freshman female top left, senior female top right, freshman male bottom left, senior male bottom right). There is similarity between the two contexts (engineering and non-engineering) for the freshman female, senior male, and freshman male participant groups. Some differences do exist though. For example, *freshman females* reveal a small distinction in their description of self during engineering and non-engineering contexts in the Big-5 factors of reverse neurotic and the reverse openness. This suggests that in the engineering context, freshman females are more likely to describe themselves as " relaxed, handles stress well", "remains calm in tense situations", and "prefers work that is routine" in engineering settings. *Freshman males* also reveal a small distinction in their description of self during engineering and non-engineering contexts. Freshman males tend to be slightly more extraverted and display more or less openness in non-academic contexts. *Senior males,* on the other hand, tend to be slightly more extraverted and displaying less openness in non-academic contexts. The *senior females* revealed the greatest variation between academic and non-academic environments, with conscientiousness as the only unchanged category. Agreeableness, extraversion, reverse extraversion, openness, and reverse neurotic all varied, with the greatest change being the extraversion category. This suggests that senior females tend to describe their selves as more agreeable, more extraverted, displaying more openness, and being less neurotic in non-academic and non-engineering contexts. Such findings corroborate that female engineering students become more introverted over time in academic/engineering contexts. This suppression of extraversion may not be a healthy sign for female students. Prior studies reveal that expressive suppression can affect social and personal behavior[26].

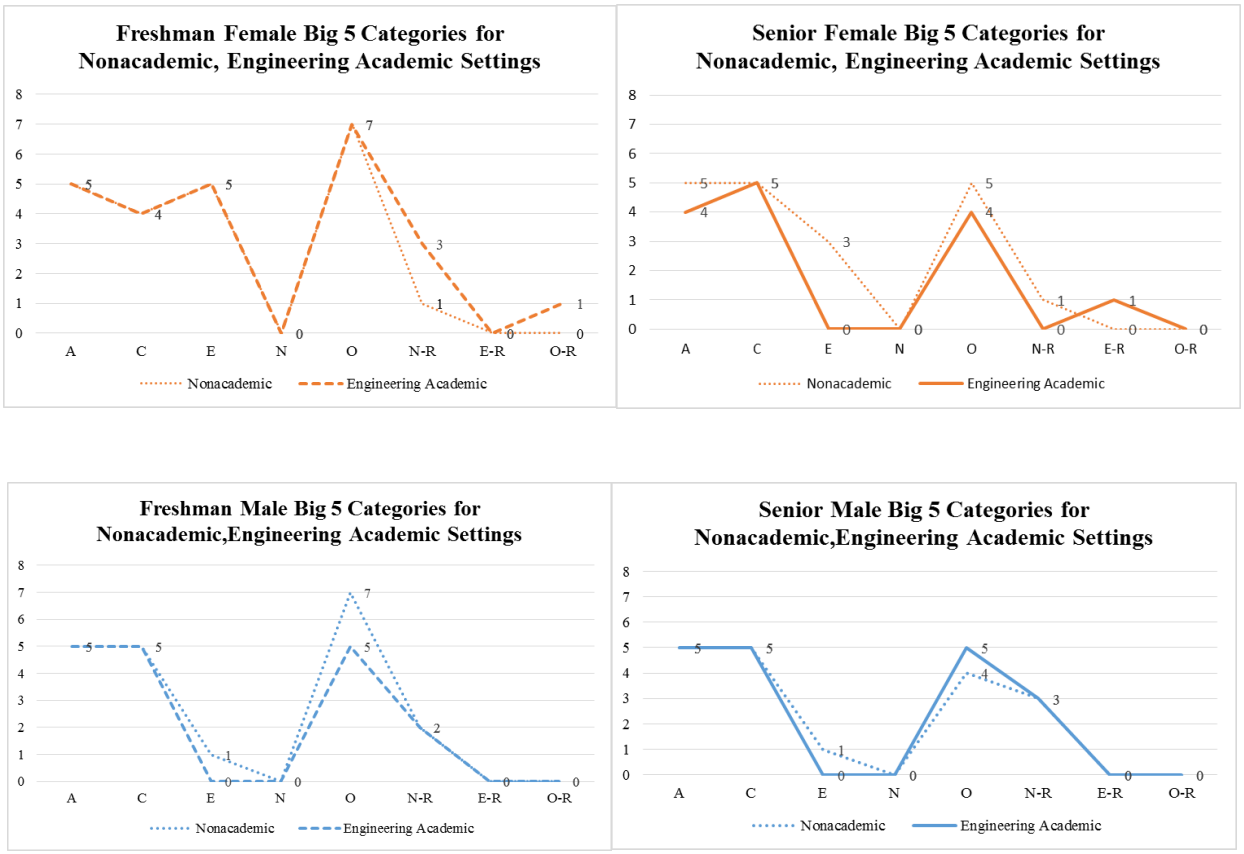

Figure 3: The number of Big 5 Category FEAs of students' personalities in nonacademic and engineering academic settings (freshman female top left, senior female top right, freshman male bottom left, senior male bottom right). (*Note*: A=agreeableness, C=conscientiousness, E=extraversion, N=neurotic, O=openness, N-R=reverse neurotic, E-R=reverse extraversion, O-R=reverse openness)

C. Research Question Three – Variation in Authenticity of Personality Comparing Engineering and Non-Engineering Contexts

RQ3: What variations in authenticity of personality are present among engineering students' different roles in engineering and non-engineering environments?

Engineering Students' Authenticity Variations between Engineering and Nonacademic Environments. While some variation in personality across environments is natural, variation in authenticity across environments indicates conflict between one's true identity and forced identity[18]. An authenticity score was developed by taking the results of the five authenticity items in the survey and totaling the mean scores. Questions 4 and 5 were reverse-authenticity

questions, so the means of those questions were subtracted by the highest possible ranking value (9) for each question, then totaled with the rest. Table 6 displays the total authenticity score for each participant group comparing nonacademic and engineering environments. Little variation in authenticity between environments indicates stability while large variation suggests conflict in one's feeling authentic in environments. The least authenticity variation came from the freshman female group, in which the scores were both rounded to the sum value of 36, and the highest authenticity variation was found in the senior female group. The senior female participants scored an authenticity score of 35 in nonacademic environments while they scored 28 in engineering academic environments, a difference of 7 authenticity points. Senior males scored an authenticity score of 33 in nonacademic environments and 31 in engineering environments, while freshman males scored similar scores of 34 and 31 in nonacademic and engineering environments, respectively. These scores indicate that female seniors feel a change in authenticity between the two settings, whereas the other participant groups may feel more authentic between them.

Table 6: Total authenticity scores between nonacademic and engineering academic settings separated into gender and academic level.

	Authenticity Score			
	Senior		**Freshman**	
Setting	**Female,** N=14	**Male,** N=27	**Female,** N=12	**Male,** N=29
Nonacademic	35	33	36	34
Engineering Academic	28	31	36	31

Referring to Table 7, which displays the mean values for each authenticity question, senior females show that they overall feel less authentic in the engineering environment than the other participant groups. Senior females scored the lowest mean values for items 1 and 3, and the highest for items 4 and 5, in which questions were posed to be reverse-authenticity questions. *These results indicate that the senior female group feels the most tension and pressure in engineering, and feel less authentic to their personality in that environment.* Results show that freshman females scored the highest in items 1 through 3, and the lowest in the reverse-authenticity questions 4 and 5, indicating that they feel the most comfortable and authentic in engineering environments.

Table 7: Mean authenticity values by gender and academic level in engineering settings. (*Note:* Mean scores are original values. Items 4 and 5 were reversed when totaling the authenticity score in Table 6 for consistency purposes. Highest score possible is 9.)

Authenticity Mean Values by Item for Engineering Academic Settings				
Item	**Senior**		**Freshman**	
	Female, N=14	**Male,** N=27	**Female,** N=12	**Male,** N=29
I experience this aspect of myself as an authentic part of who I am	5.64	6.78	7.45	6.52
This aspect of myself is meaningful and valuable to me	6.86	7.00	7.55	6.76
I have freely chose this way of being	6.36	6.96	7.64	7.03
I am only this way because I have to be	4.71	3.96	2.64	4.28
I feel tense and pressured in this part of my life	6.14	5.59	3.73	5.10

Qualitative Results. Data further explaining participants' authenticity between settings was captured in the survey question: "To what extent do you feel like you are the same person in engineering and in non-engineering settings?" This survey item consisted of an open ended response box for students to share their feelings in a more expressional and individualized way. Four major profiles resulted from this data once analyzed and categorized, and one minor.

a. PROFILE I – "I am the same in both engineering and non-engineering settings"

Students in this profile either directly or indirectly stated that they feel authentic between both engineering and non-engineering settings. One specific response said that their "personal values" are maintained between settings, while another stated that "engineering is a part of how I think about the world." All of these quotes share the feelings of contentment in both engineering and non-engineering settings. While changes in authenticity of personality across settings hint at conflict between the two environments, these students show that their authenticity is true in both areas of their life in one way or another. As a result, this profile was termed as: *I am the same in both settings.* The following are representative quotes for this student profile:

> "I feel almost identical because I am who I am no matter what situation you put me in. Part of who I am is why I thought engineering would be a good career path for me and I love it!" – *freshman female*

> "I carry myself the same way everywhere because I stick to my decisions and hold a consistent personality." – *freshman male*

> "I maintain the same personal values in engineering and non-engineering settings." – *senior female*

The next step in the process involved identifying themes among responses in each profile. Themes that resulted from this profile were mainly centered on being a hard worker and a problem solver, as seen above. One theme that did differentiate responses for this profile, though, was a more holistic and worldly perspective—a theme that hinted at making an impact.

> "I just feel that I am true to myself and engineering is a part of how I think about the world. It is the part of myself that wants to do something to make the world around me better. I see the world around me a something that I can change to help myself and those around me…" – *senior male*

> "I love to help people and give back to the community…" – *freshman female*

Both quotes showed making an impact in a way to make the world better, while the second takes an approach more aligned with service and generosity. This theme was only displayed in the profile, *I am the same in both settings.* The display of this theme could mean that these individuals feel like they can impact the world because they are the same in both settings, or they feel the same in both settings because they are set on impacting the world and it can be applied in both settings.

A response that showed a theme unique to the rest of the responses in this profile is stated below:

> "I feel like I am the same person in engineering and in non-engineering settings because I have worked so hard to get to where I am that the engineering side is who I am." – *senior female*

While this response displayed hard-working themes, the descriptors lead it to be different from the others. This respondent shows persistence, but also seems to hint at a loss of a part of who she is. Pursuing engineering has resulted feeling like she is engineering. Her shift from "I have worked so hard to get where I am" shows that she was once not there, and therefore had a different side than what she has now. Her response implies that she did not always associate herself to have a side that is engineering, as if now saying she has isolated her past side so she

only sees herself to be of the engineering side. Limitations in this response inquire whether or not she really *feels* authentic in engineering settings.

b. PROFILE II – "I am somewhat the same in engineering and non-engineering settings"

We also saw responses that suggested being somewhat the same person, giving a profile termed as: *I am somewhat the same in both settings.* Students answered the question in a way that shows they feel similar and different between settings:

> "Under all circumstances I will have the same basic thought process. The only thing that may change is the way I display my thoughts to others. Another thing that may change is from practicality or realistic to imaginative." – *freshman male*
>
> "To some extent; I have a separate engineering mindset sometimes though." – *freshman male*
>
> "Engineering settings are much more high pressure and I tend to rely more on myself than on others around me. I like group work, but only when everyone pulls their weight." –*senior female*

The engineering environment is described by these responses as to causing more pressure, being different in terms of relationships and working with others. Many respondents stated that they felt more reserved in engineering than in other settings. This theme was captured by several responses:

> "I mostly feel as though I am the same person. The one main difference in how I act is how talkative I am. In engineering settings, I spend a great deal more time thinking about what to say (which sometimes prevents me from saying anything). In non-engineering settings, I talk things out more, and get random ideas out faster." – *senior female*
>
> "I believe that I am pretty similar in engineering and in my personal life. I tend to be a little bit more reserved and less talkative in an engineering setting but that is because I am usually busy and doing work. I am more talkative when I don't have work and I want to be social." – *senior male*
>
> "I tend to be a lot quieter during class or group meetings. Other than that, I feel like I'm the same person." – *freshman male*

While the theme of feeling more reserved in engineering settings was prevalent, only one response really stated they felt that they have similar social qualities or are more sociable in engineering settings than in non-engineering settings.

> "I feel I am mostly the same person in both settings; however, I feel I am much more outgoing with my engineering friends as I feel less intimidated by them as opposed to other groups of people." – *senior male*

Many responses in this profile described engineering settings to be more pressured, but this response gives a little more reasoning behind her stress. In this response, the theme that is associated with pressure is fear. The student is a freshman female engineering student, and below is her quote:

> "I feel slightly more pressured in engineering to do well which sometimes gives me stress. This is because I really want to be an engineer and I am afraid to mess up." – *freshman female*

The last theme that was shown by a few responses is depicted from the following quotes:

> "I would say that I am pretty different when it comes to academics and personal life. I consider it more like a work and personal relationship. I believe there is definitely some overlap, however. I am definitely not two different people, I just feel that there is a time and a place for different aspects of my personality." – *senior male*

> "I feel like it doesn't necessarily change anything fundamental about who I am/act or how I think. Obviously the settings are different so you have to adapt to the situation and think about some topics in one setting more than the other but I think everyone experiences this in college…" – *senior male*

Both of the responses above were from senior males, of both whom took the idea that personalities are adaptable, and that there is a "time and place" for personalities. We can infer that students with this response, while still falling under the *I am somewhat the same in both settings* profile are okay with being similar or different between environments because they are comfortable with adapting to the environment they are in.

c. PROFILE III – "I am not the same person. I feel more myself in engineering settings."

The third profile was developed using quotes similar to the ones below:

> "…in engineering, I feel more responsibility and importance in the things I do, so I try to be more on top of things and more efficient." – *freshman female*

> "I think differently in engineering scenarios and am more focused and disciplined when dealing with academics." – *senior male*

This profile was determined as *I am not the same in both settings and feel more like myself in engineering settings*. While only five quotes were categorized to be in this profile, the ones that are in it directly or indirectly state that they are different in engineering settings and non-engineering settings. They also use language and descriptors to seem to favor their engineering personality or that setting. For example, the first quote is from a freshman female that states she feels more important in engineering settings based on her activities, and therefore tries to be more efficient. The second quote uses the descriptors *focused* and *disciplined,* which have more positive connotation than some students in other profiles that stated "stressed" and "tense". These quotes, depict a few themes that were relevant in this profile:

> "I think that I am more assertive and talkative in engineering. I think that in a social setting I am not as assertive but I wish that I was. I am naturally quiet and reserved, unreliable, and conflict avoiding." – *senior male*

> "In social situations, if other people invite me in and make me feel a part of the group, then I am comfortable, but in an engineering setting, I make sure to be more assertive with my ideas, but am also open to other people." – *freshman female*

These quotes show that the theme of assertiveness is more dominant in this profile than others. The respondents above used assertive as a descriptor for themselves in engineering settings. The senior male describes that he wishes he could be more assertive outside of engineering, which shows favor to engineering. The freshman female described herself to seem like she needs to feel included in social settings but stands out and tries to be more independent in engineering settings. She does not seem to need an "invitation" in engineering situations.

d. PROFILE IV – "I am not the same person. I feel more myself in non-engineering settings."

The last profile we developed from the qualitative results took the name *I am not the same in both settings and feel more like myself in non-engineering settings*. Quotes below are able to characterize this profile.

> "My personality is pretty much reserved for my personal life and is kept out of engineering affairs." – *freshman male*
>
> "I feel like every time I go into an engineering class I have to put on the role of an engineer, but when I'm not being an engineer I am not thinking about engineering." – *freshman male*

The quotes above are both from freshman males, and state that they do not see themselves to be the same in engineering and non-engineering settings. The first quote describes engineering as something he does not want his personality to be a part of. The second quote shows the difference in personality, when the student says that he has to put on this certain "role" when in engineering settings.

Many themes emerged from this profile, along with interesting quotes. To start, like in the other profiles, there exists a theme of feeling more reserved in engineering settings. Here are quotes that determined this theme:

> "At home and amongst close friends, I'm generally very comfortable and feel quite free to speak my mind as appropriate. In a classroom environment, this is not the case. I'm around people I barely know, if at all, and tend towards saying nothing rather than active participation in conversations that aren't directly related to a class activity." – *senior male*
>
> "I feel as though I tend to be quiet more often then not. I'm not usually the first person to talk unless it is something I have a lot of confidence talking about." – *senior male*
>
> "I lose confidence sometimes in myself in an engineering setting because I am usually intimated by others and feeling pressure to look, act, & be smart. In a non-engineering setting I have more confidence because I feel like I am one of the smartest ones." – *senior female*

> "I feel that I am capable to explain my ideas, but I lack the confidence and relaxed person I once was before entering this program. The courses have brought a lot of stress to me which has made it hard to be the social person I was before college." – *freshman female*

These responses show that the students in this category prefer their self outside of engineering from a social interaction standpoint. Subthemes emerged with greater explanation in these quotes as well. The first quote from the senior male directly states that they tend to say nothing, but the reasoning behind it is related to unfamiliarity. The last three quotes above do not seem to base their social interactions on their familiarity, but rather their confidence levels in the setting. The last three state that they lose confidence, or do not talk unless they have more confidence. The final two above, from the senior female and freshman female, share that they lack the confidence in engineering settings because they are intimidated by pressure and stress. The senior female's response in particular dwells more in value and proving herself. She therefore feels good when she is the smartest one in a social setting.

The quotes below show a different themes from this profile:

> "I started off unsure about the fit of engineering for my interests when I entered JMU. Over the course of my studies I slowly warmed up more and more to the potential of an engineering degree to open up career doors that seem meaningful to me. However, at the core, I still feel a sense of insecurity in the engineering field, and, as a result, I do not feel as much myself as I do in my non-academic life." – *senior male*

> "I do not feel like I am my authentic self when I am in an engineering academic setting. I do not share the same values as other peers and professors, so I often do not feel included into the MadE community. In non-engineering environments, I feel as though I can express myself freely around individuals that share the same values as myself." – *senior female*

These two responses are from a senior male and female, respectively, both sharing more directly than most that they do not feel like themselves. The first student explains that he always had some sense of insecurity with engineering, and even through persisting with it, he still does not feel like himself in engineering. The theme to describe this response is insecurity. The senior female writes that she does not feel like her authentic self, but as a result of not feeling included. Her values do not match up to others in the community, and she seems to find much more comfort in non-engineering settings. This depicts a student who has come to the conclusion that

she does not feel part of the community. While both of these students have persisted to their senior year, they directly stated they do not feel like their authentic self. The major point to be taken from these two responses, and some others above, is that there are students that have persisted to their senior year in the engineering program, and they do not feel like themselves.

D. Triangulation of Quantitative and Qualitative Results

With both quantitative and qualitative authenticity data analyzed, we were able to analyze and understand the implications of the results. Then, we were able to retrace the individuals' choice responses to the open responses to check alignment between the different forms of data.

As shown below in Table 8, there were a total of 72 open-ended responses. There were a total of 12 responses that answered the question but failed to enter in their identification at the end of the survey, including their gender and/or class level. Another clarification is that two of the total 72 responses did not seem to fit any of the four profiles. While they stated they were not the same person in both settings, there was no explanation that could hint at which setting they prefer.

Table 8: Profiles of Respondents to Open-Ended Authenticity Question, "To what extent do you feel like you feel like you are the same person in engineering and in non-engineering settings?"

Identification	Profile				
	I am the same in both settings.	*I am somewhat the same in both settings.*	*I am not the same in both settings and feel more like myself in engineering settings.*	*I am not the same in both settings and feel more like myself in non-engineering settings.*	*I am not the same in both settings and (unknown).*
Freshman Male	5	7	1	4	1
Freshman Female	3	3	2	3	0
Senior Male	5	9	2	4	0
Senior Female	3	4	0	4	1
Not Fully Specified	3	4	1	1	2

The profile *I am somewhat the same in both settings* had the highest number of responses, at a total of 27. The number of students that felt like *I am not the same in both settings* is the sum of the two categories *…and feel more like myself in engineering settings* and *…and feel more like myself in non-engineering settings.* This total number of students that do not feel authentic in both settings is 22. Split up, a total of 6 students felt more like themselves in engineering settings and 16 felt more like themselves in non-engineering settings. The number of students who were categorized as *I am the same in both settings* was 19.

Table 9: Percentage of Participants in Each of the 4 Main Profiles, not including students who did not specify their identification. (*Freshman Female N=11, Freshman Male N=17, Senior Male=20, Senior Female N=12*)
(Profile I: I am the same in both settings; Profile II: I am somewhat the same in both settings; Profile III: I am not the same in both settings, and feel more like myself in engineering settings; Profile IV: I am not the same in both settings, and feel more like myself in non-engineering settings.)

Freshman Female	
Profile I	27%
Profile II	27%
Profile III	18%
Profile IV	27%
TOTAL	100%

Freshman Male	
Profile I	29%
Profile II	41%
Profile III	6%
Profile IV	24%
TOTAL	100%

Senior Male	
Profile I	25%
Profile II	45%
Profile III	10%
Profile IV	20%
TOTAL	100%

Senior Female	
Profile I	27%
Profile II	36%
Profile III	0%
Profile IV	36%
TOTAL	100%

As seen in Table 9, freshman females had participant percentages of 27% among profiles I, II, and IV. This means that 27% of the freshman female participants feel like *they are the same in both settings*, 27% feel like *they are somewhat the same in both settings*, and 27% percent feel like *they are not the same in both settings and feel more like themselves in non-engineering*

settings. 18% of the freshman female participants feel like *they are not the same in both settings, but feel more like themselves in engineering settings*.

Freshman males showed that 29% of the freshman male participants *do feel like they are the same person in both settings*. 41% of the group fit profile II, that *they somewhat feel like the same in both settings.* About 6% of the freshman males showed that *they are not the same in both settings, but feel more like themselves in engineering settings*. 24% showed that *they are not the same in both settings, but feel more like themselves in non-engineering settings*.

For the senior male participants, 25% felt like *they are the same in both engineering and non-engineering settings.* 45% of the group found to be of profile II, feeling *somewhat like themselves in both settings*. 30% overall did not feel the same in both settings, as 10% felt *most like themselves in engineering settings* and 20% felt *most like themselves in non-engineering settings*.

27% of the senior female participants were categorized into *I am the same in both settings.* About 36% of senior females were concluded to fit in the profile IV, meaning *they do not feel the same in both settings and feel more like themselves in non-engineering settings* as well as 36% in *I am somewhat the same in both settings.* It is important to note that no responses from senior females seemed to fit the *I am not the same in both settings and feel more like myself in engineering settings* profile.

It is depicted from the results that 15 out of the 59 responses (about 25%) that fit one of the four profiles fit profile IV, *I am not the same in both settings, and feel more like myself in non-engineering settings.* Looking at seniors alone, 8 out of the 31 senior responses that fit one of the four profiles fit *I am not the same in both settings, and feel more like myself in non-engineering settings.* Therefore, 26% of seniors do not feel authentic in engineering settings. This is a concern that *many* seniors do not feel like they are completely the same person in both settings.

We decided to trace back the responses that fit in the *I am not the same in both settings, and feel more like myself in non-engineering settings* profile and obtain their quantitative data to better

understand this profile and make sure data was aligned well. Table 10 below shows the authenticity items and respective percentages of students that agreed with each authenticity items in *engineering settings* (answered between numbers 6-9, with 9 being strongly agree).

Table 10: Percentages of Participants that Fit the Profile *I am not the same in both settings and feel more like myself in non-engineering settings* that Agreed to the Authenticity Scale Items (numbers 6-9)

I am not the same in both settings and feel more like myself in non-engineering settings.	
Authenticity Item	**Percentage Agree (6-9)**
I experience this aspect of myself as an authentic part of who I am	73%
This aspect of myself is meaningful and valuable to me	93%
I have freely chose this way of being	80%
I am only this way because I have to be	27%
I feel tense and pressured in this part of my life	87%

These students, whose open responses depicted that they are not the same in both settings and feel more like themselves in non-engineering settings, showed mostly feelings of authenticity but high levels of tension and pressure in this area of their life. While 73% felt that they do experience engineering as an authentic part of who they are, 87% state that they feel tense and pressured in engineering settings. Even though most of the students feel pressured and tense in engineering, it does not keep them from feeling like it is a meaningful part of their life. 93% agreed that this aspect of their life is meaningful and valuable to them.

While the alignment is not quite as shown between quantitative and qualitative for this category as expected, it does confirm that personality is complex and that it is beneficial to have both quantitative and open ended qualitative data for analysis.

IV. CONCLUSIONS

This study was produced to explore engineering identity and self concept differentiation (SCD) by an investigation of freshman and senior engineering students' personality and authenticity. Two key previous studies laid a strong foundation to carrying out our work herein - Casto et al.[11] and Sheldon et al.[18]. More specifically, we used a novel approach to measuring personality using adjectives derived from the Big 5 Factors framework[11] and also measuring authenticity[18], which adds to our understanding of identity and SCD. Key findings of this study include:

- Overall, engineering students described their self with higher levels of agreeableness (i.e. helpful, trusting, considerate), conscientiousness (i.e. thorough, reliable, follows through with plans), and openness to experience (i.e. curious, inventive, deep thinker).
- Female engineering students showed a significant difference in extraversion factors between the freshman and senior classes. The results show that female engineering students become more introverted as they continue in engineering. They may not lose their extraversion in nonacademic settings, though, considering that they compress their extraversion in engineering environments. It is also considered that female students with high extraversion levels in engineering environments that do not compress their extraversion or become more introverted transfer out of engineering.
- Senior females show the greatest personality and authenticity variation between environments. The senior female group's engineering environment personality was very similar to the senior male and freshman male groups. This could mean that the longer females persist in engineering, they conform their personality to be like the dominant male personality. Senior females did result in the greatest authenticity variation out of all the groups between nonacademic and engineering environments.
- Some engineering students do not feel like themselves in engineering settings. A quarter of the participants, and particularly a quarter of senior participants do not feel like themselves in this setting. Specifically for seniors, this is concerning because students have persisted towards an engineering degree and still feel inauthentic. Low authenticity can result in anxiety and depression, and may be a result of lack of self-understanding, unbiased self-processing, or genuine behavior and relationships.

A. Limitations

This study consists of several limitations that could be considered within the context of this investigation. An important limitation is the small sample size N, especially in the female engineering groups, and the lower response rates. Thus, the generalizability of these results is not strong. The study only gathered data from freshman and senior engineering students at one participating university, thus again minimizing the ability to generalize. The students who participated also represented a cross-sectional sample. Tracking the same freshman students over time and obtaining longitudinal data is a desired design for future studies. Such a study though, takes more forethought and time to achieve. Further, it is possible that coded items could affect the validity of the results. Also, the qualitative data resulted in four profiles, which is a limitation as our study assumes a one-dimensional self, instead of acknowledging a profile that describes those who are not the same in both settings, but feel authentic in both.

B. Implications and Future Work

With these findings, we want to imply that personality and authenticity differences among engineering students may be an attribute towards their persistence in engineering programs. Identity, personality, and authenticity studies have only recently been associated with program retention. Future work for this study would include administering the survey to a larger sample of engineering students to validate that our findings can be corroborated with a larger sample. Qualitative data collection and analysis in relation to persistence in engineering is also another piece that is essential to understanding alignments between personality and authenticity results and retention trends. We would hope to perform interviews with freshman and senior engineering students to receive more thorough explanations of their feelings in engineering settings in comparison to non-engineering settings, as well as administer the survey to more class years, universities, and majors. Through this future work, we would be able to understand the relation between students' personality and authenticity in and out of engineering settings, and their feelings towards persisting.

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V. REFERENCES

1. US Congress Joint Economic Committee. (2012). STEM Education: Preparing for the Jobs of the Future. *Washington DC*.
2. Statistics. (2015). National Girls Collaborative Project. Retrieved June 15, 2015, from http://www.ngcproject.org/statistics.
3. Women, Minorities, and Persons with Disabilities in Science and Engineering. (2015). Retrieved June 15, 2015. From www.nsf.gov
4. Burke, P.J. (1991). Identity processes and social stress. *American Sociological Review*, *56*, 836-849.
5. Spears, R., Doosje, B., Ellemers, N. 1997. Stereotyping in the face of threats to group status and distinctiveness: The role of group identification. *Personality & Social Psychology Bulletin*, *23*, (538-553).
6. Boros, S. (2008). Organizational identification: Theoretical and empirical analyses competing conceptualizations. *Cognition, Brain, Behavior*, *8*, 1-27.
7. Dehing, A., Jochems, W., & Baartman, L. (2013). The development of engineering students professional identity during workplace learning in industry: A study in Dutch bachelor education. *Engineering Education*, *8*(1), 42-64.
8. London, B., Rosenthal, L., Levy, S. R., & Lobel, M. (2011). The influences of perceived identity compatibility and social support on women in nontraditional fields during the college transition. *Basic and Applied Social Psychology*, *33*(4), 304-321.
9. Hughes, R. (2014). The Effects of a Single-Sex STEM Living and Learning Program on Female Undergraduates' Persistence. *International Journal of Gender, Science, and Technology*, *6*(1), 26-54.
10. Meyers, K. L., Ohland, M. W., Pawley, A. L., Silliman, S. E., & Smith, K. A. (2012). Factors relating to engineering identity. *Global Journal of Engineering Education*, *14*(1), 119-131.
11. Casto, K., Chase, B., Pierrakos, O., & Anderson, R. (2011, December). Female and Male Engineering Students' Personality Characterization of Successful Engineering Students, Engineers, and Themselves. In *Advancing Women: Transforming Engineering Education*.
12. Donahue, E. M., Robins, R. W., Robert, B. W., & John, O. P. (1993). The divided self: Concurrent and longitudinal effects of psychological adjustment and social roles on self concept differentiation. *Journal of Personality and Social Psychology*, *64*, 834-846.
13. Lutz, C. J., & Ross, S. R. (2003). Elaboration versus fragmentation: Distinguishing between self-complexity and self-concept differentiation. *Journal of Social and Clinical Psychology*, *22*, 537-559.

14. McCrae, R. R., & John, O. P. (1998). An introduction to the five-factor model and its applications. *Personality: critical **concepts** in psychology*, *60*, 295.
15. Gosling, S. (2003). A Very Brief Measure of the Big-Five Personality Domains. *Journal of Research in Personality*, *37*, 504-528.
16. Said, H. M., KhamisAbukraa, M., & Rose, R. M. The Relationship between Personality and Job
17. Ozer, D. J., & Benet-Martinez, V. (2006). Personality and the prediction of consequential outcomes. *Annu. Rev. Psychol.*, *57*, 401-421.
18. Sheldon, K. M., Ryan, R. M., Rawsthorne, L. J., & Ilardi, B. (1997). Trait self and true self: Cross-role variation in the Big-Five personality traits and its relations with psychological authenticity and subjective well-being. *Journal of Personality and Social Psychology*, *73*(6), 1380.
19. Colvin, C. R., Funder, D. C. Jun 1991. Predicting personality and behavior: A boundary on the acquaintanceship effect. *Journal of Personality and Social Psychology*, 60(6), 884-894.http://dx.doi.org/10.1037/0022-3514.60.6.884
20. Kernis, M. H., & Goldman, B. M. (2006). A multicomponent conceptualization of authenticity: Theory and research. *Advances in experimental social psychology*, *38*, 283-357.
21. Maltby, J., Wood, A. M., Day, L., & Pinto, D. (2012). The position of authenticity within extant models of personality. *Personality and Individual Differences*, *52*(3), 269-273.
22. English, T., & John, O. P. (2013). Understanding the social effects of emotion regulation: The mediating role of authenticity for individual differences in suppression. *Emotion*, *13*(2), 314.
23. Creswell, J. W., & Plano, C. V. L. (2007). *Designing and conducting mixed methods research*. Thousand Oaks, Calif: SAGE Publications.
24. Strack, S. (1987). Development and validation of an adjective check list to assess the Million personality types in a normal population. *Journal of Personlaity Assessment*, *51*, 572-587.
25. Wood, A. M., Linley, P. A., Maltby, J., Baliousis, M., & Joseph, S. (2008). The authentic personality: a theoretical and empirical conceptualization and the development of the Authenticity Scale. *Journal of Counseling Psychology*, *55*(3), 385.
26. Srivastava, S., Tamir, M., McGonigal, K. M., John, O. P., & Gross, J. J. (2009). The Social Costs of Emotional Suppression: A Prospective Study of the Transition to College. *Journal of Personality and Social Psychology*, *96*(4), 883–897. http://doi.org/10.1037/a0014755