First-Generation College Students and Othering in Undergraduate Engineering

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Dr. Sarah Bauer is an Assistant Professor in the Department of Civil and Environmental Engineering at Rowan University. Dr. Bauer holds a doctorate degree in Civil and Environmental Engineering from the University of Virginia, Charlottesville. She is the recipient of numerous awards and scholarships as a graduate student and young professional. Her primary research interests are: water and wastewater treatment, renewable energy technologies, pollution prevention, and engineering education. Dr. Bauer is an active member of ASEE and the Society of Women Engineers (SWE) and currently serves as the Faculty Advisor for Rowan University's Student Chapter of SWE.

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Abstract

First-generation college students face considerable obstacles to college success, including a lack of role models in the family, a lack of familial mentoring and support, a lack of familiarity with the college climate, and, generally, lower socioeconomic status. For the most part, first-generation students carry an invisible minority mark. As such, they may share with other minority statuses a sense of "otherness" from the mainstream college student, and consequent obstacles to self-confidence and -efficacy, weaker academic achievement, uncertainty of future plans in their majors, and a weaker sense of being part of the (student) community in their major. Engineering students are not an exception, and successful achievement of an undergraduate degree in engineering may hinge on finding an inclusive and welcoming climate as well as nurturing professors and students. The current study focuses on first-generation engineering students at a public university in the MidAtlantic. The data are drawn from a baseline survey about the climate for diversity and inclusion administered to all engineering college students in the Fall of 2016. Suggested supports for first-generation students are discussed in the paper's conclusions.

Introduction

First-generation college students (FGCS) face considerable obstacles to college success, including a lack of role models in the family, a lack of familial mentoring and support, a lack of familiarity with the college climate, and, generally, lower socioeconomic status [1-6]. They tend to be less academically prepared for college, and English is not their native language for a higher proportion than of continuing-generation college students (CGCS) [3]. However, in many ways, recent research suggests that FGCS are very similar to CGCS. They respond to the same factors encouraging college persistence and success [7-8], and often demonstrate considerable "grit" in pursuing their undergraduate careers (9), a factor instrumental in undergraduate achievement.

Indeed, Boone and Kirk [8] found that FGCS who chose engineering show more career interest than CGCS, while using different resources than CGCS to gain entry and persist in engineering; Smith and Lucena [10] label them the "invisible innovators' in engineering. Nevertheless, they run the risk of being less involved in student activities and having lower social integration than CGCS [11], which may interfere with their self-confidence, sense of belonging and engineering identity, critical to their academic success [9].

The current study of engineering students at a public university in the MidAtlantic has focused on the climate of diversity and inclusion in engineering, examining perceptions of the students who have both visible and invisible minority status (defined below) and their differences from majority students. FGCS are about a third of the engineering students, but nevertheless a minority and characterized by disadvantages that might hinder their undergraduate success. The current paper will describe the characteristics of the FGCS in engineering, the degree to which they are integrated into the engineering community, their self-confidence and identification as engineers, and future commitment to the field.

Data

A baseline survey of students in the College of Engineering was conducted in 2016-17 to gauge the climate of diversity both within and outside of classrooms. 293 engineering students completed the online surveys, following invitations sent first by the Dean of the College and then reminders by the principal investigator. This survey collected demographic data on the existence of underrepresented visible and nonvisible minorities within the entire College of Engineering such as race/ethnicity, gender identity (beyond cisgender male-female), sexual orientation, religion, SES, and whether or not they were first-generation college students (FGCS). Background data included pre-college courses related to science, math and engineering; extra-curricular activities related to STEM in high school; high school GPA and class rank, and SAT scores. The climate of diversity in the college of engineering was assessed by probing the extent to which students and faculty were comfortable in situations of diversity (using both visible and nonvisible criteria of diversity); were comfortable voicing opinions about diversity topics; had witnessed tensions, stereotyping, or discriminatory acts on the basis of any of these minority characteristics (implying a dominant cultural capital excluding minorities); and whether minorities felt pressured to act in any particular way inside or outside of the classroom (reflecting both social and cultural capital).[1] Climate indices were derived from factor analyses of each of these sets of questions (see the Appendix for index construction). Further, self-confidence as an engineer and in terms of academic suitability to engineering were assessed; indices for these sets of questions were also developed through factor analysis (see the Appendix); as were future plans to be employed in the engineering field and/or continue to graduate education in the field. Operationalization of the variables included in this analysis are presented in the Appendix.

Because recent research has challenged the "deficit" model for understanding FGCS, we wanted to use our data to explore the extent of "deficit" and subsequent differences in terms of engagement in the engineering community, perceived belongingness to the engineering community vs. perceived "otherness", self-confidence as an engineer; and long-term commitment to engineering.

Using the survey results, we therefore analyzed:

(1) the background differences that FGCS entered into the College of Engineering (pre-college preparation and background differences), data that typically supports a "deficit" model of understanding FGCS;

(2) differences in behavior of FGCS and CGCS while in the College of Engineering, in terms of participation in both engineering-related and university-wide extra-curricular activities at the College and University level which are typically associated with greater integration into the College and facilitate identification with the major and subsequent retention;

(3) perceived feelings of self-confidence as an engineering student, which is associated with retention and commitment;

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[1] The researchers adapted questions about personal perceptions of the culture of diversity from Vu et. al. [12] who based their survey on Helm et al. [13] the research team expanded the questions to cover other visible and nonvisible minorities than were originally surveyed. Questions regarding the engineering curriculum and learning environment were adapted from [14]. Satisfaction and self-confidence scales were adapted from the PACE survey [15].

(4) self-reported perceptions of

(a) "otherness"—feeling "othered" by the interpersonal climate (perceiving a sense of difference from the other students in a variety of situations), which is associated with perceptions of a chilly climate that may alienate students, and hence a lack of integration into the engineering community, as well as

(b)identifying as belonging to the engineering community;

(5) long-term commitment to the field of engineering, either in terms of graduate education or expectations of employment.

Findings

First-generation college students make up 36.8% (n=105) of the engineering students who completed the survey. They were overrepresented in some of the characteristics that we had designated as visible and invisible minority status but were underrepresented in others.

Minority identities

Table 1. First- and Continuing Generation College Students in the College of Engineering by Other Minority Identities (Percentages)

	FGCS	**CGCS**	**Statistical Significance (Chi-square)**
% low SES growing up	**52.8**	**27.7**	**.001**
% whose parents made less than $100,000 last year	**52.9**	**29.0**	**.006**
% confident they will have sufficient funds to complete college ed	**37.7**	**53.8**	**.035**
% women	21.2	30.6	NS*
% LGBQ+	19.0	15.1	NS*
% white, non-Hispanic	90.9	88.5	NS*
% non-Christian	46.4	54.1	NS*
% disabled	8.5	10.9	NS*
% English not first language	**6.6**	**1.6**	**.028**
(n)	**(105)**	**(180)**	

*NS=not statistically significant at $p<.05$.

Clearly there is an overlap between being first-generation college and lower SES, including feeling vulnerable in terms of having enough funds to complete their college education.

In terms of other visible and non-visible minority status, there is no statistically significant difference between FGCS and CGCS in the College of Engineering except for the small percentage for whom English is not their first language.

In terms of their academic preparation for college engineering, there are some differences. FGCS were not significantly different from CGCS in terms of their class rank or SAT scores; while their difference in high school GPA was statistically significant, it was a small difference (mean being above 3.61 compared to 3.78 for CGCS).

They were less likely to participate in AP/honors STEM classes (which may be a function of their high schools not offering as many of these classes). In terms of extra-curricular activities, FGCS are less likely to have gone to a summer camp or summer course in science or engineering while in high school, but this is balanced by greater participation in online science, engineering or computer programming courses, and robotics competitions, so there is no significant overall difference in high school extra-curricular STEM activities.

Table 2: Pre-College Academic and Extra-Curricular Activities by First- and Continuing-Generation College Status

	FGCS	**CGCS**	**Stat. Signif. (Chi-square or T-test)**
% Top 10% of class rank	59.6	60.5	NS*
% Math SAT score 750+	17.3	18.4	NS*
% Critical reading score 750+	8.3	2.0	.064
Mean GPA in high school (4-point scale)	3.61	3.78	.004
Honors STEM Index	1.78	2.22	NS*
AP STEM Index	1.23	1.64	.030
High school extracurricular STEM activities Index	1.0	.8	NS*

*NS=not statistically significant at p<.05

Engineering college experience

First generation college students have some characteristics related to their socio-economic status that differentiate them from CGCS. While a minority of students, they are more likely to be transfer students (most having attended community college for the first two years of college rather starting their first year at the university), they are more likely to be in-state students. Interestingly, however, they are not significantly different in terms of being employed during the academic year.

Table 3 Student Status During College by First- and Continuing-Generation College Status

	FGCS	**CGCS**	**Statistical Significance (Chi-Square)**
% transfers	**14.2**	**4.3**	**.003**
% in-state tuition	**99.1**	**89.1**	**.002**
% employed during school year (FT or PT)	56.7	58.1	NS*

*NS=not statistically significant at p<.05

Extra-Curricular activities during college

First-generation college students participate less in extra-curricular engineering activities, including extra-curricular engineering projects, engineering service clubs and student

professional societies, the engineering learning community[2], and mentoring programs; they also participate significantly less in university-wide extra-curricular activities, such as volunteer work, the Honors program, collegiate or intramural athletics.

Table 4: Extra-Curricular STEM and Non-STEM Activities During College by First- and Continuing- Generation College Status

	FGCS	CGCS	Statistical Significance (T-test)
Engineering Related Index (Mean)	1.9	2.2	.090
Non-engineering related index (Mean)	1.1	1.6	.002

Perceptions of "othering" among first-generation college students

In this section we explore the extent to which FGCS feel comfortable in the following interpersonal situations in engineering: (1) Climate Index 1 measures comfort being with people whose race/ethnicity, religion, gender, sexual orientation and/or socio-economic status is the same as or different from theirs; (b) Climate Index 2 measures comfort saying what they think about race/ethnicity, religion, gender, sexual orientation and/or socio-economic status; (c) Climate index 3 measures their comfort level when speaking with others about their race/ethnicity, religion, gender, sexual orientation and/or socio-economic status; and (d) Climate Index 4 measures their comfort level in situations where they are the only one of their race/ethnicity, religion, gender, sexual orientation and/or socio-economic status. It should be mentioned that in previous analyses of gender, sexual orientation, and race/ethnicity, we had found significant indications of feeling less comfortable, or "other," among the minority statuses.

Table 5: Indices of Diversity Climate perceptions by First- and Continuing-Generation College Status

	FGCS	CGCS	Statistical significance (T-test)
Climate Index 1 (mean)	-.030	.025	NS*
Climate index 2 (mean)	.031	.010	NS*
Climate index 3 (mean)	-.097	.068	NS*
Climate index 4 (mean)	.055	-.029	NS*

*NS=not significant at p<.105.

[2] The Engineering Learning Community is a first-year program for engineering students. Students in the ELC live in the same dorm, take classes together their first two semesters at the university and participate in group activities. Junior/Senior engineering students (who did the ELC their first-year) mentor ELC students. The ELC helps students form bonds with each other and faculty and helps with the transition to college.

Among FGCS, however, there are no significant differences in perceptions of being uncomfortable because of minority identities.

When we break down FGCS by gender, we see an interaction between gender and first-generation college status. FGCS women do feel more uncomfortable than FGCS men on three of the four climate indices (Climate Index 4 differences being statistically significant). Among CGCS, women are more uncomfortable on three of the four climate indices as well, reaching statistical significance for Indices 3 and 4. On three of the four climate indices, we also see that FGCS women are more uncomfortable than CGCS women, indicating an interaction. They are not less comfortable speaking about their minority identities than CGCS women, but they feel uncomfortable when their minority identity leaves them alone in a group or categorized because everyone in the group shares the minority status. The differences between FGCS and CGCS men are less pronounced, suggesting that the vulnerability of being a woman (a minority status) with another minority status is increased among FGCS.

Table 6
Mean Scores on Diversity Climate factors by First- and Continuing-Generation College Status and Gender

	Climate Index 1	Climate Index 2	Climate Index 3	Climate Index 4
FGCS (Total)	-.032	-.110	.059	.039
Men	.051	-.105	.043	.215
Women	-.351****	-.130	.120	-.637*
CGCS (Total)	.038	.089	-.005	-.041
Men	-.033	.129	.095	.062
Women	.190	.002	-.219**	-.259**
Men (total)	.001	.033	.074	.124***
Women (total)	.039	-.035	-.125	-.364

*Gender difference among FGCS statistically significant at p=<.001
**Gender difference among CGCS statistically significant at p=<.05
***Gender difference (total) statistically significant at p<.001.
**** First-generation difference among women statistically significant at p<.05.

We see a similar interaction between being LGBQ+ and FGCS on index 1 (not shown), but not for non-white or low-SES FGCS students.

In terms of index 3, comfort in speaking about their other minority identities, LGBQ+ FGCS are *more* comfortable than CGCS in speaking about their minority identity, just as FGCS women are *more* comfortable than CGCS women speaking about their minority identity. This may be attributed to greater maturity or a different kind of social capital (which has been alluded to in other studies, such as [10]); understanding this might be important in better understanding some of the strengths FGCS bring to engineering.

Self Confidence in Engineering

Students were asked about their academic proficiency (their confidence that they will succeed in their major, in their engineering courses, in their overall academic ability and their academic abilities compared to their peers, their competencies the skills required in their major), and about their confidence in their employability as engineers after graduation (their expectations that engineering will be a rewarding career, that someone like them would succeed in an engineering career, that they would have no problem finding a job with their degree, and that their coursework would prepare them for an engineering job). Using principal components factor analysis, these indicators separated into two indices, which are detailed in the Appendix.

Table 7 Academic and Employability Self-Confidence by First-Generation College Status
No significant differences in their academic or employability self-confidence as an engineer, although the FGCS were considerably more apprehensive that their coursework would prepare them for a job in engineering; perhaps their greater economic vulnerability leads to skepticism about the job market.

	FGCS	**CGCS**	**Significance (T-test)**
Self-Confidence Factor 1 (Academic Ability)	007	-.003	NS
Self-Confidence Factor 2 (Employability)	-.031	.028	NS

NS=Not statistically significant at $p<.05$.

The interactions between other minority statuses that we saw for the climate indices were not apparent for the self-confidence indices (not shown), indicating that the extent to which there is vulnerability of gender and sexuality minority statuses, it is not intensified by first-generation college status.

FGCS feel as strongly that they belong in the college's engineering environment and community as much as do CGCS. There are no significant interactions between FGCS and gender, sexuality, race or socio-economic status in terms of this identification with the engineering community.

Table 8 Identification with Engineering Community by First- and Continuing-Generation College Status

	FGCS	**CGCS**	**Statistical Significance (Chi-Square)**
Feel like you are part of an engineering community (% All the time)	38.0	39.2	NS*

I feel as though I belong in this engineering environment (% All the time)	30.0	38.5	NS*

*NS=not significant at p<.05.

Long-term commitment to the field of engineering does not differ between FGCS and CGCS.

Table 9 Long-term Commitment to engineering by First- and Continuing-Generation College Status

	FGCS	**CGCS**	**Statistical Significance (Chi-Square)**
% Expecting highest degree in engineering to be BS	43.6	35.6	NS*
% Expecting highest degree in engineering to be PhD	6.9	13.6	NS*
%Very likely to be working in engineering-related field ten years from now	72.3	66.1	NS*

*NS=not significant at p<.05.

Conclusions

Like previous research, we found that FCGS in engineering at this university entered with significantly lower socio-economic status from home and, perhaps, related, had less STEM advanced preparation (honors or AP classes, extra-curricular activities) in high school. They did not differ significantly in class rank or SAT math scores, however.

While FCGS are a minority of the engineering students in the study's sample, they make up around a third of the students, which gives them more than a critical mass to identify with should they wish to. While they are more likely to be transfer students than CGCS and to pay in-state rather than out-of-state tuition, they are not more likely to be employed during the school year than CGCS. They are less likely than CGCS to share characteristics of other minority statuses or show no significant difference. Thus, the effect of having the minority status (both in terms of numbers and disadvantage) on their engineering process or outcomes cannot be assumed *a priori*. The changing perspectives of recent research about FGCS from a deficit model to a social capital or empowered perspective that we reviewed above, reinforce this lack of clarity of what the effect of being FGCS actually is.

Their engineering experience differs from CGCS in that they are less likely to participate in extra-curricular engineering-related activities and university extra-curricular activities, both of which indicate less social integration into the community. However, FGCS are as likely to say they feel a part of the engineering community as do CGCS. Further, FGCS do not differ from CGCS in terms of their academic self-confidence as engineering students nor in terms of their

confidence in their employability as engineers. They do not differ significantly in terms of the academic degree they expect to reach nor whether they are likely to be employed as engineers in ten years. This, too, reinforces the suggestion of Smith and Lucena [10] and Verdin et. al. [9] that FGCS draw on other resources and social capital than CGCS to get to similar outcomes.

It should be noted that some of these students participate in a special mentoring program for transfer students that encourages frank discussion of problems encountered and strategies of success, indicating their willingness to find ways to succeed in engineering and to talk about their needs to fellow transfer students and faculty. Anecdotal feedback is very positive; however, it does not extend to all engineering departments yet.

The results of the analysis regarding the diversity and inclusion climate suggest that as FGCS these students do not see themselves as "other" in a negative way. They tend to feel as comfortable as CGCS in situations when they are the sole individuals of their other minority identities, when speaking about their other minority identities, or when being with people who share their same identity. In fact, they seem to be significantly more comfortable than CGCS in terms of speaking about their other identities. Understanding this may shed light on the types of social capital FGCS can draw upon that differ from CGCS in positive ways, enabling greater "grit" and perseverance.

There are, however, two important exceptions: FGCS who are women, and FGCS who identify as LGBQ+. These two cases of FGCS feel less comfortable than other FGCS in situations when they are the sole representative of their identity or when they are only with others who share their identity; they also feel less comfortable than CGCS who identify with the same identity. The two statuses together tend to intensify the lack of comfort. This suggests that special care should be given to these FGCS to empower them to manage the effects of this double minority status.

Further research needs to determine whether the success of the majority of engineering FGCS at this institution is related to particular features characteristics of the engineering program, such as the mentoring program mentioned above; and whether the supports for FGCS at the university level extend the successful outcomes to FGCS in other majors than engineering.

Appendix
Definitions of Variables and Indices

Variable	Definition
First-generation college student	No parent has more than high-school education
Continuing-generation college student	At least one parent has some postsecondary education
Gender	1=Male; 2=Female (Gender non-conforming were not included in the analysis in this paper)
Heterosexual	1=Heterosexual; 2=homosexual, asexual, bisexual, queer, questioning/unsure, other (LGBQ+)
Race/ethnicity	1=Non-Hispanic White; 2=Hispanic, African-American or other race/ethnic minority
Disability	Answered yes to having disability affecting their ability to perform as a student
Religion	1=Christian religion (Protestant-Catholic-Christian); 2=non-Christian religion; 3=No religion, atheist, agnostic
Low socio-economic status	Best estimate of parents'/guardians' total income last year<$100,000 (median income)
SES growing up	When you were growing up (between the ages of 5-17), where would you place yourself on a 6-rung e... (1-3=low; 4-6=high)
English not first language	"Is your first language English?" 1=Yes, 2=No
Honors high school STEM classes index	Sum of classes (Honors Calculus, Honors Chemistry, Honors Physics, Honors Biology)
AP high school STEM classes index	Sum of classes (AP Calculus AB or BC, AP Chemistry, AP Physics, AP Biology)
High school extra-curricular STEM activities	Sum of activities (Science fairs, Magnet programs in science or engineering, Robotics competitions, Summer course or camp in science or engineering)
College extra-curricular engineering-related activities	Sum of activities (Engineering student or professional societies, Department lectures or speakers, engineering service clubs, engineering learning community, environmental action league, engineering internship or co-op, mentoring programs, engineering projects, undergraduate research experience)
College extra-curricular non-engineering-related activities	Sum of activities (volunteer work, collegiate or intramural athletics, non-engineering internships, disability services, university honors program, ethnic/race organizations, feminist/sexuality groups, religious organizations, progressive student alliance)

Climate Indices
Principal Components Factor Analysis, Varimax Rotation with Kaiser Normalization

Rotated Component Matrix[a]

	Climate Index			
	1	2	3	4
Q37_1 Please indicate how comfortable you feel in the following situations at Rowan (Very uncomfortable...-Being with people whose race/ethnicity is the same as my own[b]	.889	.125	.218	.198
Q37_2 Please indicate how comfortable you feel in the following situations at Rowan (Very uncomfortable...-Being with people whose religion is the same as my own	.859	.151	.196	.212
Q37_3 Please indicate how comfortable you feel in the following situations at Rowan (Very uncomfortable...-Being with people whose gender is the same as my own	.853	.146	.192	.155
Q37_4 Please indicate how comfortable you feel in the following situations at Rowan (Very uncomfortable...-Being with people whose sexual orientation is the same as my own	.878	.138	.229	.222
Q37_5 Please indicate how comfortable you feel in the following situations at Rowan (Very uncomfortable...-Being with people whose socioeconomic is the same as my own	.828	.113	.259	.203
Q37_6 Please indicate how comfortable you feel in the following situations at Rowan (Very uncomfortable...-Being with people whose race/ethnicity is different from my own	.808	.223	.213	.350
Q37_7 Please indicate how comfortable you feel in the following situations at Rowan (Very uncomfortable...-Being with people whose religion is different from my own	.842	.188	.186	.266
Q37_8 Please indicate how comfortable you feel in the following situations at Rowan (Very uncomfortable...-Being with people whose gender is different from my own	.759	.130	.271	.363
Q37_9 Please indicate how comfortable you feel in the following situations at Rowan (Very uncomfortable...-Being with people whose sexual orientation is different from my own	.691	.216	.116	.394
Q37_10 Please indicate how comfortable you feel in the following situations at Rowan (Very uncomfortable...-Being with people whose socioeconomic background is different from my own	.801	.202	.218	.342

Q37_11 Please indicate how comfortable you feel in the following situations at Rowan (Very uncomfortable...-Saying what I think about race/ethnicity issues	.159	.860	.241	.196
Q37_12 Please indicate how comfortable you feel in the following situations at Rowan (Very uncomfortable...-Saying what I think about religious issues	.137	.835	.342	.159
Q37_13 Please indicate how comfortable you feel in the following situations at Rowan (Very uncomfortable...-Saying what I think about gender issues	.183	.859	.240	.132
Q37_14 Please indicate how comfortable you feel in the following situations at Rowan (Very uncomfortable...-Saying what I think about sexual orientation issues	.151	.880	.225	.210
Q37_15 Please indicate how comfortable you feel in the following situations at Rowan (Very uncomfortable...-Saying what I think about socioeconomic issues	.227	.729	.370	.214
Q37_16 Please indicate how comfortable you feel in the following situations at Rowan (Very uncomfortable...-Being in situations where I am the only one of my race/ethnicity	.379	.299	.156	.742
Q37_17 Please indicate how comfortable you feel in the following situations at Rowan (Very uncomfortable...-Being in situations where I am the only one of my religion	.513	.249	.282	.615
Q37_18 Please indicate how comfortable you feel in the following situations at Rowan (Very uncomfortable...-Being in situations where I am the only one of my gender	.374	.130	.272	.686
Q37_19 Please indicate how comfortable you feel in the following situations at Rowan (Very uncomfortable...-Being in situations where I am the only one of my sexual orientation	.389	.258	.166	.727
Q37_20 Please indicate how comfortable you feel in the following situations at Rowan (Very uncomfortable...-Being in situations where I am the only one of my socioeconomic status	.435	.235	.270	.703
Q37_21 Please indicate how comfortable you feel in the following situations at Rowan (Very uncomfortable...-Speaking with others about my race/ethnicity	.284	.365	.758	.198
Q37_22 Please indicate how comfortable you feel in the following situations at Rowan (Very uncomfortable...-Speaking with others about my religion	.233	.396	.768	.182

Q37_23 Please indicate how comfortable you feel in the following situations at Rowan (Very uncomfortable...- Speaking with others about my gender	.303	.282	.730	.184
Q37_24 Please indicate how comfortable you feel in the following situations at Rowan (Very uncomfortable...- Speaking with others about my sexual orientation	.331	.287	.676	.203
Q37_25 Please indicate how comfortable you feel in the following situations at Rowan (Very uncomfortable...- Speaking with others about my socioeconomic status	.242	.385	.702	.232
Percent of variance explained (Total=81.0%):	32.8	18.6	15.2	14.4

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.[a]

a. Rotation converged in 8 iterations.

b. Answer categories: Very uncomfortable, uncomfortable, neutral, comfortable, very comfortable

Self-Confidence Indices
(Principal Components Factor Analysis, Varimax Rotation with Kaiser Normalization)

Rotated Component Matrix[a]

	Self-Confidence Index	
	1	2
Q47_1 Self-Confidence in Engineering Students have different assessments of their own engineering str...-I am well suited for my choice of college major[b]	.776	.392
Q47_2 Self-Confidence in Engineering Students have different assessments of their own engineering str...-I am confident in my overall academic ability	.760	.398
Q47_3 Self-Confidence in Engineering Students have different assessments of their own engineering str...-I am confident in my ability to succeed in my college engineering courses	.788	.444
Q47_4 Self-Confidence in Engineering Students have different assessments of their own engineering str...-I am competent in the skills required for my major	.843	.306
Q47_5 Self-Confidence in Engineering Students have different assessments of their own engineering str...-I am confident that someone like me can succeed in an engineering career	.669	.542
Q47_6 Self-Confidence in Engineering Students have different assessments of their own engineering str...-I expect that engineering will be a rewarding career	.273	.754
Q47_7 Self-Confidence in Engineering Students have different assessments of their own engineering str...-I will have no problem finding a job when I have obtained an engineering degree	.269	.716
Q47_8 Self-Confidence in Engineering Students have different assessments of their own engineering str...-My engineering coursework will prepare me for a job in engineering	.157	.811
Q48 Compared to other students in my classes, I think my academic abilities in my engineering classes...[c]	.807	
Percentage of variance explained (71.3% total)	42.0	71.3

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]

a. Rotation converged in 3 iterations.
b. Answer categories: Strongly agree, agree, neural, disagree, strongly disagree
c. Answer categories: Far below average, below average, average, above average, far above average

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