

The influence of background characteristics on socialization processes in engineering

Introduction

A wide variety of pre-college characteristics and experiences can influence a student's social and academic transition to college. In an exploratory multi-institutional study, Terenzini and colleagues (1994) characterized the college transition process as "a highly interrelated, web-like series of family, interpersonal, academic, and organizational pulls and pushes" (p. 61), noting the influences of parental education, age, race, and class while emphasizing the importance of validation in the college environment. Particular attention has been paid to the experiences of students who are the first in their families to attend college, especially those coming from lower income backgrounds. London (1992) noted that while "college changes all students" (p. 10), first generation students coming from working class backgrounds in particular may experience more cultural challenges during their transition to college. More recently, Stephens et al. (2012) emphasized difficulties arising from the "cultural mismatch" between working class first generation students and university cultural norms. Other characteristics that have been explored with respect to college transitions include sex (Enochs & Roland, 2006; Buchmann, 2009), race and ethnicity (Hurtado & Carter, 1997; Fischer, 2007; Wilkins, 2014), autism (Adreon & Durocher, 2007), and learning disabilities (Skinner & Lindstrom, 2003; Madaus, 2005).

One useful framework for understanding students' transition to college and acculturation into the college environment is Weidman's framework of undergraduate socialization (1989, 2006). Socialization is described by Weidman as the "acquisition and maintenance of membership in salient groups... as well as society at large" (p. 294, 1989). His comprehensive conceptual framework includes "socializing influences experienced by undergraduates from a variety of sources, both within and external to" the college environment (p. 290, 1989). These include student background characteristics and pre-college normative pressures, collegiate experiences and in-college normative pressures, the ongoing influence of non-college reference groups and parental socialization, and finally socialization outcomes such as career choices and aspirations.

Weidman's conceptual framework provides a useful model to understand how socialization comes into play with other influences, it does not afford means to explicitly measure specific socialization processes. The field of organizational behavior, however, operationalized two primary socialization processes: organization-driven institutional tactics (Van Maanen & Schein, 1979; Jones, 1986) and individual-driven proactive behaviors (Ashford & Black, 1996). Therefore, we operationalized Weidman's conceptual framework (shown in Figure 1) by integrating these specific mechanisms in order to understand both how the institution shapes undergraduate socialization (through institutional tactics) and how students themselves take an active role in the socialization process (through proactive behaviors). Scales measuring institutional tactics and proactive behaviors have been used together in studies of organizational behavior (Kim, Cable, & Kim, 2005; Ashforth, Sluss, & Saks, 2007) but never in the context of higher education.

In this paper, we examine this portion of our model, namely the relationships between students' background characteristics and the socialization processes students experience in their first year at an elite public college of engineering. It is reasonable to expect that students with particular background characteristics would also adopt specific proactive socialization behaviors consistent with those characteristics. For example, it would not be surprising to learn that students who have some previous ties to the university, such as a parent or sibling who went to the same institution, would have different patterns of behavior than their less connected peers. Likewise, students from different backgrounds may respond differently to institutional socialization tactics. Understanding these college transition experiences and how they differ for students from different backgrounds may aid the design and implementation of targeted interventions supporting particular segments of the student population.

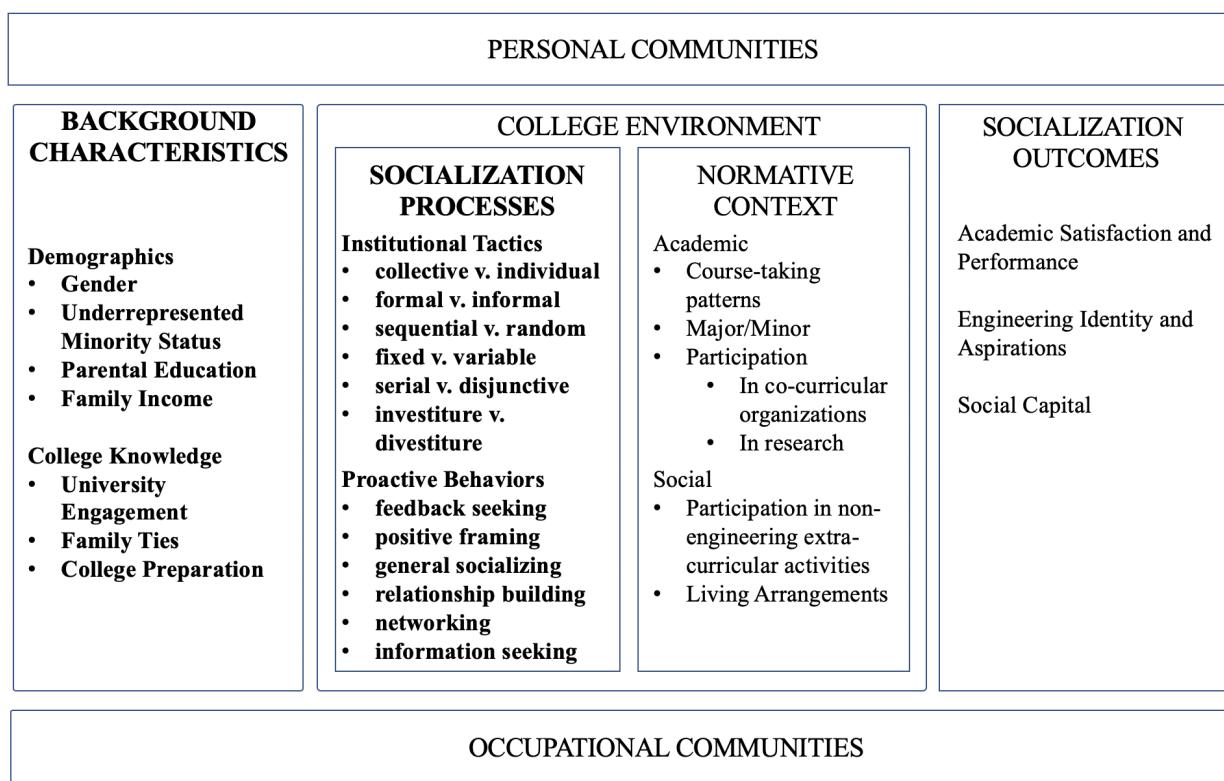


Figure 1. Student Participation and Socialization Mechanisms (SPASM) framework. Bolded text denotes the factors considered in this paper.

Methods

We conducted a survey of third- and fourth-year domestic undergraduate students majoring in engineering at a large public Midwestern university. Although our survey instrument included questions about all sections of the SPASM framework as shown in Figure 1 (i.e., background characteristics, socialization processes, normative contexts, socialization outcomes, and non-college personal and occupational communities) we consider in this work only the relationships between background characteristics and socialization processes.

Background Characteristics

In total, we considered nineteen dichotomous indicators that captured various aspects of students' backgrounds before coming to college. These nineteen indicators fall broadly into two categories: *demographics*, characteristics such as sex and race/ethnicity, and *college knowledge*, a collection of college preparatory resources and experiences the student may have had in high school.

Demographics

Our measures of sex, underrepresented ethnic/racial minority (URM) status, and parental education (operationalized as first generation status) were taken from an institutional database. Our measure of family income was derived from United States Census data, wherein students were assigned the median family income based on their home ZIP Code, which was also obtained from the institutional database. Family income was coded into two dichotomous indicators based on institutional cutoff values for low and high income status: low income students are those students who qualified for free tuition at our institution (annual family income <\$65,000), and high income students were those who did not qualify for any need-based tuition support (annual family income >\$180,000).

Table 1. College knowledge inventory: items measuring pre-college resources and experiences

Category	Items
<i>Family Ties to the University</i>	I had a family member that graduated from the university. I had family ties to the university (e.g., a family member that worked at the university).
<i>High School College Prep</i>	I took Advanced Placement (AP) courses. I spoke with a high school counselor about college. I participated in a math, science, or engineering-focused club, organization, or camp.
<i>College Course Taking</i>	I took college courses for credit (high school and/or college credit). I took college courses non-credit.
<i>Private College Prep</i>	I had a private tutor for high school classes. I took SAT/ACT preparation courses (e.g., Kaplan, Princeton Review, etc.). I had a private tutor for SAT/ACT preparation. I used a college admissions or educational consultant.
<i>University Engagement</i>	I visited the university's campus. I attended a university sponsored recruitment visit. I spoke with a representative of the university.

College Knowledge

We collected information about students' college preparatory resources and experiences through a series of survey items, adapted from a pre-college survey from Duke University as part of the Campus Life and Learning Project (Spenner & Bryant, 2002). Our instrument included a list of fourteen affirmatively-worded statements with an instruction to "indicate all of the things that were true for you while you were preparing for and applying to college." The fourteen items, displayed in Table 1, were grouped into five categories post-hoc: family ties to the university, high school college prep, college course taking, private college prep, and university engagement.

Socialization Processes

The survey instrument also measured students' experiences with two types of socialization processes taken from the organizational behavior literature: institutional tactics and proactive behaviors. In order to measure these two sets of socialization processes, we adapted scales from the literature (Jones, 1986; Ashford and Black, 1996) to reflect the context of students entering the College of Engineering and validated them for internal consistency, removing individual survey items due to poor factor loading when necessary. Sample items for both scales are shown in Tables 2 and 3. All items measuring students' experiences with institutional tactics and proactive behaviors were measured using a seven-point Likert scale, with 0 = Strongly Disagree and 6 = Strongly Agree.

Table 2. Summary of institutional tactics including Cronbach's alpha (α) for each scale

Dimension	α	Description	Sample Items
<i>Collective vs. individual</i>	0.64	Common learning experiences designed to standardize knowledge and behaviors. Higher score is <i>more collective</i> .	“Other first-year students were instrumental in helping me adjust to college.” “There was a sense of ‘being in the same boat’ amongst first-year students in engineering.”
<i>Formal vs. informal</i>	0.49	Socialization occurring in settings specifically intended for newcomers. Higher score is <i>more formal</i> .	“I went through a set of experiences that were specifically designed to give students a thorough knowledge of the University.” “I was very aware that I was seen as ‘learning the ropes’ in the College of Engineering.”
<i>Investiture vs. divestiture</i>	0.63	Affirmation of new students’ unique identities, strengths, and capabilities within the institution. Higher score is <i>more investiture</i> .	“I was made to feel that I had great academic potential in the College of Engineering.” “Almost all of my peers were supportive of me personally.”
<i>Sequential vs. random</i>	0.65	Explicit information about activities and processes that they would experience during college. Higher score is <i>more sequential</i> .	“The steps in the student experience in the College of Engineering were clearly specified.” “There was a clear pattern in the way I was expected to move through the engineering college experience.”
<i>Serial vs. disjunctive</i>	0.74	Extent to which more experienced institutional agents, such as older students, served as mentors to new students. Higher score is <i>more serial</i> .	“I gained a clear understanding of how to succeed in the College of Engineering by observing more senior students.” “Experienced people in the College of Engineering (e.g., older students, staff) believed helping first-year students was important.”
<i>Fixed vs. variable</i> *	–	Communication of timetable of events and processes during college. Higher score is <i>more fixed</i> .	“I could predict my future path in engineering by observing other students’ experiences.” “I had a good knowledge of the time it would take me to graduate with a degree in engineering.”

* The fixed. vs. variable dimension was removed due to significant collinearity with sequential vs. random scale.

Table 3. Summary of proactive behaviors including Cronbach's alpha (α) for each scale

Dimension	α	Description	Sample Items
Feedback seeking	0.89	Behaviors that allow new students to understand how they are being perceived by superiors and colleagues.	“I often sought feedback on my performance after assignments.” “I solicited critiques from my professors/instructors.”
General socializing	0.66	Engagement with informal social opportunities, helping new students adapt to institutional social norms.	“I attended parties with friends I met in engineering.” “I participated in social events on campus outside of the College of Engineering to meet people.”
Information seeking	0.81	Behaviors that help new students to learn about institutional rules, norms, and expectations.	“I tried to learn the important policies and procedures of the university.” “I tried to learn the official organizational structure of the College of Engineering.”
Networking	0.78	Active engagement with people outside of the college of engineering.	“I started conversations with people from different academic majors than my own.” “I tried to socialize with people (faculty, students, or staff) who are not in engineering.”
Positive framing	0.78	Recasting potentially challenging or discouraging experiences in a more optimistic light, promoting confidence and self-efficacy.	“I tried to see my engineering major as a challenge rather than a problem.” “I often tried to look on the bright side of things.”
Relationship building with older students	0.89	Efforts to form connections with more senior students.	“I worked hard to get to know more senior students.” “I tried to spend as much time as I could with more senior students.”

Institutional Tactics

In order to measure students' experiences with institutional tactics, we adapted scales published by Jones (1986) for a university context. Students were asked to reflect on their first year at the institution and respond to a set of items related to institutional socialization tactics across six dimensions representing a continuum from *institutionalized* to *individualized* socialization: collective vs. individual, formal vs. informal, investiture vs. divestiture, sequential vs. random, serial vs. disjunctive, and fixed vs. variable. For each dimension, the first of the two poles listed (i.e., collective, formal, investiture, sequential, serial, fixed) corresponds to more institutionalized socialization, characterized by the presence of a formalized system to integrate new students, while the second pole (i.e., individual, informal, divestiture, random, disjunctive, variable) corresponds to more individualized socialization, which leaves new students to “sink or swim” (Jones, 1986; Ashforth, Sluss, & Saks, 2007). Cronbach's alpha for each scale based on our current survey data, a description of each dimension, and sample survey items are shown in Table 2. The fixed vs. variable dimension was removed from subsequent analysis due to issues of collinearity with the the sequential vs. random dimension. Although these two dimensions are distinct in the workplace contexts originally considered by Jones, the fixed sequencing of experiences (e.g., coursework) and the set timelines (e.g., semesters) in undergraduate education led to significant semantic overlap between the two dimensions in our adapted versions of the items.

Proactive Behaviors

Along similar lines, we adapted scales from Ashford and Black (1996) measuring proactive behaviors across six dimensions: feedback seeking, general socializing, information seeking, networking, positive framing, and relationship building with older students. The seventh dimension included in Ashford and Black's scale, job-change negotiation, was excluded because there was no clear parallel between this dimension and the experiences of new students at a university. For all six proactive behavior scales, displayed in Table 3, a higher agreement score was associated with more engagement with that particular behavior.

Table 4. Summary of student background characteristics

	Study Sample (%)	Sampling Frame (%)
	<i>N</i> = 860	<i>N</i> = 3,618
Sex		
Male	504 (58.6)	2,691 (74.4)
Female	365 (41.4)	927 (25.6)
Race/Ethnicity		
Underrepresented minority (URM)	85 (9.9)	353 (9.8)
Socioeconomic Status		
Low income (family income <\$65K)	118 (13.7)	503 (13.9)
High income (family income >\$180K)	46 (5.4)	195 (5.4)
First generation college student	106 (12.3)	525 (14.5)
Family Ties to University		
Family member graduated	275 (32.0)	
Other family ties	88 (10.2)	
High School College Prep		
Took AP Courses	806 (93.7)	
Spoke with high school counselor	618 (71.9)	
STEM-focused camp or club	492 (57.2)	
College Course Taking		
For credit	303 (35.2)	
Non-credit	74 (8.6)	
Private College Prep		
Private tutor for high school classes	53 (6.2)	
Took SAT/ACT prep course	324 (37.7)	
Private SAT/ACT tutor	135 (15.7)	
College admissions consultant	123 (14.3)	
University Engagement		
Visited campus	696 (80.9)	
Recruitment visit	321 (37.3)	
Spoke with a representative	265 (30.8)	

Analytical Procedure

The purpose of this analysis was to identify significant relationships between background characteristics and socialization processes, operationalized as institutional tactics and proactive behaviors. We did so by constructing a series of multiple linear regression models and examining the regression coefficients. First, we obtained factor-based scores for each of the five institutional tactics and six proactive behaviors by computing the unweighted mean of the item responses belonging to each dimension, resulting in a theoretical minimum score of 0 and a theoretical maximum of 6 for each dimension. Next, a series of linear regression models was constructed with each of the eleven socialization processes factor-based as outcomes and the nineteen background characteristics variables described previously as predictors. Models were evaluated for predictive significance by examining the overall model p-value, and variance inflation factors (VIFs) were calculated for each model to detect multicollinearity. Descriptive and analytic statistics were carried out using Stata/IC 15.1 (StataCorp. 2017. Stata Statistical Software: Release 15. College Station, TX: StataCorp LLC).

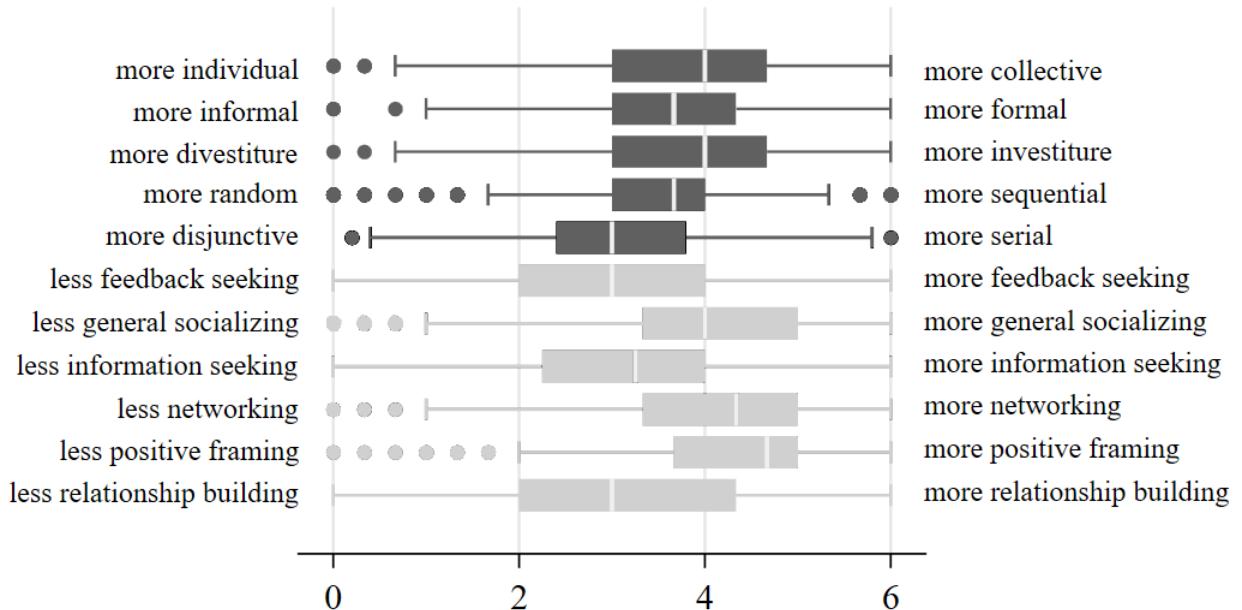


Figure 2. Box and whisker plots for the factor scores of the socialization processes. Darker bars are institutional tactics and lighter bars are proactive behaviors. Circles denote outliers.

Findings

Descriptive Results

The survey was sent to 3,618 domestic third- and fourth-year undergraduate engineering students. A total of 931 domestic students responded to the survey, yielding a response rate of 25.7%. We excluded 71 students (7.6%) from the sample due to missing item responses. In the end, the sample for the present work includes 860 domestic undergraduate engineering students, constituting approximately 23% of the third- and fourth-year undergraduate engineering student population at the college.

A summary of the nineteen measures of student background characteristics, including both demographics and college knowledge, is shown in Table 4. Comparisons between the study sample and the domestic student population are shown for demographic measures. Women were overrepresented in the sample compared with the student population at our institution, but our sample was otherwise representative along lines of race and socioeconomic status.

In order to detect collinearity among background characteristics, we calculated Pearson correlation coefficients between all nineteen variables. Demographic characteristics do not appear to be strongly correlated with college knowledge. Only four pairs of variables had $|r| > 0.25$: attending a university-sponsored recruitment visit and speaking with a university representative (+0.38), having a private tutor for high school classes and having a private tutor for SAT/ACT prep (+0.30), being low income and being a first-generation college student (+0.29), and attending a university-sponsored recruitment visit and visiting the university's campus (+0.28).

Factor scores for each of the five institutional tactics (excluding the fixed vs. variable dimension) and six proactive behaviors, representing the unweighted mean of the item responses belonging to each dimension, are displayed in Figure 2.

Table 5. Goodness of fit indices for all models. Significant (overall $p < 0.05$) models are highlighted.

Socialization Processes	F(19, 840)	p > F	R ²	Adj. R ²	Root MSE
<i>Institutional tactics</i>					
Collective vs. individual	2.95	< 0.001	0.063	0.041	1.170
Formal vs. informal	1.49	0.080	0.033	0.011	0.970
Divestiture vs. investiture	1.55	0.062	0.034	0.012	1.102
Sequential vs. random	0.92	0.557	0.020	-0.001	0.993
Serial vs. disjunctive	1.10	0.347	0.024	0.002	1.088
<i>Proactive behaviors</i>					
Feedback seeking	2.56	< 0.001	0.055	0.033	1.364
General socializing	3.00	< 0.001	0.064	0.042	1.242
Information seeking	1.06	0.388	0.023	0.001	1.289
Networking	2.62	< 0.001	0.056	0.035	1.163
Positive framing	2.72	< 0.001	0.058	0.037	1.095
Relationship building	2.51	< 0.001	0.054	0.032	1.522

Analytic Results

A summary of the eleven multiple linear regression models is displayed in Table 5. Of note, only one institutional tactics model achieved overall predictive significance at the $p < 0.05$ level: collective vs. individual. Five out of six proactive behaviors models (all but information seeking) were significant at the $p < 0.05$ level. VIFs were below 1.5 for all predictors with a mean of 1.14, indicating that the predictors are not strongly correlated with one another. Regression coefficients and standard errors for the six models with predictive significance are displayed in Table 6.

Discussion

The primary goal of this paper is to determine whether or not there are any relationships between student background characteristics and the socialization processes they experience during the transition to college. Overall, we found evidence to support the hypothesis that background characteristics, including both demographic factors and college preparatory resources and experiences, were predictive of some but not all socialization processes. Although the overall model p-values indicated that six out of eleven models had some predictive value, the coefficients of determination R^2 were low (<0.065) for all models. This suggests that the background characteristics in our models explain only a small percentage of the variance in our outcomes of interest. Nonetheless, several interesting trends appear having to do with sex, socioeconomic status, and two key college knowledge items.

Table 6. Regression coefficients and standard errors for the six significant socialization processes.

	Institutional Tactics		Proactive Behaviors			
	Collective vs. Individual	Feedback Seeking	General Socializing	Networking	Positive Framing	Relationship Building
	$R^2 = 0.063$ ($p < 0.001$)	$R^2 = 0.055$ ($p < 0.001$)	$R^2 = 0.064$ ($p < 0.001$)	$R^2 = 0.056$ ($p < 0.001$)	$R^2 = 0.058$ ($p < 0.001$)	$R^2 = 0.054$ ($p < 0.001$)
	β (SE)					
Demographics						
Male sex	-.264 (.082)**	-.174 (.096)	-.252 (.087)**	-.135 (.082)	-.040 (.077)	.238 (.107)*
URM	.053 (.136)	.098 (.159)	-.072 (.145)	-.042 (.135)	.183 (.127)	-.212 (.177)
Income < \$65K	-.118 (.126)	-.305 (.147)*	-.160 (.134)	-.082 (.125)	-.020 (.118)	-.332 (.164)*
Income > \$180K	-.026 (.183)	-.039 (.213)	.357 (.194)	.149 (.181)	.104 (.171)	.095 (.238)
First generation	-.200 (.128)	-.068 (.149)	-.244 (.136)	-.108 (.127)	-.348 (.120)**	-.379 (.167)*
Family Ties to University						
Family member graduated	-.190 (.090)*	-.058 (.105)	.044 (.096)	-.188 (.089)*	-.100 (.084)	.090 (.117)
Other connection	-.091 (.137)	.126 (.160)	-.019 (.145)	-.209 (.136)	-.074 (.128)	-.134 (.178)
High School College Prep						
Taking AP courses	-.019 (.176)	-.006 (.206)	.179 (.187)	.416 (.175)*	.016 (.165)	-.260 (.229)
Spoke with HS counselor	.296 (.096)**	-.025 (.112)	.302 (.102)**	.172 (.096)	.252 (.090)**	.145 (.125)
STEM camp	-.028 (.084)	.104 (.099)	.030 (.090)	.020 (.084)	.020 (.079)	.202 (.110)
College Course Taking						
For credit	-.022 (.087)	.147 (.102)	.045 (.093)	.000 (.087)	.109 (.082)	.133 (.113)
Non-credit	-.195 (.146)	.425 (.170)*	-.184 (.155)	-.016 (.145)	.149 (.137)	.142 (.190)
Private College Prep						
HS class tutor	-.207 (.181)	-.182 (.211)	-.085 (.192)	.270 (.180)	-.636 (.169)***	.062 (.235)
SAT/ACT prep course	.039 (.086)	.176 (.100)	.005 (.091)	-.068 (.085)	-.017 (.080)	-.123 (.111)
SAT/ACT tutor	.136 (.119)	.256 (.139)	.240 (.127)	.069 (.119)	.145 (.112)	-.059 (.155)
Admissions consultant	.014 (.122)	-.011 (.142)	.040 (.129)	.223 (.121)	-.070 (.114)	.263 (.158)
University Engagement						
Visited campus	.257 (.111)*	-.308 (.130)*	.197 (.118)	.220 (.111)*	.149 (.104)	-.311 (.145)*
Recruitment visit	.132 (.092)	.099 (.108)	.090 (.098)	.141 (.092)	.101 (.087)	.268 (.120)*
Spoke with representative	.040 (.099)	.327 (.115)**	-.032 (.105)	.008 (.098)	.049 (.092)	.074 (.128)
(Constant term)	3.56 (.20)***	3.11 (.23)***	3.57 (.21)***	3.48 (.20)***	4.05 (.19)***	3.14 (.26)***

Note: * denotes $p < 0.05$, ** denotes $p < 0.01$, *** denotes $p < 0.001$.

Perhaps the most unique contribution of this work is the finding that some of the college knowledge variables, which reflect college preparatory resources and experiences during high school, are significantly related to socialization during the first year of college. This is noteworthy because unlike other background characteristics like sex and socioeconomic status, these factors can be actively shaped. We found that visiting the university's campus and speaking with a high school counselor about college were each related to three or more socialization processes. While it is known that high school guidance counselors can affect college application rates (Bryan et al., 2011), this is the first work to our knowledge that shows a correlation with student behavior once they arrive on campus. These two college preparatory experiences in particular may help new students anticipate what awaits them in college, promote the formation of connections with others in their class, and encourage engagement with the broader context of the university outside of the College of Engineering. However, visiting the campus was associated with *lower* levels of both feedback seeking from instructors and relationship building with older students. This may indicate that students who did not visit campus prior to enrollment feel the need to be more proactive in their efforts to learn about the academic and social expectations of the College of Engineering from more experienced institutional agents. Other college knowledge variables with relationships to at least one socialization process were having a family member that graduated from the university, taking AP courses, taking college courses non-credit during high school, having a private tutor for high school coursework, attending a recruitment visit, and speaking with a representative of the university.

Consistent with other work, we find that certain demographic factors are predictive of some socialization processes. Among demographic measures, indicators of sex and socioeconomic status (i.e., family income and parental education) were related to at least two socialization processes. Male sex was negatively related to general socializing behavior and positively related to relationship building with older students. Although the mean score was higher for women than for men for all three items within the general socializing subscale, the difference by sex was particularly marked for the item "I attended social gatherings to meet new people" ($\mu_m - \mu_f = -0.38$, $p < 0.001$). Conversely, while men scored significantly higher on all three of the items measuring relationship building with older students, the discrepancy was largest for the item "I tried to form a relationship with more senior students" ($\mu_m - \mu_f = 0.34$, $p < 0.01$). These results suggest that while men are looking to connect with older students specifically, women may be forming more relationships within their own cohort. In addition, male sex was associated with less collective (more individual) socialization, further indicating female students' higher levels of engagement with peers in their own academic year.

Our findings with regard to sex differences in general socializing and relationship building behaviors are generally in agreement with the findings of others who have studied gendered aspects of college friendships and communities. For example, in a study of social connectedness during college, Lee and Robbins (2000) found that women tend to prefer friendships that emphasize non-authoritarian alliance and mutual intimacy such as those with same-age peers, while men feel more socially connected when they have friendships that reassure their worth as individuals, as a friendship with a higher-status, older student would.

In addition, Frey et al. (2006) found that while community relational quality was significantly related to lower levels of psychological distress for both male and female college students, the quality of peer relationships was a significant predictor of distress for women only. The authors also found that women had higher mean scores for peer relationship quality compared with men (Frey et al., 2006). Our study, however, is the first to detect gender differences in college student socialization using adaptations of Ashford and Black's (1996) measures of proactive behavior.

Two indicators of socioeconomic status, low income and first generation status, were each found to have negative relationships with various socialization dimensions. All else being equal, first generation status was negatively related to two proactive behaviors: positive framing and relationship building with older students. Similarly, having a family income of less than \$65,000 was negatively related to two proactive behaviors: relationship building with older students and feedback seeking. A series of t-tests comparing students who are both low income and first generation, who comprise 5.0% of our sample (N = 43), differed significantly from their peers across two institutional tactics and three proactive behaviors dimensions. Specifically, students who were both low income and first generation reported more individual (less collective) socialization ($p < 0.05$), more divestiture ($p < 0.05$), less general socializing behavior ($p < 0.01$), less positive framing ($p < 0.05$), and less relationship building with older students ($p < 0.05$). These results indicate that first generation students and low income students, compared with their peers, may experience more isolation from others in the College of Engineering and the university context more broadly, and may feel more discouraged by academic and social challenges they face during college.

Our observation that low income and first generation students may experience difficulties during their social and academic transition to college is not without precedent. Terenzini et al. (1996) found that these first generation students not only enter college with background characteristics that put them at a possible disadvantage, but also differ significantly from their peers with respect to both academic and extracurricular experiences during the first year of college. Collier and Morgan (2008) highlighted discrepancies in "mastery of the student role" between first generation and traditional college students, noting the particular challenges that first generation students may encounter in understanding faculty expectations for academic work, while Orbe (2004) observed that students who are the first in their family to go to college may experience stigma or feel "out of place" both in their home communities and at school and that they lack a collective identity with other first generation students. Nonetheless, our work offers a new look into the experiences of first generation and low income students with respect to specific socialization mechanisms (i.e., institutional tactics and proactive behaviors) and in the context of an elite college of engineering.

One background characteristic that did not appear as a significant predictor in any of our models was URM status. While we expected to find differences between URM and non-URM (i.e., White and Asian) students similar to those between students of lower socioeconomic status and their more privileged peers, no such relationships were found. Although the lack of statistically significant findings does not mean that there is no relationship between race/ethnicity and socialization, we speculate that participation in organizations such as the National Society of Black Engineers (NSBE) and the Society of

Hispanic Professional Engineers (SHPE) may alleviate some potential disparities in first-year socialization experiences between URM and non-URM students in engineering. In contrast, we are not aware of any student organizations with the specific mission of supporting low income and/or first generation students in engineering at our institution at the time that the survey was administered, and it may be difficult for these students to independently identify and form relationships with other students from similar socioeconomic backgrounds.

Conclusion

The purpose of this work was to identify relationships between engineering student background characteristics (including demographics and college knowledge) and socialization (operationalized as institutional tactics and proactive behaviors) during the first year of college. We surveyed 860 undergraduate students majoring in engineering at a large, public, Midwestern R1 university about their background and experiences in college. Linear regression models were predictive of six out of eleven socialization processes investigated, and we identified four major findings. First, we find for the first time that speaking with a high school counselor about going to college and visiting the university's campus emerged as significant predictors of many different socialization processes, perhaps because they help incoming students understand what college will be like. This finding is especially important because unlike demographic characteristics, these experiences can be shaped. The second finding is that male and female students tend to socialize differently during the first year of college, with men reporting more relationship building with older students and women socializing more with same-age peers. Third, low income and first generation college students seemed to have a more difficult academic and social transition to college, marked by lower levels of affirmation from the institution, social engagement with both peers and older students, and positive framing behaviors. Finally, no differences in socialization were found between students belonging to underrepresented ethnic/racial minorities and non-minority students, perhaps due to student involvement in identity-affirming engineering organizations such as the National Society of Black Engineers (NSBE). While some of our findings are consistent with the literature, this work highlights the need for support for low income and first generation students in engineering, perhaps in the form of peer mentoring or networking opportunities. Furthermore, our findings show that institutions themselves—either through high school counseling or encouraging student visits to campus, for example—can have important and lasting impact on how students socialize into the college environment.

Acknowledgements

The authors gratefully acknowledge the support of the National Science Foundation under Grant No. EEC-1640417.

References

Adreon, D., & Durocher, J. S. (2007). Evaluating the College Transition Needs of Individuals With High-Functioning Autism Spectrum Disorders. *Intervention in School and Clinic*, 42(5), 271–279. <https://doi.org/10.1177/10534512070420050201>

Ashford, S. J., & Black, J. S. (1996). Proactivity during organizational entry: The role of desire for control. *Journal of Applied Psychology*, 81(2), 199–214.
<https://doi.org/10.1037/0021-9010.81.2.199>

Ashforth, B. E., Sluss, D. M., & Saks, A. M. (2007). Socialization tactics, proactive behavior, and newcomer learning: Integrating socialization models. *Journal of Vocational Behavior*, 70(3), 447–462. <https://doi.org/10.1016/j.jvb.2007.02.001>

Bryan, J., Moore-Thomas, C., Day-Vines, N. L., & Holcomb-McCoy, C. (2011). School Counselors as Social Capital: The Effects of High School College Counseling on College Application Rates. *Journal of Counseling & Development*, 89(2), 190–199.
<https://doi.org/10.1002/j.1556-6678.2011.tb00077.x>

Buchmann, C. (2009). Gender inequalities in the transition to college. *Teachers College Record*, 111(10), 2320–2346.

Collier, P. J., & Morgan, D. L. (2008). “Is that paper really due today?”: differences in first-generation and traditional college students’ understandings of faculty expectations. *Higher Education*, 55(4), 425–446. <https://doi.org/10.1007/s10734-007-9065-5>

Enochs, W. K., & Roland, C. B. (2006). Social adjustment of college freshmen: the importance of gender and living environment. *College Student Journal*, 40(1), 63-73.

Fischer, M. J. (2007). Settling into Campus Life: Differences by Race/Ethnicity in College Involvement and Outcomes. *The Journal of Higher Education*, 78(2), 125–156.
<https://doi.org/10.1353/jhe.2007.0009>

Frey, L. L., Beesley, D., & Miller, M. R. (2006). Relational health, attachment, and psychological distress in college women and men. *Psychology of Women Quarterly*, 30(3), 303-311.

Hurtado, S., & Carter, D. F. (1997). Effects of College Transition and Perceptions of the Campus Racial Climate on Latino College Students’ Sense of Belonging. *Sociology of Education*, 70(4), 324–345. <https://doi.org/10.2307/2673270>

Jones, G. R. (1986). Socialization Tactics, Self-Efficacy, and Newcomers’ Adjustments to Organizations. *Academy of Management Journal*, 29(2), 262–279.
<https://doi.org/10.5465/256188>

Kim, T.-Y., Cable, D. M., & Kim, S.-P. (2005). Socialization Tactics, Employee Proactivity, and Person-Organization Fit. *Journal of Applied Psychology*, 90(2), 232–241.
<https://doi.org/10.1037/0021-9010.90.2.232>

Lee, R. M., & Robbins, S. B. (2000). Understanding social connectedness in college women and men. *Journal of Counseling & Development*, 78(4), 484-491.

London, H. B. (1992). Transformations: Cultural challenges faced by first-generation students. *New Directions for Community Colleges*, 1992(80), 5–11.
<https://doi.org/10.1002/cc.36819928003>

Madaus, J. W. (2005). Navigating the College Transition Maze: A Guide for Students with Learning Disabilities. *TEACHING Exceptional Children*, 37(3), 32–37.
<https://doi.org/10.1177/004005990503700305>

Orbe, M. P. (2004). Negotiating multiple identities within multiple frames: an analysis of first-generation college students. *Communication Education*, 53(2), 131–149.
<https://doi.org/10.1080/03634520410001682401>

Skinner, M. E., & Lindstrom, B. D. (2003). Bridging the Gap Between High School and College: Strategies for the Successful Transition of Students With Learning Disabilities. *Preventing School Failure: Alternative Education for Children and Youth*, 47(3), 132–137.
<https://doi.org/10.1080/10459880309604441>

Spenner, K., & Bryant, A.-Y. (2002). Pre-College Questionnaire. Campus Life and Learning Project. Retrieved from http://www.soc.duke.edu/undergraduate/cll/Precollge_survey.pdf

Stephens, N. M., Fryberg, S. A., Markus, H. R., Johnson, C. S., & Covarrubias, R. (2012). Unseen disadvantage: how American universities' focus on independence undermines the academic performance of first-generation college students. *Journal of Personality and Social Psychology*, 102(6), 1178–1197. <https://doi.org/10.1037/a0027143>

Terenzini, P. T., Rendon, L. I., Lee Upcraft, M., Millar, S. B., Allison, K. W., Gregg, P. L., & Jalomo, R. (1994). The transition to college: Diverse students, diverse stories. *Research in Higher Education*, 35(1), 57–73. <https://doi.org/10.1007/BF02496662>

Terenzini, P. T., Springer, L., Yaeger, P. M., Pascarella, E. T., & Nora, A. (1996). First-generation college students: Characteristics, experiences, and cognitive development. *Research in Higher Education*, 37(1), 1–22. <https://doi.org/10.1007/BF01680039>

Weidman, J. (1989). Undergraduate socialization: A conceptual approach. In *Higher education: Handbook of theory and research* (Vol. 5, pp. 289–322).

Weidman, J. (2006). Socialization of students in higher education: Organizational perspectives. In *The Sage handbook for research in education: Engaging ideas and enriching inquiry* (pp. 253–262).

Wilkins, A. C. (2014). Race, Age, and Identity Transformations in the Transition from High School to College for Black and First-generation White Men. *Sociology of Education*, 87(3), 171–187. <https://doi.org/10.1177/0038040714537901>

