Public vs. Private, Large vs. Small: Significant Differences in Student Affective Experience

Dr. Denise Wilson, University of Washington

Denise Wilson received the B.S. degree in mechanical engineering from Stanford University, Stanford, CA, in 1988 and the M.S. and Ph.D. degrees in electrical engineering from the Georgia Institute of Technology, Atlanta, in 1989 and 1995, respectively. She received the M.Ed. from the University of Washington in 2008. She is currently an Associate Professor with the Electrical Engineering Department, University of Washington, Seattle, and she was previously with the University of Kentucky, Lexington, in a similar position from 1996 to 1999. Her research interests in engineering education focus on the role of belonging, self-efficacy, and other non-cognitive factors on success and persistence. She is also managing director of Coming Alongside, a non-profit environmental health services organization.

Dr. James J. Pembridge, Embry-Riddle Aeronautical Univ., Daytona Beach
Mrs. Caitlin H. Wasilewski, Seattle Pacific University

Public vs. Private, Large vs. Small
Significant Differences in Student Affective Experience

Abstract

This study looks at differences in non-intellective measures expressed by two engineering student populations, one at a large public university in the pacific northwest and the other a small private aerospace institution in the southeast. Both student populations are in their first year of study in their respective engineering majors. Previously validated, Likert scale items were used to measure self-efficacy, task value, peer support, two forms of faculty support, and two forms of belonging using a survey instrument. Students at the small private university reported that their institution was friendlier and had a greater sense of togetherness than the public institution. However, no significant differences were found in the sense of belonging to the university reported by the two groups of students. These same students also reported no significant differences in their sense of peer support, but those students at the small private institution experienced a greater sense of faculty support, both within the context of a course and outside of it. Task value scores associated with engineering were high at both institutions and were not significantly different. Finally, students at the small private institution reported higher levels of self-efficacy than their peers at the public institution, although self-efficacy scores between women at each institution had no such difference. While limited in scope to only a single large and a single small institution, these results provide further insight into the academic and affective correlates of institutional differences and also suggest that students may adapt to develop a sense of belonging regardless of institutional culture.

Introduction

Historically, a great deal of attention, in teaching and in research, has been focused on the influence of cognitive factors, including past cognitive (academic) performance and present cognitive capability, on the performance and persistence of the engineering student in higher education. Less attention has been paid to non-intellective factors that do not directly relate to measures of thinking and learning. Yet, these factors can influence students' short term performance on any given day, their long term ability to remain in the engineering environment, and other performance measures that are measured on time scales in between the short and the long haul. This paper reports on preliminary analyses of these measures between two very different university environments. While all measures in this study assess the way a student feels about his or her engineering program, different measures look at distinctly different aspects of the affective experience in how students perceive their (a) own ability (self-efficacy); (b) chosen field and program (task value); (c) allies in the program (peer support and faculty support); and (d) institutional culture (university belonging).

Self-Efficacy: In this study, self-efficacy measures the degree to which the student believes he or she has the ability to succeed in the chosen engineering major. Although self-efficacy is not the same as self-confidence, the two go hand in hand when high task value is associated with the task or domain in which the efficacy is measured[1]. In the academic realm, self-efficacy often bears strong links to academic outcomes. In a comprehensive meta-analysis of 1,105 studies across the higher education literature, Richardson and Abraham[2] found that academic self-efficacy was one of only three non-intellective constructs to show a moderate correlation to GPA and that the strongest correlate to GPA was performance self-efficacy. Social cognitive theory speaks to the role of academic self-efficacy in persistence in that students with low self-efficacy are more likely to withdraw or disengage from their domain (major)[3]. On the other hand, those who have high self-efficacy are much more likely to remain engaged and exert effort in order to be successful at completing a task or tasks associated with the course of study[3]. In this investigation, we use a self-efficacy scale that has been designed to measure efficacy in the academic environment. The academic self-efficacy (ASE) scale is part of the Motivated Strategies for Learning Questionnaire (MSLQ) developed, extensively refined, and heavily used by Pintrich et al.[4] to assess motivational orientations and learning strategies used by college students in college courses. The scales in the ASE are well established and have been refined based on multiple waves of data collection using college students, internal reliability and factor analyses, and correlations with academic performance.

Task Value: Task value was also measured using items from Pintrich's Motivated Strategies for Learning Questionnaire[4-6]. In this study, task value was conceptualized as students' perception of how interesting, important, or useful tasks in their engineering major and program are, including the importance and utility of corresponding course material. Task value is critical to consider as it is a major motivator to learn according to Eccles' expectancy-value model[7, 8]. In physical and information technology sciences, in particular, task value is closely linked with the student's desire to pursue and persist in these subject areas even two years after the task value is measured[9]. Self-reported or subjective task value has also been linked to future course plans and actual choices of courses as well as achievement[10-12]. Task value has multiple components including the intrinsic, attainment, and utility value of a task as well as the perceived cost of pursuing that task[7]. Intrinsic value refers to the inherent enjoyment that engineering is expected to provide the student over the course of his or her program. Attainment, on the other hand, speaks to the student's perception of how important the engineering course of study is to his or her future career and the closely related utility value is the perceived usefulness of completing an engineering degree in the achievement of short or long term goals in this field[7]. In this study, the items used to measure task value capture these first three components of pursuing engineering as a major. The perceived cost of the engineering program is not measured; however, the perceived cost of most undergraduate engineering programs is quite high, as student generally know that, in choosing such a major, they are giving up a great deal of time and putting forth significant effort compared to other degree options[13].

Faculty Support: Two aspects of faculty support were evaluated in this study to identify different means through which faculty members affect students. The first measure (Faculty Support 1) evaluated faculty support within the context of the student's classes in the major and included items such as "the instructor in this class is interested in helping me learn". Items from the Faculty Support 1 scale were designed using a variation of the Teacher Support subscale of

the Classroom Life Scale[13]. The second measure of faculty support (Faculty Support 2) examined the student's sense of support from faculty outside the classroom and used items that were adapted from scales developed by Pascarella and Terenzini[14].

Faculty support in the form of supportive interactions with students has been demonstrated in a wide range of studies to be positively related to both academic and non-intellective outcomes. Higher achievement levels[15], academic[16] and intellectual[17] development, and student persistence[18] are just a few of the academic outcomes that have been positively associated with faculty-student interactions. An equally broad range of non-academic factors have been positively associated with faculty-student interactions including students' increased satisfaction with college[15], social[16] and personal[17] development, motivation[18], and relationships with the home department[20].

Despite all these positive associations, there is some evidence that the positive impacts of faculty interaction may be limited. For example, Szelényi et al. showed that faculty interactions, either within a class context or outside of it, did not predict the professional outcome expectations of women in STEM[21]. Faculty attention to interactions with students may be especially important in male-dominated engineering fields because these interactions especially in the form of in-classroom praise have been shown drop off as the number of males in the classroom increases[22]. Also important to engineering fields, Micari et al.[23] showed that in difficult and challenging courses, student-faculty interactions positively predict grades and academic confidence.

What makes faculty-student interactions and support even more important is the snowball effect of these interactions. Students who observe negative interactions between another student and a faculty member, are less likely to seek out help or interact with faculty members in the future[24]. Thus, when faculty interact positively with a student, they are likely to have a positive impact on the student's academic and emotional/relational life, while also influencing the propensity of other students to pursue such interactions, to their benefit.

Peer Support: Unlike faculty support, a single measure was used to capture students' perceptions of peer support. These peer support items were extracted from the same Classroom Life Scale[13] as the Faculty Support 1 items. Peer support describes students' perception of how friendly and supportive peers in both their classes and major seem to them. The peer support scale consisted of eight items that measured perceptions of peer support at both class and major level.

Peer support, like faculty support, can predict a variety of outcomes associated with the student's academic experience. Strong perceived attachments to peers have been found to be positive predictors of scholastic competence[25]. Conversely, a lack of peer support has been a negative predictor of subsequent grades and adjustment in college[26]. In another study, participation in peer support sessions was correlated positively to academic performance, although there is some indication that the quality of learning dropped with participation in these peer groups as students became more focused on strategically oriented approaches to making grades than learning[27]. Little is know about the pathways by which peer support and interaction result in positive academic outcomes, but the positive links remain consistent for majority and minority students alike. For minority students in engineering, peer support and interactions in their home

department help them to feel more comfortable and less alone or isolated on campus[28]. Peer support groups also provide important increases in social capital for Hispanic women engineers[29]. These studies of engineering alone and of broader undergraduate populations speak to the importance of peer support in the student experience and justify the use of a peer support scale in this study.

Belonging: In the higher education literature, belonging is typically measured on a broad scale at the college or university level as a Psychological Sense of Community (PSOC). Since our goal in this analysis was to understand the role that significantly different institutional cultures play in belonging, PSOC was an appropriate measure. PSOC has been a central concept of belonging within the community psychology field and refers to "… the perception of similarity to others, an acknowledged interdependence with others, a willingness to maintain this interdependence by giving to or doing for others what one expects from them, and the feeling that one is part of a larger dependable and stable structure" [30]. PSOC thus embodies not only feelings of belonging but also feelings of commitment, fulfillment of needs, attachment, and overall sense of community[31]. In higher education, PSOC has been found to vary broadly by institution size, by a student's in-state vs. out-of-state status, and by personality type[31-33]. PSOC has been positively associated with lower levels of burnout among college students[34], increased GPA among undergraduate transfer students when combined with strong participation in transfer student communities[35], decreased loneliness in college[36], and greater first year persistence in college when measured in the context of residence halls[37]. To measure university belonging in this study, items from the Collegiate Psychological Sense of Community (PSC) scale were used[38]. These items have been previously validated in other university studies and in our own study in a previous tool-development phase of the research.

This Study: This study evaluates student reports of these seven affective measures from two distinctly different populations. The first population consists of engineering majors at a large flagship public research university in the pacific northwest which serves over 43,000 students and confers over 600 degrees in engineering annually. This institution, classified as RU/VH by the Carnegie Foundation (2010)[39] offers ten engineering and computer science undergraduate degrees, and is characterized by large classes in freshman and sophomore years (100-500) and smaller classes in junior (40-80 students) and senior (15-40 students) year. Most students are competitively admitted to engineering and computer science majors after their second year. The second population in this study consists of a small private teaching university in the southeast which serves approximately 5,000 students with 33% enrolled in one of the following engineering programs: Aerospace, Civil, Computer, Electrical, Mechanical, Software, and still exploring. The university is primarily residential undergraduate institution. All engineering programs begin with a common first-year experience with typical class sizes throughout the undergraduate curriculum below 40 students.

The Large Public University vs. the Small Private University: Several differences are notable when comparing large and small universities, especially concerning class sizes, access to resources, and community. The most salient are differences in class size as smaller universities tend to have smaller class sizes as seen in our two study populations. Several studies have explored differences in class size and have noted that while grades do not explicitly reflect knowledge gains, there is a negative relationship between grades and class size [40]. In K-12

environments it has been shown that smaller classes offer faculty the opportunity to give attention to individual students leading to increased individualized learning and the greater frequency of support for active engagement in class activities In addition, individual attention also appears to limit the occurrence of students being off-task[40, 41]. Interactions in smaller classes also included significantly more ($p < .05$) non-academic interaction with faculty[41]. The relationship between faculty and student also appears to differ in discourse at the introduction of lectures. In small classes, the relationship between lecturer and student is generally closer so there is less of a need to maintain positive politeness. Larger classes impose an affective and physical distance between faculty and student leading to less of a use of the pronouns *I* and *you* to enhance the need to establish rapport with the students[42]. While there is stronger and more frequent interactions between faculty and students in smaller classes, students in small classes had fewer interactions with their fellow classmates in comparison to students in large classes ($p =.001$). Students in smaller classes were also less likely to help other students because they viewed this activity as a non-academic behavior ($p < .001$)[41].

The availability of resources is also critical to involvement at institutions. Due to their size and access, larger universities tend to have more resources and opportunities to encourage undergraduate student involvement. Involvement is described as the investment of physical and psychological energy in various objects that occurs across a continuum of degrees[43]. The amount of student learning and personal development is directly proportional to the quantity and quality of student involvement. Astin[43] identified that involvement can be described through several theories associated with subject-matter theory where traditional lecture and power dynamics tend to favor highly motivated students, resource theory where the student-faculty ratio when faculty are high-quality favor involvement and availability of student time to devote to activities, and eclectic theory that emphasizes the importance of individualized counseling and independent study. Living in campus residence positively relates to retention across all demographics[43]. In addition, participation in social organizations, extracurricular activities, honors programs, involvement in ROTC, involvement in undergraduate research projects , and holding part-time jobs on campus lead to increased retention and the likelihood of interaction with fellow students, faculty, and staff whereas off-campus activities and decentralized activities such as off-campus jobs decrease this involvement [43]. The proximity to campus also is negatively correlated with critical interactions. Students who drive to campus have less interaction with faculty (especially seniors) and do not take advantage of co-curricular activities, community service, and internships. Therefore, students who tend to have a centralized community tend to see gains in personal and social competence associated with ethical development, appreciation for diversity, understanding of self, and citizenship [44].

Methods

A quantitative approach was used to explore the seven affective measures between student populations at the large public research institution (hereafter referred to as Public) and the small private teaching institution (hereafter referred to as Private).

A. Research Questions

Our choice of these two very different institutions for this study allows us to focus on two distinct questions:

- *Research Question #1: Which of the seven non-intellective factors differ significantly across institutional differences?*
- *Research Question #2: Do gender or ethnicity play a major role in these differences?*

We anticipate that findings regarding these research questions will give some additional insight regarding more subtle differences in the student experience for those at larger or smaller institutions.

B. Subjects and Procedures

A total of over 650 randomly selected engineering students from these two institutions began participation in this study by completing a survey of their experiences, including reporting basic demographic information and answering items associated with the seven affective items of interest in this study. Surveys were sorted to include only students reporting majors which were common between the two institutions (aeronautical, civil, electrical, mechanical, and pre-engineering) and only freshman and sophomore students in both populations. All other majors and years in school were discarded for this study. After this data filtering was complete, the sample for this study was 276 students.

The distribution of survey participants by major and by institution among these 276 students is summarized in Table 1.

Table 1: Demographics of Undergraduate Study Population

		N (%)	N (%)	N (%)
Demographic		**Private**	**Public**	**Total**
Total	All	157 (57%)	119 (43%)	276 (100%)
Gender	Men	128 (58%)	93 (42%)	221 (80%)
	Women	29 (53%)	26 (47%)	55 (20%)
Ethnicity	Black	11 (92%)	1 (8%)	12 (4%)
	Asian*	13 (17%)	65 (83%)	78 (28%)
	Caucasian	89 (63%)	52 (37%)	141 (51%)
	Hispanic	30 (79%)	8 (21%)	38 (14%)
Major	Aeronautical	116 (94%)	7 (6%)	123 (44.6%)
	Civil	3 (21%)	11 (79%)	14 (5.1%)
	Electrical	4 (6%)	62 (94%)	66 (23.9%)
	Mechanical	18 (33%)	36 (67%)	54 (19.6%)
	Pre-Engineering	-	19 (100%)	19 (6.8%)

* Includes South Asian/South Asian American and Asian/Asian American

The mean age of the sample was 19.3 years and their mean reported grade point average (GPA) was 3.24. The sample included freshman and sophomores (N = 158) at the Private institution and at the Public institution (N =118) in order to adequately represent those students who were at the start of their engineering programs. The ethnic make-up of the sample was primarily White (51%), Asian/Asian American including South Asian/South Asian American (28.2%), and

Hispanic (13.8%).

Table 2: Questions addressing each of the measures reported in this Study

Measure	Reliability*	Items
Faculty Support 1[13]	0.90 (0.88)	The instructor in this class is willing to spend time outside of class to discuss issues that are of interest and importance to me. The instructor in this class is interested in helping me learn. The instructor in this class cares about how much I learn. The instructor in this class treats me with respect.
Faculty Support 2[14]	0.90 (0.88)	Since coming to this university I have developed a supportive relationship with at least one faculty member. My non-classroom interactions with instructors have had a positive influence on my personal growth, values, and attitudes. My non-classroom interactions with faculty have had a positive influence on my career goals and aspirations. My non-classroom interactions with faculty have had a positive influence on my intellectual growth and interest in ideas.
Peer Support[13]	0.90 (0.92)	In my major classes, other students are friendly to me. In my major classes, other students are helpful to me. In my major classes, other students are supportive. In my major classes, other students are a reliable resource to me. In this class, other students are a reliable resource to me. In this class, other students are supportive. In this class, other students are helpful to me. In this class, other students are friendly to me.
PSOC 1[38]	0.90 (0.87)	I really enjoy going to school here. I feel like I really belong at this school. I wish I had gone to another school instead of this one.** I wish I were at a different school.**
PSOC 2[38]	0.90 (0.80)	People at this school are friendly to me. I feel that there is a real sense of community at this school. I feel like there is a strong feeling of togetherness on campus.
Self-Efficacy[4]	0.89 (0.88)	I believe I will receive excellent grades in the classes in my major. I'm confident I can understand the most complex material presented by the instructors in the classes in my major. I expect to do well in the classes in my major. I'm certain I can understand the most difficult material taught in the classes in my major. I'm confident I can do an excellent job on the assignments and tests given in the classes in my major.

Task Value[4]	N/A (0.72)	I am very interested in the content area of courses in my major. It is important for me to learn the material presented in the classes in my major. I think I will be able to use what I learn in classes in my major in my chosen profession. I think the material learned in classes in my major is useful for me to learn.

*Cronbach's Alpha in other, previous research (this study) ; **Reverse Coded Items

C. Instruments

Quantitative survey data were used to answer the two research questions in this study. Additional information regarding this survey is described in Floyd-Smith et al.[45]. Items corresponding to each of the seven measures captured in this study are described in detail in Table 2. All items were measured on a five point Likert scale: 5 (Strongly Agree); 4 (Agree); 3 (Somewhat Agree); 2 (Disagree); and (1) Strongly Disagree. Reliability for all scales except for task value were established in previous studies. Reliability for each construct was also confirmed for this study. Both reliabilities are tabulated in Table 2.

For five of the seven constructs, confirmatory factor analysis showed that the items used to evaluate each construct loaded onto factors consistent with previous studies. Thus, the items used to measure Faculty Support 1, Faculty Support 2, Peer Support, Self Efficacy, and Task Value were identical to those used in previous studies at other institutions. However, items from PSOC which loaded onto a single factor in previous studies, loaded onto two different factors in this study. As a result, PSOC was broken down into two subscales, PSOC1 and PSOC2 for this study to reflect these differences. Items corresponding to each construct are listed in Table 2.

D. Data Analysis

The analysis associated with this study was intended to be exploratory. To this end, descriptive statistics, including mean and standard deviation (SD) were tabulated for each of the affective items described in Table 3. Comparisons of the sample means were evaluated through one way analysis of variance (ANOVA), the results of which were identical to a t-test since in all cases considered herein because only two groups (e.g. Public and Private populations) were involved in the comparison. Statistical significance was evaluated at 0.05 and 0.01.

Results and Discussion

A. Research Question #1:

Which of the five non-intellective factors differ significantly across institutional differences?

Descriptive statistics for the five groups of non-intellective factors evaluated in this study are summarized in Table 3. Statistically significant differences between student populations at the Private and Public institutions were found for both measures of Faculty Support ($p < 0.1$), only one of the two measures of University Belonging, PSOC 2 ($p < 0.01$), and for Self-Efficacy ($p < 0.01$). No significant differences were found for one measure of University Belonging, PSOC 1, Peer Support, or Task Value. Particularly interesting among these measures that are not proven to be statistically different is Peer Support, whose means at Private (29.4) and Public (29.2) institutions appear so similar that levels of peer support are likely to be equivalent at both institutions.

Although students at both institutions seem to find comparable peer support regardless of institutional culture, the institution seems to be a larger contributing factor to perceptions of faculty support, as both measures of faculty support were higher at the Private institution than the Public institution. Part of this difference may be attributed simply to the fact that classes at the Private institution are smaller on average than at the Public institution where class size in freshman and sophomore year averages between 25 and 40 for the Private institution and 150 and 500 for the Public institution. Small class sizes translate to smaller faculty-to-student ratios and limited research requirements allow at the Private institution allow more time for faculty to spend with each individual student. As seen in the previous literature, the small class encourages more rapport with faculty and facilitates both academic and non-academic interactions[40-42]. This rapport can lead to an openness that allows for students to comfortably approach faculty. At the same time, faculty can determine which students are having difficulty sooner and can provide the necessary support thereby making it difficult for the student to hide in the class.

Table 3: Descriptive Statistics for Non-Intellective Constructs

Measure		Private		Public		F	Significance
	Possible	Mean	SD	Mean	SD		
Faculty Support 1	20	15.9	3.29	15.0	2.88	5.71	**0.02**
Faculty Support 2	20	14.7	3.45	12.8	3.16	22.7	**0.00**
Peer Support	40	29.4	5.07	29.2	4.62	0.146	0.70
PSOC 1	20	15.8	3.43	15.3	3.08	1.17	0.28
PSOC 2	15	10.6	2.37	9.70	2.08	9.81	**0.00**
Self-Efficacy	25	19.0	3.56	17.8	3.04	8.52	**0.00**
Task Value	20	16.9	2.67	17.2	1.95	1.52	0.22

In contrast, students do not report differences in perceived level of peer support between the Private and Public institutions. This result may be the result of small sample size but given the large p value (0.70), some consideration of equal levels of peer support is merited. These findings are in contrast to the literature in K-12 regarding student interactions in class[41]. The previous studies noted that students in smaller classes had less help from their fellow students than those in large classes, rather than finding no difference as is the case in this study. Differences in this perspective could be due to the intellectual and emotional development of the student, changes in the operations of the academic climate when comparing K-12 to undergraduate education, or changes in teaching that encourage or necessitate the use of collaborative and cooperative learning techniques independent of the size of the institution.

Significant differences in task value are also not apparent in this population. On average, students report task value of approximately 85% of the maximum score of 20 in both Private and Public institution samples in this study, a level that is higher than all of the other non-intellective factors evaluated. Although small sample size may again be a limiting factor, these results are consistent with the fact that engineers spend more time preparing for class than any other major, as reported by the National Survey on Student Engagement[46]. High task value also means that self-efficacy and self-confidence are likely to go hand-in-hand among these engineering students[1].

The two constructs representing the non-intellective factor, psychological sense of community (PSOC), shows mixed results between the Private and Public institution samples. While no significant differences are found in the first measure of PSOC (PSOC 1), significant differences do emerge for the second measure (PSOC 2). In other words, from the items in each PSOC measure (Table 3), we can conclude that while students do not report significant differences in the degree to which they feel they belong or enjoy being at each school, they do report that the school itself provides a greater feeling of community and togetherness at the small Private institution when compared to the larger Public institution. It is interesting that the institutional culture of togetherness does not seem to readily translate to a sense of belonging, suggesting that students at the Public institution, who do not feel that the institutional culture is as welcoming as at the Private institution, are satisfying their need to belong elsewhere. The strong feelings of togetherness reported by the Private students (PSOC 2) likely reflect the strong focus that this institution has on a specific industry which allows these students to connect to not only their major and institution but also a specific yet larger industrial community. The private institution also has a strong participation (~25%) in honors program and ROTC experiences that have been shown to increase involvement in and connection to a university[43]. On the other hand, the fact that the PSOC 1 scores are not significantly different between the two institutions is consistent with previous studies that show students at a large institution participate in more localized communities, such as those provided by extracurricular activities and in-major study groups, to meet their belonging needs[48].

Finally, students at the Private institution reported higher levels of self-efficacy than their peers at the Public institution. This result is inconsistent with Concannon and Barrow's study[47] that shows self-efficacy among students tends to improve with number of years spent in undergraduate engineering programs. In this study, most beginning students at the Private institution were freshman while most at the Public institution were sophomores. All other factors being equal, we would then expect the Public student population to report higher self-efficacy than the Private student population. The reverse is true. Thus, we can conclude that other factors may be at work in enabling the Private university students to hold greater self-efficacy than their Public institution peers. Bandura[1] identified that sources of self-efficacy are related to mastery experiences, vicarious experiences, verbal persuasion and physiological state. Verbal persuasion refers to persuasion from others that an individual has the desire and ability to succeed. The fact that the Private institution provides a greater sense of belonging (PSOC 2) to students than the Public institution suggests that students at the Private institution could be getting increased positive verbal encouragement from others to help overcome doubts about their own abilities to the extent that they can more readily focus on the task at hand. Another factor that may enable greater self-efficacy at the Private institution is that students in the Private population are already accepted into their engineering majors at the time this survey was taken, whereas at the Public institution, many students in this study were still competing to get into their chosen field of engineering.

B. Research Question #2:

Do gender or ethnicity groups play a major role in these differences?

Differences between women at the Private and Public institution were examined separately from men at both institutions (Table 4). Interesting results include:

- While in general students at the Private institution reported greater faculty support on both measures (in the context of a course and in general) than students at the Public institution, these significant differences did not hold for women when separately considering their perceptions of faculty support in the context of a course. However, the samples sizes were sufficiently small (N< 30) for both groups of women so this lack of statistical significance (p = 0.11) is likely due to small sample sizes.
- Gender appears to play no role in the difference in PSOC 2 between Private and Public institutions. Both men and women perceive a stronger sense of community, friendliness, and togetherness at the Private institution as compared to the Public institution.
- However, some women may be experiencing a greater sense of belonging (PSOC 1) at the Private institution than at the Public institution. Although the difference between women at these two institutions is not significant (p = 0.08), it could be emerging and small sample size may be limiting it significance.
- While men at the Public institution report significant lower levels of self-efficacy than men at the Private institution, the same is not true for women, where no significant differences in self-efficacy between the two institutions emerged.

Table 4: Descriptive Statistics for Five Categories of Non-Intellective Constructs by Gender

Measure		Private		Public		F	Significance
	Gender	Mean	SD	Mean	SD		
Faculty Support 1	Male	15.9	3.43	15.0	2.96	3.97	**0.05**
	Female	16.2	2.54	15.0	2.80	2.66	0.11
Faculty Support 2	Male	14.8	3.40	12.8	3.31	17.9	**0.00**
	Female	14.1	3.65	12.4	2.67	3.70	**0.06**
Peer Support	Male	29.5	4.94	28.9	4.43	0.747	0.39
	Female	29.0	5.76	30.0	5.45	0.441	0.51
PSOC 1	Male	15.5	3.61	15.5	3.00	0.035	0.85
	Female	16.6	2.33	15.1	3.42	3.28	0.08
PSOC 2	Male	10.5	2.42	9.80	2.20	4.73	**0.03**
	Female	10.8	2.20	9.42	1.63	6.43	**0.01**
Self-Efficacy	Male	19.3	3.48	18.1	2.88	6.66	**0.01**
	Female	17.7	3.75	16.6	3.35	1.33	0.26
Task Value	Male	17.0	2.77	17.3	1.78	0.962	0.33
	Female	16.5	2.24	17.1	2.20	1.04	0.31

The result that women report comparable self-efficacy at both institutions while men report lower self-efficacy at the Public institution is an interesting one. Although gender differences in a single institution were not explicitly emphasized in this study, a comparison of men and women within both the Private and Public institution reveals that women at the Private institution have significantly lower self-efficacy than men at the Private institution ($p < 0.05$) and likewise, women at the Public institution have significantly lower self-efficacy than the men at the same

institution. This result is inconsistent with Concannon and Barrow's study[49] which showed that freshman women had lower coping efficacy than men but had comparable levels of self-efficacy to men. Another study of self-efficacy among engineering women and men[50], however, showed that women showed higher levels of general self-efficacy than men in engineering but when measuring domain specific self-efficacy (engineering), women reported lower levels of efficacy. These inconsistencies in results may be a result of the different scales used in these three studies and may reflect some subtle differences in how women perceive their capability in engineering compared to men.

While we would have liked to look at differences among ethnicity groups between the two institutions, small sizes and different ethnic compositions prevented this comparison. Asian students were the dominant minority at the Public institution with very small populations of Black and Hispanic students while at the Private institution, Hispanic students were the dominant minority with very small populations of Black and Asian students. We did, however, look at differences in the majority population (Caucasian students) to gain some insight as to whether institutional differences were stemming from majority or minority students. These results are tabulated in Table 5. While statistically significant differences between faculty support outside of the class context (Faculty Support 2) and PSOC 2 were consistent with the overall population (Table 3), statistically significant differences between schools for self-efficacy and faculty support within the class context (Faculty Support 1) disappeared when considering only the majority (Caucasian) population students. This analysis suggests that minority students may be responsible for the differences between Public and Private institutions in self-efficacy and course related faculty support. In other words, minority students at the public institution are likely to feel less course-related faculty support and lower self-efficacy than minority students at the Private institution. Understanding the different roles that ethnicity and gender play in these differences, however, will require a regression or similar analysis which is deferred to future work.

Table 5: Descriptive Statistics for Five Categories of Non-Intellective Constructs for Caucasians

Measure	Private		Public		F	Significance
	Mean	SD	Mean	SD		
Faculty Support 1	15.9	3.51	15.4	3.21	0.806	0.37
Faculty Support 2	14.6	3.40	13.0	3.11	7.42	**0.01**
Peer Support	30.0	29.4	5.18	4.42	0.400	0.53
PSOC 1	15.9	3.56	15.8	2.89	0.051	0.82
PSOC 2	10.6	2.46	9.52	2.38	6.58	**0.01**
Self-Efficacy	19.2	3.04	18.6	2.52	1.38	0.24
Task Value	17.1	2.43	17.7	1.63	2.09	0.15

C. Summary

With respect to the five non-intellective categories of data (seven total constructs) considered in this study, the Private institution provides an advantage to students when it comes to small class size which the literature has indicated provides additional interaction and rapport between faculty

and students. This advantage of faculty support can be seen across all demographics of the student sample. In large public institutions the development of this relationship can be difficult to foster when there are an excess of 100 students in a single class.

Undoubtedly, the large public institution tends to have more and more diverse resources in the form of funding and faculty support for student organizations, funding for undergraduate research, and opportunities for on-campus employment and extracurricular activity. This wide range of opportunities for students may be beneficial for supporting a broader range of involvement by students, but it does not translate to a greater feeling of togetherness on the campus. However, as seen by comparable levels of PSOC 1, these resources may offset the lack of close community on campus and institution culture that embraces students on a more personal level, thereby allowing students to develop a comparable sense of belonging (PSOC 2) through different pathways.

It is likely that women derive a greater sense of faculty support from smaller classes than their male peers at the Private institution. Yet, the fact that self-efficacy on both campuses is lower for women than for men is cause for concern for academic performance as well as for general well-being and persistence.

Clearly, the smaller private institution culture has provided a greater sense of togetherness and friendliness (PSOC 2) than the large public institution culture. This close knit community along with small class size and greater faculty investment in undergraduate students is likely to have additional benefits that are not shown in this study. The fact that students seem to adapt however and derive the same sense of belonging (PSOC 1) at both institutions is very interesting, proving the resilience of both groups of engineering students as they progress through their programs.

Concluding Remarks

This study looked at how engineering students feel about their own abilities, their engineering major, their support network, and their overall university community. Herein, we have focused on differences that emerge between these non-intellective or affective factors among students early in their engineering programs at a small Private university and a large Public university. While, in general, it appears that students at the Private university perceive their environment and experience as more positive than students at the Public university, these differences are not as numerous as one would expect from previous work which frequently demonstrates better academic outcomes for those enrolled in smaller classes than larger ones. Overall, students at both institutions report comparable levels of institutional belonging, task value, and peer support. However, students at the Private institution tend to report that their university projects a greater sense of community and that their faculty provide greater support, both in the context of a specific course and in general. Self-efficacy differences between the two institutions appear to be limited to men where male students at the Private institution report higher self-efficacy than males at the Public institution. Women at the two institutions report no such differences in self-efficacy but nevertheless report that they feel less capable than their male peers at both institutions.

This study is limited in scope and sample size, and the results must be approached cautiously. We have not considered other institutional differences beyond the large class size/large institution vs. small class size/small institution difference in this study. The two institutions

considered in this study are in very different geographical locations, are fundamentally different in their mission (education vs. research), have engineering programs whose overall role in the university is very different, and differ in numerous other ways which we have not considered. However, these results lay a foundation for evaluating differences in the student experience at different institutions in a broader sense that goes beyond academic outcomes. This preliminary analysis has also helped us understand what types of differences merit framing in underlying educational and social psychology for future work.

Acknowledgements
The authors would like to gratefully acknowledge the National Science Foundation for their partial support of this work under the REESE program (DRL-0909817). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

Bibliography

1. Bandura, A., (1997) *Self-efficacy: The exercise of control.* Macmillan.
2. Richardson, M., Abraham C., & Bond, R. (2012) Psychological correlates of university students' academic performance: A systematic review and meta-analysis. *Psychological Bulletin,138*(2), 353.
3. Bandura, A. (1994), *Self-efficacy*. John Wiley & Sons, Inc.
4. Pintrich, P.R. (1991), *A manual for the use of the motivated strategies for learning questionnaire (mslq)*, Ann Arbor, Mich.; [Washington, DC]: University of Michigan ; U.S. Dept. of Education, Office of Educational Research and Improvement, Educational Resources Information Center.
5. Pintrich, P. R., & De Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology*, *82*(1), 33-42.
6. Pintrich, P.R., Smith, D., García. T., & McKeachie, W.J. (1993) Reliability and predictive validity of the motivated strategies for learning questionnaire (mslq). *Educational and Psychological Measurement. 53*(3), 801-813.
7. Eccles, J. (1983). Expectancies, values, and academic behaviors. In J. T. Spence (Ed.), *Achievement and achievement motives*: San Francisco, CA: Freeman.
8. Eccles, J. S., & Wigfield, A. (1998). Motivation to succeed. *Handbook of child psychology* (5th ed.): New York: Wiley.
9. Chow, A. & Salmela-Aro (2011) Task-values across subject domains: A gender comparison using a person-centered approach. *International Journal of Behavioral Development. 35*(3), 202-209.
10. Eccles, J., Adler, T. F., Futterman, R., Goff, S. B., Kaczala, C. M., Meece, J. L., & Midgley, C. (1983). Expectancies, values, and academic behaviors. In J.T. Spenc, (Ed.), *Achievement and achievement motives: psychological and sociological approaches*. San Francisco: W.H. Freeman.
11. Eccles, J., Adler, T.F., & Meece, J.L. (1984) Sex differences in achievement: A test of alternative theories. *Journal of Personality and Social Psychology, 46*, 26-43.
12. Updegraff, K.A., Eccles, J.S., Barber, B.L., & O'brien, K.M. (1996) Course enrollment as self-regulatory behavior: Who takes optional high school math courses? *Learning and Individual Differences. 8*(3),239-259.
13. Van Ryzin, M.J., Gravely, A.A., & Roseth, C.J. (2009) Autonomy, belongingness, and engagement in school as contributors to adolescent psychological well-being. *Journal of Youth and Adolescence. 38*(1), 1-12.
14. Pascarella, E. T., & Terenzini, P. T. (1980). Predicting freshman persistence and voluntary dropout decisions from a theoretical model. *Journal of Higher Education, 51*(1), 60-75.
15. Lamport, M. A. (1993). Student-faculty informal interaction and the effect on college student outcomes: a review of the literature. *Adolescence, 28*(112), 971-990.
16. Owen, P.R. & Zwahr-Castro, J. (2007) Boundary issues in academia: Student perceptions of faculty—student boundary crossings. *Ethics & Behavior. 17*(2), 117-129.
17. Halawah, I. (2006) The impact of student-faculty informal interpersonal relationships on intellectual and personal development. *College Student Journal. 40*(3), 670-678.

18. Nakajima, M.A., Dembo, M.H., & Mossler, R. (2012) Student persistence in community colleges. *Community College Journal of Research and Practice, 36*(8), 591-613.
19. Lundberg, C.A. & Schreiner, L.A. (2004) Quality and frequency of faculty-student interaction as predictors of learning: An analysis by student race/ethnicity. *Journal of College Student Development, 45*(5), 549-565.
20. Cho, M. & Auger, G.A. (2013) Exploring determinants of relationship quality between students and their academic department perceived relationship investment, student empowerment, and student–faculty interaction. *Journalism & Mass Communication Educator, 68*(3), 255-268.
21. Szelényi, K., Denson, N., & Inkelas, K.K. (2013) Women in stem majors and professional outcome expectations: The role of living-learning programs and other college environments. *Research in Higher Education, 54*(8), 851-873.
22. Tatum, H.E., Schwartz, B.M., Schimmoeller, P.A., & Perry, N. (2013) Classroom participation and student-faculty interactions: Does gender matter? *The Journal of Higher Education, 84*(6), 745-768.
23. Micari, M. & Pazos, P. (2012) Connecting to the professor: Impact of the student–faculty relationship in a highly challenging course. *College Teaching, 60*(2), 41-47.
24. Hong, B.S. & Shull, P.J. (2010) A retrospective study of the impact faculty dispositions have on undergraduate engineering students. *College Student Journal, 44*(2), 266-278.
25. Fass, M.E. & Tubman, J.G. (2002) The influence of parental and peer attachment on college students' academic achievement. *Psychology in the Schools, 39*(5), 561-573.
26. Dennis, J.M., Phinney, J.S., & Chuateco, L.I. (2005) The role of motivation, parental support, and peer support in the academic success of ethnic minority first-generation college students. *Journal of College Student Development, 46*(3), 223-236.
27. Ashwin, P. (2003) Peer support: Relations between the context, process and outcomes for the students who are supported. *Instructional Science, 31*(3), 159-173.
28. Litzler, E. (2013). How underrepresented minority engineering students derive a sense of belonging from engineering. *ASEE Annual Conference and Exposition*: Atlanta, GA.
29. Martin, J.P., Simmons, D.R., & Yu, S.L. (2013) The role of social capital in the experiences of hispanic women engineering majors. *Journal of Engineering Education, 102*(2), 227-243.
30. Sarason, S. (1974) *The psychological sense of communitiy.* San Franzisco: Jossey-Bas.
31. Lounsbury, J.W. & DeNeui, D. (1996) Collegiate psychological sense of community in relation to size of college/university and extroversion. *Journal of Community Psychology, 24*(4), 381-394.
32. Lounsbury, J. W., & DeNeui, D. (1995). Psychological sense of community on campus. *College Student Journal, 29*(3), 270-282.
33. DeNeui, D.L. (2003) An investigation of first-year college students' psychological sense of community on campus. *College Student Journal, 37*(2), 224-234.
34. McCarthy, M. E., Pretty, G. M., & Catano, V. (1990). Psychological sense of community and student burnout. *Journal of College Student Development, 31*(3), 211-216.
35. Townley, G., Katz, J., Wandersman, A., Skiles, B., Schillaci, M.J., Timmerman, B.E., & Mousseau, T.A. (2013) Exploring the role of sense of community in the undergraduate transfer student experience. *Journal of Community Psychology, 41*(3), 277-290.
36. Pretty, G.M., Andrewes, L., & Collett, C. (1994) Exploring adolescents' sense of community and its relationship to loneliness. *Journal of Community Psychology, 22*(4), 346-358.
37. Berger, J.B. (1997) Students' sense of community in residence halls, social integration, and first-year persistence. *Journal of College Student Development, 38*(5), 441-52.
38. Lounsbury, J.W. & De Neui, D. (1996) Collegiate psychological sense of community in relation to size of college/university and extroversion. *Journal of Community Psychology, 24*(4), 381-394.
39. Carnegie Foundation (2010). The Carnegie Classification of Institutions of Higher Education Retrieved October 16, 2012, from http://classifications.carnegiefoundation.org/.
40. Kokkelenberg, E.D. (2008) The effects of class size on student grades at a public university. *Economics of Education Review Economics of Education Review, 27*(2), 221-233.
41. Finn, J.D., Pannozzo, G.M., & Achilles, C.M. (2003) The "why's" of class size: Student behavior in small classes. *Review of Educational Research, 73*(3), 321-368.
42. Lee, J.J. (2009) Size matters: An exploratory comparison of small-and large-class university lecture introductions. *English for Specific Purposes, 28*(1), 42-57.
43. Astin, A.W. (1999) Student involvement: A developmental theory for higher education. *Journal of College Student Development, 40*(5), 518-529.

44. Kuh, G.D., Gonyea, R.M., & Palmer, M. (2001) The disengaged commuter student: Fact or fiction. *Commuter Perspectives, 27*(1), 2-5.
45. Floyd-Smith, T., Wilson, D., Campbell, R., Veilleux, N., Bates, R., Plett, M., Scott, E., & Peter, D. (2010). A multi-institutional study of connection, community, and engagement in STEM education: Conceptual model development, *ASEE Annual Conference and Exposition*: Arlington, Virginia.
46. National Survey on Student Engagement (NSSE) (2011). *Fostering student engagement campuswide*. Retrieved from: http://nsse.iub.edu/html/annual_results.cfm
47. Concannon, J. P., & Barrow, L. H. (2012). A reanalysis of engineering majors' self-efficacy beliefs. *Journal of Science Education and Technology, 21*(6), 742-753.
48. Allendoerfer, C., Wilson, D., Bates, R., Crawford, J., Jones, D., Floyd-Smith, T., ... & Veilleux, N. (2012). Strategic pathways for success: The influence of outside community on academic engagement. *Journal of Engineering Education*, *101*(3), 512-538.
49. Concannon, J. P., & Barrow, L. H. (2009). A cross-sectional study of engineering students' self-efficacy bygender, ethnicity, year, and transfer status. *Journal of Science Education and Technology*, *18*(2), 163-172.
50. Wilson, D., Shaffer, J., & Freed, L. (2011). Differences in self-efficacy: Is it women or is it engineering? *WEPAN (Women in Engineering Program Pro-Advocates Network) 2011:* Seattle, Washington.