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A Cross-Sectional Study of Engineering Students' Self-Efficacy by Gender, Ethnicity, Year, and Transfer Status

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Abstract This is a cross-sectional study of 519 undergraduate engineering majors' self-efficacy beliefs at a large, research extensive, Midwestern university. Engineering self-efficacy is an individual's belief in his or her ability to successfully negotiate the academic hurdles of the engineering program. Engineering self-efficacy was obtained from four variables: self-efficacy 1, self-efficacy 2, engineering career outcome expectations, and coping self-efficacy. The four variables were analyzed using a repeated analysis of variance among levels of gender, ethnicity, years students had been enrolled in their engineering program, and transfer status. No significant differences in mean engineering self-efficacy scores were found by gender, ethnicity, and transfer status. However, significant interactions between gender and the subscales, ethnicity and the subscales, and transfer status and the subscales were found. Significant differences in mean engineering self-efficacy scores were found among years students had been enrolled in the program.

Keywords Engineering · Self-efficacy · Gender · Ethnicity · Transfer

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Introduction

The National Science Board (2007) posits one challenge in engineering education is the retention of engineering students. Some of the best undergraduate engineering majors are lost. The attrition rate of all undergraduate engineering majors is an issue. About 60% of individuals who enter engineering programs graduate in 6 years (National Science Board 2007). Although this is comparable to other undergraduate programs, it is of specific concern to undergraduate engineering programs. This is because while other academic majors can compensate for the 40% loss of individuals who originally enter, engineering cannot (National Science Board 2007). The set coursework in the engineering program and students' acquisition of trade skills limit the movement of undergraduates into engineering programs. In addition, "students develop little identity as engineering in their first 2 years of college because they take math and science courses and have little exposure to the engineering practice" (National Science Board 2007, p. 3). Consequently, peak attrition for undergraduate engineering majors occurs during the freshmen and sophomore years (Brainard and Carlin 1998).

The attrition of women and minorities in undergraduate engineering programs is significantly higher than White males (National Science Board 2007). National Science Board (2007) noted, "These groups most likely lack role models in engineering" (p. 3). Over an 11 years longitudinal study, Adelman (1998) found that men had a 61.6% retention rate in undergraduate engineering programs. This retention rate was 20% higher than women. Additionally, the National Science Foundation (NSF 2007) explains that over the past 10 years there has been a decline nationally in women receiving bachelor's degrees in chemical engineering. Organizations and companies need women and minorities in engineering to ensure they are able "to meet the needs of an increasingly diverse customer base or to expand the current market for their products and services" (Johnson et al. 2008, p. 1000).

Attrition in undergraduate engineering programs could be a factor when considering the low representation of minority and women engineers in the workforce. It is imperative to retain men and women in undergraduate engineering programs who can continue the technological revolution which began in the United States 50 years ago. Advances in technology can open new industries and a host of new jobs; and new jobs will continue to drive the United States economy. In 2003, there were approximately 1,554,800 engineers in the United States workforce: 1,382,500 were men, fewer than 80,000 were Hispanic, and fewer than 60,000 were Black (NSF 2003). Under representation of women and minority groups in science and engineering is stressing the nation's economic capacity and growth in a time of global competitiveness (NSF 1998).

The underrepresentation of women and minority groups are not a result of their inabilities; rather, underrepresentation is due to the public's image of engineers (Goodman Research Group 2002). This image intensifies the natural barriers that an individual must overcome. The lack of underrepresented groups in engineering will not be entirely resolved until the public's image of an engineer changes. As awareness increases, K-16 educators will need to recognize that the present state of science and mathematics education is a cause for women's and minorities' loss of interest in engineering. One common way researchers examine students' persistence in a specific field of study is by measuring their self-efficacy beliefs.

Theoretical Background

This study is based on Albert Bandura's foundational work in social-cognitive psychology: self-efficacy theory. Bandura (1986) defined self-efficacy as an individual's judgments of his or her abilities to accomplish specific tasks or objectives. Subsequently, Bandura (1986, p. 391) modified the definition as "not the skills one has, but the judgments of what one can do with whatever skills one possesses". Individuals' behaviors and motives are better predicted by what they believe they are able to do more so than what they are actually capable of doing (Bandura 1997). Individuals with high efficacious beliefs think, feel, and act in such ways that they can actually create their own future rather than simply foretelling it (Bandura 1986).

In the early 1980s and into the 1990s, the self-efficacy construct branched into broader measures of self-efficacy, such as career (occupational) self-efficacy, academic milestones self-efficacy, and mathematics and science self-efficacy. Betz and Hackett (1981) established the field of occupational self-efficacy research. Lent et al. (1986) proposed the first academic milestones measure of self-efficacy. Academic milestones self-efficacy is related to a person's ability to cope through barrier situations. This area of self-efficacy research is particularly relevant with regards to retention of undergraduates in engineering degree programs.

Lent et al. (2005) posits that a person's career interests play the most important role in his or her career related pursuits. A person's career interests are based upon two major themes: (1) an individual's expectations of the career; and (2) an individual's beliefs that he or she can complete the requirements to attain such a career (academic milestones self-efficacy).

Academic milestones self-efficacy is an individual's judgment of their capabilities with respect to desirable outcomes. Self-efficacy has been found to be a strong predictor of academic achievement, career selection, interest in engineering, and course selection (Britner and Pajares 2006; Mau 2003). Students with high self-efficacy exhibit higher achievement (Lin and Cheng 2007). An individual's belief in his or her ability stems from prior mastery experiences, being able to cope with the hurdles of the academic program, and knowledge of the social supports that he or she can turn to.

One's confidence in his or her ability to reach academic milestones significantly predicts his or her desire to become an engineer (Lent et al. 2005, 2007). A person's occupational self-efficacy beliefs are the strongest predictor for one's mathematics-based career choice (Hackett and Betz 1989; Lent et al. 1987), selection and persistence in college majors (Hackett and Betz 1989; Lent et al. 1986), and continued vocational interest (Hackett et al. 1992; Lapan et al. 1989; Lent et al. 1987).

Mau (2003) posits that academic proficiency and mathematic task-specific self-efficacy are two major predictors of a person's occupational interest. Mathematics self-efficacy not only significantly predicts occupational interest, but also predicts academic milestones self-efficacy. Likewise, Britner and Pajares (2006) posit that mathematics and science self-efficacy significantly predicts an individual's science grade.

Coping self-efficacy also significantly predicts persistence in engineering majors (Lent et al. 2007, 2000). Lent et al. (2000) posit in their social-cognitive career theory how support increases coping self-efficacy and academic milestones. Lent et al.'s (2007) study supports his earlier (Lent et al. 2000) social-cognitive career theory that environmental supports and resources significantly predict a person's academic milestones and coping self-efficacy.

Research Questions

Question One

Are there significant differences between engineering majors' engineering self-efficacy scores by gender? The majority of the prior studies that have examined engineering self-efficacy found no statistically significant differences in self-efficacy by gender. For example, Concannon and Barrow (2008) found there were no significantly differences in engineering self-efficacy beliefs by gender; however, women exhibited lower engineering career outcome expectations and coping self-efficacy scores. Oppositely, Bradburn (1995) did find significant differences in self-efficacy between men and women.

Question Two

Are there significant differences among engineering majors' engineering self-efficacy scores across ethnic groups? Prior studies have found differences in self-efficacy across ethnicities; however, these studies are inconclusive and not consistent. Mau (2003) explained that Asians are most likely to persist in their engineering aspirations. Marra and Bogue (2006) found statistically significant differences between "feelings of inclusion" scores between African Americans and Caucasians. Conversely, Hackett et al. (1992) explained that Mexican–Americans had statistically lower self-efficacy scores than Caucasians, but no differences between African Americans and Caucasians existed.

Question Three

Are there significant differences among engineering majors' engineering self-efficacy scores by length students have been in the program? Brainard and Carlin (1998) found differences in engineering majors' self-concept across grade levels. Oppositely, Marra and Bogue (2006) found no statistically significant differences in engineering self-efficacy across grade levels.

Question Four

The last purpose of this study is to address an area that is not established in the literature. Are there differences among these social-cognitive constructs for individuals who are non-transfer to the university versus transfer students?

Methodology

Site

The study was conducted at a research extensive public institution located in a Midwestern state. In 2006, the undergraduate was 52.2% female. Approximately 60% of the undergraduate student body was between the ages of 18 and 21. Since 2004, the representation of women in the College of Engineering has dropped from 13.0 to 11.9% in 2006. The College of Engineering has a 70.0% 6 year graduation rate and an 86.1% 1 year retention rate. In 2006, the College of Engineering awarded 343 Bachelor's degrees (Office of the University Registrar 2007).

Participants

The surveys were administered to 519 undergraduate engineering students. The sample consisted of a broad range of students by year, ethnicity, and engineering specialty.

Research Design

This research study used a two factor analysis of variance with repeated measures for one factor, engineering self-efficacy. Engineering self-efficacy consisted of four repeated scores (Appendix 1). The four repeated measures were self-efficacy 1 (Cronbach's Alpha = .89), self-efficacy 2 (Cronbach's Alpha = .91), career outcome expectations (Cronbach's Alpha = .89), and coping self-efficacy (Cronbach's Alpha = .79). The subscales were modified from four of six longitudinal assessment of engineering self-efficacy (LAESE) subscales developed by Marra and Bogue (2006; Appendix 2). The first dependent variable, self-efficacy 1, was designed to measure a student's academic milestones self-efficacy. The questions focused on participants' confidence in obtaining an A or a B in a difficult course, and confidence of succeeding in the engineering curriculum. Self-efficacy 2 is somewhat different than self-efficacy 1. Self-efficacy 2 identifies a student's confidence in completing the undergraduate engineering requirements when compared to students in all other engineering specialties. An individual's engineering career expectations score reflects his or her perceptions of the benefits of working as an engineer. The fourth dependent variable, coping self-efficacy, is a person's ability to manage stressful circumstances in an attempt to decrease internal stress (Weiten and Lloyd 2006).

The independent variables in this study were: (a) gender; (b) ethnicity; (c) number of years enrolled in an engineering major (Year); and (d) transfer status. Year was defined as the total number of years a student had been in the university's engineering degree program at the end of the 2008 Winter/Spring semester. Transfer student was defined as an individual who received 20 or more college credit hours prior to entering the university's College of Engineering bachelor's degree program. Using these definitions, there was a percentage of year one students who were transfers.

Each research question required the calculation of three *F*-values. The *F*-value was significant if it was higher than the critical *F*-value at the 95% confidence level. The assumptions concerning the nature of the data were: (1) both factors show normally distributed data for the dependent variables; (2) independent samples; (3) independent subjects; (4) compound symmetry; and (5) homogeneity of variance.

Due to a low number of African American, Asian, and Hispanic students in the sample, convenience samples of at least 12 students per level were used for data analyses by ethnicity. The "other" ethnic and the Native American groups were deleted from the sample prior to running any repeated measures analysis of variance due to the low number of individuals. Convenience sampling was also used for determining differences by gender, engineering specialty, and transfer status.

Demographics

The sample consisted of 86% men and 14% women (Table 1). More women had a mentor (63.8%) than men (38.2%). This difference was statistically significant ($X^2 = 15.05, p = .001$). Also, there was a greater percent of women who were members of at least one engineering organization compared to men ($X^2 = 18.89, p < .001$).

The majority of the engineering majors in this sample were Caucasian (87.4%). There was high percent of African Americans who were members of an undergraduate engineering organization compared to all other ethnic groups. Seventy percent of African Americans participated in at least one undergraduate engineering organization (Table 1; $X^2 = 12.58$, $p = .01$). Likewise, there was a significantly low percentage of Asians who participated in at least one undergraduate engineering organization (Table 1).

The majority of the students were majoring in mechanical/aerospace engineering, civil engineering, or computer/electrical engineering (Table 1). There was a significant difference between the number of chemical engineering majors (90.0%) who were members of an undergraduate engineering organization versus the number of computer science majors ($X^2 = 32.91$, $p < .001$). There was also a statistically significant larger percentage of biological and chemical engineering majors who had a mentor ($X^2 = 8.44$, $p < .01$). Computer science was the specialty with the lowest percentage of students with a mentor (21.6%).

There was a statistically significant difference in the number of transfer students by engineering specialty. A larger percent of students in the sample transferred into computer

Table 1 Demographics

Group	*n*	%	Mentor		Transfer		FIG member		Member of an engineering organization	
			n	%	*n*	%	*n*	%	*n*	%
Gender										
Men	424	86.0	162	38.2	87	20.5	100	23.6	188	44.3
Women	69	14.0	44	63.8	11	15.9	24	34.7	51	73.9
Total	493	100.0	206	41.8	98	19.9	124	25.2	239	48.5
Ethnicity										
African American	20	4.1	9	45.0	4	20.0	5	25.0	14	70.0
Asian	20	4.1	8	40.0	2	10.0	4	20.0	5	25.0
Caucasian	431	87.4	179	41.5	86	20.0	112	26.0	211	49.0
Hispanic	12	2.4	6	50.0	4	33.3	2	16.7	6	50.0
Other	10	2.0	4	40.0	2	20.0	1	10.0	3	30.0
Total	493	100.0	206	41.8	98	19.9	124	25.2	239	48.5
Engineering specialty										
Biological	31	6.9	16	51.6	3	9.7	6	19.4	22	71.0
Chemical	20	4.4	10	50.0	1	5.0	7	35.0	18	90.0
Civil	95	21.0	47	48.0	28	28.6	23	23.5	50	51.0
Computer/Electrical	83	18.4	32	38.1	1	1.2	20	23.8	39	46.4
Computer Science	36	8.0	8	21.6	13	35.1	7	18.9	10	27.0
Industrial	54	11.9	26	45.6	7	12.3	17	29.8	35	61.4
Mechanical	130	28.8	5	37.9	18	13.6	35	26.5	55	41.7
Total	449	100.0	189	41.2	71	15.8	115	25.1	229	49.9

science and computer/electrical engineering ($X^2 = 20.73$, $p < .01$). More than 90% of the students in biological and chemical engineering were non-transfer students; whereas, more than one-third of the computer science students transferred from a different school. More than 20% of civil engineering majors were transfer students (Table 1).

Findings

Gender

There were no statistically significant differences in engineering self-efficacy between men and women; however, a statistically significant interaction was found [$F(3, 1{,}380) = 2.946$, $p = .03$]. The interaction resulted from a statistically significant difference in mean coping self-efficacy scores between men and women [$t\ (442) = 2.00$, $p = .01$]. Women had a lower mean coping self-efficacy than men (Fig. 1). There were no statistically significant differences for the other three subscales.

Ethnicity

There were no statistically significant differences among engineering self-efficacy scores across ethnic groups [$F(3, 310) = .52$, $p = .67$]; however, there was a statistically significant interaction between the self-efficacy subscales and ethnicity [$F(9, 930) = 1.95$, $p = .04$; Fig. 2]. The interaction was due to differences in mean engineering career outcome expectations scores. African Americans had significantly lower engineering career outcome expectations than Caucasians [$F(3, 448) = 4.62$, $p < .01$].

Years

Differences in engineering self-efficacy were found among the number of years students had been in their engineering program (Table 2). Year four students had higher engineering self-efficacy scores than year five engineering students $F(3, 457) = 2.96$, $p < .05$. However, a statistically greater percent of fifth year students had transferred into the College of Engineering.

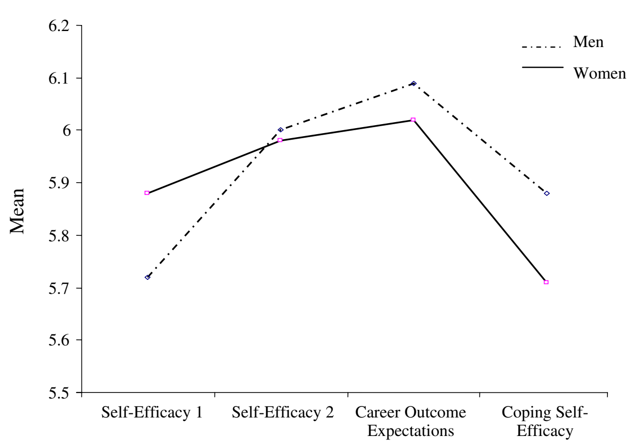

Fig. 1 Interaction between the four subscales and gender

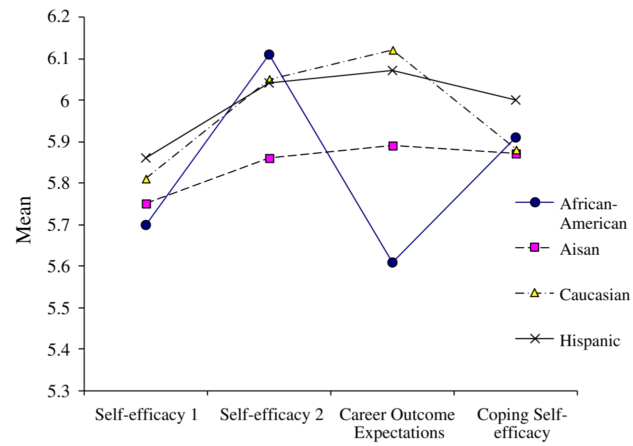

Fig. 2 Interaction between the self-efficacy subscales and ethnicity

Table 2 Tukey's post hoc analysis of mean engineering self-efficacy scores by year (Column Mean–Row Mean)

Group	2	3	4	5
1. Year 1	.025	−.073	−.143	.158
2. Year 2	–	−.098	−.169	.133
3. Year 3		–	−.070	.231
4. Year 4			–	.302*
5. Year 5				–

* $p < .05$; ** $p < .01$

Transfer Status

The majority of the individuals in the sample were non-transfer students (Table 3). No statistically significant differences were found in mean engineering self-efficacy between transfer and non-transfer students (Table 4); however, a statistically significant interaction was found between the subscales and transfer status [$F(3, 1{,}380) = 3.73$, $p = .01$; Table 4; Fig. 3]. An independent t test found that non-transfer students had a significantly higher mean self-efficacy 1 score than transfer students (Table 5).

Table 3 Demographics by transfer status

Group	n	%
Transfer	98	19.9
Non-transfer	394	79.9
Missing	1	.2
Total	493	100.0

Table 4 Repeated measures ANOVA of engineering self-efficacy by transfer status

Source	*df*	SS	MS	*F*	*p*	η_p^2
Between subjects effects						
Transfer (A)	1	.28	.28	.28	.60	.001
Within group error	456	443.98	.97			
Within subjects effects						
Subscales (B)	3	17.89	5.96	20.35	.00	.043
A × B	3	3.28	1.09	3.73	.01	.008
Within group error	1,368	400.83	.29			

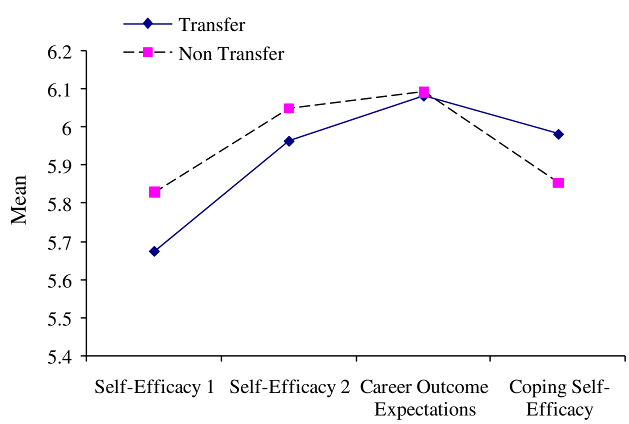

Fig. 3 Line graph displaying the interaction between the four engineering self-efficacy subscale scores and participants' transfer status

Table 5 Independent *t*-tests of mean subscale scores between transfer and non-transfer students

Variable	*df*	*t*	*p*
Self-efficacy 1	306	−2.191	.03
Self-efficacy 2	306	−1.027	.31
Career outcome expectations	306	.046	.96
Coping self-efficacy	306	.883	.38

Conclusion

No significant differences in engineering self-efficacy were found by gender, ethnicity, and transfer status. However, significant interactions were found between gender and the subscales, ethnicity and the subscales, and transfer status and the subscales. The significant interactions resulted from differences for one subscale between genders, among ethnicities, and between transfer and non-transfer students. The interaction by gender was due to differences between men's and women's coping self-efficacy scores. Women had significantly lower coping self-efficacy. The interaction by ethnicity was due to differences between African American's and Caucasian's career outcome expectations scores. Caucasians had significantly higher career outcome expectations. The significant interaction found by transfer status was resulted from non-transfers having higher self-efficacy one scores. Significant differences were found by year. No significant interactions were found between the subscales and year. Year four engineering students had significantly higher engineering self-efficacy scores than year five students. However, a high percentage of year five students were transfers majoring in computer science. Secondly, transfer students were less likely to be a member of an undergraduate engineering organization.

Discussion

This study confirmed that there is no statistically significant difference between mean engineering self-efficacy scores by gender (Concannon and Barrow 2008; Hackett et al. 1992; Lent et al. 1986; Schaefers et al. 1997). Likewise, this study refutes Bradburn's (1995) finding that women engineering majors have lower self-efficacy beliefs than men. Bradburn explains that women in the sample received high level of negative persuasions. Oppositely, in the present study 63.8% of women compared to 38.2% of men claimed to have someone who they could turn to for encouragement and support. There is little evidence that gender differences exist between men and women engineering majors' self-efficacy (Schaefers et al. 1997). No differences in engineering self-efficacy beliefs were found because all enrolled individuals had similar abilities, measured by high school grades and college entrance scores. The homogeneous sample stems from the nature of the College of Engineering's selection process (Vogt 2003).

This study did find differences in mean engineering career outcome expectations scores by ethnicity. Caucasians had significantly higher engineering career outcome expectation scores than African–Americans. This finding does not suggest that African–Americans perceive themselves as having a more difficult time finding a job; rather, African–Americans perceive that as an engineer they will not be given the opportunities as others to use their talent and creativity, be a part of a "group", have similar pay raises as their colleagues, or have a successful career as an engineer. In prior studies, Mau (2003) studied junior high school students' interests in engineering over a 6 years period. Mau's study suggests that from junior high to high school, and then again to college, African Americans are more likely to become disinterested in engineering and are less likely to persist with their engineering intentions. Similarly, Seymour (1995) examined the causes for undergraduate majors to drop out of science, mathematics, and engineering (SME) degree programs in college. The individuals in the study were selected on the basis of their mathematics SAT score. The 460 participants were capable of handling the required coursework for the 4 year degree. Seymour's results indicated that science, mathematics, and engineering switchers differed from SME persisters in that switchers: (1) perceived that the job options were not worth staying the degree program; (2) perceived that the lifestyle of an engineer was not something they wanted in the future; and (3) perceived non-SME careers to be more appealing. Seymour's study, in conjunction with this present study, suggests that because African–Americans have lower career outcome expectations, they are more likely to switch out of their engineering major.

Differences in engineering self-efficacy were found among the number of years students had been an engineering major. Year four students had higher engineering self-efficacy scores than year five engineering students. However, a statistically higher percentage of fifth year students had transferred into the College of Engineering. The significantly lower engineering self-efficacy scores for fifth year students most likely did not result from the amount of time they had been in the program; rather, the difference resulted from the high percentage of transfer students in the fifth year group. No significant differences in engineering self-efficacy were found from year one students to year four students. This supports Marra and Bogue's (2006) findings which found no statistically significant differences in engineering self-efficacy among women in their first 4 years of their engineering program. This finding also supports Bandura's (1997) explanation of self-efficacy threshold. A threshold, in Bandura's (1997) words, is a level of self-efficacy required for continued interest. As long as an individual maintains or exceeds the required self-efficacy threshold, a temporal lag sustains his or her interests, and likewise persistence in engineering.

No statistically significant differences were found in engineering self-efficacy scores by transfer status; however, a statistically significant interaction was found. Transfer students had significantly lower self-efficacy 1 subscale scores and lower, but not significant, self-efficacy 2 scores. Transfer students lower self-efficacy 1 beliefs could be a result of transfer shock. Rhine et al. (2000) explained that community college students experience transfer shock after beginning coursework at a university. Transfer shock is a decrease in students GPA that often results in attrition at the university. Self-efficacy 1, which measures academic milestones self-efficacy, has the strongest correlation to GPA compared to all social-cognitive measures (Hackett et al. 1992). Transfer shock has been found to affect mathematics and science students more so than students majoring in education, fine arts or humanities.

Implications

Transfer students commonly receive good grades at the institution from where they transferred from, but frequently the self-efficacy beliefs constructed upon those grades are lower than the self-efficacy beliefs developed by the non-transfer student. The first implication of this study is directed toward community colleges. Rather than lowering the expectations at the university, community colleges, especially mathematics and physics departments, should identify students that are bound for engineering. Engineering bound students need to take similar course requirements that are offered at the university. The physics and mathematics faculty at the community college should have similar expectations for their students as university faculty.

The second implication is that there is a need for professional development for engineering faculty, teaching assistants, and physics and mathematics tutors designed to promote transfer students' self-efficacy. Individuals in these roles have a strong influence over individuals' self-efficacy beliefs (Seymour and Hewitt 1997). Engineering faculty need to meet with transfer students prior to the first week of coursework. Transfer students need to know that they have a faculty mentor they can visit with, and know that they have a faculty mentor who will take into consideration their feelings of their own abilities. Mentors should meet with transfer students frequently during their first year to discuss social and academic experiences, and be willing to provide stories about their hurdles as an engineering undergraduate. Engineering students need to be paired to mentors who share common interests. Mentors provide information about tutoring, opportunities for research internships, scholarships offered within the college, and on-campus undergraduate engineering organizations.

The third implication is based upon differences in career outcome expectations scores between African Americans and Caucasians. African Americans had significantly lower engineering career outcome expectations. African Americans believed that they were less likely to be treated fairly on the job, get similar pay raises, feel "part of the group", and obtain a job that provides the lifestyle they want. These beliefs may or may not be true. Employers cannot discriminate based upon employees' ethnicity. The low representation of African Americans in the engineering workforce could be perceived by the public that discrimination, in some form, is occurring. To increase the number of African American engineers, African American engineering students need opportunities to work with and observe engineers in their engineering field early in their degree program. African–American students need African–American mentors who have successful engineering careers. African–American students would likely benefit from having African–American faculty advisors who make them aware of their career opportunities.

Appendix 1

Table 6 Alignment of the survey questions to the self-efficacy subscale

Subscales from original LAESE survey	Item numbers on survey	Score calculation	Score range
Engineering self-efficacy I	1, 3, 5, 7, 9	(Sum of items)/ 5	1–7
Engineering self-efficacy II	2, 4, 6, 8, 11	(Sum of items)/5	1–7
Engineering career outcome expectations	12, 14, 16, 18, 19, 20, 21	(Sum of items)/7	1–7
Coping self-efficacy	13, 15, 17, 22, 23	(Sum of items)/5	1–7
Persistence[a]	10	Item score	1–7[a]

[a] Persistence is not included in total score

Appendix 2

Table 7 Survey

1. I can succeed in an engineering curriculum	1	2	3	4	5	6	7
2. I can complete the math requirements for most engineering majors	1	2	3	4	5	6	7
3. I can succeed in an engineering curriculum while not having to give up participation in my outside interests (e.g., extra curricular activities, family, sports)	1	2	3	4	5	6	7
4. I can excel in an engineering major during the current academic year	1	2	3	4	5	6	7
5. I can succeed (earn an A or B) in an advanced physics course	1	2	3	4	5	6	7
6. I can complete any engineering degree at this institution	1	2	3	4	5	6	7
7. I can succeed (earn an A or B) in an advanced math course	1	2	3	4	5	6	7
8. I can complete the physics requirements for most engineering majors	1	2	3	4	5	6	7
9. I can succeed (earn an A or B) in an advanced engineering course	1	2	3	4	5	6	7
10. I intend to persist majoring in engineering next year	1	2	3	4	5	6	7
11. I can complete the chemistry requirements for most engineering majors	1	2	3	4	5	6	7
12. Someone like me can succeed in an engineering career	1	2	3	4	5	6	7
13. I can cope with not doing well on a test	1	2	3	4	5	6	7
14. A degree in engineering will allow me to obtain a well paying job	1	2	3	4	5	6	7
15. I can make friends with people from different backgrounds and/or values	1	2	3	4	5	6	7
16. I expect to be treated fairly on the job. That is, I expect to be given the same opportunities for pay raises and promotions as my fellow workers if I enter engineering	1	2	3	4	5	6	7
17. I can cope with friends' disapproval of chosen major	1	2	3	4	5	6	7
18. A degree in engineering will give me the kind of lifestyle I want	1	2	3	4	5	6	7
19. I expect to feel "part of the group" on my job if I enter engineering	1	2	3	4	5	6	7
20. A degree in engineering will allow me to obtain a job that I like	1	2	3	4	5	6	7
21. A degree in engineering will allow me to get a job where I can use my talents and creativity	1	2	3	4	5	6	7
22. I can approach a faculty or staff member to get assistance	1	2	3	4	5	6	7
23. I can adjust to a new campus environment	1	2	3	4	5	6	7

Directions: for each statement below indicate whether you strongly disagree, disagree, slightly disagree, neither disagree nor agree, slightly agree, agree, strongly agree, or do not know by circling the appropriate number. 1 strongly disagree, 2 disagree, 3 slightly disagree, 4 neither agree or disagree, 5 slightly agree, 6 agree, 7 strongly agree

Please Answer the Following Demographic Questions

1. Have you ever lived in, or are you currently living in an Engineering Freshman Interest Group?

   If so, how many semesters had /have you lived in the FIG?

2. Did you transfer here from a different college?

   If yes, what type of college did you transfer from?
   (e.g. community college, large university, 4-year private, 4-year public)

   If yes, how many credit hours did you complete prior to transferring to the degree program here?

3. Are you a member of any engineering organizations? Yes No (circle one)

   If so, which ones?

4. What would you consider to be your engineering specialty (e.g. civil)?

5. How many years, at the end of this academic year, have you been perusing an engineering degree?

6. Do you have an academic mentor; someone you look to for support and guidance (yes or no)?

   If so, who? (e.g. a professor, parents, brother, sister, friend)?

7. What is your gender? Male Female (please circle one)

8. What is your ethnicity?
   (optional)

   African-American
   Asian
   Hispanic
   Native American
   White (Non-Hispanic)

   Other (please specify) ________________________

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