Pilot Project: Assessing First-Year Engineering Student Motivation

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Abstract

Although enrollment in engineering schools across the country is increasing, the field is faced with high attrition rates, both during degree completion and after graduation. Several studies point to the misalignment of student expectations, identities and values with their understanding of the field as a cause for this phenomenon. The goal of this study is to increase our understanding of first year students' perceptions of engineering, to better understand their motivations and to apply this knowledge to improve the first year curriculum. Using a survey based on a similar study for first-year engineering students at another university, Virginia Tech, we are assessing the students' interest in engineering, identity with the field, sense of utility (how useful they believe engineering is), sense of belonging, expectancy of success, and perceived cost (e.g. whether engineering is worth the commitment). The results from our initial survey administered two weeks into the first semester are shared here. Overall, engineering students at UM report similar results to those at Virginia Tech with the exception of higher interest in engineering, a lower sense of perceived cost and decreased likelihood to pursue an engineering career. UM male participants reported a significantly higher expectance of success in engineering as compared to UM women. All other comparisons were non-significant. These findings are similar to previous results reported by Virginia Tech.

Research Questions

-What are first year students' perceptions of and motivations toward the field of engineering?
-What is the difference between the perceptions of men and women in the field of engineering?
-How do these perceptions change over the course of the first year?
-Do these perceptions relate to other factors or experiences (e.g. GPA, specific course experiences)?

[1]Jones, B.D., Paretti, M.C., Hein, S.F. & Knott, T.W. (2010) An analysis of motivation constructs with first-year engineering students: Relationships among expectancies, values, achievement, and career plans. *Journal of Engineering Education, 99*, 319-336.

Methodology

The survey is based on a similar study of first-year engineering students at Virginia Polytechnic Institute and State University[1] (VT). All engineering first year students at the University of Michigan were invited to participate in a computer-based Likert-style survey during the second week of Fall semester 2011. Respondents were invited back to participate in a second identical survey the first week of Winter 2012, and will be invited a third time at the end of the academic year.

	Women (% of Cohort)	Men (% of Cohort)	Overall Resp Rate
Fall 2011	107 (36%)	215 (23%)	26%
Winter 2012	70 (65% of initial respondents)	121 (56% of initial respondents)	60% of initial respondents

Table I. Survey respondents by gender

We performed a confirmatory factor analysis allowing us to confidently group questions across the key categories. We completed an ANOVA with follow-up T-tests to examine any effect of gender on the assessment categories.

Results - Cross-Institutional

Table II provides a comparison with mean results from the VT study (students), from the first administration of each instrument at each institution. It should be noted that *Belonging* was not assessed in the initial VT study.

Category (Likert scale)	Michigan	Virginia Tech
Expectancy (7)	5.25 (0.80)	5.31 (0.92)
Identity (7)	6.03 (0.72)	5.89 (0.80)
Interest (7)*	**6.03 (0.76)**	**5.34 (1.03)**
Utility (7)	6.45 (0.58)	6.31 (1.09)
Cost (7)*	**5.59 (0.93)**	**6.17 (0.72)**
Career (5) **	4.07 (0.93)	4.29 (1.12)

Table II. Mean (SD) survey responses by institution. (*) p<0.001 (**) p<0.01

While many factors may preclude direct comparison between institutions, there are some interesting differences to note for future study. For example, the student cohort at UM appeared to enter the college reporting a higher *Interest* in engineering, a lower sense that their degree is worth the cost (stress, time, expense) and lower intention to pursue a career in engineering than the VT cohort.

Results – Gender Comparison

Figure 1 shows the UM responses by gender for the first survey administration. The only statistically significant gender difference occurs for *Expectancy* (p<0.001), where men report higher expectancy for success than women. This result is comparable to those reported by Virginia Tech. The next most significant difference is *Belonging* (P=0.076), where men exhibit a higher sense of belonging in engineering than women.

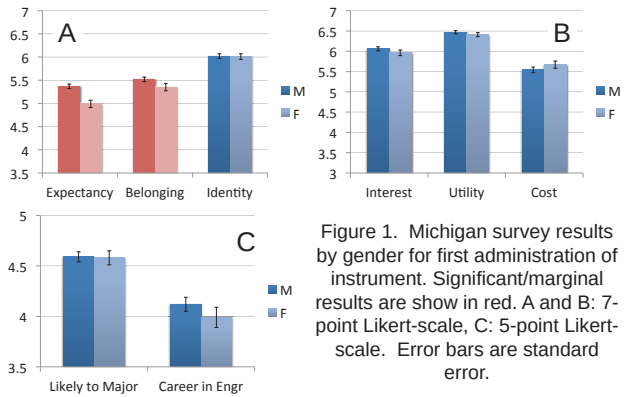

Figure 1. Michigan survey results by gender for first administration of instrument. Significant/marginal results are show in red. A and B: 7-point Likert-scale, C: 5-point Likert-scale. Error bars are standard error.

Conclusion

Preliminary results of this survey indicate that some differences may exist across institutions in various factors that have been reported to be important in student motivation and persistence in engineering. It is interesting to note the common gender difference in expectancy for success that is strongly represented in both studies. Next steps include analysis of data collected during Winter semester and evaluation of other factors.

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