

Research Brief

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Does Major Matter? A Look at What Motivates Engineering Students in Different Majors

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There is strong evidence showing that the choice of undergraduate major has a significant net impact on future earnings. Other work shows motivational differences between men and women. In building on this previous work, this study looked at what motivates students in six different engineering majors to study engineering.

Implications of Findings

The results of this study show that students' engineering major does matter when looking at what motivates them to study engineering. Findings suggest treating students in different majors differently when considering motivational factors of undergraduate engineering students. The work presented here may prompt changes to support programs and engineering curriculum so that they better meet the needs of women and men in each of the engineering disciplines by addressing the motivational factors that are specific to each group.

Motivation to study engineering for women is different from men and different among majors.

Methods and Background

The goal of the Center for the Advancement of Engineering Education's (CAEE) Academic Pathways Study (APS) is to understand the engineering student learning experience. The online Academic Pathways of People Learning Engineering Survey (APPLES) was deployed in the spring of 2008 to over 4000 undergraduate engineering students at 21 different institutions. The 21 APPLES institutions were selected to broadly represent American undergraduate engineering students. The survey took about 10 minutes to complete and participants were paid \$4.

At the core of the APPLES instrument are a set of variables that influence undergraduates' persistence in the engineering major, including motivation to study engineering. The survey probed six factors affecting motivation: financial, parental influence, social good, mentor influence, intrinsic psychological, and intrinsic behavioral.

The analysis included only juniors and seniors who were treated as one group for each major. Men and women were analyzed separately. Independent t-tests, paired t-tests, and analysis of variance tests (ANOVA) were conducted.

Six engineering majors were selected for comparison: mechanical, electrical, chemical, industrial, aerospace and bioX. BioX engineering includes all biology-related engineering majors (e.g., biosystems engineering, biomechanical engineering, etc.) in the sample. We selected these

six majors because of the broad picture of engineering they represent. These majors are offered at many institutions, and the APPLES data set for each of these six majors contains data from at least nine of the 21 APPLES schools.

For a complete description of the analysis methods, please see the full paper at the link below.

What We Found

Findings from this study indicated there are significant differences between majors with respect to students' motivations to study engineering. These results also vary by gender.

Male engineers appear to be motivated similarly across the different engineering majors except for intrinsic behavioral motivation. The majors with the highest mean values for intrinsic behavioral motivation are mechanical, aerospace, and electrical engineering. Mechanical and aerospace engineering students show significant differences (higher motivation; $p < 0.001$) compared to industrial engineering students. Further investigation into the curriculum for each major may indicate a link between opportunities for hands-on building within an engineering major curriculum and intrinsic behavioral motivation.

Women's motivation to study engineering is different from men and different among majors. For women, the mean values for each major are spread over a larger range than they are for men. This range is statistically significant ($p < 0.001$) for intrinsic behavioral, intrinsic psychological, and financial motivational factors. The level of intrinsic behavioral motivation to study engineering is significantly different ($p < 0.001$) between female students majoring in industrial engineering and mechanical engineering, industrial engineering and electrical engineering, and chemical engineering and electrical engineering. The level of intrinsic psychological motivation to study engineering is also significantly different between those majoring in industrial engineering and electrical engineering and those majoring in industrial engineering and mechanical engineering. Female students' level of financial motivation differs between industrial engineering students and bioX engineering majors. (See the full paper at the link below to view the associated figures.)

Industrial engineering women had a lower overall level of motivation relative to men and women in other majors. We are not claiming that these women are less motivated to study engineering, although that may be one explanation. There are also other motivational factors that we did not inquire about in the APPLES instrument. Some possibilities for additional motivational factors could include: a "coolness" factor to the major, flexibility of the degree plan and/or post-graduation plans, prestige of a degree, and interactions with peers.

Another notable result is that mentor influence and parental influence ranked at or near the bottom for all the majors, and for men and women.

These findings indicate that we cannot simply group all students together when describing engineering students; this is especially true for women, whose motivational factors vary by major.

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