

## **Socioeconomic Status and the Undergraduate Engineering Experience: Preliminary Findings from Four American Universities**

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Students of lower socioeconomic status (SES) tend to be underrepresented in American higher education, particularly at four-year institutions and more selective universities. Education researchers have shown that in the four year period following high school, low SES students are less likely to persist to a bachelor's degree or have graduate degree aspirations.

### **Implications of Findings**

The high number of significant differences between high and low SES groups found when analyzing data from the Academic Pathways of People Learning Engineering Survey (APPLES or APPLE survey) suggests that research studies of student groups should consider controlling for SES. This may particularly be the case when looking at other traditionally underrepresented populations in engineering.

### **Methods and Background**

The APPLE survey is one of several data collection methods of the Academic Pathways Study (APS), under the NSF-funded Center for the Advancement of Engineering Education (CAEE). APPLES was first deployed in spring of 2007, sampling over 800 students with an online survey designed to take about 10 minutes to complete. APPLES was deployed a second time in spring 2008. This paper discusses the preliminary findings related to SES from the spring 2007 deployment.

**These results suggest that SES plays a role in professional persistence in engineering, confidence in technical skill sets, extracurricular fulfillment, perception of curriculum overload and general satisfaction with the collegiate experience.**

The team calculated SES on a 0-1 scale with equal weight to perceived family income level and parents' combined educational levels. For perceived family income level, students were asked if they would describe their family as low, middle, upper-middle, or high income. For parents' education levels, there were two items on APPLES – one each asking about mother's and father's education level. High and low quartiles were chosen for analysis because findings could be compared to those of non-engineering university students also analyzed by high and low quartiles. For details on the data collection methods and data analysis, please see the full paper at the link below.

### **What We Found**

The team was surprised by the number of differences between high and low SES—12 of the 21 APPLES variables had a significant difference. (See the full paper for data tables with details of the survey variables analyzed.)

Differences that are related to students' finances were unsurprising. Intuitively, the team expected students of the low SES quartile to have greater financial motivation in attaining a university degree than their high quartile counterparts. Similarly, the low SES quartile students felt greater financial pressure and uncertainty during their undergraduate careers.

Findings regarding extracurricular fulfillment constructs were, however, somewhat surprising (fulfillment measured how important the activity is to the student and their level of participation). The team expected a larger number of students with greater financial uncertainty would be working while attending school than those with less financial insecurity. Low SES students might then have lower fulfillment for both engineering and non-engineering extracurricular activities. However, data show differing results for engineering and non-engineering extracurricular activities—low SES students show significantly higher fulfillment with engineering and significantly lower fulfillment with non-engineering activities.

Low SES students were found to have lower confidence with skills related to engineering: math and science confidence and confidence in solving open-ended problems. No broad statement could, however, be made about the students' confidence levels in general as there was no significant difference between the quartiles for professional and interpersonal confidence.

Though there was no significant difference between the SES quartiles in terms of academic persistence (defined as intending to complete an engineering major), the results showed that low SES students were more likely to persist professionally (defined as intending to do engineering-related work and/or study for three years following graduation) than their high SES counterparts. The team hypothesized that this may be because low SES students choose engineering for the profession's perceived financial security and focus on the steps needed to reach that goal, whereas high SES students are more likely to see an engineering degree as a stepping stone to many different professions, including law, business, or medicine.

There was no significant difference for the quartiles in terms of frequency of faculty interaction, and no significant difference with mentors' contributions to motivation to study engineering. These preliminary APPLS findings suggest the following plausible explanations: that low SES students are not targeted for formal mentoring programs even though they would benefit from such relationships given their documented underrepresentation in higher education; low SES students spend less time on campus thereby reducing potential opportunities for mentoring, and, according to other researchers, their chance for academic success; or simply they are already more secure in their decision to pursue an engineering degree than their high SES counterparts.

These results suggest that SES plays a role in professional persistence in engineering, confidence in technical skill sets, extracurricular fulfillment, perception of curriculum overload and general satisfaction with the collegiate experience. SES does not appear to play a role in other areas, such as academic persistence in engineering, academic disengagement or motivations for studying engineering.

Engineering education researchers, educators, and administrators should consider and/or control for SES in their evaluations and studies of the engineering student experience to better understand the effect of SES on engineering student outcomes.