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


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# Overview

- Socioeconomic Status & Overview of previous work
- A bit about APPLES
- How we calculated SES
- How we analyzed the APPLES data
- Preliminary results (APPLES1) … & some discussion
  - What was not significant
  - What was significant
- Implication and next steps

# Socioeconomic Status & Higher Education

**SES = a proxy for a family's or individual's relative resources and opportunities within society**

- Students of lower socioeconomic status (SES) are underrepresented in American higher education, particularly at four-year institutions and in more selective universities (Hearn 1988, McDonaugh 1997)

- 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 (Walpole 2003)

There has been no examination of the role of SES in the undergraduate engineering experience

# Academic Pathways of People Learning Engineering Survey

## What is APPLES?

- An online 10-minute survey which seeks information about student identity, skills and educational experience.
- There are 50 items (many multi-part), including demographic data and 26 variables.
- One of several data collection methods of the Academic Pathways Study (APS), which is part of the Center for the Advancement of Engineering Education (CAEE).

## Who were the participants?

- Recruitment targeted undergraduate students
  - studying engineering
  - thinking about studying engineering, and
  - who thought they would study engineering, but chose another field

# Academic Pathways of People Learning Engineering Survey

continued

**Nuts & Bolts**

- Participants are offered $4 incentive paid through PayPal
- Two deployments:
  - APPLES1: Broader Core Sample (4 core APS institutions, >800 participants, Winter 2007)
  - APPLES2: Broader National Sample (21 institutions, >4,200 participants, Winter 2008)

**Data presented here are from the first deployment (APPLES1)**

# Determination of Socioeconomic Status

- It is challenging to operationalize SES from survey data – particularly for youth and students
- Researchers use a variety of methods, such as income, mother's education, financial aid status, zip codes

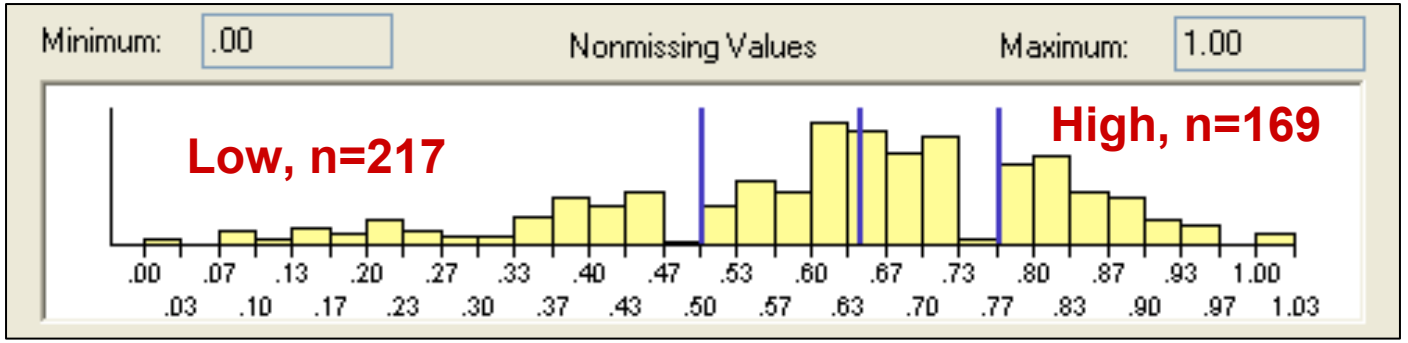
- APPLES has three demographic items used to determine SES:
  - Mother's education level (*m*)
  - Father's education level (*f*)
  - Perceived family income level (*i*)
- Our SES half student perception (income) and half grounded research (parents' education levels)

- Cronbach alpha, α = 0.700

$$SES = \frac{i + \left( \frac{m + f}{2} \right)}{2}$$

# Analysis Methodology

APPLES participants were divided into quartiles:




(Screen shot from SPSS)

Low and high quartiles were compared for 20 core APPLES variables using t-tests.

# APPLES Core Variables

| APPLES variable | | α |
|---|---|---|
| 1 | Financial motivation | .82 |
| 2 | Family motivation | .87 |
| 3 | Social good motivation | .64 |
| 4 | Mentor motivation | .60 |
| 5 | Math and science confidence | .82 |
| 6 | Professional and interpersonal confidence | .80 |
| 7 | Confidence in solving open-ended problems | .68 |
| 8 | Perceived importance of math and science skills | .79 |
| 9 | Perceived importance of professional and interpersonal skills | .83 |
| 10a | Extra-curricular fulfillment – non-engineering | .82 |
| 10b | Extra-curricular fulfillment – engineering | -- |
| 11 | Curriculum overload | .78 |
| 12 | Academic disengagement in engineering classes | .86 |
| 13 | Academic disengagement in liberal arts classes | .88 |
| 14 | Frequency of interaction with instructors | .74 |
| 15 | Satisfaction with instructors | .72 |
| 16 | Financial difficulties | -- |
| 17 | Overall satisfaction with collegiate experience | -- |
| 18a | Academic persistence | -- |
| 18b | Professional persistence | .80 |

"--" refers to single item variable

# Core Variables – No significant findings

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# Core Variables - Significant findings

| APPLES construct | | α | Low SES | High SES | p |
|---|---|---|---|---|---|
| 1 | Financial motivation | .82 | .656 | .593 | .025 |
| 2 | Family motivation | .87 | .107 | .168 | .013 |
| 5 | Math and science confidence | .82 | .693 | .738 | .017 |
| 7 | Confidence in solving open-ended problems | .68 | .734 | .792 | .001 |
| 9 | Perceived importance of professional and interpersonal skills | .83 | .659 | .592 | .000 |
| 10a | Extra-curricular fulfillment – non-engineering | .82 | .654 | .728 | .013 |
| 10b | Extra-curricular fulfillment – engineering | -- | .344 | .250 | .003 |
| 11 | Curriculum overload | .78 | .596 | .515 | .000 |
| 15 | Satisfaction with instructors | .72 | .679 | .717 | .061 |
| 16 | Financial difficulties | -- | .471 | .170 | .000 |
| 17 | Overall satisfaction with collegiate experience | -- | .719 | .818 | .000 |
| 18b | Professional persistence | .80 | .764 | .663 | .000 |

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# Implication and Next Step

## Implication

- These early findings suggest that researchers may want to control for SES when doing analysis of university students

## Next Steps

- Refine and repeat analysis with APPLES2 data
  - More granularity added to SES operationalization
  - Seeking larger-scale validation of measurement
  - See if these findings hold up with national sample (>4,200 students from 21 institutions)

# Thanks and …

This material is based on work supported by the National Science Foundation under Grant No. ESI-0227558, which funds the Center for the Advancement of Engineering Education (CAEE).


## Questions?

More information (including this paper and others!) can be found at:
**www.applesurvey.org**

# Calculating SES (An Example)

1. **What is the highest level of education that your mother completed? (Mark one)**

2. **What is the highest level of education that your father completed? (Mark one)**

| Mother/Father's education level (*m,f*) | Value |
|---|---|
| Don't know or Not applicable | 0 |
| Did not finish high school | 0.14 |
| Graduated from high school | 0.29 |
| Attended college but did not complete degree | 0.43 |
| Completed an Associate degree (AA, AS, etc.) | 0.57 |
| Completed a Bachelor degree (BA, BS, etc.) | 0.71 |
| Completed a Masters degree (MA, MS, etc.) | 0.86 |
| Completed a Doctoral or Professional degree (JD, MD, PhD, etc.) | 1.0 |

3. **Would you describe your family as: (Mark one)**

| Perceived family income level (*i*) | Value |
|---|---|
| Low income | 0 |
| Middle income | 0.50 |
| Upper-middle income | 0.75 |
| High income | 1.0 |

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| Upper-middle income | 0.75 |
| High income | 1.0 |

**A subject who reports to have a mother with a professional degree, a father with a bachelor degree and a perceived family income of "middle" would be assigned the following values for each: *m*=1.0, *f*=0.71, *i*=0.5**

# Calculating SES (An Example) - continued

A subject who reports to have a mother with a professional degree, a father with a bachelor's degree and a perceived family income of "middle" would be assigned the following values for each:

*m*=1.0
*f*=0.71
*i*=0.5

$$SES = \frac{i + \left(\frac{m + f}{2}\right)}{2} = \underline{.667}$$

This subject would be in the middle-high SES quartile.