

APS and SEED: Introduction and Methodology



Cynthia J. Atman and Sheri D. Sheppard, Moderators

Presentation based on research led by Cindy Atman, Lorraine Fleming, Ron Miller, Sheri Sheppard, Karl Smith, Reed Stevens, Ruth Streveler, Jennifer Turns



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CAEE is a collaboration of five partner universities: Colorado School of Mines, Howard University, Stanford University, University of Minnesota, and University of Washington.

For further information see the CAEE Web site at <http://www.engr.washington.edu/caee> or contact Cindy Atman at caee@engr.washington.edu

Addressing Three Aspects of Engineering Education

- Academic Pathways Study (APS); **students**
- Studies of Engineering Educator Decisions (SEED); **faculty**
- Institute for Scholarship in Engineering Education (ISEE); building **rigorous research capability**

Academic Pathways Study Research Questions

And....Implications for Educational Practice...

- **Skills**
How do students' skills and knowledge develop and change over time?
- **Identity**
How do students come to identify themselves as engineers?
- **Education**
What elements of a student's education contribute to changes observed in skills and knowledge development?
- **Workplace**
What skills do early career engineers need?

APS Details

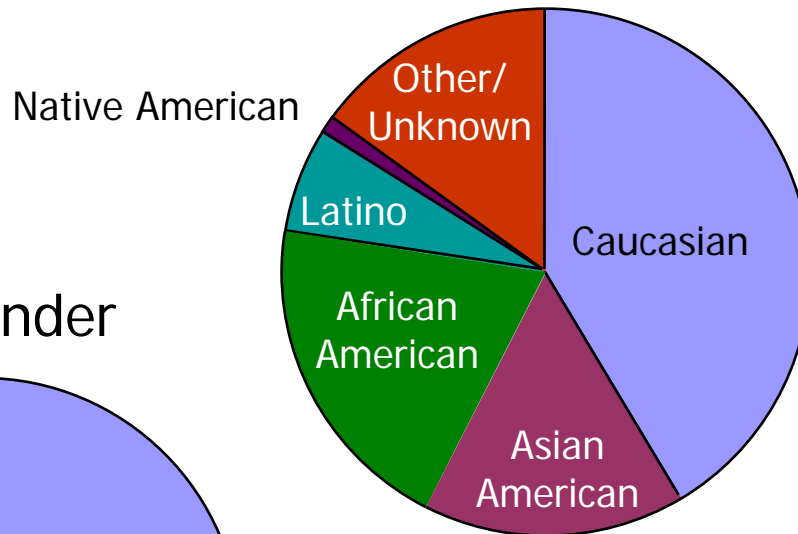
Sheppard (Lead), Atman, Fleming, Miller, Smith, Stevens, Streveler

- Large scale, multi-method study of undergraduate engineering students
- 3 cohorts of student participants
- 1 cohort of early career engineers
- Research on the engineering learning experience *from the student perspective*

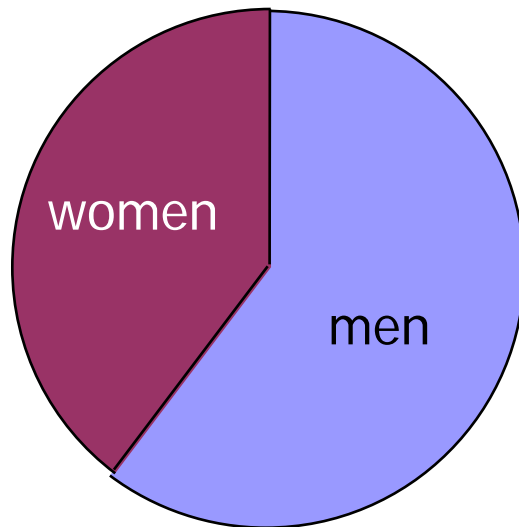
Longitudinal Cohort

(160 total - 40 undergraduates per school; Fall 2003)

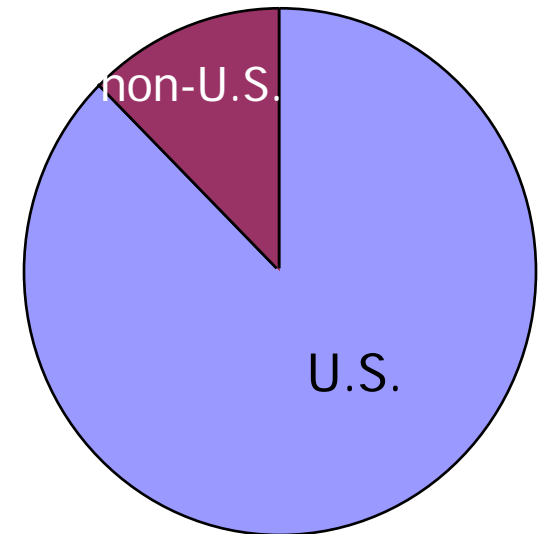
by race/ethnicity



by gender



by citizenship



APS Institution Descriptions

- Large Public University
- Suburban Private University
- Technical Public Institution
- Urban Private University

APS Longitudinal Cohort Research Methods

- Surveys
- Structured interviews
- Ethnographic interviews and observations
- Engineering design tasks
- Supplementary data
 - academic transcripts
 - exit interviews

Longitudinal Cohort Design

Breadth →

Depth ↓

	Low Contact Group	Medium Contact	High Contact
	<p>Target N = 96 (24 per school)</p> <ul style="list-style-type: none">• 7 Surveys• 3 Structured Interviews• 3 Engr. Design Tasks• Academic Transcripts• Exit Interview if needed	<p>Target N = 32 (8 per school)</p> <ul style="list-style-type: none">• 7 Surveys• 1 Struct Interv• 4 Semi-struc Interviews• 4 Engr. Design Tasks• Academic Transcripts• Exit Interview if needed	<p>Target N = 32 (8 per school)</p> <ul style="list-style-type: none">• 7 Surveys• 4 Semi-struc Interviews• 3 Engr. Design Tasks• Field Observations*• Academic Transcripts• Exit Interview if needed

*Field Observations were limited after the first year

Longitudinal Cohort Papers Monday

AC2008-1307 Moving From Pipeline Thinking to Understanding Pathways: Findings from the Academic Pathways Study of Engineering Undergraduates

AC2008-906 Academic Pathways Study: Processes and Realities

AC2008-1034 From PIE to APPLES: The Evolution of a Survey Instrument to Explore Engineering Student Pathways

AC2008-1039 Engineering Students Define Diversity: An Uncommon Thread

AC2008-1010 Socioeconomic Status and the Undergraduate Engineering Experience: Preliminary Findings From Four American Universities

AC2008-768 Same Courses, Different Outcomes? Variations in Confidence, Experience, and Preparation in Engineering Design

Longitudinal Cohort Papers Tuesday

AC2008-827 A Qualitative Study of the Early Work Experiences of Recent Graduates in Engineering

AC2008-2433 Students' Changing Images of Engineering and Engineers

AC2008-960 Being and Becoming: Gender and Identity Formation of Engineering Students

AC2008-950 Will I Succeed in Engineering? Using Expectancy-Value Theory in a Longitudinal Investigation of Students' Beliefs

AC2008-985 Graduate School or Not: Engineering Students Consider Continuing Their Education in Co-terminal Programs

AC2008-1199 We All Take Learners Into Account In Our Teaching: Wait, Do We?

APS Participants

- Longitudinal Cohort – 160 at 4 schools (2003-2007)
- Broader Core Sample – 842 at 4 schools (2007)
- Broader National Sample – 4,200+ at 21 national institutions (2008)

Survey Instruments

- Academic Pathways of People Learning Engineering Survey (APPLES)
 - Administered to Broader Core and Broader National Samples
 - Goal to corroborate findings from the PIE survey at a larger set of institutions and sample size
 - PIE survey modified for a shorter time-to-take
- Broader Sampling Papers in Monday's Session

AC2008-1034

From PIE to APPLES: The Evolution of a Survey Instrument to Explore Engineering Student Pathways

AC2008-1010

Socioeconomic Status and the Undergraduate Engineering Experience: Preliminary Findings From Four American Universities

APS Participants

- Longitudinal Cohort – 160 at 4 schools (2003-2007)
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- **Workplace Cohort – over 40 at 7 private companies and 2 public sector organizations (2005-08). Paper on Tuesday**

AC2008-
827

A Qualitative Study of the Early Work Experiences
of Recent Graduates in Engineering

Results of Analysis:

- Stories of engineering learning...*from the students' perspective*
- Linking with stories of engineering teaching...*from the faculty perspective*

AC2008-1199 We All Take Learners Into Account In Our Teaching: Wait, Do We?

- Strength of the multi-method, multi-institution approach
- Development of instruments that can be adapted for use at other institutions

Remainder of Today's Session

- Next 6 papers will present research results from CAEE's research
- Discussion period at the end of the session with all of the authors

CAEE Papers on Monday

- AC2008-1307 Moving From Pipeline Thinking to Understanding Pathways: Findings From the Academic Pathways Study of Engineering Undergraduates
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Methods Backup Slides

Survey Instruments

- Persistence in Engineering (PIE) survey instrument
 - Seven administrations to Longitudinal Cohort
 - Over 100 items comprising approximately 25 constructs that ranged from motivations for studying engineering, to enjoyment of and engagement with the curriculum

Structured Interviews

- Administered to subset of Longitudinal Cohort
- Focus on engineering education and identity development
- Added insights to the PIE survey by exploring topics that were more suited to qualitative analysis
- Interviews averaged one hour in length and included approximately 28 questions

Ethnographic Interviews and Observations

- Administered to subset of Longitudinal Cohort
- Enabled researchers to glean aspects of engineering student culture and everyday life experiences through open-ended questions
- Additional field observations of participants (e.g., project work and extra-curricular activities)
- Interviews ranged from one to three hours, depending on the student

Engineering Design Activities

- Administered to subset of Longitudinal Cohort
- A combination of tasks and survey questions:
 - Engineering design tasks designed to investigate how students approach engineering problems at various stages of their academic careers
 - Specific survey questions relating to students' conceptions of design and engineering work