APS and SEED: Introduction and Methodology

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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

- Caucasian
- Asian American
- African American
- Latino
- Other/Unknown
- Native American

by gender

- women
- men

by citizenship

- non-U.S.
- U.S.
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

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<td><strong>Low Contact Group</strong>&lt;br&gt;Target N = 96&lt;br&gt;(24 per school)&lt;br&gt;• 7 Surveys&lt;br&gt;• 3 Structured Interviews&lt;br&gt;• 3 Engr. Design Tasks&lt;br&gt;• Academic Transcripts&lt;br&gt;• Exit Interview if needed</td>
<td><strong>Medium Contact</strong>&lt;br&gt;Target N = 32&lt;br&gt;(8 per school)&lt;br&gt;• 7 Surveys&lt;br&gt;• 1 Struc Interv&lt;br&gt;• 4 Semi-struc Interviews&lt;br&gt;• 4 Engr. Design Tasks&lt;br&gt;• Academic Transcripts&lt;br&gt;• Exit Interview if needed</td>
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<td><strong>High Contact</strong>&lt;br&gt;Target N = 32&lt;br&gt;(8 per school)&lt;br&gt;• 7 Surveys&lt;br&gt;• 4 Semi-struc Interviews&lt;br&gt;• 3 Engr. Design Tasks&lt;br&gt;• Field Observations*&lt;br&gt;• Academic Transcripts&lt;br&gt;• Exit Interview if needed</td>
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*Field Observations were limited after the first year*
### Longitudinal Cohort Papers Monday

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<tr>
<td>AC2008-1307</td>
<td>Moving From Pipeline Thinking to Understanding Pathways: Findings from the Academic Pathways Study of Engineering Undergraduates</td>
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<td>We All Take Learners Into Account In Our Teaching: Wait, Do We?</td>
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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)
• Broader Core Sample – 842 at 4 schools (2007)
• Broader National Sample – 4,200+ at 21 national institutions (2008)
• 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*

• 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

AC2008-906  Academic Pathways Study: Processes and Realities

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