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

Center for the Advancement of Engineering Education

PIE vs. APPLES

• Longitudinal (7x)
  • 160 students paid $175 annually
  • Up to 40 minutes to complete

• Cross-sectional (1x)
  • 4,200+ students paid $4
  • 10 minutes to complete
Variables common to both PIE and APPLES instruments

- Academic and professional persistence
- Motivations for studying engineering
- Confidence in engineering-related skills and abilities
- Perceived importance of engineering-related skills and abilities
- Extracurricular involvement
- Curriculum overload
- Academic disengagement
- Exposure to and knowledge of the engineering profession
- Overall satisfaction with collegiate experience
- Interactions and satisfaction with instructors
PIE to APPLES Transition

• Reworded prompts and items
• Identified variables to be carried over
• Improved the measurement of common variables
• Added new variables
Prompt and Item Wording

- Will the items make sense to all survey respondents?
- PIE: engineering students from one academic year
- APPLES: engineering (current, former, and prospective) students; all academic years as well as transfer and part-time students
Which PIE variables should be carried over to APPLES?

• Based on the preliminary analysis of PIE data, identified promising variables
  – Analysis of persister vs. non-persister differences

• Looked at Cronbach’s alpha scores from PIE, APPLES1 (Spring 2007), pilot tests
  – Generally speaking, for this kind of exploratory work, an alpha of .7 or above is acceptable
## Financial Motivation

<table>
<thead>
<tr>
<th></th>
<th>PIE  α</th>
<th>APPLES 2007 α</th>
<th>APPLES 2008 α</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineers are well paid.</td>
<td>.76</td>
<td>.82</td>
<td>.81</td>
</tr>
<tr>
<td>Engineers make more money than most other professionals.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>An engineering degree will guarantee me a job when I graduate.</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
Improving the measurement of PIE variables to be carried over

• The Cronbach’s alphas were used to identify scales with low internal reliability such as Motivation (Mentor Influence)
• New items were piloted and then added to APPLES 2008
# Motivation (Mentor Influence) Alphas

<table>
<thead>
<tr>
<th></th>
<th>PIE</th>
<th>APPLES 2007</th>
<th>APPLES 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>A faculty member, academic advisor, TA or other university affiliated person inspired me to study engineering.</td>
<td>.65</td>
<td>.60</td>
<td>.77</td>
</tr>
<tr>
<td>A non-university affiliated mentor has encouraged and/or inspired me to study engineering.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NEW:</strong> A mentor has introduced me to people and opportunities in engineering.</td>
<td></td>
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</table>
New APPLES variables

• Based on responses to the open-ended question in APPLES 2007: *Is there anything else you want to tell us about your experiences in engineering?*

• 2 new variables added to APPLES 2008: Intrinsic Motivation: Psychological and Behavioral
Intrinsic Motivation

**Psychological** (α=.75)
- I think engineering is fun.
- I think engineering is interesting.
- I feel good when I am doing engineering.

**Behavioral** (α=.72)
- I like to figure out how things work.
- I like to build stuff.
Dissemination of Findings

- Reports for institutions participating in APPLES
- PIE analysis in the final stages
  - Paper focusing on the longitudinal aspects
- APPLES analysis ongoing
  - Paper focusing on the generalizability of longitudinal findings
  - Pragmatically, provides participating institutions with data they can act on
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Frequency of Interaction with Instructors

<table>
<thead>
<tr>
<th></th>
<th>PIE ( \alpha )</th>
<th>APPLES 2007 ( \alpha )</th>
<th>APPLES 2008 ( \alpha )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructors during class</td>
<td>.69</td>
<td>.74</td>
<td>.70</td>
</tr>
<tr>
<td>Instructors during office hours</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instructors outside of class or office hours</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
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