Engineering Curriculum Change: Summary Survey Results

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Glean insights into how universities worldwide define the “Future Engineer” and uncover hurdles to overcome and success factors to build-in so these ideals can be effectively and sustainably integrated into the curriculum.
Background and methodology

Curriculum change GOALS

TARGET ATTRIBUTES

DISCUSSION TOPICS
Background and methodology
Aim of the Survey

1. Identify **GOALS** of engineering curriculum change around the world

2. Identify **BARRIERS & KEY SUCCESS FACTORS** in those change efforts

3. Identify critical **ATTRIBUTES** of new engineering graduates

4. **Assess the success** programs have had instilling those attributes in their graduates.
Two ways of driving respondents to survey:
• Targeted email blast (>3000 recipients)
• Survey URL posted on Purdue website
355 total submissions (some unusable)

204 participants from 136 different colleges/universities and 2 different high schools

77% of respondents employed by U.S. institutions; 23% outside of the U.S.
Curriculum Change Goals
INSTITUTION ENGAGED IN CURRICULUM CHANGE

- **No**: 46%
- **Yes**: 54%

**Base:** Total answering (N=201)

**Source:** Is your institution engaged in a significant program of change in its curriculum?

**At what level is your institution engaged in curriculum change?**

**Base:** Institution engaged in curriculum change (N=93)

- **Institution**: 19%
- **Department**: 35%
- **College/School**: 46%
The majority of respondents indicated that their institution was involved in some curriculum change, most often at the college- or department-level.

Changes were often sought to allow for an academic experience that is more relevant/practical and grounded in hands-on/experiential and/or interdisciplinary learning.

- A secondary reason for change was to become more streamlined and/or eliminate redundancies within the curriculum.
- Biggest Obstacle:

- Biggest Success Factor:
Biggest Obstacle: FACULTY

Biggest Success Factor:
- Biggest Obstacle: FACULTY

- Biggest Success Factor: FACULTY
### SUCCESS OF CHANGE

| Source: How would you rate the effectiveness of your curriculum change? |
|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| Extremely successful | Very successful     | Moderately successful | Somewhat successful | Few minor successes | Stuck in neutral   | Not at all successful |
| 10%                 | 28%                | 34%                | 18%                | 4%                 | 6%                 | 0%                 |

**62%**
http://mech.ubc.ca/undergraduate-students/mech-2/
http://es21c.okstate.edu
http://www.newhaven.edu/9454/
http://engineering.utep.edu/create/index.html
http://www.livingwiththelab.com
http://www.uc.edu/conversion.html
http://carpintero.uis.edu.co/eisi/eisi.jsp?IdServicio=S74ch
http://www.grandchallengescholars.org/
https://engineering.purdue.edu/Engr/Academics/Engineer2020/
Target Attributes Analysis
In the table below is a list of 20 skills and attributes that the Purdue College of Engineering has selected as key points of focus to guide future change in our engineering curricula. Your institution may share some of these but not others, or may have entirely different ideas about what should be included.

For each attribute, indicate in the first column if the item IS or IS NOT a focus for your institution. If you answer no, ignore the last two columns. In the second column, rate the importance of the attribute to your institution and in the last column, rate the level of success you feel you have had in integrating the attribute into your curricula.

Please feel free to enter any other attributes your institution has adopted at the end of the table.

<table>
<thead>
<tr>
<th>Leadership</th>
<th>Is this a focus for you?</th>
<th>Level of Importance</th>
<th>Level of Success</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td>High</td>
</tr>
<tr>
<td>Teamwork</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strong Work Ethic</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Communication</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Innovation</td>
<td></td>
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<tr>
<td>Entrepreneurship</td>
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<tr>
<td>Decision Making</td>
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<td></td>
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<tr>
<td>Adaptability</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Managing Change</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethical Awareness</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Examples of Other Attributes Cited

- Professionalism
- competitiveness
- Sustainability
- Developing personal, social, moral responsibility
- Curiosity
- Career Development
- integrating engineering with languages
## 20 Attributes Tested

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Focus for you</th>
<th>High Importance*</th>
<th>Complete integration*</th>
<th>Beginning integration*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teamwork</td>
<td>97%</td>
<td>76%</td>
<td>40%</td>
<td>4%</td>
</tr>
<tr>
<td>Communication</td>
<td>94%</td>
<td>77%</td>
<td>28%</td>
<td>7%</td>
</tr>
<tr>
<td>Open Ended Design and Problem Solving</td>
<td>90%</td>
<td>74%</td>
<td>34%</td>
<td>9%</td>
</tr>
<tr>
<td>Strong Engineering Fundamentals</td>
<td>90%</td>
<td>89%</td>
<td>58%</td>
<td>2%</td>
</tr>
<tr>
<td>Strong Science &amp; Math Foundation</td>
<td>88%</td>
<td>81%</td>
<td>54%</td>
<td>5%</td>
</tr>
<tr>
<td>Analytical Skills</td>
<td>88%</td>
<td>75%</td>
<td>43%</td>
<td>5%</td>
</tr>
<tr>
<td>Integration of Analytical, Problem Solving</td>
<td>87%</td>
<td>65%</td>
<td>24%</td>
<td>13%</td>
</tr>
<tr>
<td>Ethical Awareness</td>
<td>86%</td>
<td>56%</td>
<td>22%</td>
<td>20%</td>
</tr>
<tr>
<td>Lifelong Learner</td>
<td>85%</td>
<td>51%</td>
<td>16%</td>
<td>25%</td>
</tr>
<tr>
<td>Multidisciplinarity Within &amp; Beyond Engineering</td>
<td>75%</td>
<td>39%</td>
<td>18%</td>
<td>26%</td>
</tr>
<tr>
<td>Innovation</td>
<td>73%</td>
<td>56%</td>
<td>17%</td>
<td>46%</td>
</tr>
<tr>
<td>Leadership</td>
<td>73%</td>
<td>47%</td>
<td>10%</td>
<td>18%</td>
</tr>
<tr>
<td>Global Competency</td>
<td>72%</td>
<td>44%</td>
<td>11%</td>
<td>45%</td>
</tr>
<tr>
<td>Strong Work Ethic</td>
<td>70%</td>
<td>72%</td>
<td>40%</td>
<td>15%</td>
</tr>
<tr>
<td>Diversity</td>
<td>67%</td>
<td>52%</td>
<td>13%</td>
<td>22%</td>
</tr>
<tr>
<td>Decision Making</td>
<td>66%</td>
<td>41%</td>
<td>9%</td>
<td>26%</td>
</tr>
<tr>
<td>Entrepreneurship</td>
<td>62%</td>
<td>30%</td>
<td>11%</td>
<td>46%</td>
</tr>
<tr>
<td>Synthesize Engineering, Business &amp; Social Systems</td>
<td>58%</td>
<td>31%</td>
<td>6%</td>
<td>36%</td>
</tr>
<tr>
<td>Adaptability</td>
<td>52%</td>
<td>38%</td>
<td>13%</td>
<td>26%</td>
</tr>
<tr>
<td>Managing Change</td>
<td>34%</td>
<td>40%</td>
<td>2%</td>
<td>24%</td>
</tr>
</tbody>
</table>
The majority of survey participants agreed that their institution was focused on 19 of the 20 attributes selected by Purdue College of Engineering as key points of focus.

- Lone exception was “managing change”
Attributes most often completely integrated into the curriculum included:

- Strong engineering fundamentals
- Strong science and math foundation
- Analytical skills
- Teamwork

Attributes most frequently only beginning to be integrated into the curriculum were:

- Innovation
- Entrepreneurship
- Global competency
- Synthesize engineering, business & social factors
See the following URL for more analysis of the survey:

http://cobweb.ecn.purdue.edu/~wiliams/E2020/
1. Distributing design through the curriculum
2. Achieving truly multidisciplinary experiences
3. Achieving meaningful global competency
4. Moving beyond traditional lecture
5. Integrating professional skills
6. Streamlining the curriculum
7. Developing strategies for effective change
8. Developing engineering faculty for the 21st century