The Importance & Development of Engineering Leadership

ICTIEE, Hyderabad; January 2019

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A leader is one who knows the way, goes the way and shows the way.

—John Maxwell
Why is leadership important to engineering?
Why?

• Industry needs engineers who
  • Work in teams, lead teams
  • Understand the broader picture
  • Work with non-technical staff
  • Manage people and resources

• But, engineering executives report that when relatively inexperienced engineers run their first projects, they FAIL.

• Accreditation criteria

  ABET criteria 2019-20 (outcomes): an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

https://www.youtube.com/watch?v=-NuAvAGwu8Q
Attributes employers seek on a candidate’s resume

Source: *Job Outlook 2017*, National Association of Colleges and Employers

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Percentage of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ability to work in a team</td>
<td>78.0%</td>
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<tr>
<td>Problem-solving skills</td>
<td>77.3%</td>
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<tr>
<td>Communication skills (written)</td>
<td>75.0%</td>
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<tr>
<td>Strong work ethic</td>
<td>72.0%</td>
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<tr>
<td>Communication skills (verbal)</td>
<td>70.5%</td>
</tr>
<tr>
<td>Leadership</td>
<td>68.9%</td>
</tr>
<tr>
<td>Initiative</td>
<td>65.9%</td>
</tr>
<tr>
<td>Analytical/quantitative skills</td>
<td>64.4%</td>
</tr>
<tr>
<td>Flexibility/adaptability</td>
<td>63.6%</td>
</tr>
<tr>
<td>Detail-oriented</td>
<td>62.1%</td>
</tr>
<tr>
<td>Interpersonal skills (relates well to others)</td>
<td>58.3%</td>
</tr>
<tr>
<td>Technical skills</td>
<td>56.8%</td>
</tr>
<tr>
<td>Computer skills</td>
<td>49.2%</td>
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<tr>
<td>Organizational ability</td>
<td>47.7%</td>
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<tr>
<td>Strategic planning skills</td>
<td>37.9%</td>
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<tr>
<td>Friendly/outgoing personality</td>
<td>25.8%</td>
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<tr>
<td>Tactfulness</td>
<td>25.8%</td>
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<tr>
<td>Creativity</td>
<td>21.2%</td>
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<tr>
<td>Entrepreneurial skills/risk-taker</td>
<td>19.7%</td>
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<tr>
<td>Fluency in a foreign language</td>
<td>4.5%</td>
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The World’s Grand Challenges will require ENGINEERING LEADERSHIP
India’s Top 7 Challenges (WEF)

1. Education and skills
2. Urbanization
3. Health
4. Sanitation
5. Gender
6. Water Scarcity
7. Transparency

https://www.weforum.org/agenda/2014/11/seven-key-priorities-indias-future/
But, leadership development comes too late!
Leadership development in academia & industry

• @ engineering curriculum - inexistent or serendipitous at best
  • students understand the importance of leadership but have little confidence in their leadership abilities

• @ workplace – while supervising begins ~ 30 years, first leadership training happens at 42 years of age.
  • 97% of employers think leadership development should begin by 21 years or earlier

Paul & Gradon, Schulich School of Engineering, University of Calgary, Canada, 2015
2012 Leadership Insights Survey - Center for Creative Leadership (CCL). Survey of business, government, nonprofit, and education leaders, male and female 462 respondents from around the world
“The symptoms of “engineering without leadership” include organizational indecision about new products and services, disagreements between product management and engineering, delayed and halted projects, reduced R&D productivity, poor technology strategies, team morale and retention issues, and overall poor competitive performance”.

- Berkeley Engineering Leadership Program
How can we integrate leadership development in the engineering curriculum?
Follow suggested curriculum innovation steps

1. Define and validate competencias/learning outcomes
2. Plan the teaching/learning process (when, who, how)
3. Measure and analyze outcomes
4. Share and discuss results
5. Make decisions to improve and re-engineer
outcomes/competency based curriculum

“backward design”
Integrating leadership competencies into the curriculum

1. Course
   - Workshop
   - Experience
   - etc

2. Course
   - Course
   - Experience
   - etc

3. Course
   - Course
   - Internship
   - Research
   - etc

4. Course
   - Course
   - Internship
   - Capstone Design

Students → Engineering Graduate
Competencies
leadership
Engineering leadership skills & attitudes

**Vision:** Ability to create and share compelling image of the future

**Initiative:** Willingness to fulfill the vision through an appropriate course of action to move from abstraction to implementation

**System Thinking:** Understanding the linkages and interactions between the components that comprise the entirety of the system

**Strategic Focus:** Ability to look forward and see the bigger picture, to think at a higher level than what’s on your daily action list

**Resourcefulness:** Willingness to embrace various views to respond to change, and take alternative courses of action when necessary

- Communication
- Interpersonal Skills
- Ethical Actions and Integrity
- Decision Making
- Responsibility and Determination
- Self-Awareness and Self-Improvement
- Engage and Connect
- Negotiate and Compromise
Beihang University SGE Curriculum Model

YEAR 1
Courses
Course projects with industry, start-ups, community (s, m, b)

YEAR 2
Courses

YEAR 3
Courses

YEAR 4
Courses

Graduates with 8 Learning Outcomes (ABET)

Incoming students

Industry Advisory Board | Partner Universities | Continuous Assessment for Improvement

US-GLOBAL Engineering Grand Challenges Scholars Program

BeihangU Engineering Leadership Program

IIDEAX FACTORY

Industry Internships | Student e-portfolios | Project Fair
Job Fair | Industry Seminars | Music/Arts/Sports Activities…
Engineering Leadership Certificate Program at Beihang University
(4 badges; 4 credits)

<table>
<thead>
<tr>
<th>Leadership Fundamentals I</th>
<th>Leadership Fundamentals II</th>
<th>Leadership Fundamentals III</th>
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<tbody>
<tr>
<td>1 credit</td>
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<tr>
<td>Summer 1</td>
<td>Summer 2</td>
<td>Summer 3</td>
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<tr>
<td>Delineate CEEL Profile &amp;</td>
<td>360° Leadership Feedback</td>
<td>360° Leadership Feedback</td>
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<tr>
<td>Launch PLDP</td>
<td>&amp; PLDP Reassertion</td>
<td>&amp; PLDP Closure</td>
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<td>Emotional Intelligence (EI)</td>
<td>Emotional Intelligence (EI)</td>
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<td>Assessment</td>
<td>Assessment - Follow-up</td>
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<tr>
<td>Leadership Development</td>
<td>Leadership Development</td>
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<tr>
<td>Workshops</td>
<td>Internship</td>
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<td>Leadership Development Labs</td>
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<td>Workshops</td>
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<td>Engineering Leader Interview</td>
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**Leadership Fundamentals IV**

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<tbody>
<tr>
<td>Long-term project</td>
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<td>Major Project (GCSP or other approved)</td>
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Earning Badge 1!
“If your actions inspire others to dream more, learn more, do more and become more, you are a leader.”
- John Quincy Adams

“Leadership is the constructive influencing of others to achieve organizational objectives in the way to convert ideas into reality”.
- First Group of ELP Students, Beihang University
To learn more about Beihang University Engineering Leadership Program
download paper @ www.luenymorell.com
Thank you!
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