Educational Innovation and ABET-Accredited Programs: Can They Co-Exist?

Examples from Research

Ann F. McKenna
Arizona State University

ASEE Annual Conference and Exposition
Vancouver, BC, Canada
June 29, 2011
Collaborative Research - Teaching the Global, Economic, Environmental, and Societal Foundations of Engineering Design through Product Archaeology

Kemper Lewis and Deborah Moore-Russo University at Buffalo – SUNY
Timothy Simpson and Gul Kremer, Penn State University
Wei Chen, Northwestern University    Ann McKenna, Arizona State University

CCLI/TUES Type II: DUE-0920259, 0920047, 0919724
• the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
Product Archaeology

• the process of reconstructing the lifecycle of a product – the customer requirements, design specifications, and manufacturing processes used to produce it – to understand the decisions that led to its development.

• Phases:
  • Preparation: background research about a product, including market research, patent searches, benchmarking existing products
  • Excavation: digging, exploring, searching for evidence
  • Evaluation: chronological, social, environmental, and technical analysis
  • Explanation: theory development and discussions
Examples of Activities

Solar Power

Clean Water

Sustainable Infrastructure
Lisa R. Lattuca  
Professor of Education and Senior Scientist

Patrick T. Terenzini  
Distinguished Professor of Education and Senior Scientist Emeritus

Gül E. Kremer  
Associate Professor of Engineering Design and Industrial Engineering

Thomas A. Litzinger  
Professor of Mechanical Engineering and Director of the Leonhard Center

Betty J. Harper and Alexander C. Yin  
Senior Project Associates

Kevin W. Barron, Saraj Gupta, David B. Knight, Amber D. Lambert, India M. McHale, Daniel S. Merson, David Perez II, Hyun Kyoung Ro, and Travis T. York  
Graduate Research Assistants

Ardie D. Walser  
Associate Professor of Electrical Engineering and Dean of Undergraduate Studies

Latif Jiji  
Herbert G. Kayser Professor of Mechanical Engineering
P360 Prototyping the Engineer of 2020: A 360-degree Study of Effective Education
http://www.ed.psu.edu/educ/e2020

Lisa R. Lattuca, Professor of Education & Senior Scientist
Patrick T. Terenzini, Distinguished Professor of Education & Senior Scientist Emeritus
Gül E. Kremer, Associate Professor, Engineering Design and Industrial Engineering
Betty J. Harper and Alexander C. Yin, Senior Project Associates
Kevin Barron, Saraj Gupta, Hyun Kyoung Ro, India McHale, David Knight, Dan Merson,
David Perez, and Travis York, Graduate Research Assistants

Betsy Palmer, Associate Professor of Education
Sarah L. Codd, Associate Professor of Mechanical and Industrial Engineering
Carolyn S. Plumb, Director of Educational Innovation and Strategic Projects
Barbara Komlos, Graduate Research Assistant

Rose M. Marra, Associate Professor of Learning Technologies
Katie Piacentini, Graduate Research Assistant

Ann F. McKenna, Associate Professor of Engineering, Arizona State University
Lois C. Trautvetter, Assistant Professor and Associate Director, Higher Education Administration, and Policy
Tonya Saddler, Post-Doctoral Student
Carla Cortes, Graduate Research Assistant
Related ABET Accreditation Criteria

- (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- (d) an ability to function on multi-disciplinary teams
- (f) an understanding of professional and ethical responsibility
- (g) an ability to communicate effectively
- (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

Attributes of the Engineer of 2020

- Strong analytical skills
- Practical ingenuity, creativity
- Communication competencies (oral, written, and cultural)
- Business, management, and leadership skills
- High ethical standards and professionalism
- Agility, resilience, flexibility
## P2P Participating Institutions

### Research Institutions (n = 19)
- Arizona State University (Main & Polytechnic)
- Brigham Young University
- Case Western Reserve University
- Colorado School of Mines
- Dartmouth College
- Johns Hopkins University
- Massachusetts Institute of Technology
- Morgan State University
- New Jersey Institute of Technology
- North Carolina A&T
- Purdue University
- Stony Brook University
- University of Illinois at Urbana-Champaign
- University of Michigan
- University of New Mexico
- University of Texas, El Paso
- University of Toledo
- Virginia Polytechnic Inst. and State University

### Master’s Institutions (n = 6)
- California Polytechnic State University
- California State University, Long Beach
- Manhattan College
- Mercer University
- Rose-Hulman Institute of Technology
- University of South Alabama

### Baccalaureate/Special Institutions (n = 6)
- Harvey Mudd College
- Lafayette College
- Milwaukee School of Engineering
- Ohio Northern University
- Penn State Erie, The Behrend College
- West Virginia University Inst. of Technology

---

1 P360 Institution
2 Historically Black Colleges or University
3 Hispanic-Serving Institution
### P360 Case Study Sites

<table>
<thead>
<tr>
<th>Institution</th>
<th>Administrators</th>
<th>Faculty</th>
<th>Students</th>
<th>Other</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASU - Tempe &amp; Polytechnic</td>
<td>24</td>
<td>33</td>
<td>21</td>
<td></td>
<td>78</td>
</tr>
<tr>
<td>Harvey Mudd College</td>
<td>11</td>
<td>20</td>
<td>24</td>
<td>7</td>
<td>62</td>
</tr>
<tr>
<td>Howard University</td>
<td>12</td>
<td>28</td>
<td>62</td>
<td></td>
<td>102</td>
</tr>
<tr>
<td>MIT</td>
<td>20</td>
<td>17</td>
<td>16</td>
<td></td>
<td>53</td>
</tr>
<tr>
<td>University of Michigan</td>
<td>27</td>
<td>31</td>
<td>45</td>
<td>8</td>
<td>103</td>
</tr>
<tr>
<td>Virginia Tech</td>
<td>11</td>
<td>30</td>
<td>21</td>
<td></td>
<td>70</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>105</strong></td>
<td><strong>159</strong></td>
<td><strong>189</strong></td>
<td><strong>15</strong></td>
<td><strong>468</strong></td>
</tr>
</tbody>
</table>
The College Experience: A Conceptual Framework (Adapted from Terenzini & Reason, 2005)

- Precollege Characteristics & Experiences
  - Sociodemographic Traits
  - Academic Preparation and Performance
  - Personal & Social Experiences

- Institutional and Program Context
  - Leadership
  - Organizational Structures, Policies, and Practices
  - Academic and Co-Curricular Programs, Policies, & Practices
  - Faculty Culture

- Peer Environment
  - Student Experiences
    - Classroom Experiences
    - Out-of-class Experiences
    - Curricular Experiences

- Outcomes
  - Fundamentals
  - Design
  - Interdisciplinary Competence
  - Contextual Competence
  - Teamwork
  - Communication
  - Leadership
  - Recruit and Retain