ABET, Global Competencies in STEM Education, and Future Challenges

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Topics

- Who is ABET?
- ABET’s Global Engagement
- Competencies for Global Technical Professionals
- How we Influence Programs
- Examples
- Future Challenges
Who is ABET?

ABET Essentials
ABET is a *Program Accreditor*
Also called “Specialized” Accreditor

- Not-for-profit organization
- Evaluates academic programs
  - Not Institutions, degrees, or courses
  - AS, BS, MS levels
- Programs are relevant, technically strong
  - Technical and professional skills
- Peer review process
  - Evaluators from ABET’s technical societies
- Quality assurance
  - Inspires confidence that graduates are prepared to enter the profession
ABET Mission

ABET serves the public globally through the promotion and advancement of education in applied science, computing, engineering, and engineering technology
ABET Vision

Provide world leadership in assuring quality and stimulating innovation in

- Applied Science
- Computing
- Engineering, and
- Engineering Technology Education
ABET’s 34 Member Societies

- 1.5 million individual members
- Represent the “profession”
ABET Program Evaluators

Academe, Industry, Government

- Academe: 68.7% (1,087)
- Industry: 28.6% (452)
- Government: 1.8% (28)
- Other: 0.9% (15)
Components of ABET Accreditation

- “Outcomes-based” Criteria (“EC2000”)
  - “What is learned” vs. “what is taught”
  - Focus on constituent needs
  - Prepare graduates to enter “the profession” (AS, BS, MS)
  - Encourages program innovation, “uniqueness”
    - International engagement: prepare students for globalization through international exchanges, study abroad, foreign work experience, etc.
    - Entrepreneur skills, enhanced liberal arts education

- Continuous Quality Improvement
  - Formal assessment processes

- 18-month Evaluation Process
  - Self-Study, Campus Visit, Decision Meeting
Global Quality Assurance

ABET’s Global Engagement
Why a Global Focus for ABET?

- Global Education
  - International Students
  - Global Institutions
  - Growth of (global) Distance Learning

- Global Business
  - Global technical professionals

- Developing Nations & Economies
  - Rapid growth in technical capacity building

- Global Challenges
# Global Challenges

<table>
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<tr>
<th>Environment</th>
<th>World Population</th>
<th>Clean Water</th>
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<tr>
<td>Conflict</td>
<td>Aging Population</td>
<td>Energy</td>
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ABET’s Global Engagement
Consistent with ABET’s Mission & Vision

- Overarching goals
  - Assist in the development & advancement of technical education worldwide
  - Promote quality and innovation
- Accredit Programs outside the U.S.
  - 324 programs in 23 countries
- Partnerships
  - Memoranda of Understanding (MOUs)
  - Mutual Recognition Agreements (MRAs)
- Membership in Global Organizations
  - IFEES, GEDC
International Partnerships
Mutual Recognition Agreements (MRAs)

- International agreements
  - Between bodies responsible for accrediting engineering degree programs
- Recognizes “substantial equivalency”
  - of accrediting systems
- Graduates of accredited programs are prepared to practice engineering at the entry level to the profession
International Engineering Alliance (IEA)

- Washington Accord*
  - Engineering
- Sydney Accord*
  - Engineering Technology
- Dublin Accord*
  - Engineering Technician
- APEC Engineer Agreement
  - Asia Pacific Economic Cooperation
- Engineers Mobility Forum
  - Professional Engineers Register
- Engineering Technologist Forum

* ABET is Full Signatory
Washington Accord Engineering

- **IEAust**: Australia (1989)
- **CEAB**: Canada (1989)
- **IEI**: Ireland (1989)
- **IPENZ**: New Zealand (1989)
- **EngC**: UK (1989)
- **HKIE**: Hong Kong (1995)
- **ECSA**: South Africa (1999)
- **JABEE**: Japan (2005)
- **IES**: Singapore (2006)
- **IEET**: Chinese Taipei (2007)
- **ABEEK**: South Korea (2007)
- **BEM**: Malaysia (2009)
- **MUDEK**: Turkey (2011)
- **AEER**: Russia (2012)
Mutual Recognition Agreements
Seoul Accord

- Founded in 2007
- Computing Programs
  - Computer Science
  - Information Technology (IT)
  - Information Systems (IS)
- Signatories
  - ABEEK (S. Korea), ABET (USA), ACS (Australia), BCS (UK), CIPS (Canada), HKIE (Hong Kong), IEET (Chinese Taipei), JABEE (Japan)
Competencies for
Global Technical Professionals
Professions of the Future

- Immense challenges
  - Large scale, complex systems
  - Multidisciplinary “systems” approach
  - Strong interaction with non-technical experts and the general public
  - Globalization
  - “Technology will solve our problems”
Global Technical Professionals

- Requires unique attributes and skills
  - Work anywhere, with anyone
  - Appreciation for and ability to function in multicultural environment
Global Professional Skill Set

- Requires unique attributes and skills
  - Language, history, cultural sensitivity, and curiosity
  - Understand impact of solutions in global context
  - Ability to reinvent oneself multiple times over a lifetime in response to changing technology and situations
Washington Accord
Global Graduate Attributes

• Engineering Knowledge
• Problem Analysis
• Design/Development of Solutions
• Investigation & Experimentation
• Modern Tool Usage
• The Engineer and Society
• Environment and Sustainability
• Ethics
• Individual and Teamwork
• Communication
• Project Management and Finance
• Lifelong Learning
How we Influence Programs
ABET Criteria
Engineering Accreditation Commission

1. Students
2. Program Educational Objectives
3. Student Outcomes
4. Continuous Improvement
5. Curriculum
6. Faculty
7. Facilities
8. Support
+ Program Specific Criteria (if applicable)
Criterion 2: Program Educational Objectives

- The program must have published program educational objectives that are consistent with the mission of the institution, the needs of the program’s various constituencies, and these criteria. There must be a documented, systematically utilized and effective process, involving program constituencies, for the periodic review of these program educational objectives that ensures they remain consistent with the institutional mission, the program’s constituents’ needs, and these criteria.
Criterion 3: Student Outcomes

Engineering Accreditation Commission

- The program must *demonstrate* that their students attain the following outcomes:
  
a) An ability to apply knowledge of mathematics, science, and engineering

b) An ability to design and conduct experiments, as well as to analyze and interpret data
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
Criterion 3: Student Outcomes

Engineering Accreditation Commission

d) An ability to function on \textit{multidisciplinary teams}

e) An ability to identify, formulate, and solve engineering problems

f) An understanding of \textit{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
Criterion 3: Student Outcomes

Engineering Accreditation Commission

i) A recognition of the need for, and an ability to engage in life-long learning

j) A knowledge of contemporary issues

k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

• Plus any outcomes specific to field of study ("Program Criteria")
Internationalize STEM Education: Examples
Computer Science Exchange

- **Seaton Hall**
  - Johannes Kepler University Linz (Linz, Austria)
  - Math, computer science, German courses
  - Spring/summer semester, junior year

- **Univ of Washington**
  - KTH Royal Institute of Technology, Stockholm
  - ETH Zurich, Switzerland
  - Math, computer science, language courses
  - Year-long programs
Dual Degree International Engineering Programs

- University of Rhode Island
  - BS; BA German, French, Spanish (or Chinese minor)
  - Foreign language & culture each semester
  - 5 Year program (year 4 abroad: school + work)

- Milwaukee School of Engineering
  - Lubeck University of Appl Sci
  - BS from MSOE, Diplom-Ingenieur degree from Lubeck
  - Junior year; courses in German culture and language
  - Attend with German students
Peace Corps International Programs
Master’s in Civil & Environmental Engineering

• MS + Peace Corps Service
  – Enhance quality of life, enhance sustainable development

• Program Skills
  – Ability to work in other countries
  – Ability to write and orally communicate
  – Work in diverse teams; build coalitions and consensus
  – Devise strategies and long range plans
  – Ability to budget and manage projects
International Education Programs
Multiple Formats*

- Dual Degree
- Exchange students
- Extension of home university campus/programs/courses
- Partner Sub-Contract
- Internship or Co-op
- Mentored Travel
- Extended Field Trip
- Project-Based Learning/Service Learning
- Research Abroad

* Alan Parkinson
Organizations
International Engineering Education Focus

- Global Engineering Education Exchange (GE3 of IIE)
- University of Rhode Island Colloquium
- IES Study Aboard
- ASEE Engineering Deans Council
- Global Engineering Deans Council (GEDC)
- International Federation of Engineering Education Societies (IFEES)
- Academic Institutions
- Engineers Without Borders (EWB)
Future Challenges

Education, Students & ABET
Education is **CHANGING**

- Non-traditional students
- Diversity of student population
- Globalization of the workforce

Students are changing: Gen X, Gen Y, Gen Z

- Explosion of distance learning: online education

- “Density” of academic programs

The Internet: a tool for learning
Distance Learning

- Revolutionary change to education
- 6.7 million students online
- Why Online?
  - Improves access, degree completion
  - Attracts students outside traditional service area
Students are Changing

- Digital Natives (Gen Z)
  - Born between mid-1990s and end of 2000s
- Lifelong users of
  - Internet
  - Instant messaging and text messaging
  - MP3 players
  - Cell phones/smart phones
  - Electronic tablets
  - YouTube, Facebook, Twitter, etc.
- Educational experience: What is their expectation?
Challenges to Incorporating more International Content

- Challenges to Changing Curriculum
  - “Inflexibility” of STEM curricula: Perceived and real
  - How to incorporate “international experience” without study abroad
  - Density: increased technical content + enhanced liberal arts
    - Languages, culture, history
    - Advance business skills, entrepreneurship

- Faculty “buy-in”

- ABET
  - Potential or perceived impact on accreditation status
  - Evolution of criteria: include international experience
  - Commitment of ABET’s professional societies
Way Forward

- Technical Education is evolving
  - Globalization
  - Demands from Students
  - Demands from Industry
  - Global Challenges

- ABET encourages Innovation
  - International experiences

- Challenges Ahead
85,000 students graduate from ABET accredited programs each year!
Questions?
Thank You!

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