

# Engineering Education and Globalization

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## Outline


- Current variants in engineering education
- Examples of non-traditional programs
- Global perspectives
- Current realities in Canadian engineering education
- The hard questions
- Summary thoughts

## Current Engineering Education Pedagogical Methods

- A mix, by institution and program, of:
  - Traditional (lecture/lab/tutorial – theory based)
  - “Active” learning (class engaged, actively “doing”)
  - Problem-based learning (driven by application)
  - Project-based learning, JIT with lectures
  - Project-based learning with tutorial support (Sherbrook EE)
  - Virtually all “residential” learning

## Influences on Engineering Education

- Accreditation
- Research funding
- Faculty member interests
- Competition for students
- Employer/practitioner feedback
- Institutional history
- Post-graduate preparation



What is already out there?

## Distance Learning

- Very few accredited engineering programs in NA
- Example: U of North Dakota - 6+yrs, online lectures, on campus labs, proctored exams, ABET accredited
- A few other courses (math, comp, basic science) at various institutions

## “Integrated”/General Engineering

- Typically draw from Mech/Elec/Civil/Chem
- UBC & UWO
- Harvey Mudd/Utah/UK-Bath, Liverpool
- Strong design/project content
- Well suited for SME’s
- Why are there not more?

## “Flexible” Engineering Programs

- Less core content, more student choice
- More discipline specific than “integrated”
- MIT Mech & Aero/Astro “Flexible eng degree”
- Is this really new, or is it marketing?
- Example: Queen’s Civil (minimal core, open electives within AU requirements)

## “Global” Engineering Education

### Current Options...

- Spotty courses exploring global considerations
- Dual degrees with eng & language/culture (Rhode Island... but others in Canada)
- Semester/Year Exchanges – Purdue, Virginia Tech, Queen’s, others
- Course/placements (UBC Global Eng Leadership with Mexico placement – Mech 410)

## UK Example...

### University of Strathclyde, Glasgow

- Undergraduate Department of Design, Manufacture, and Engineering Management
  - Strong design focus with business & mfg elements
  - Accredited in UK, may not meet CEAB
  - Very popular with students and employers
  - Includes a Global Design course with international student teams (Swinburne, Malta)

## Also at Strathclyde...

- “Global Innovation Management” Masters Program
  - 20 students from international locations (quota)
  - First year at Strathclyde
  - Second year at Arlborg or Hamburg
  - Arlborg – project based with industry internship
  - Hamburg – course based
  - Global Design course is core

## Graduate Attributes – the List

- A knowledge base for engineering
- Problem analysis
- Investigation
- Design
- Use of engineering tools
- Individual and teamwork
- Communication skills
- Professionalism
- Impact of engineering on society & environment
- Ethics and equality
- Economics and project management
- Life-long learning
  
- ... WHILE ensuring academic unit requirements are met

## Distance/Correspondence Learning

- Can engineering be learned by “distance” or correspondence?
  - Most common graduate engineering weaknesses reported by multiple employer surveys: teamwork, communication, creativity/design
  - CDIO surveys often report “less math”, more professional practice skills

## What can engineering education afford?

- Discipline specific
- Multi-disciplinary
- Interdisciplinary (multi-faculty)
- Multi-institutional (Provincial or National)
- International

**= Increasing resource requirements**

## Current realities

- Most engineering educators are going flat out
- 4 academic years = 96-104 weeks (2 years)
- Push for more research & publications
- Shrinking budgets = larger class sizes, less TA support, older equipment
- Virtually no grant funds to support engineering education research (versus NSF in US)
- Grappling with Accreditation: attributes & units & demonstrable “continuous improvement”
- Dedicated progress in engineering education is happening, but needs help

## Some critical questions...

- Where are the needs of the profession heading? (for Canada and the world)
- Are we willing to give up any currently required outcomes/AU's to accommodate more societal & global learning?
- What are the risks of harmonized accreditation standards?
- How much can and should we expect of an undergraduate engineering program?
- Where is the line between formal education and engineering training in practice?
- Can we accommodate more program variation (traditional technical specialization vs global/design/business focus)?

## General thoughts...

- Engineering education programs cannot “do it all”, but they can do better
- Some countries have been evolving engineering education for many years
- Encouraging multidisciplinary and global perspectives will better prepare our graduates
- Accreditation regulations do and will drive engineering education direction
- A ongoing dialogue is needed with all stakeholders

## We have made progress...

- Canada has several examples of evolutionary engineering education
- Many schools have dual degree, international exchange, and/or internship options
- Global awareness is growing, especially amongst students
- Birth of the Canadian Engineering Education Association in 2010 – come to the 2<sup>nd</sup> annual conference!



# Questions?

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