Recent Developments in Engineering Education

Ali Ashrafizadeh
Faculty of Mechanical Engineering
K. N. Toosi University of Technology
May 2017
Outline

- Why This Talk
- Engineering Education: Historical Notes
- Accreditation: Historical Notes
- Challenges in the Design of Engineering Education
- Finding Solutions via Research
- CDIO: A Research-Based Movement in Engineering Education
- University Experiences
- Summary
Why This Talk on Engineering Education?

- IICEE2017 at K. N. Toosi University of Technology
- Sharing My Findings with Colleagues
- Changes in Technology and the Nature of Engineering
- International Academic Initiatives in Eng. Edu. (CDIO, …)
- Revolutionary Movements in Education (OE, …)
- Future of Our Country (Role of Engineers)
## History of Engineering Schools

<table>
<thead>
<tr>
<th>Engineering School</th>
<th>Country</th>
<th>Establishment</th>
<th>Years (till 2017)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecole Polytechnic</td>
<td>France</td>
<td>1794</td>
<td>223</td>
</tr>
<tr>
<td>Rensselaer Polytechnic Institute</td>
<td>USA</td>
<td>1824</td>
<td>193</td>
</tr>
<tr>
<td>Queen’s University</td>
<td>Canada</td>
<td>1842</td>
<td>175</td>
</tr>
<tr>
<td>University of Bath</td>
<td>UK</td>
<td>1856</td>
<td>161</td>
</tr>
<tr>
<td>Massachusetts Institute of Technology (MIT)</td>
<td>USA</td>
<td>1861</td>
<td>156</td>
</tr>
<tr>
<td>Stevens Institute of Technology</td>
<td>USA</td>
<td>1870</td>
<td>147</td>
</tr>
<tr>
<td>TU Darmstadt</td>
<td>Germany</td>
<td>1877</td>
<td>140</td>
</tr>
<tr>
<td>Georgia Institute of Technology</td>
<td>USA</td>
<td>1885</td>
<td>132</td>
</tr>
<tr>
<td>California Institute of Technology</td>
<td>USA</td>
<td>1891</td>
<td>126</td>
</tr>
<tr>
<td>Carnegie Mellon University</td>
<td>USA</td>
<td>1900</td>
<td>117</td>
</tr>
<tr>
<td>K. N. Toosi University of Technology</td>
<td>Iran</td>
<td>1928</td>
<td>89</td>
</tr>
</tbody>
</table>

Note:
- Istanbul Technical University (ITU): 1773 (Imperial School of Naval Engineering, Ottoman Turkish)
- Oldest Comprehensive University in North America: Universite Laval, Canada, 1663
- Oldest Comprehensive University in Europe: University of Bologna, Italy, 1088
- Oldest University in the World: Jundishapur University of Medical Sciences, Ahvaz, Iran, 200BC
History of Engineering Disciplines

- Civilian vs Military Engineers
- Civil Engineers
- Mechanical Engineers
- Electrical Engineers
- Industrial and Chemical Engineers
- Currently: 250 to 300 Engineering Disciplines

The boundaries between many disciplines are now blurred.
History of Engineering Education Paradigms

Before ~1950
    Focus on Practical Skills

Between ~1950 to ~1990
    Need for Professional Recognition (Similar to MDs, Lawyers)
    Focus on Engineering Sciences (Curriculum, Faculty)
    Golden Years: 1960s

After ~2000
    Complains from Industry in U.S.A. (Boing Initiative)
    Employers Could not Afford Training for Skills
    Focus on Professional Capabilities
History of Engineering Education Paradigms

Technician

Engineering Scientist
(The Current System in Iran and Many Countries)

Professional Engineer
Professional Capabilities

- Knowledge (Engineering Sciences)
- Skills (Technical, Personal, Interpersonal)
- Attitudes
- Entrepreneurship*
History of Engineering Education Paradigms

Attributes to the Engineers of 2020

- Strong Analytical Skills
- Practical Ingenuity
- Creativity
- Good Communication
- Understanding Business and Management
- Understanding the Principles of Leadership
- High Ethical Standards
- Resilience and Flexibility
- Lifelong Learning Ability

NAE, 2004
History of Engineering Education Accreditation

Need for Evaluation/Quality Assurance in Engineering Education

USA
- ABET (Accreditation Board for Engineering and Technology): 1932
- In 1994, ABET workshops with NSF and industries
- Center for the Study of Higher Education at Pennsylvania State University (founded in 1969, monitored the EC2000 implementation)

Euro Zone
- Sorbonne declaration: 1998
- European Higher Education Area (EHEA), Bologna Declaration, 1999
- EUR-ACE (EURopean ACcredited Engineer) Project
- ENAEE (European Network for Accreditation of Engineering Education)
- Germany: Since 1948

Iran
- IAIIE (Iran Accreditation Institute for Engineering Education): 2011

China
- CEEAA (China Engineering Education Accreditation Association): 2012
Washington Accord

- An agreement that allows for recognition that basic engineering education of members meets similar standards.

- Originally between Australia, Canada, Hong Kong, Ireland, New Zealand, South Africa, the United Kingdom and the USA (1989).

- More countries joined later.

Philip et al., 2000
History of Engineering Education Accreditation

Engineering Criteria 2000 (EC2000)

- Shift from Content-Based to Outcome-Based
- Shift from Input Measures to Student Outcomes
- Shift from What Is Taught to What Is Learned
ABET’s General Criteria for Baccalaureate Level Programs

- Criterion 1: Students
- Criterion 2: Program Educational Objectives
- Criterion 3: Student Outcomes
- Criterion 4: Continuous Improvement
- Criterion 5: Curriculum
- Criterion 6: Faculty
- Criterion 7: Facilities
- Criterion 8: Institutional Support
History of Engineering Education Accreditation

Criterion 3
Student 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
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(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
(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.

ABET, 2016-2017
Accreditation of Engineering Programs in Iran

Internal Evaluation
- K. N. Toosi University of Technology: All Engineering Disciplines
- University of Tehran: Electrical Engineering
- Sharif University of Technology: Mechanical Engineering

External Evaluation by IAIIEE
- None

International Evaluation
- None
Challenges in the Design of Engineering Education

- Curriculum Issues

- Pedagogical Issues

- Faculty Issues

- Financial Support and Workspace Issues

- The Inertia Issue

- Implementation Issues (Comprehensive vs Gradual)
Finding Solutions via Research

Engineering Education: A Really Difficult Design Problem

Sources of Information
- Books, Theses and Research Reports on Educational Sciences
- Journals
- Conference Proceedings
- Visits, Field Experiences, Observations
- Interviews and Questionnaires
  - Faculty Members
  - Policy Makers
  - Administrative Staff
  - Industry Partners
  - Students
  - Graduates
- Public
## Important Journals

<table>
<thead>
<tr>
<th>Title</th>
<th>Since</th>
<th>Frequency (per year)</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Journal of Engineering Education</td>
<td>1910</td>
<td>4</td>
<td>ASEE</td>
</tr>
<tr>
<td>J. of Prof. Issues in Eng. Edu. and Practice</td>
<td>1983</td>
<td>4</td>
<td>ASCE</td>
</tr>
<tr>
<td>Science and Engineering Ethics</td>
<td>1995</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Iranian J. of Eng. Edu.</td>
<td>1999</td>
<td>4</td>
<td>ASIRI</td>
</tr>
<tr>
<td>Int. J. for Service Learning in Engineering</td>
<td>2006</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Australian J. of Eng. Edu.</td>
<td>2007</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

ASEE: American Society for Engineering Education
ASCE: American Society of Civil Engineers
ASIRI: Academy of Sciences of Islamic Republic of Iran
Finding Solutions via Research

Important Conferences

- ASEE Conference and Exposition (annual, since 1893)
- AAEE Conference (annual, since 1990)
- International CDIO Conference (annual, since 2005)
- IEEE Global Engineering Education Conference (annual, since 2009)
- CAEE Conference (annual, since 2009)
- IICEE Conference (ISEE, bi-annual, since 2009)

* AAEE: Australian Association for Engineering Education
Development of a Taxonomy of Keywords for Engineering Education Research

- Finelli et al. (Latest version, 2016)
- Published simultaneously in a number of journals

A taxonomy of terms:
a standardized terminology and organizational system to map the field and to communicate and connect research initiatives.

The resulting taxonomy comprises
- 6 levels
- 14 branches
- 455 terms
Professional Associations

- ASEE: American Society for Engineering Education (1893)
- AAEE: Australian Association for Engineering Education (1990)
- AEER: Association for Engineering Education of Russia (1992)
- CEEA: Canadian Engineering Education Association (2009)

- NAE: National Academy of Engineering (1964), part of NAS (1863)
- Education Research and Methods division of the ASEE,
- IEEE (Institute of Electrical and Electronics Engineers) Education Society (1957)
- CASEE: Center for the Advancement of Scholarship on Engineering Education (CASEE) at NAE

- ILT: Institute for Teaching and Learning (ILT), legislated in UK in 2000 (Some universities require all newly appointed teachers to take certificate courses accredited by the ILT).

- More than 20 centers for engineering education at American universities.
University Programs

- School of Engineering Education at Purdue University (2004)

- School of Engineering Education at Virginia Polytechnic and State University (Virginia Tech)
Finding Solutions via Research

Books
(Engineering Education Reform Bibles)

- **Educating Engineers: Designing for the Future of the Field**
  Sheri D. Sheppard et al., 2009.
  Mech. Eng., Stanford
  Professor of the year in 2014 (Carnegie Foundation)

- **Rethinking Engineering Education, The CDIO Approach**
  Edward F. Crawley et al., 2014.
  Professor of Aeronautics and Astronautics, MIT
Three overall goals of the CDIO initiative:

- educating students with a deep working knowledge of technical fundamentals (knowledge)

- educating students who are able to lead in the creation and operation of new products and systems (skills)

- Educating students who understand the importance and impact of technological development on society (attitude)
CDIO Initiative Addresses the Following Questions

- What should we teach?
- How should we teach?
- How should we assess our students?
- How should we design and assess our programs?
- How should we ensure constant improvement?
CDIO

Some Important Terms and Considerations at Both Course and Program Levels

- Repetition
- Feedback
- Reflection
- Integration of Theory and Practice
- Integration of Teaching and Research
- Focusing on Both Problem Definition and Solution

Sheppard et al., 2009
Some Important Concepts

- Professional Spine

- Integrated (Networked) Curriculum (vs Linear Curriculum)

- Context-Based Curriculum
A Context-Based Curriculum

- Philosophy
  Teach engineering in the context of engineering practice.

- Argument
  Context of engineering practice is the life cycle of the development and deployment of engineering products (products, processes, or systems).

Note 1: Similarity with the education of MDs and lawyers
Note 2: The life cycle is not the same in all disciplines
The CDIO approach envisions an education that stresses the fundamentals, set in the context of conceiving-designing-implementing-operating products, processes, and systems (which is the aforementioned life cycle).

- **Establishment**: 2000

- **Founders**: MIT+3 Swedish Universities (KTH, Chalmers, Linköping)

- **Current Members**: More than 130 Universities
CDIO

CDIO Annual Conferences

• 2017 (13th): University of Calgary, Calgary, Canada.
• 2016 (12th): Turku University of Applied Sciences, Turku, Finland.
• 2015 (11th): Chengdu University of Information Technology, Chengdu, China.
• 2014 (10th): Universitat Politècnica de Catalunya, Barcelona, Spain.
• 2013 (9th): MIT-Harvard, Cambridge, USA.
• 2012 (8th): Queensland University of Technology, Brisbane, Australia.
• 2011 (7th): Technical University of Denmark, Lyngby, Denmark.
• 2010 (6th): École Polytechnique de Montréal. Montréal, Québec, Canada.
• 2009 (5th): Singapore Polytechnic, Dover, Singapore.
• 2008 (4th): Hogeschool Gent, Gent, Belgium.
• 2007 (3rd): Massachusetts Institute of Technology, Cambridge, USA.
• 2006 (2nd): Linköping University, Linköping, Sweden.
• 2005 (1st): Queens University, Kingston, Ontario, Canada.
CDIO Vision: The Evolution of Engineering Education

Crawley et al., 2014
Metaphor of An Integrated Curriculum Structure

- Science Courses
- Disciplinary Courses
- Introductory Course
- Capstone Course

Crawley et al., 2014
The CDIO syllabus

- The main resource for setting the learning outcomes

- Consists of four parts:
  - Technical knowledge and reasoning
  - Personal and professional skills
  - Interpersonal skills
  - CDIO

CDIO Standards

- 12 principles of effective practice.
The CDIO Syllabus (v2.0) at the First Level of Detail

1 Disciplinary Knowledge and Reasoning
   (Knowledge, Program specific)

2 Personal and Professional Skills and Attributes
   (Personal skills, General)

3 Interpersonal Skills: Teamwork and Communication
   (Interpersonal skills, General)

4 Other Skills
   (PPS building skills, General and program specific parts)
Excerpts from The CDIO Syllabus (v2.0) at the Second Level of Detail

1 Disciplinary Knowledge and Reasoning
   1.1 Knowledge of Underlying Mathematics and Science
   1.2 Core Engineering Fundamental Knowledge
   1.3 Advanced Engineering Fundamental Knowledge, Methods and Tools

2 Personal and Professional Skills and Attributes
   2.1 to 2.5

3 Interpersonal Skills: Teamwork and Communication
   3.1 Teamwork
   3.2 Communications
   3.3 Communications in Foreign Languages

4 Other Skills
   4.1 to 4.8
3  INTERPERSONAL SKILLS: TEAMWORK AND COMMUNICATION

3.1 TEAMWORK
   3.1.1 Forming Effective Teams
   3.1.2 Team Operation
   3.1.3 Team Growth and Evolution
   3.1.4 Team Leadership
   3.1.5 Technical and Multidisciplinary Teaming

3.2 COMMUNICATIONS
   3.2.1 Communications Strategy
   3.2.2 Communications Structure

The CDIO Syllabus (v2.0) has been expanded up to the 5th level of detail.
The CDIO Syllabus Correlated with ABET’s Evaluative Criterion 3

<table>
<thead>
<tr>
<th>CDIO Syllabus</th>
<th>ABET’s Evaluative Criterion 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Knowledge of Underlying Mathematics, Science</td>
<td></td>
</tr>
<tr>
<td>1.2 Core Engineering Fundamental Knowledge</td>
<td></td>
</tr>
<tr>
<td>1.3 Adv. Engr. Fund. Knowledge, Methods, Tools</td>
<td></td>
</tr>
<tr>
<td>2.1 Analytical Reasoning and Problem Solving</td>
<td></td>
</tr>
<tr>
<td>2.2 Exper. Investigation and Knowledge Discovery</td>
<td></td>
</tr>
<tr>
<td>2.3 System Thinking</td>
<td></td>
</tr>
<tr>
<td>2.4 Attitudes, Thought, and Learning</td>
<td></td>
</tr>
<tr>
<td>2.5 Ethics, Equity, and Other Responsibilities</td>
<td></td>
</tr>
<tr>
<td>3.1 Teamwork</td>
<td></td>
</tr>
<tr>
<td>3.2 Communications</td>
<td></td>
</tr>
<tr>
<td>3.3 Communication in Foreign Languages</td>
<td></td>
</tr>
<tr>
<td>4.1 External, Societal, and Environmental Context</td>
<td></td>
</tr>
<tr>
<td>4.2 Enterprise and Business Context</td>
<td></td>
</tr>
<tr>
<td>4.3 Conceiving, Systems Engr., and Management</td>
<td></td>
</tr>
<tr>
<td>4.4 Designing</td>
<td></td>
</tr>
<tr>
<td>4.5 Implementing</td>
<td></td>
</tr>
<tr>
<td>4.6 Operating</td>
<td></td>
</tr>
</tbody>
</table>

- **Strong Correlation**
- **Good Correlation**
Design and Development of a CDIO Approach

Crawley et al., 2014
Constructive Alignment: A Model for Course Design

Crawley et al., 2014
CDIO
An Example of Course Level Considerations

Definitions of Introduce (I), Teach (T), and Utilize (U)

<table>
<thead>
<tr>
<th></th>
<th>Learning outcomes</th>
<th>Learning activities</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduce</td>
<td>Probably not an explicit learning outcome</td>
<td>Topic is included in an activity</td>
<td>Not assessed</td>
</tr>
<tr>
<td>Teach</td>
<td>Must be an explicit learning outcome</td>
<td>Included in a compulsory activity. Students practice and receive feedback</td>
<td>Students’ performance is assessed. May be graded or ungraded.</td>
</tr>
<tr>
<td>Utilize</td>
<td>Can be a related learning outcome</td>
<td>Used to reach other intended outcomes</td>
<td>Used to assess other outcomes</td>
</tr>
</tbody>
</table>

Crawley et al., 2014
Excerpt of A Program Design Matrix for An Engineering Curriculum

<table>
<thead>
<tr>
<th></th>
<th>Course 1</th>
<th>Course 2</th>
<th>Course 3</th>
<th>Course 4</th>
<th>Course 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1.1 Problem identification and formulation</td>
<td>T</td>
<td>I</td>
<td>T</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>2.1.2 Modeling</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>2.2.2 Survey of print and electronic literature</td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.2.3 Experimental inquiry</td>
<td></td>
<td></td>
<td>T</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>2.4 Attitudes, thought and learning</td>
<td>T</td>
<td>T</td>
<td></td>
<td>U</td>
<td></td>
</tr>
<tr>
<td>3.1 Teamwork</td>
<td>T</td>
<td>U</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.2.3 Written communication</td>
<td>U</td>
<td>T</td>
<td></td>
<td>U</td>
<td></td>
</tr>
<tr>
<td>3.2.4 Electronic/multimedia communication</td>
<td>I</td>
<td></td>
<td>T</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.2.5 Graphical communication</td>
<td></td>
<td></td>
<td>T</td>
<td>U</td>
<td></td>
</tr>
<tr>
<td>3.2.6 Oral presentation</td>
<td>U</td>
<td></td>
<td></td>
<td>T</td>
<td></td>
</tr>
</tbody>
</table>

Crawley et al., 2014
CDIO
An Example of Program Level Considerations

Four Approaches to Curriculum Organization

A strict disciplinary curriculum
Organized around disciplines, with no explicit introductions or skills

An integrated curriculum
Organized around disciplines, with skills and projects interwoven

A problem-based curriculum
Organized around problems, with disciplines interwoven

An apprenticeship model
Based on projects, with no organized introductions of disciplines

Disciplines run vertically; projects and skills run horizontally

Crawley et al., 2014
CDIO
Considerations Regarding the Curriculum Integration

Alternative Integration Plans for Curriculum Structure

Black = Disciplinary Subjects
Shaded = Professional Skills

Temporal Integration

Parallel Integration

Integral

Crawley et al., 2014
## CDIO
### An Example of Program Level Considerations

Integrating Communication Skills into the Curriculum
(An Example from KTH)

### Development Routes -- Vehicle Engineering -- KTH

<table>
<thead>
<tr>
<th>CDIO Syllabus</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.2.3 Written communication</td>
<td>Introductory course</td>
<td>Mech I</td>
<td>Thermo-dynamics</td>
</tr>
<tr>
<td>3.3 Communication in English</td>
<td>Math I</td>
<td>Mech II</td>
<td>Control Theory</td>
</tr>
<tr>
<td></td>
<td>Numerical Methods</td>
<td>Product development</td>
<td>Statistics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fluid Mechanics</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sound and Vibrations</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Signal Analysis</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Optimization</td>
<td></td>
</tr>
</tbody>
</table>

Crawley et al., 2014
Experiential Learning Model

Crawley et al., 2014
Student Learning Assessment Process

Crawley et al., 2014
Program Evaluation and the CDIO Standards

Institutional Mission Program Goals
(Std 1)

- Faculty Development (Std 9, 10)
- Program Objectives and Outcomes (Std 2)
- Learning Assessment (Std 11)
- Learning Environment (Std 6)
- Teaching and Learning (Std 7, 8)
- Curriculum (Std 3, 4, 5)

Crawley et al., 2014
Continuous Program Improvement Process

Crawley et al., 2014
University Experiences

Queen’s University, Ontario, Canada
- Engineering Design and Practice Sequence
- Centre for Teaching and Learning
- EGAD Project

Ryerson University, Ontario, Canada
- Learning and Teaching Office
- Student Learning Centre

University of Toronto, Ontario, Canada
- New Administrative Position
- Centre for Teaching Support & Innovation

University of Waterloo, Ontario, Canada
- New Administrative Position
- Center for Teaching Excellence
Queen’s University
Welcome to the Centre for Teaching and Learning!

The Centre for Teaching and Learning is the academic service unit that promotes and supports quality teaching and builds teaching and educational leadership capacity in direct support of Queen’s students’ learning experiences. We support evidence-based, innovative and sustainable strategic program enhancement initiatives, and encourage and support emerging, grassroots investigations of novel approaches to teaching and learning.
### University Experiences

**CDIO at Queen’s University**

![Queen's University Logo]

**EDPS**

**Engineering Design and Practice Sequence**

<table>
<thead>
<tr>
<th>Year</th>
<th>Courses</th>
<th>Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 4</td>
<td>Disciplinary</td>
<td>Final capstone project integrating technical and professional skills</td>
</tr>
<tr>
<td>Year 3</td>
<td>Disciplinary</td>
<td>Disciplinary project using design tools and processes</td>
</tr>
<tr>
<td></td>
<td>APSC-221</td>
<td>Engineering economics and project management</td>
</tr>
<tr>
<td>Year 2</td>
<td>APSC-200/293</td>
<td>Design, innovation, communications, and professional practice</td>
</tr>
<tr>
<td>Year 1</td>
<td>APSC-100</td>
<td>Introduction to problem solving, investigation, design, and professional practice</td>
</tr>
</tbody>
</table>
The Queen’s Undergraduate Internship Program (QUIP) provides students with a 12-16 month work experience.

QUIP internships are paid, professionally supervised, career-related positions designed to offer second or third year students the opportunity to learn about current advances, practices and technologies in business and industry.

The program is open to domestic and international students in the Faculty of Engineering and Applied Science, Faculty of Arts and Science, and School of Computing.
University Experiences

Queen’s University

Workspaces at Queen’s University, Ontario, Canada
Workspaces at Queen’s University, Ontario, Canada
Welcome

As Canadian faculties and schools of engineering make the transition to outcome-based programming, assessment, and accreditation, the Engineering Graduate Attribute Development (EGAD) Project has been formed in order to assist our engineering colleagues in this endeavour. It is a collaborative effort that is co-sponsored by the National Council of Deans of Engineering and Applied Science (NCDEAS), and Engineers Canada.
University Experiences

Ryerson University
WELCOME

The LTO is the leader in learning and teaching at Ryerson. As the primary support for the teaching community at Ryerson, the LTO fosters a culture of excellence and innovation in teaching, working to continually enhance student learning across the university. Read more about the LTO.

Have a question about teaching? Write us at lto@ryerson.ca. We would love to hear from you!

Keynote Address by Dr. George Kuh

We are pleased to welcome Dr. George Kuh to deliver our 2017 keynote address for the Ryerson Learning & Teaching Conference. Dr. George Kuh is the Founding Director, Senior Scholar and Co-Principal Investigator at the National Institute for Learning Outcomes Assessment.

MAY 18 | RYERSON LEARNING & TEACHING CONFERENCE
Workspaces at Ryerson University, Ontario, Canada
The SLC Building
University of Toronto
University of Toronto

Vice-Provost, Innovations in Undergraduate Education

- New Position (Under Vice-President & Provost)

- Approved by the Executive Committee of the Governing Council of the University

- From 2015
Center for Teaching Support & Innovation
Helping faculty members with their teaching and assessment of learning.

The Centre for Teaching Support & Innovation (CTSI) provides leadership in teaching and learning at the University of Toronto and provides support for pedagogy and pedagogy-driven instructional technology for all teaching staff and teaching assistants across the university’s campuses and divisions.

Contact Information:

www.teaching.utoronto.ca

CENTRE FOR TEACHING SUPPORT & INNOVATION (CTSI)
Robarts Library 4th Floor (130 St. George Street)
Phone: 416-946-3139
ctsi.teaching@utoronto.ca

CTSI News & Events:

Grade Center: Providing Feedback and Marks Online (Apr 25)

Facilitator: Melvin Chien, Faculty Liaison, Technology Grade Center is an online repository for assessment data for your courses. It is a user friendly and flexible tool which allows the instructor to enter grades directly into their Blackboard course. Grade Center can be used in conjunction with other Blackboard tools to develop an efficient grading and [...] The post Grade Center: Providing Feedback and Marks Online (Apr 25) appeared first on Centre for Teaching Support & Innovation.

More info: http://teaching.utoronto.ca/event/grade-center-apr-25/
University Experiences

University of Waterloo
University Experiences

University of Waterloo

Associate Dean, Teaching Portfolio

- New Position in Waterloo Engineering
- Under Dean of Engineering
- From 2012
University Experiences

Teaching and Learning

Waterloo Engineering values quality teaching and learning experiences. Our expert instructors work to ensure that their teaching effectively supports our highly engaged learners.

In May 2012, Waterloo Engineering established the Associate Dean, Teaching portfolio with the following mission: to provide leadership in teaching within engineering to improve the depth, effectiveness and efficiency of student learning.

HANDS-ON LEARNING
Engineering Ideas Clinic

RESOURCES AND EXPECTATIONS FOR
Teaching Assistants

FEEDBACK FOR INSTRUCTORS
Course Evaluations

RECOGNIZING EXCELLENCE
Effective Teaching

ACCESS THE
Engineering Teaching SharePoint
About CTE

History, mission, and vision

Waterloo is among the first universities in Canada to have instituted teaching development, inaugurating a centre in 1976. Reconfigured in 2007 to bring together support for classroom teaching, new technologies, and scholarly investigation, the CTE’s mission is to foster teaching and learning of the highest quality at Waterloo. We do this by working collaboratively with departments and individuals at all career stages across the University.

Our vision as a unit is to inspire teaching **excellence**, **innovation**, and **inquiry**. These represent our main areas of instructional support, which we provide primarily through community-building and capacity-building while making ourselves available for one-on-one consultations at point of need. Visit our vision page for more information.

Breadth of programs
Summary

- Rapid Changes in Society and Technology
- Shift in Engineering Education Paradigm
- Shift in Accreditation Criteria
- Challenges in Engineering Education
- Resources for Research on Engineering Education
- A Context-Based Educational Strategy (CDIO)
- Comments on University Experiences