Overview

- Why do we need to rethink “Engineering Education”?
- What is CDIO?
- CDIO Framework
  - CDIO Syllabus
  - CDIO Standards
- How to implement CDIO to our current situation?
- Curriculum improvement plan

What is CDIO?

Conceive – Design – Implement - Operate

What does CDIO stand for?

- **CONCEIVE**: To identify and define real world problems with creative thinking (design thinking)
- **DESIGN**: To be able to approach a problem and outline possible solutions
- **IMPLEMENT**: To apply and verify the possible solutions
- **OPERATE**: To optimize and improve the final product and determine its life cycle

Over 90 institutions worldwide and still growing!

Source: http://www.cdio.org/
Asia Region

- Singapore Polytechnic (Regional Centre)
- Beijing Institute of Petrochemical Technology (BIPT)
- Beijing Jiaotong University
- Chengdu University of Information Technology
- Dalian Neusoft Institute of Information
- Duy Tan University
- Kanazawa Institute of Technology
- Kanazawa Technical College
- Nanyang Polytechnic
- Rajamangala University of Technology Thanyaburi (RMUTT)
- Shantou University
- Suzhou Industrial Park Institute of Vocational Technology
- Taylor's University, School of Engineering
- Tsinghua University
- Vietnam National University
- Yanshan University

Source: http://cdio.org/cdio-collaborators/school-profiles

CDIO In Thailand

Projects funded by Temasek Foundation
And supports from Singapore Polytechnic
1. Chulalongkorn University
2. Rajamangala University of Technology Thanyaburi, RMUTT

Why CDIO?

Are we developing the engineers desired by the industry?
Feedback from industries, graduates and practicing engineers that certain important professional skills are not developed in the existing curriculum.

- **SKILLS** 概念
  1. **Personal skills** 个人能动性与批判
     1. 21st century learning
     2. Work empowerment
     3. Creativity
     4. Leadership
     5. Entrepreneurship
  2. **Interpersonal skills** 人际沟通与协作
     1. Leadership
     2. Teamwork
     3. Communication skills
     4. Social responsibility
  3. **Professional processes and systems** 专业流程与系统
     1. Product development
     2. Project management
     3. Quality control
     4. Data analysis
  4. **Building skills** 建设技能

Pre-1950s: Practice

1980s: Science

2000s: CDIO

DISCIPLINARY KNOWLEDGE 交叉领域
From Underlying Need To Program Learning Outcomes

Educate students who:
- Understand how to conceive-design- implement-operate
- Complex products and systems
- In a modern team-based engineering environment
- And are mature and thoughtful individuals

The CDIO Syllabus - a comprehensive statement of detailed goals for an engineering education

Validation Against National Accreditation Frameworks

- The CDIO syllabus has been compared national accreditations in many countries
- Same pattern:
  - The CDIO Syllabus states outcomes for engineering education that reflect a broader view of the engineering profession
  - Its greater levels of detailing facilitate program and course development.
  - A program whose design is based on the CDIO Syllabus will also satisfy its national requirements for specified program outcomes.

CDIO is conformed with Accreditation Framework

CDIO Syllabus:
- Knowledge of Underlying Mathematics, Science
- Core Engineering Fundamentals
- Analytical Reasoning and Problem Solving
- Teamwork, Interaction and Knowledge Discovery
- System Thinking
- Attitudes, Thought and Learning
- Ethics, Equity and Other Responsibilities
- Teamwork
- Communications
- Language and Cultural Context
- Enterprise and Business Context
- Computing Systems and Management
- Designing
- Implementing
- Operating

ABET EC 2010 Criteria:
- Knowledge of Underlying Mathematics, Science
- Engineering Fundamentals
- Analytical Reasoning and Problem Solving
- Character, Interaction and Knowledge Discovery
- System Thinking
- Attitudes, Thought and Learning
- Ethics, Equity and Other Responsibilities
- Teamwork
- Communications
- Language and Cultural Context
- Enterprise and Business Context
- Computing Systems and Management
- Designing
- Implementing
- Operating

Strong Correlation
Good Correlation
CDIO – Thai Qualification Framework

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CDIO – Thai Qualification Framework

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CDIO is conformed with Accreditation Framework

Why CDIO?
Is Our Engineering Education meeting the standards?
What : CDIO Syllabus

1. Disciplinary Knowledge & Reasoning
   - Knowledge of underlying mathematics and sciences
   - Core engineering fundamental knowledge
   - Advanced engineering fundamental knowledge, methods and tools

2. Personal and Professional Skills & Attributes
   - Analytical reasoning and problem solving
   - Experimentation, investigation and knowledge discovery
   - System thinking
   - Attitude, thought and learning
   - Ethics, equity and other responsibilities

3. Interpersonal Skills: Teamwork & Communication
   - Multi disciplinary teamwork
   - Communications
   - Communication in a foreign language

- External, societal and environmental context
- Enterprise and business context
- Conceiving, systems engineering and management
- Designing
- Implementing
- Operating

Adopt CDIO as a context

Adoption of the principle that product, process, and system lifecycle development and deployment – Conceiving-Designing-Implementing-Operating – are the context for engineering education

Rationale:
- It’s what engineers do
- Provide framework for teaching skills
- Allow deeper learning of the fundamentals
- Help to attract, motivate and retain students
How: 12 Standards

<table>
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<tr>
<th>Curriculum</th>
<th>Standard 2</th>
<th>CDIO syllabus outcomes</th>
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<td>Standard 12</td>
<td>CDIO Program Evaluation</td>
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Specific, detailed learning outcomes for personal, interpersonal, and product and system building skills, consistent with program goals and validated by program stakeholders

Rationale:
- Curriculum design
- The basis of student learning assessment
- Stakeholders
  - Students and graduates
  - Alumni members
  - Faculty members
  - Employers

The CDIO Syllabus

1.0 Disciplinary Knowledge & Reasoning
1.1 Knowledge of underlying mathematics and sciences
1.2 Core engineering fundamental knowledge
1.3 A discreet engineering fundamental knowledge, methods and tools

2.0 Personal and Professional Skills & Attributes
2.1 Analytical reasoning and problem solving
2.2 Experimentation, investigation and knowledge discovery
2.3 System thinking
2.4 Attitude, thought and learning
2.5 Ethics, equity, and other responsibilities

3.0 Interpersonal Skills: Teamwork & Communication
3.1 Multidisciplinary teamwork
3.2 Communications
3.3 Communication in a foreign language

4.0 Conceptualising, Designing, Implementing & Operating Systems in the Enterprise, Societal & Environmental Context
4.1 Concepts, societal and environmental context
4.2 Enterprise and business context
4.3 Conceptualising, systems engineering and management
4.4 Development
4.5 Implementing
4.6 Operating
4.7 Leadership
4.8 Entrepreneurship

13 Skills

+ 2 skills for version 2
RMUTT Graduate Attributes

A curriculum designed with mutually supporting disciplinary subjects, with an explicit plan to integrate personal, interpersonal, and product and system building skills

Rationale:
- Disciplinary courses or modules make explicit connections among related and supporting content and learning outcomes
- Explicit plan identifies ways in which the integration of engineering skills and multidisciplinary connections are to be made

Curriculum Model

The Integrated Curriculum

Systematic Integration of Skills

Ref: Royal Institute of Technology (KTH) in Stockholm