SP4: Engineering Education and Baseline Assessment

Unified Engineering Spring 2004
Thu 3-Mar-04
Charles P Coleman, MIT
Outline

• Reflections on Seering 2003
• SP4
Seering 2003: Same story!
Life Cycle: CDIO in Industry

Conceive-Design-Implement-Operate

Bus Case
- Vision
- Plan

System Delivery
- Propose
- Define
- Demo
- Deliver

Operations
- Ops
Why is Reform/Redefinition Needed?

- **Emphasis** on teaching of engineering science.
- **De-emphasis** on teaching engineering practice.
- Students lacking abilities required in real world engineering situations.

**Widening Gap between engineering education and engineering practice.**
Attributes: Desired Outcomes

**Boeing**
- Good understanding of engineering science
- Good understanding of design and manufacturing
- Multi-disciplinary, systems perspective
- Understanding of the *context* in which engineering is practiced.
  - Economics
  - History
  - The environment
  - Customer and societal needs
- Good communication skills
- Profound understanding of the importance of teamwork

**ABET**
- Ability to apply knowledge
- Ability to design and conduct experiments
- Ability to design system, component, or process
- Ability to function on multi-disciplinary teams
- Understanding of ethical responsibility
- Understand impact of engineering in global and societal context
- Ability to use techniques, skills and tools necessary for engineering practice

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Teaching the Engineering Method?

**Essential Functions of an Engineer:**
Graduation engineers should be able to:
- Conceive-design-implement-operate (CDIO)
- Complex value-added engineering systems (Technical)
- In a modern team-based environment (Interpersonal)
- And are mature and thoughtful individuals (Personal)
Map of the new CDIO syllabus

Educate students who:

- Understand how to conceive-design-implement-operate
- Complex value-added engineering systems
- In a modern team-based engineering environment
- And are mature and thoughtful individuals

4. CDIO

1. Technical
2. Personal
3. Interpersonal

Process

Product

Team

Self
### CDIO Syllabus covered by System Problems

#### Fall
- Weekly individual assignments
- Self-contained assignments
- Progressively more complex assignments
- Integration of 1-2 disciplines

#### Spring
- Semester long team assignment
- Interdependent assignments
- Progressively more complex assignments
- Integration of 2-3+ disciplines

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#### 2.4 Personal Skills
- 2.1 Problem Solving
- 2.2 Knowledge Discovery
- 2.3 System Thinking

#### 2.5 Professional Skills
- 2.1 Problem Solving
- 2.2 Knowledge Discovery
- 2.3 System Thinking

#### 3.1 Teamwork

#### 3.2 Communication

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Map of the new CDIO syllabus

Educate students who:

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1. Technical
2. Personal
3. Inter-personal
4. CDIO

Process
Product
Team
Self
# Engineering Method Tools

## Design
- Process
- Analysis

**Tools:**
- FRDIARRC
- Design Selection Matrix

## Project Mgmt
- Time
- Resources
- Risk

**Tools:**
- WBS
- Gantt Chart

## Teamwork
- Communication
- Coordination
- Roles & Responsibilities
- Motivation!

**Tools:**
- Comm Plan
- Roles & Resp
- Ground Rules
- Effective Mtgs

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## McDonald's Functional Requirements Design Ideas

<table>
<thead>
<tr>
<th>Functional Requirements</th>
<th>Design Idea</th>
<th>Analysis</th>
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<tbody>
<tr>
<td>Take orders</td>
<td>Internet</td>
<td>Cost, Time</td>
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<tr>
<td></td>
<td>At counter terminal</td>
<td>Efficiency, <strong>Course 6</strong></td>
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<tr>
<td>Cook burgers</td>
<td>Flame broil</td>
<td>Patent infringement?</td>
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<tr>
<td></td>
<td>Nuke</td>
<td><strong>Course 22</strong></td>
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<tr>
<td></td>
<td>Fry</td>
<td><strong>Thermo, Course 2</strong></td>
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<tr>
<td>Deliver burgers</td>
<td>Delivery</td>
<td>Cost, Time, Cust Sat Efficiency, packaging</td>
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<tr>
<td></td>
<td>At the counter</td>
<td><strong>Robotics, Course 2</strong></td>
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<tr>
<td></td>
<td>Dispensing machine</td>
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