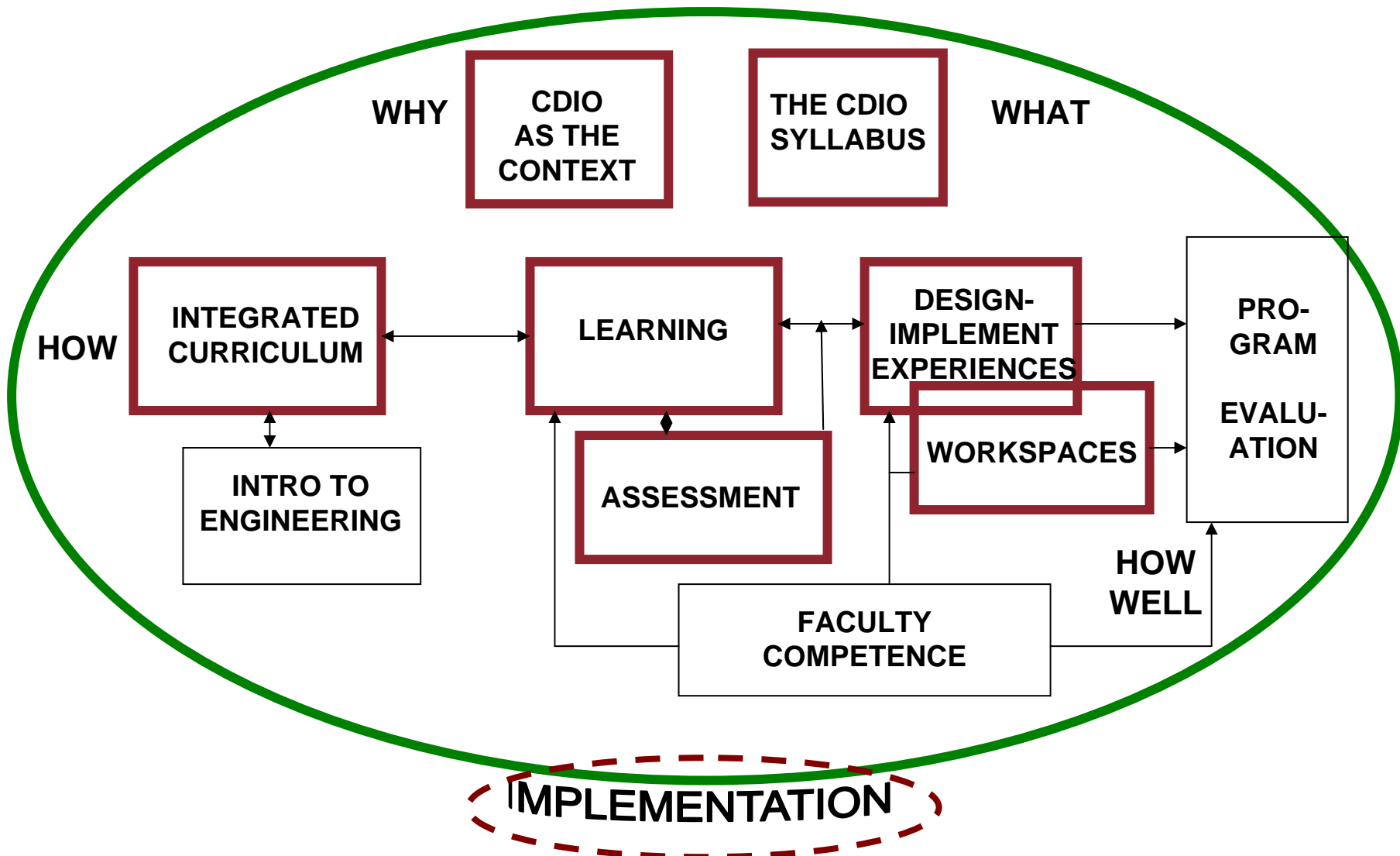




# THE CDIO APPROACH TO ENGINEERING EDUCATION: 6. Adapting And Implementing The CDIO Approach

## INTRODUCTION



# SESSION SIX OBJECTIVES



**Recognize key factors that influence change in an organization**

**Examine the implementation process in a selected CDIO program**

**Describe resources that facilitate the adoption of CDIO in engineering programs**

# KEY FACTORS THAT PROMOTE CULTURAL CHANGE



## GETTING OFF TO THE RIGHT START

- 1 Understanding the need for change
- 2 Leadership from the top
- 3 Creating a vision
- 4 Support of early adopters
- 5 **Early successes** (see examples)

## BUILDING MOMENTUM IN THE CORE ACTIVITIES OF CHANGE

- 6 Moving off assumptions
- 7 Including students as agents of change
- 8 Involvement and ownership
- 9 Adequate resources

**(See Handbook, pp. 41-43)**

## INSTITUTIONALIZING CHANGE

- 10 Faculty recognition and incentives
- 11 **Faculty learning culture** (see examples)
- 12 Student expectations and academic requirements

# EXAMPLES:

## #5 EARLY SUCCESSES



- Identify learning outcomes for several courses.
- Start, or modify, a first-year engineering course that includes a simple design-implement experience.
- Modify an upper-level course to include a simple, low-cost design-implement experience.
- Modify an appropriate meeting room or flexible classroom space to create a design-implement workspace that supports hands-on and social learning.

### Enhancement of CDIO Skills

- Hire faculty with industrial experience
- Give new hires a year to gain experience before beginning program responsibilities
- Create educational programs for current faculty
- Provide faculty with leave to work in industry
- Encourage outside professional activities that give faculty appropriate experiences
- Recruit senior faculty with significant professional engineering experience

### Enhancement of Teaching Skills

- Hire faculty with interest in education and ask them to discuss teaching during their interviews
- Encourage faculty to take part in CDIO workshops
- Connect with the teaching and learning centers at your universities
- Invite guest speakers on teaching topics
- Organize coaching by educational professionals or distinguished peers
- Participate in teaching mentorship programs

# ACTIVITY: KEY CHANGE FACTORS



Working with the key change factor assigned to your group, and the descriptions found in the **Handbook**, pp. 41-43

- Discuss what the factor means
- List 3 or 4 examples of ways that you can apply that change factor in your engineering program
- Share an example with the whole group





## The Change Process At École Polytechnique de Montréal



# 1. UNDERSTANDING THE NEED FOR CHANGE



- To adapt the program in order for students to achieve the new outcomes
- To address the drop in enrollment and low retention (output) despite high-quality students (input)
- To create better connections between mathematics, science, and engineering as required by the new common first-year program
- To help students, who are good technically, to integrate what they learn, and develop personal and interpersonal skills

### 3. CREATING A VISION



To modernize the programs,  
taking into account the needs of society.  
while focusing on students' strengths

Evolution



***Educate mechanical engineering professionals competent in the development of complex products and systems who will be leaders in their domains***

Align project with the CDIO approach to structure, support and accelerate the implementation

- Increase general satisfaction and student success
- Increase student retention in the program
- Make academic programs more attractive
- Change perceptions of the common first year
- Answer today's needs of organizations

# 12. STUDENT EXPECTATIONS AND ACADEMIC REQUIREMENTS



The development of the **new curriculum** is articulated around four principles.

To educate graduates

- With a strong knowledge of fundamental sciences
- With a solid experience in design
- Who master personal and interpersonal skills
- Ready for multidisciplinary international projects

# INTEGRATION OF SUBJECTS



## Projects, Design and Engineering Practice

Version : L (26 novembre 2004)

Fichier : Cheminement\_L\_vsd

Trimestre 1		Trimestre 2		Trimestre 3		Trimestre 4		Trimestre 5		Trimestre 6		Trimestre 7		Trimestre 8	
		MEC1xxx (1-3-4) 3cr Projet I				MEC2xxx (1-3-5) 3cr Projet II		MEC3310 (3-3-3) 3cr Éléments de CFAO		MEC3xxx (0-2-7) 3cr Projet III		MEC4xxx (1-3-5) 6cr Projet IV			
MEC1xxx (3-3-3) 3cr Mod. Prod. Syst. Méc.				MEC2500 (3-2-4) 3cr Def. techno. prod. méc.				MEC3310 (3-3-3) 3cr Éléments de CFAO							
MEC1xxx (3-2-4) 3cr Thermodynamique				ING2xxx (4-1-4) 3cr Chimie pour ingénieur				MEC3xxx (4-2-3) 3cr Fabrication							
MEC1xxx (4-1-4) 3cr Résist. corps d. forma.				MEC2200 (3-2-4) 3cr Dynamique des fluides				MEC13200 (4-1-4) 3cr Transmis. de chaleur		MEC3210 (3-0-3) 2cr Syst. pomp. ventil. comp.					
MEC1xxx ( - - - ) 2cr Statique				MAT2xxx ( - - - ) 3cr Matériaux		MEC2400 (3-2-4) 3cr Résistance matériaux		MEC3320 (3-0-3) 2cr Plast. élasto. & compo.		MEC3230 (3-2-4) 3cr Élem. finis thermofluide					
ELE1xxx (3-2-4) 3cr Élem. électronique				MEC2420 (4-1-4) 3cr Dynamique de l'ing.		MEC2430 (3-0-3) 2cr Vibrations		MEC3300 (3-0-3) 2cr Anal & comm syst dyn.		MEC3xxx ( - - - ) 2cr Syst. hydro. et pneu.					
ING1008 (2-2-2) 2cr Algèbre linéaire		MEC2510 (2-2-4) 2cr Techno. inform.		MEC2110 (2-1-3) 2cr Méth exp instrum méc.		INF3xxx (3-3-3) 3cr Informatique		MTH2210 (3-2-4) 3cr Calcul scientifique ing.		MEC3330 (3-2-4) 3cr Transmiss. puiss. méc.		MEC3xxx (1-1.5-3.5) 2cr Laboratoires q.méca. I		MEC4xxx (0-2-4) 2cr Laboratoires q.méca. II	
ING1005 (2-2-2) 2cr Calcul I		ING1007 (2-2-2) 2cr Calcul II		ING1003 (4-2-3) 3cr Équations diff.						MTH2301 (3-3-3) 3cr Méth. statistiques ing.					
SSHxxxx ( - - - ) 2cr Comportement organis.												SSH5201(3-1.5-4.5)3cr Economique de l'ing.		SSH5501 (3-0-3) 2cr Éthique appl. à l'ing.	
												SSH5101 (3-0-6) 3cr Techno. et organisation			
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												MEC4xxx 3cr		MEC4xxx 3cr	

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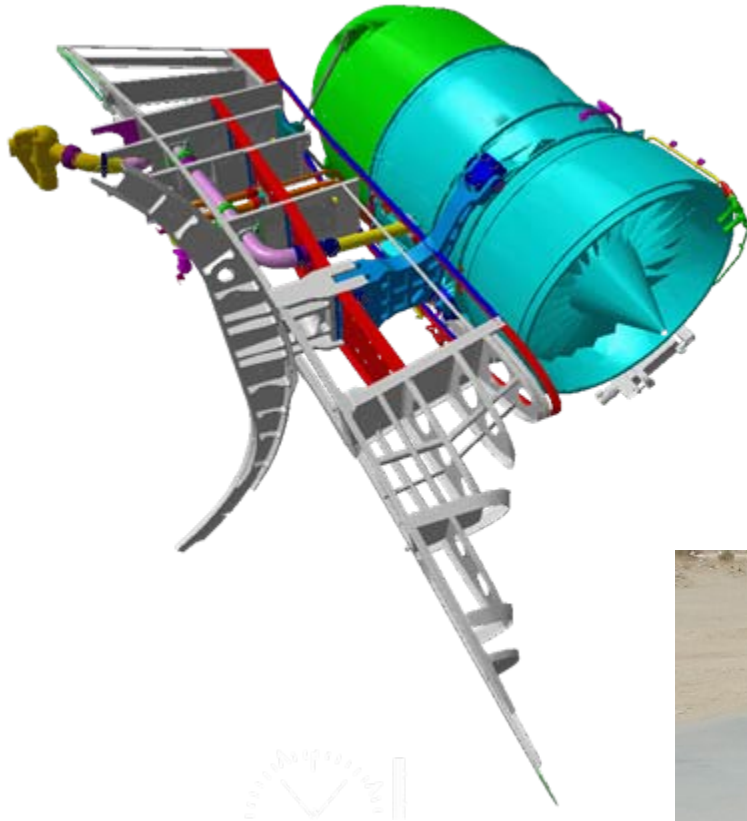
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par G. Courcier



- Built on past experience
- Collaboration with industry
- C-D-I-O

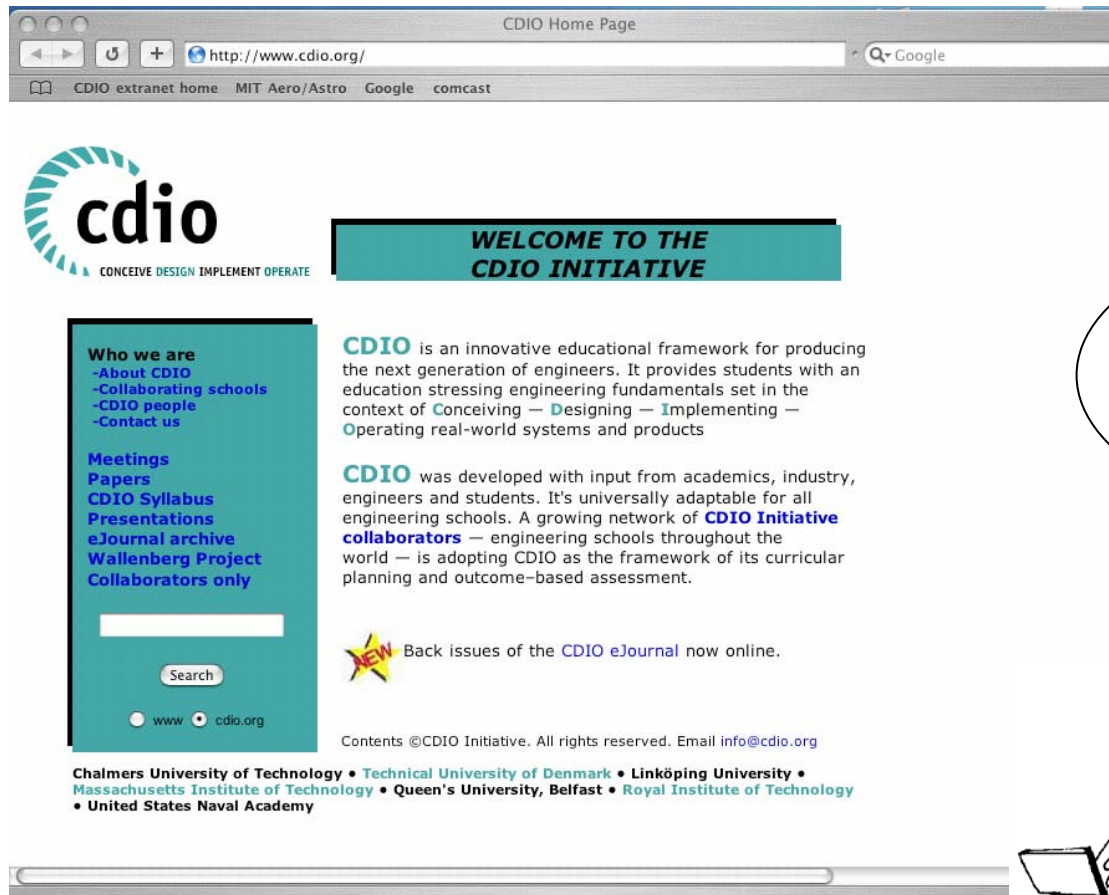




- Stakeholder survey completed in 2006-2007
- Personal and interpersonal skills: communication, teamwork, critical thinking, listening, leadership
- C-D-I-O projects and workspaces
- Teaching Technology CDIO Chair
- Design Chair Initiative: Engineering-Industrial Design-Business schools collaboration

- Evaluate your program. What are your strengths and weaknesses with respect to the CDIO Syllabus?
- Identify some early successes **(5. Early Successes)**
  - Easy to implement
  - Quick payoff
  - Visible results
- Generate buy-in from faculty **(8. Involvement and Ownership)**
  - Give them tools to help with changes
  - Reward faculty who embrace CDIO
  - Give faculty ownership in the project
- Be ready to assess changes
- Identify resources needed before you embark on large changes – especially project-based courses **(9. Adequate Resources)**

# TO LEARN MORE ABOUT CDIO ...



The screenshot shows a web browser window titled "CDIO Home Page" with the address bar containing "http://www.cdio.org/". The browser's address bar also shows "Google" and "CDIO extranet home MIT Aero/Astro Google comcast". The main content area features the CDIO logo and a teal banner that reads "WELCOME TO THE CDIO INITIATIVE". Below this, there is a sidebar with a teal background containing a "Who we are" section with links to "About CDIO", "Collaborating schools", "CDIO people", and "Contact us". There is also a "Meetings" section with links to "Papers", "CDIO Syllabus", "Presentations", "eJournal archive", "Wallenberg Project", and "Collaborators only". A search bar is present with a "Search" button. At the bottom of the sidebar, there are radio buttons for "www" and "cdio.org". The main content area contains two paragraphs of text about CDIO, a "NEW" starburst icon, and a link to "Back issues of the CDIO eJournal now online." At the bottom of the page, there is a copyright notice: "Contents ©CDIO Initiative. All rights reserved. Email info@cdio.org" and a list of member institutions: "Chalmers University of Technology • Technical University of Denmark • Linköping University • Massachusetts Institute of Technology • Queen's University, Belfast • Royal Institute of Technology • United States Naval Academy".

*Visit [www.cdio.org](http://www.cdio.org)!*



## Available at <http://www.cdio.org>

- The CDIO Syllabus
- The CDIO Standards
- Start-Up Guidance
- Implementation Kit (I-Kit)
- Instructional Resource Materials (IRMs)

## Other

- *Rethinking Engineering Education: The CDIO Approach* by Crawley, Malmqvist, Östlund, & Brodeur, 2007
- Annual international CDIO conference
- Local, regional, and international workshops

## CHALLENGES

Identify 3 key challenges that you face in implementing a CDIO approach in your program.

What resources can you draw on to address these challenges?



**See Handbook, pp. 45-47 for Frequently Asked Questions**

# SUMMARY: How much progress did you make toward the workshop objectives?



	Little or no progress	Some progress	Very good progress
Explain the CDIO approach to engineering education			
Determine ways in which the CDIO approach may be adapted to your own programs			
Share your ideas and experiences of engineering education reform			
Other (please specify)			

**(See Handbook, p. 51)**

Please write additional comments on the back of this page.