



CDIO IMPLEMENTATION

PERRY ARMSTRONG
SCHOOL OF MECHANICAL & AEROSPACE ENGINEERING
QUEEN'S UNIVERSITY BELFAST

**THE CDIO INITIATIVE
IS AN INTERNATIONAL INITIATIVE
TO REFORM ENGINEERING EDUCATION,
WHICH INVOLVES COLLABORATION BETWEEN
LEADING ENGINEERING SCHOOLS AND
DEPARTMENTS FROM AROUND THE WORLD.**

- [Massachusetts Institute of Technology](#), Cambridge, USA
- [Chalmers University of Technology](#), Göteborg, Sweden
- [Linköping University](#), Linköping, Sweden
- [Royal Institute of Technology](#), Stockholm, Sweden
- [Queen's University Belfast](#), Belfast, Northern Ireland
- [Technical University of Denmark](#), Lyngby, Denmark
- [U.S. Naval Academy](#), Annapolis, Maryland, USA
- [Singapore Polytechnic](#), Singapore
- [Queen's University](#), Kingston, Ontario, Canada
- [University of Auckland](#), Auckland, New Zealand
- [University of Pretoria](#), Pretoria, South Africa
- [University of Liverpool](#), Liverpool, UK

THE CDIO COLLABORATORS



- Hogeschool Gent, Gent, Belgium
- École Polytechnique de Montréal, Montreal, Canada
- Lancaster University, Lancaster, UK
- California State University, Northridge, USA
- University of Bristol, Bristol, UK
- Hochschule Wismar, Germany
- Shantou University, China
- Umeå University, Sweden
- Daniel Webster College, USA
- University of Colorado, USA
- University of Sydney, Australia
- Politecnico di Milano, Milan, Italy

THE CDIO COLLABORATORS



- [Turku University of Applied Sciences](#), Turku, Finland
- [Jönköping University](#), Jönköping, Sweden
- [Instituto Politécnico do Porto](#), Porto, Portugal
- [University of Leeds](#), Leeds, UK
- [Metropolia University](#), Helsinki, Finland
- [Tsinghua University](#), China
- [Arizona State University](#), USA
- [University of Calgary](#), Canada
- [Queensland University of Technology](#), Australia
- [Australian Association for Engineering Education](#)

MIT (late 1990s)

ENGINEERING EDUCATION WAS PROVIDING STUDENTS WITH ADEQUATE KNOWLEDGE OF ENGINEERING SCIENCE, BUT WAS FAILING TO PREPARE THEM FOR EMPLOYMENT AS PRACTISING ENGINEERS.

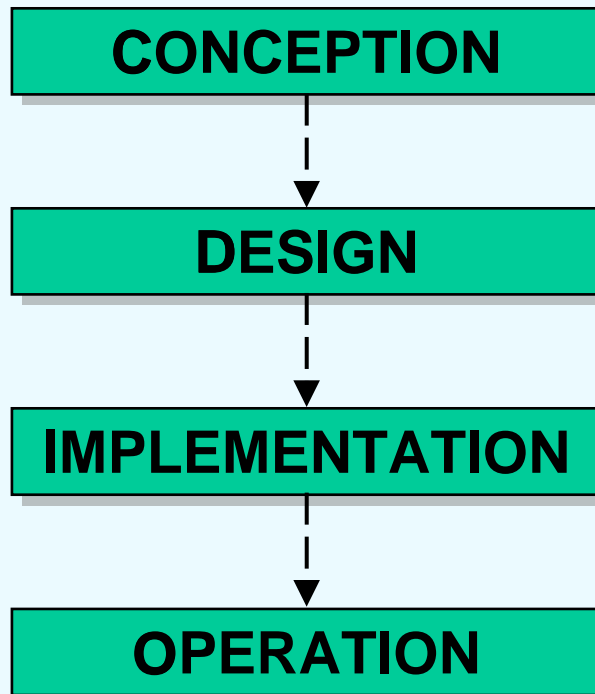
WHY CDIO?



ENGINEERING IS A **CREATIVE** PROFESSION

ENGINEERS CREATE PRODUCTS, PROCESSES AND SYSTEMS.

IN FACT, ENGINEERS MAY BE INVOLVED
IN ALL STAGES OF THE LIFECYCLE
OF A PRODUCT, PROCESS OR SYSTEM



IMPORTANT THAT
STUDENTS ACQUIRE
THE KNOWLEDGE &
SKILLS ASSOCIATED
WITH THESE
LIFECYCLE STAGES

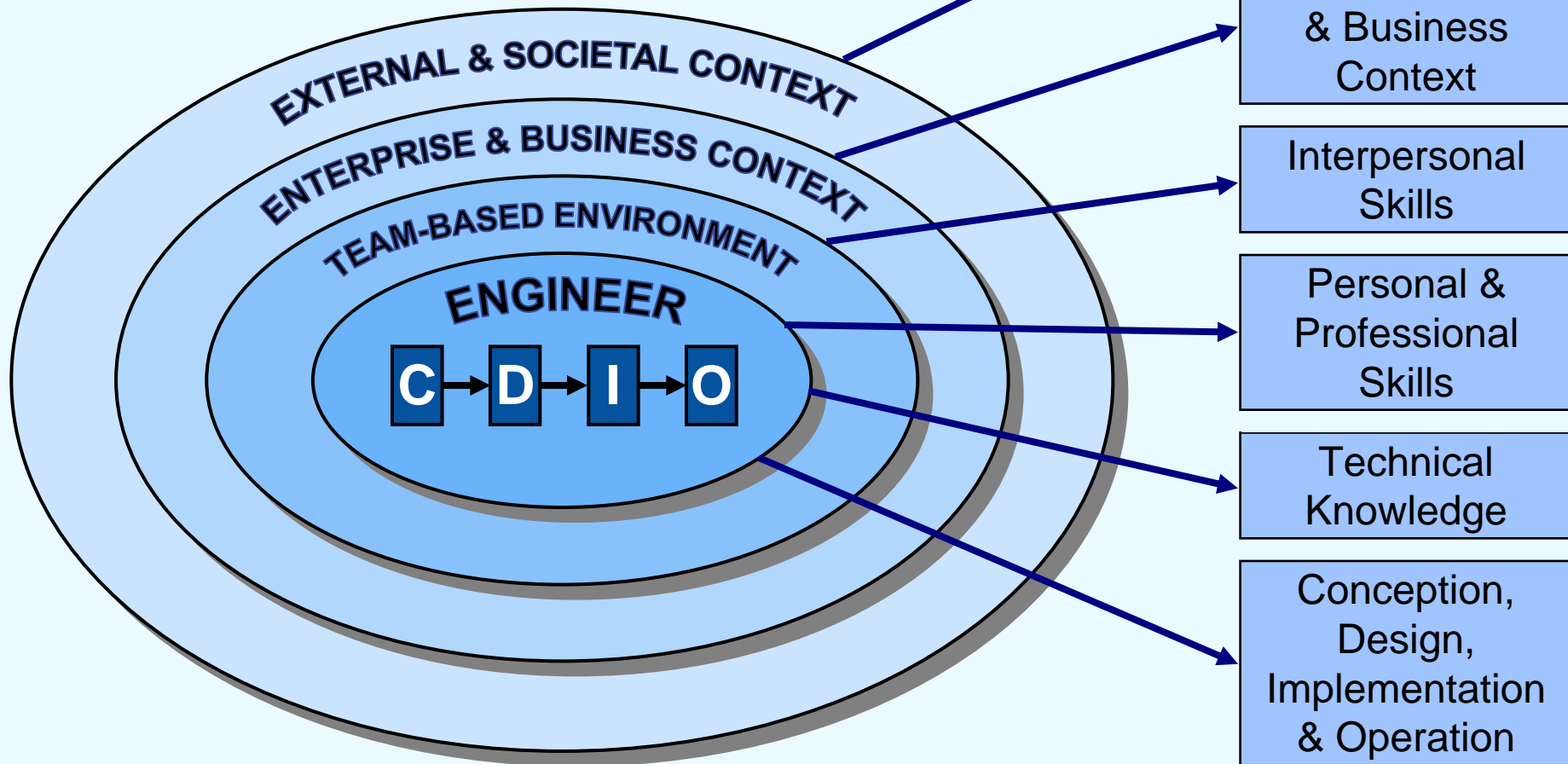
THE TOTAL REQUIREMENT



THE PRACTISING ENGINEER



Knowledge
& Skills
Required



1. Technical Knowledge (associated with the specific Engineering discipline)
2. Personal & Professional Skills
 - 2.1 Engng Reasoning and Problem Solving
 - 2.2 Experimenting and Knowledge Discovery
 - 2.3 Systems Thinking
 - 2.4 Personal Skills & Attributes
 - 2.5 Professional Skills & Attitudes
3. Interpersonal Skills
 - 3.1 Teamwork and Leadership
 - 3.2 Communication
4. Product, Process & System Building Skills
 - 4.1 External & Societal Context
 - 4.2 Enterprise & Business Context
 - 4.3 Conceiving
 - 4.4 Designing
 - 4.5 Implementing
 - 4.6 Operating

Two further levels of detail added with input from Industry

THE CDIO APPROACH (What to Teach)



CDIO: A “Back to the Drawing Board” Approach

**WHAT TO
TEACH?**

**THE CDIO
SYLLABUS**

**CUSTOMISED
SYLLABUS**

**PROGRAMME
LEARNING
OUTCOMES**

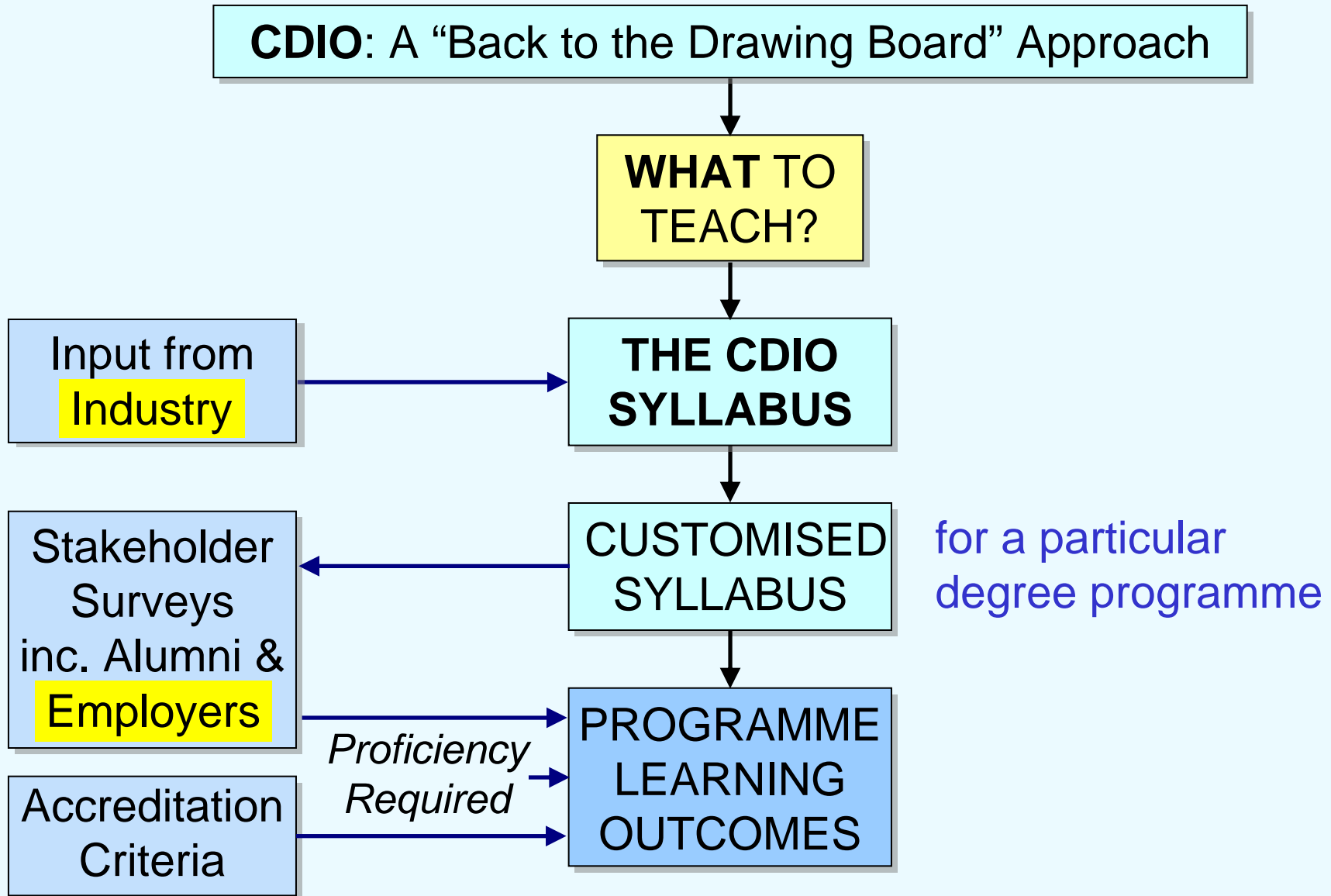
Input from
Industry

Stakeholder
Surveys
inc. Alumni &
Employers

Accreditation
Criteria

*Proficiency
Required*

for a particular
degree programme



CDIO: A “Back to the Drawing Board” Approach

**HOW TO
TEACH?**

**THE CDIO
STANDARDS**

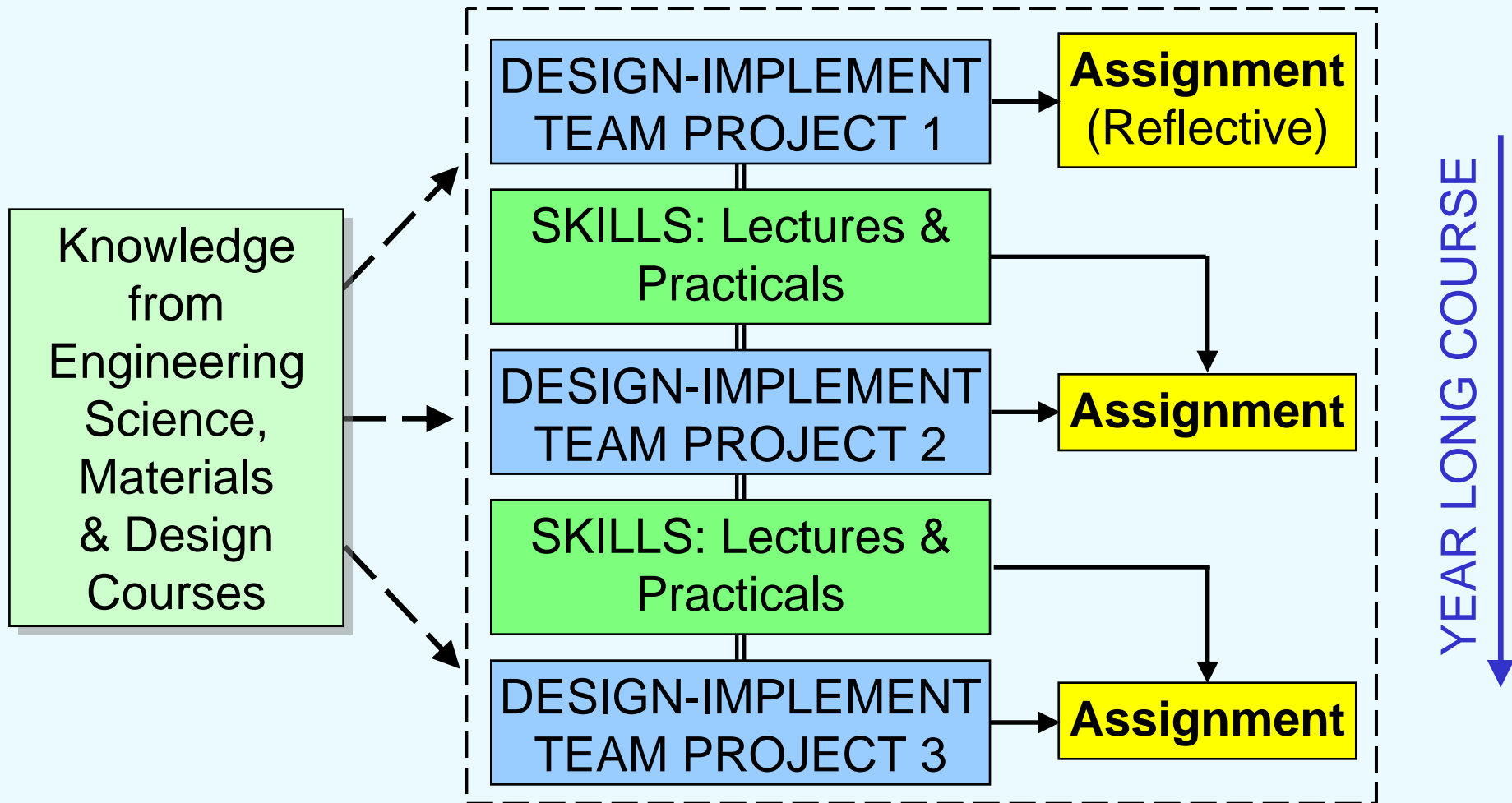
Twelve Requirements for an Engineering Degree Programme including the need for:

- An Introductory Course
- Design-Implement Experiences
- An Integrated Curriculum

THE INTRODUCTORY COURSE



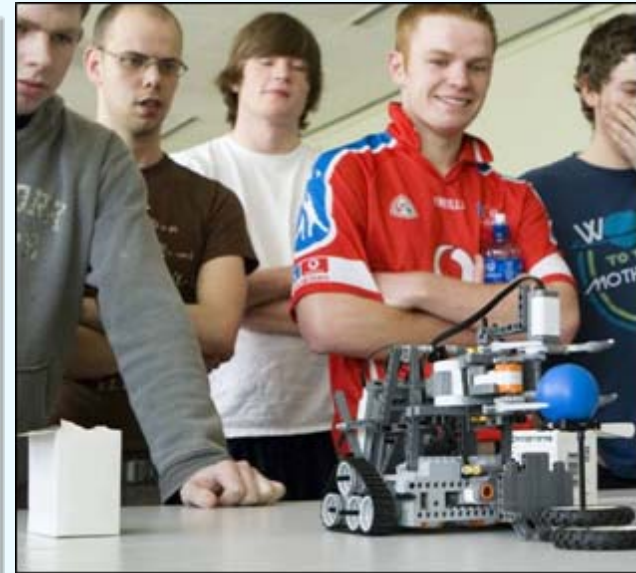
MECHANICAL & MANUFACTURING ENGINEERING YEAR 1: INTRODUCTORY COURSE



THE INTRODUCTORY COURSE



MECHANICAL & MANUFACTURING ENGINEERING YEAR 1: INTRODUCTORY COURSE



MECHANICAL & MANUFACTURING ENGINEERING YEAR 2: STRENGTH OF MATERIALS COURSE



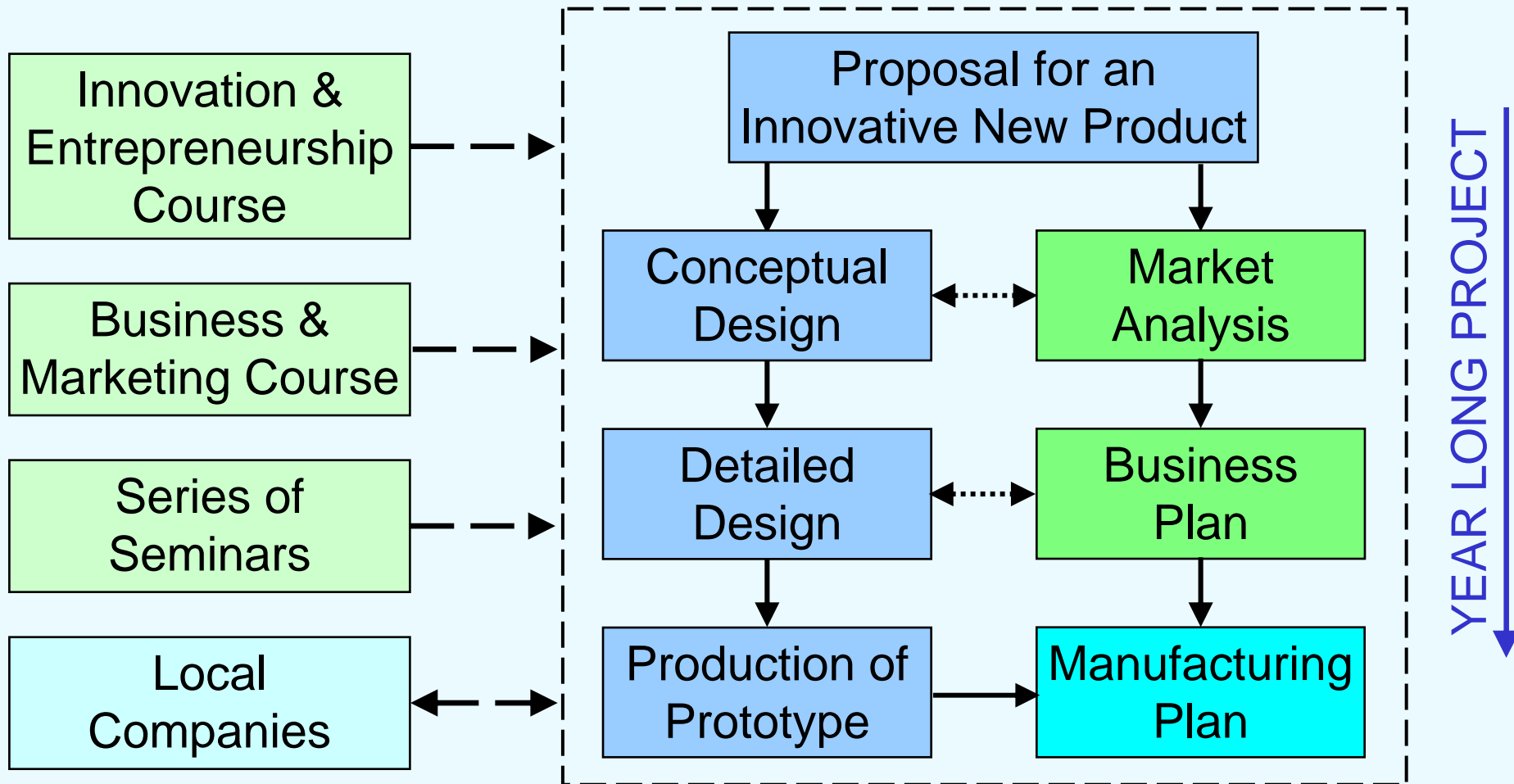
DESIGN-IMPLEMENT EXPERIENCES



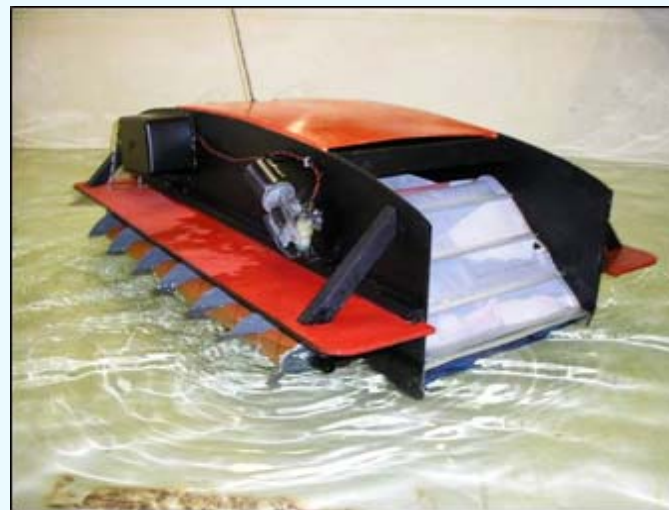
MECHANICAL & MANUFACTURING ENGINEERING YEAR 3: FORMULA STUDENT COMPETITION



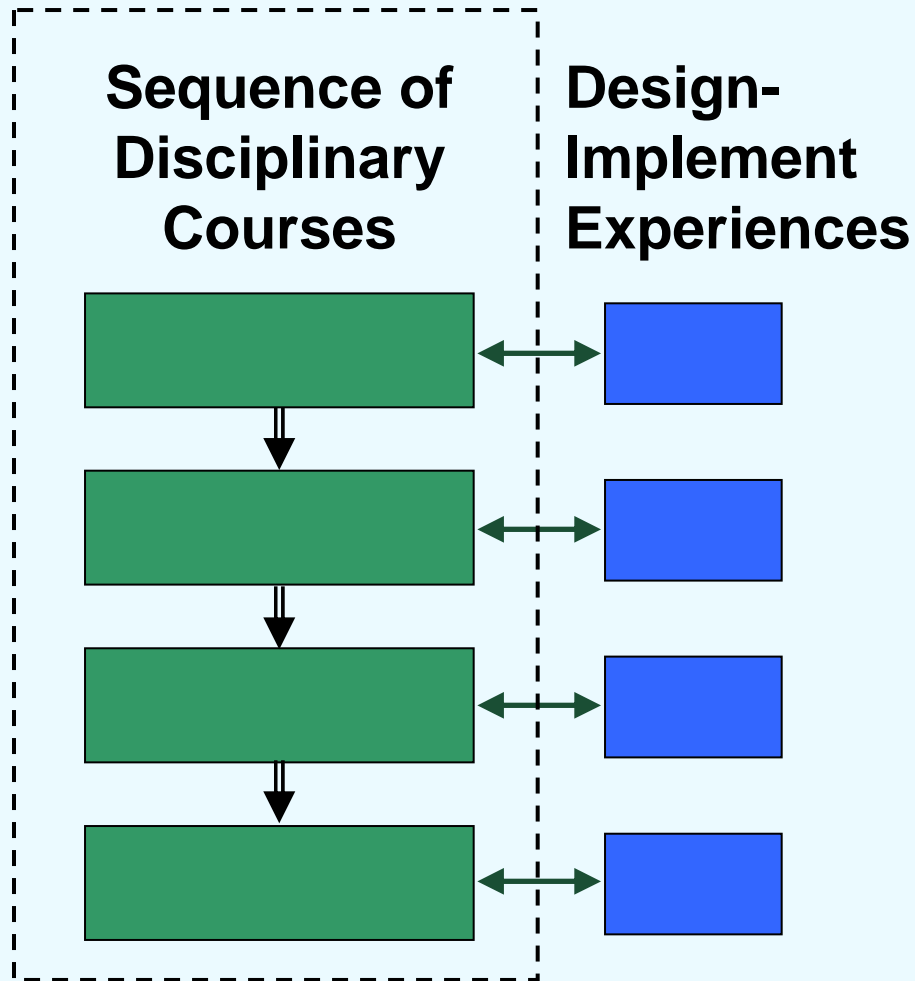
MECHANICAL & MANUFACTURING ENGINEERING YEAR 4: FINAL YEAR TEAM PROJECT



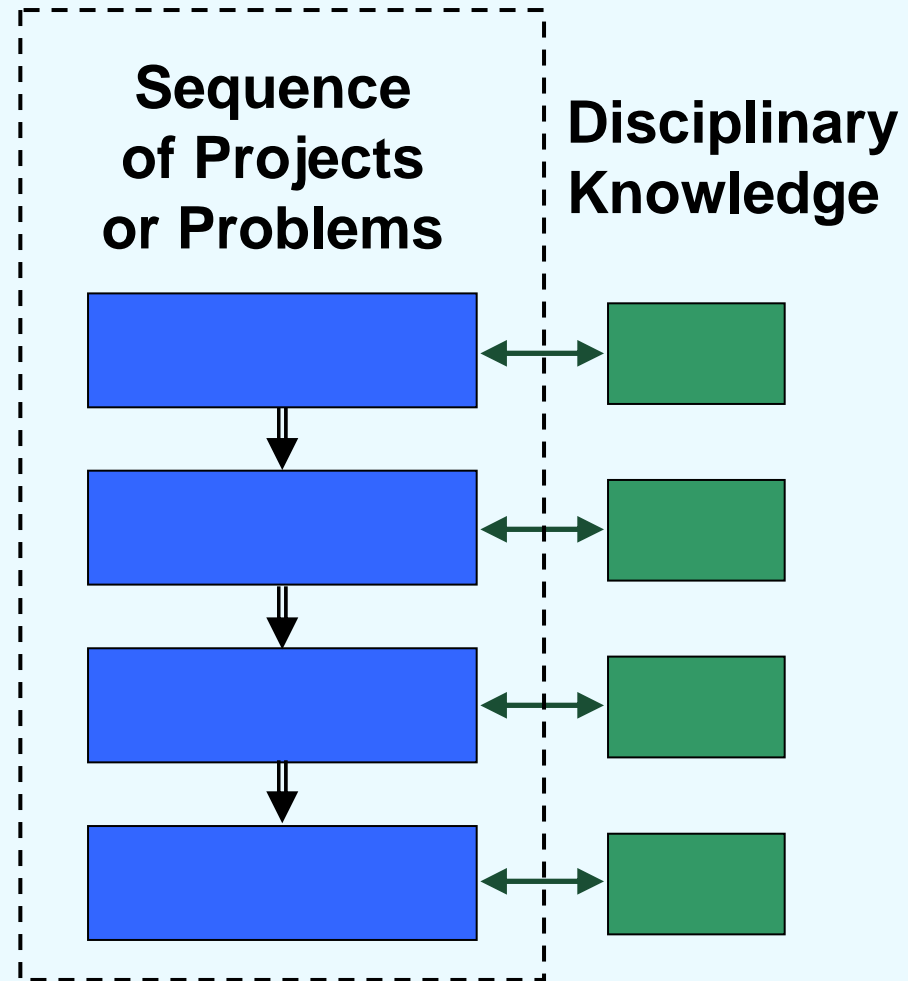
MECHANICAL & MANUFACTURING ENGINEERING YEAR 4: FINAL YEAR TEAM PROJECT



CDIO



PBL



THE INTEGRATION OF SKILLS



CDIO APPROACH

Plan a Logical Sequence of Learning Experiences for each Skill

Skill A

Skill B

1

2

3

4

5

6

1

2

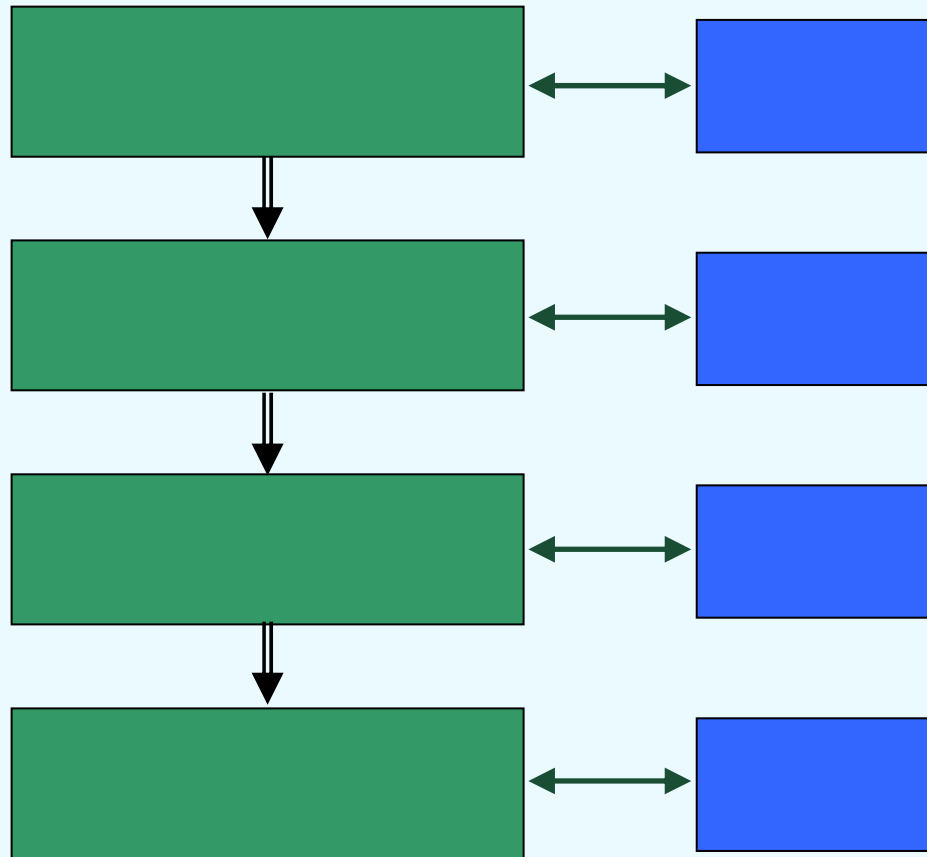
3

4

5

Sequence of Disciplinary Courses

Design-Implement Experiences



THE INTEGRATION OF SKILLS



CDIO APPROACH

Plan a Logical Sequence of Learning Experiences for each Skill

Skill A

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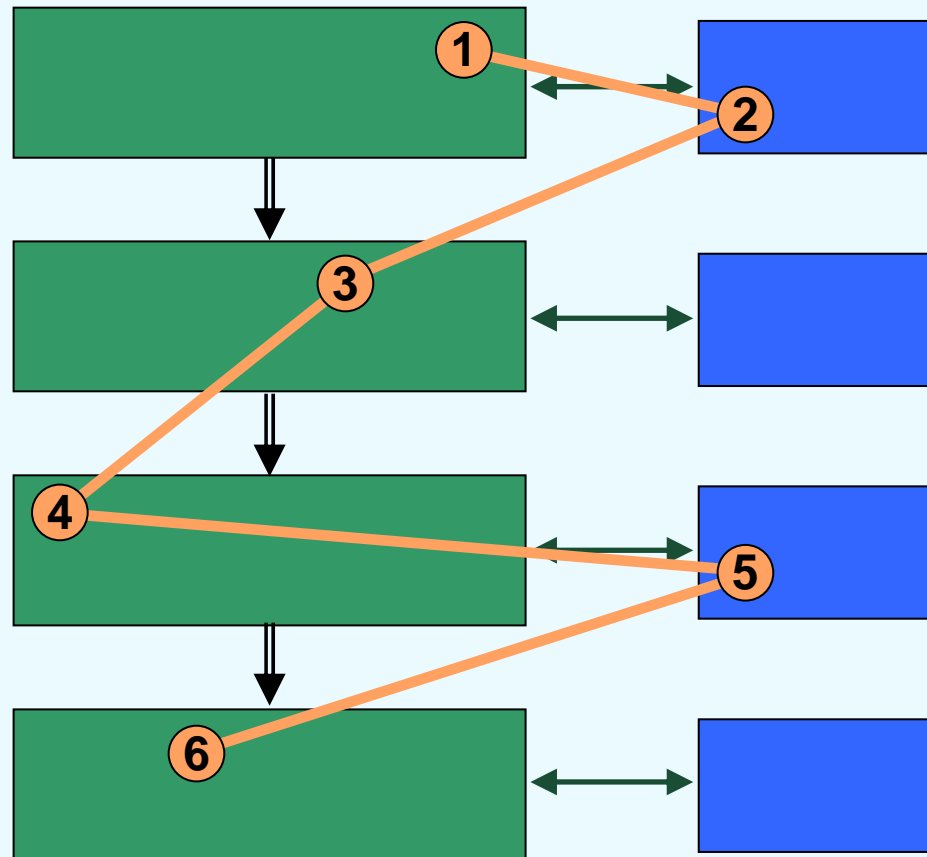
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Sequence of Disciplinary Courses

Design-Implement Experiences



THE INTEGRATION OF SKILLS



CDIO APPROACH

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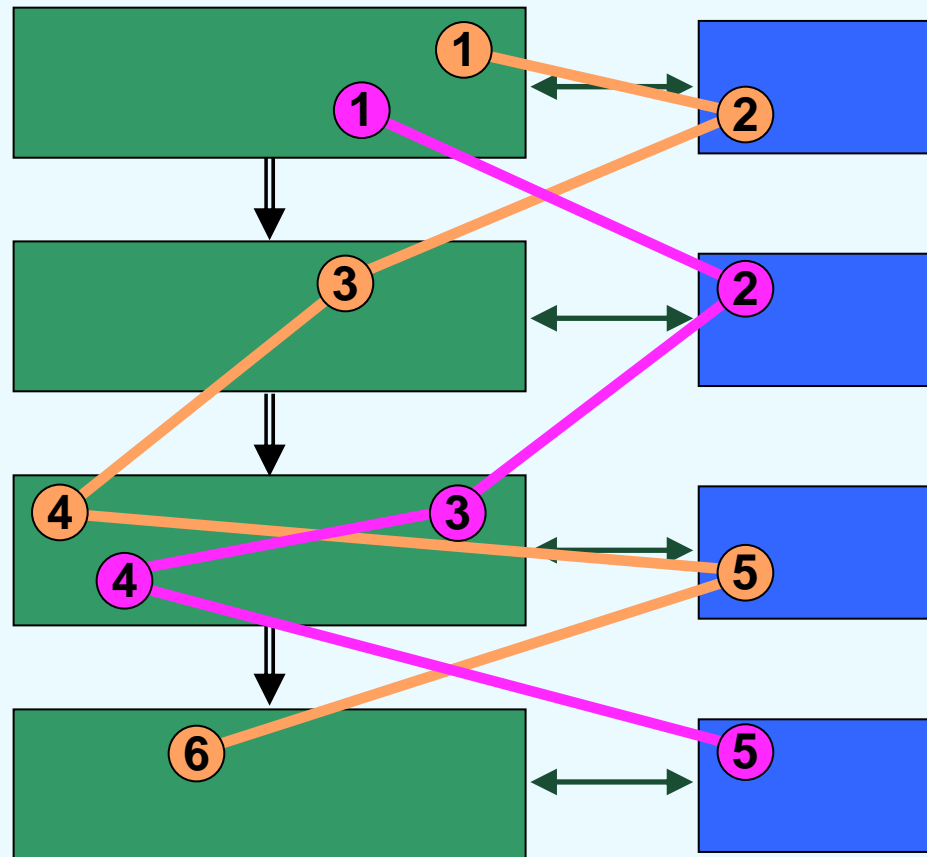
Skill A

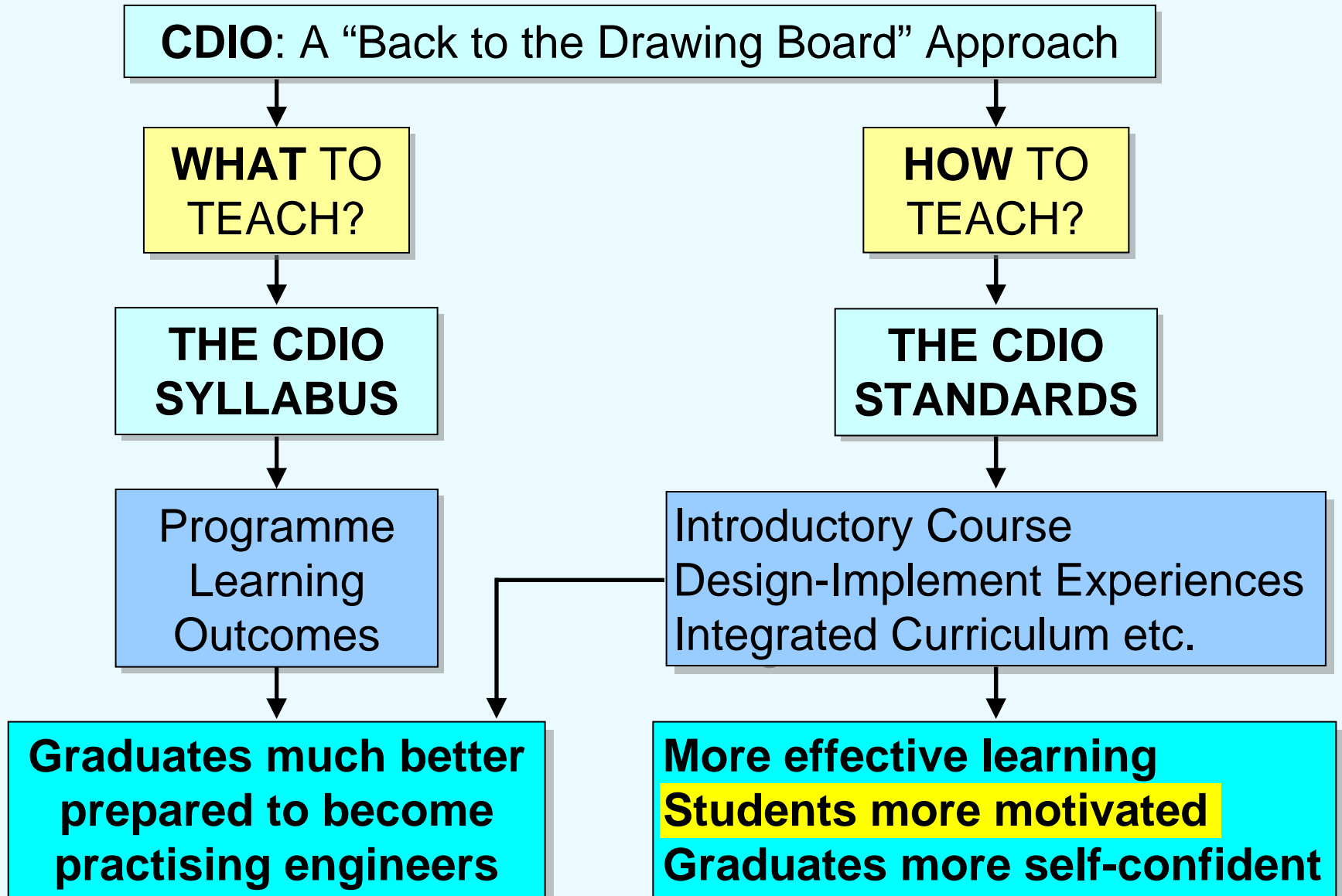
Skill B



Sequence of Disciplinary Courses

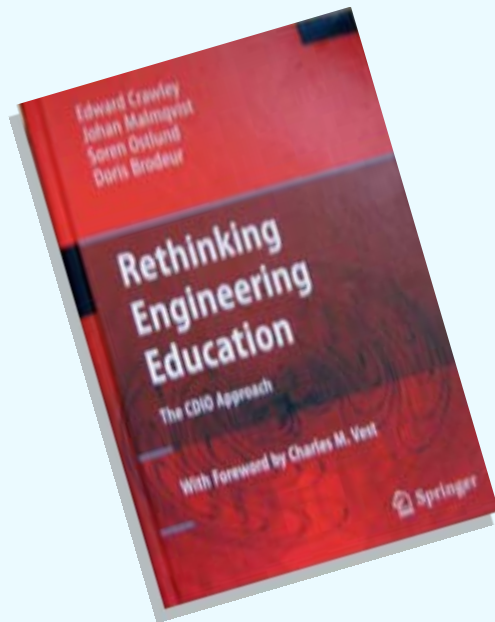
Design-Implement Experiences







www.cdio.org



Rethinking Engineering Education

Edward Crawley et. al.,
Springer, 2007