CONCEIVE DESIGN IMPLEMENT OPERATE™

Oman Society of Engineers

Federation Of Arab Engineers

28TH ARAB ENGINEERING CONFERENCE

Sheraton hotel, Muscat. 11-13 Dec, 2018

Engineering Education for Future World: The CDIO Approach (*Conceive, Design, Implement, Operate*)

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ACK
الكلية الأسترالية في الكويت
Australian College of Kuwait

Presentation Outline

- Engineering Education Challenges , Drives for Change, and Employability.
- The Learning Context for Professionals Practice and the Context of Engineering Education.
- The CDIO Initiative Reforming Engineering Education
- The CDIO Standards
- The CDIO Syllabus
- The Assessment and Levels of Proficiency
- The CDIO Faculty Development Program
- CDIO Academy
- How to Join

Engineering Education Challenges
Drives for Change and Employability

"The measure of intelligence is the ability to change."

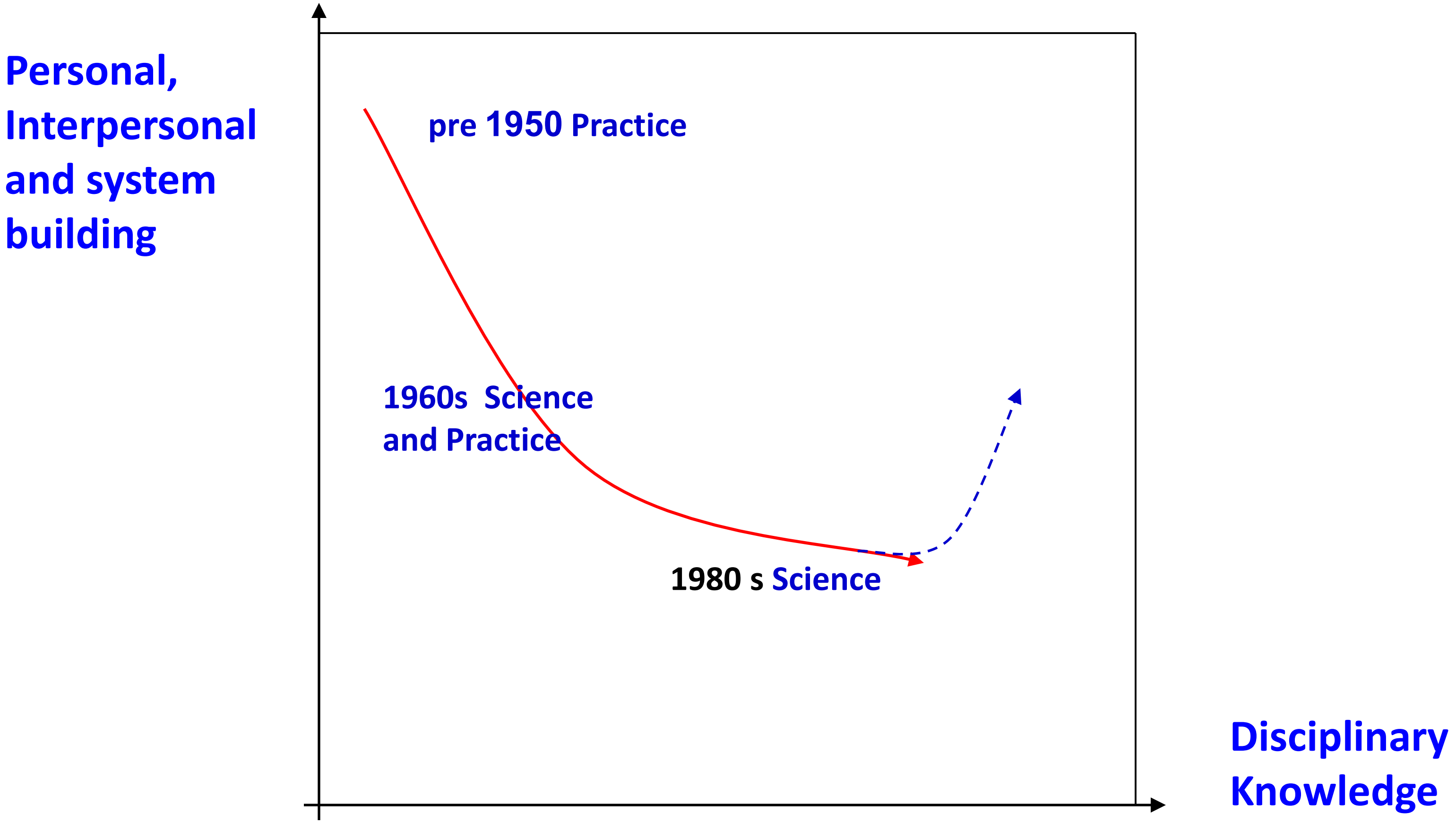
Albert Einstein

The Purpose of Engineering Education

The purpose of engineering education is to provide the learning required by students to become successful engineers—technical expertise, social awareness, and a bias toward innovation. This combined set of knowledge, skills, and attitudes is essential to strengthening productivity, entrepreneurship, and excellence in an environment that is increasingly based on technologically complex and sustainable products, processes, and systems. It is imperative that we improve the quality and nature of undergraduate engineering education.

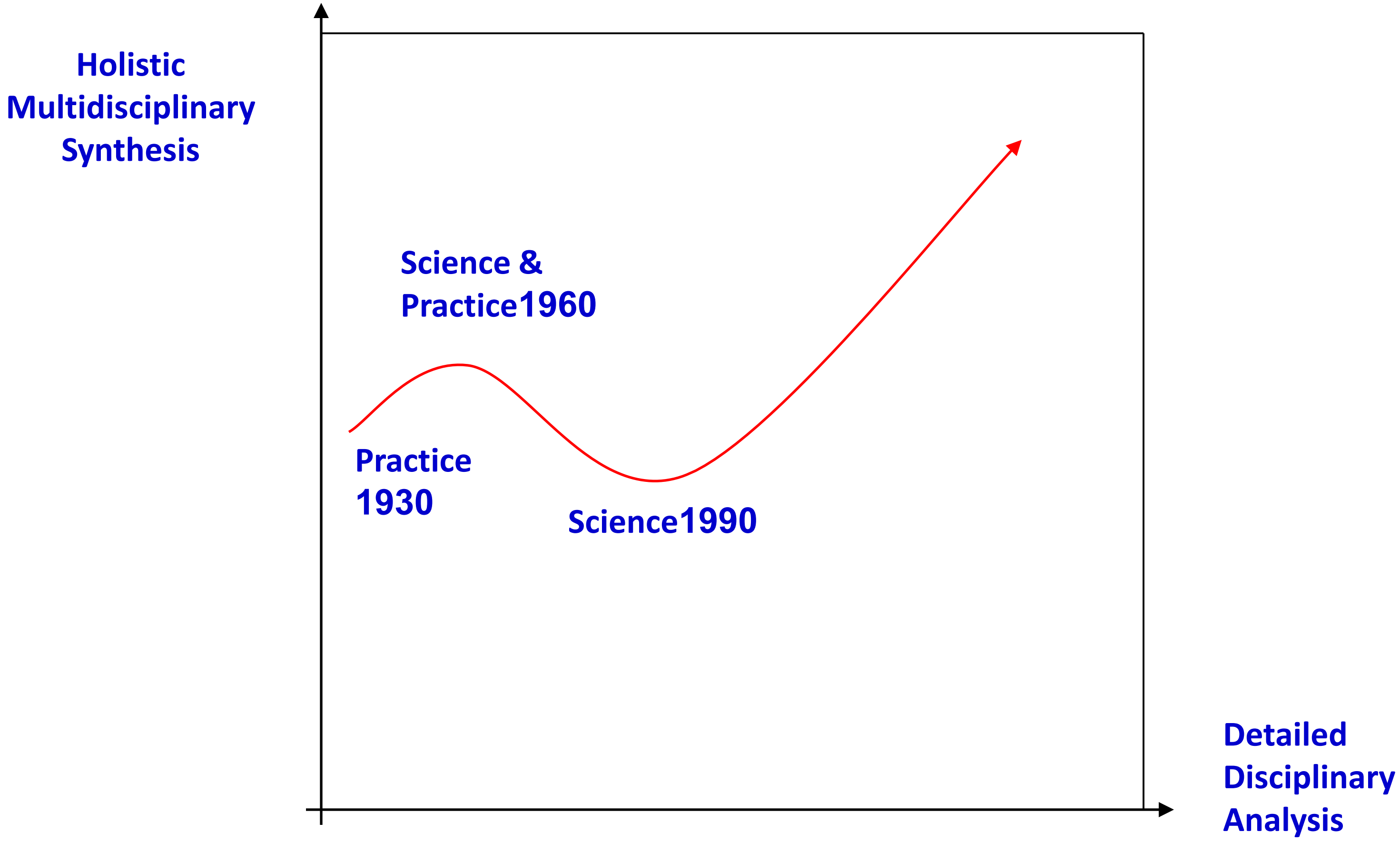
E. F. Crawley et al., Rethinking Engineering Education,
DOI: 10.1007/978-3-319-05561-9_1,

Development of engineering education



Engineers need both dimensions, and we need to develop education that delivers both

Development of engineering education



Engineers need both dimensions, and to understand the role of technology in society

Professional Engineer

- professional, ENGINEER as one who has attained and continuously enhances technical, communications, and human relations knowledge, skills, and attitudes, and who contributes effectively to society by theorizing, conceiving, developing, and producing reliable structures, devices, systems and services of practical and economic value.

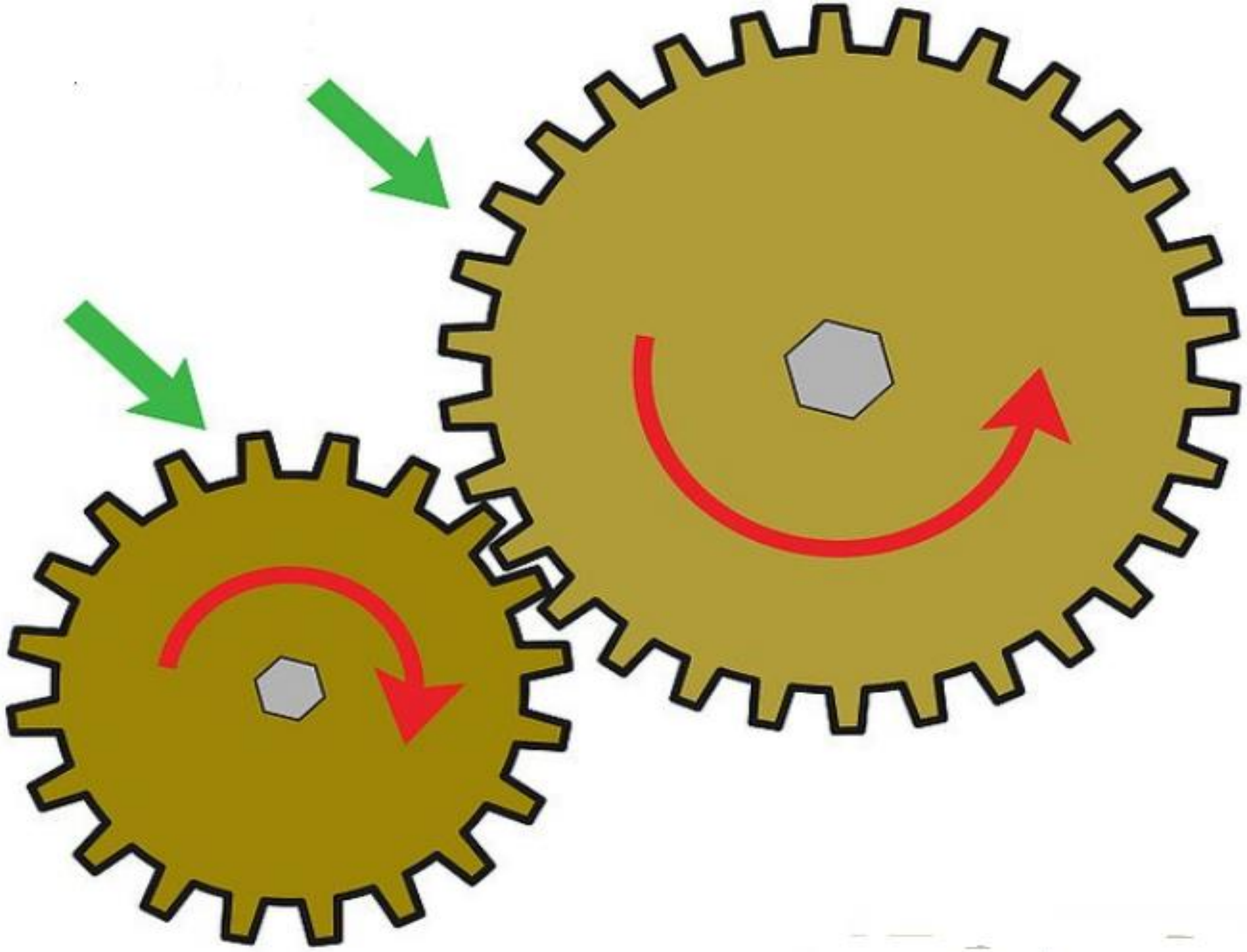
- The industry looking for graduates with a specific set of attributes.

- Critics of engineering education often cite number of inadequacies among the complains about the engineering education system

The Role of Engineering Colleges

- What engineering colleges should do to prepare the graduates to be able to become professional engineers and to have the required attributes?

- The Engineering Education developers should look at the context of engineering profession very closely to perform the required reform



Central Questions for Engineering Colleges

What is the professional role and practical context of the profession(al)? *(need)*

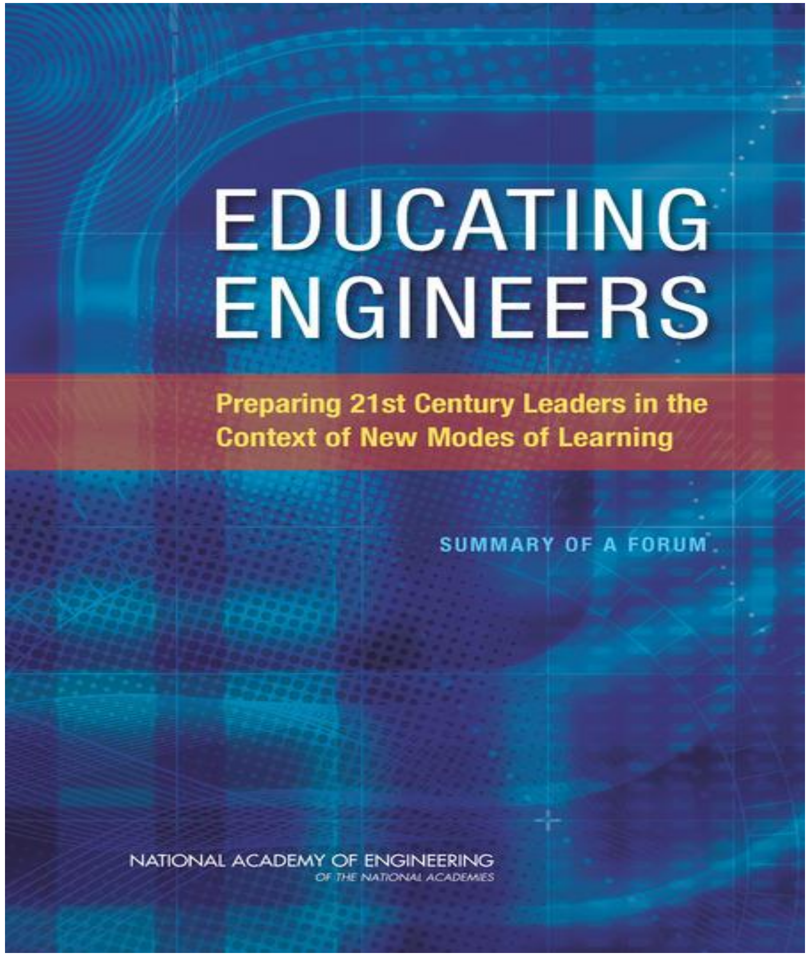
What knowledge, skills and attitudes should students possess as they graduate from our programs? *(program learning outcomes)*

How can we do better at ensuring that students learn these skills? *(curriculum, teaching, learning, workspaces, assessment)*

The Context of the Engineering Profession and Engineering Education

The word **context.**

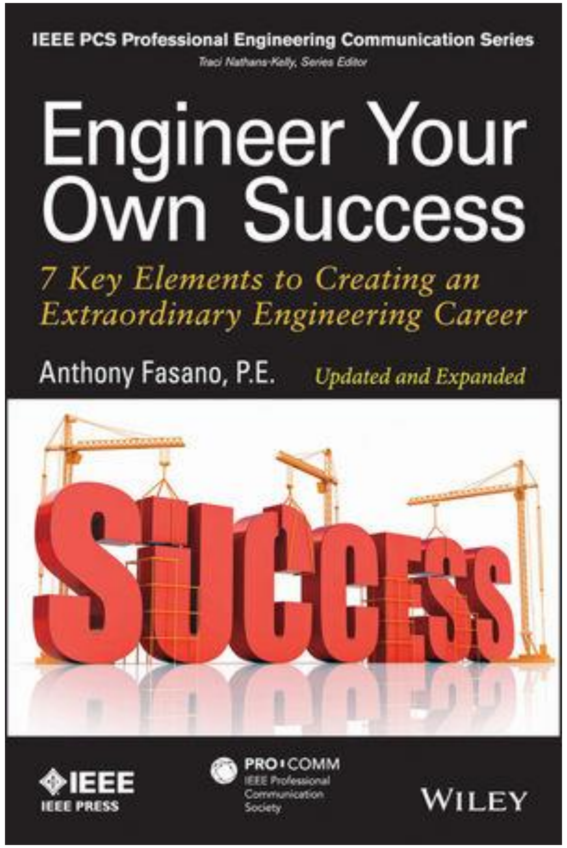
- One definition of context is “the circumstances or events that form the environment within which something exists or takes place, and that help in understanding.”
- The definition has two parts: that there are surroundings, and that the surroundings help with understanding or the interpretation of meaning.
- An architect might say that to understand a building, one must examine the context of the neighborhood.
- It is this meaning of context—circumstances and surroundings that aid in understanding—that we use.



The Evolution of a Professional Engineering Context

A. The contextual elements that have not materially changed for PE include

- A focus on the problems of the customer and society.
- The delivery of new products, processes and systems.
- The role of invention and new technology in shaping the future.
- The use of many disciplines to develop the “solution”.
- The need for engineers to work together, to communicate effectively, and to provide leadership in technical endeavors.
- The need to work efficiently, within resources and/or profitably



The Evolution of a Professional Engineering Context

B. Evolvement Seen in the context of engineering Profession

- Sustainability
- Globalization
- Innovation
- Leadership
- Entrepreneurship
- Knowledge Economy
- Demographics
- Technological Change
- Exponentiating technologies,
- Business Plan
- Mobility

Oman Professional Engineers Network

PROFESSIONAL ENGINEERING

Critics of engineering education

- Disproportionately low and increasingly poor economic return for the amount of employed engineering resources.
- Limited formal training in, and exposure to, a breadth of basic technical knowledge.
- Inadequate training and orientation to a meaningful depth of engineering skills.
- Inadequate understanding of the importance of precise test and measurement.
- Insufficient competitive drive an perseverance.
- Inadequate communication skills.
- Lack of discipline and control in work habits.
- Fear of taking personal risks.

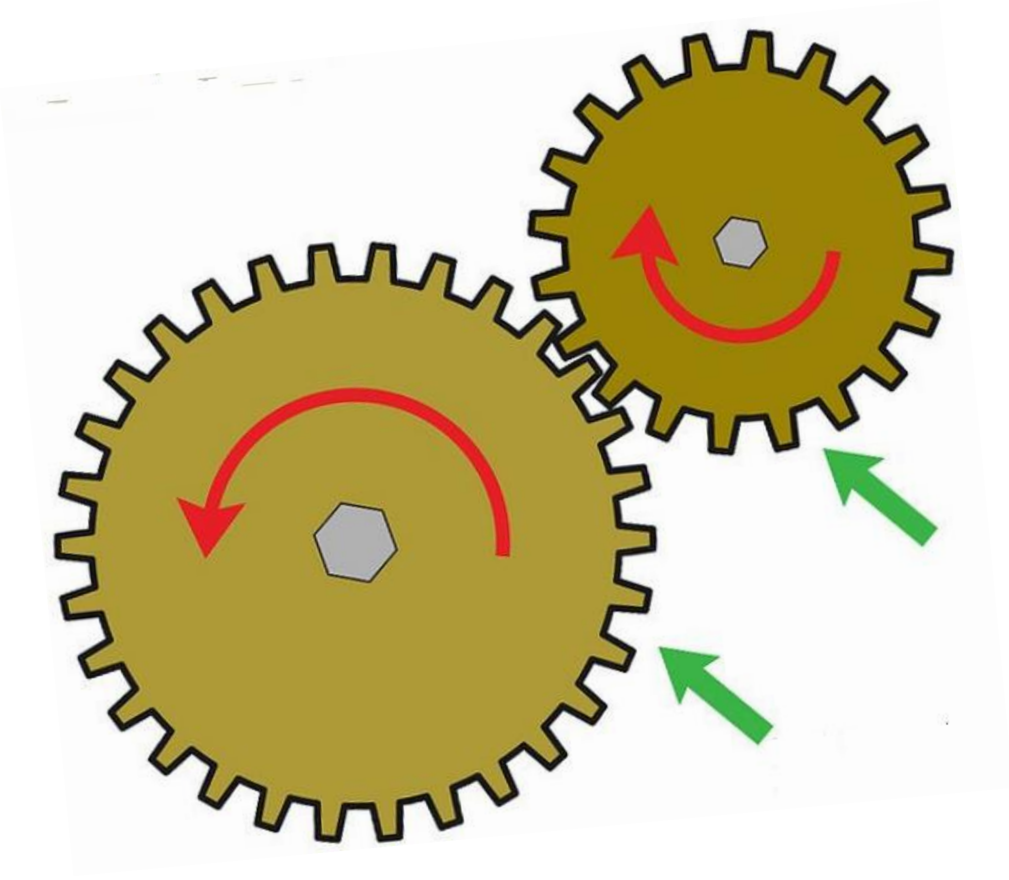
—B. M. Gordon, Analogic Corporation

Industry Expectations
“Desired Attributes Of An Engineer”

1. A good understanding of engineering science fundamentals
   - Mathematics (including statistics)
   - Physical and life sciences
   - Information technology (far more than computer literacy)
2. A good understanding of design and manufacturing processes
3. A multi-disciplinary systems perspective
4. A basic understanding of the context in which engineering is practiced
   - Economics (including business practices)
   - History
   - The environment
   - Customer and societal needs
5. Good communication skills
   - Written, oral, graphic, and listening
6. High ethical standards
7. An ability to think both critically and creatively—independently and operatively
8. Flexibility, i.e., the ability and self-confidence to adapt to rapid or major change
9. Curiosity and a desire to learn for life
10. A profound understanding of the importance of teamwork.

—The Boeing Company

Engineering Education Context Based on the Professional Context



- A focus on the needs of customers, clients, and patients
- Delivery of products, processes, and services
- Incorporation of inventions and new technologies
- Stewardship of the environment
- A focus on solutions, not disciplines
- Working with others and providing leadership in technical endeavors
- Communicating effectively
- Working efficiently, within resources, and/or profitably

Graduates Employability Outcomes

1. **Professional behaviors**

   Ability to implement professional behaviors in the workplace.

2. **Communication and Teamwork Skills**

   Effectively use communication as a tool for negotiating and creating new understandings, and interacting with others in a team environment.

3. **Critical Thinking**

   Ability to apply critical thinking and decision making skills to solve complex and ambiguous problems.

4. **Entrepreneurial Skills**

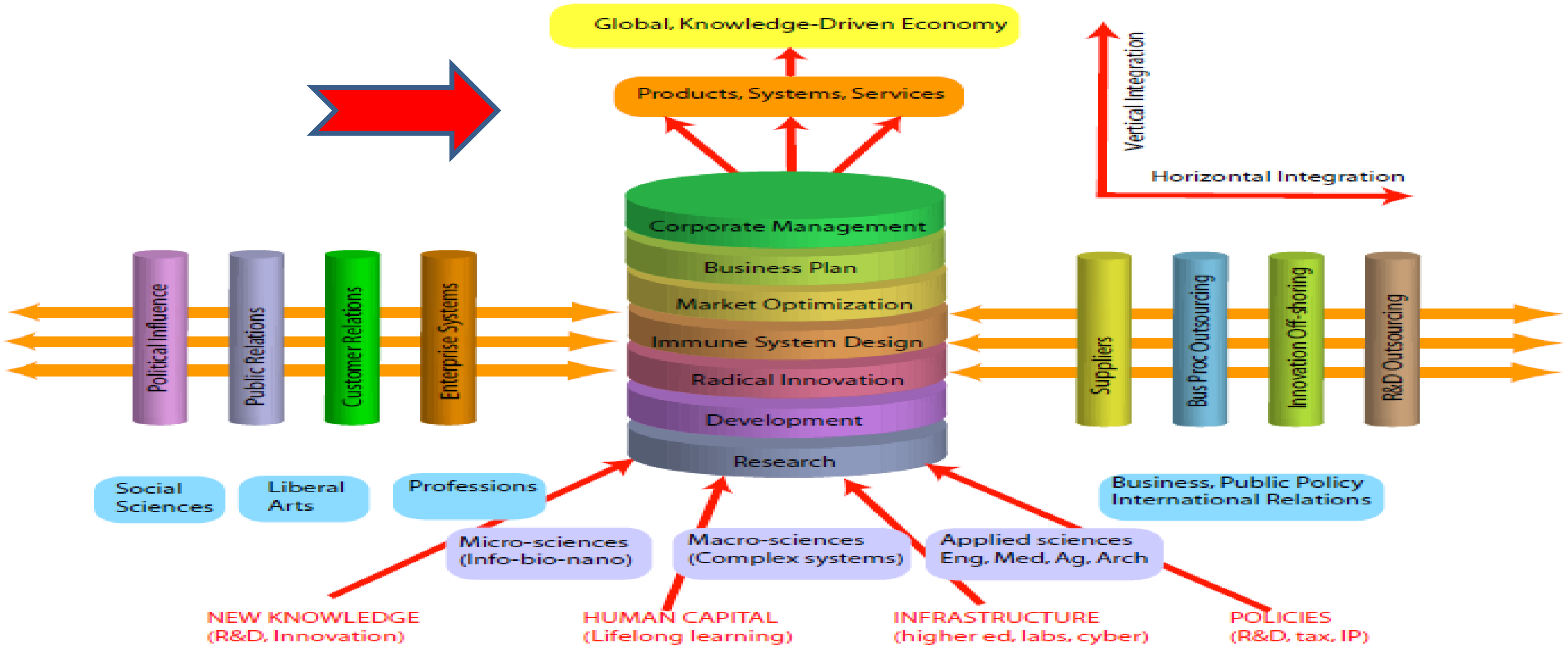
   Ability to work effectively in an environment characterized by uncertainty and risk, and a willingness to meet new challenges innovatively and independently.

5. **Planning & Organizational Skills**

   Ability to plan, organize, and control professional projects.

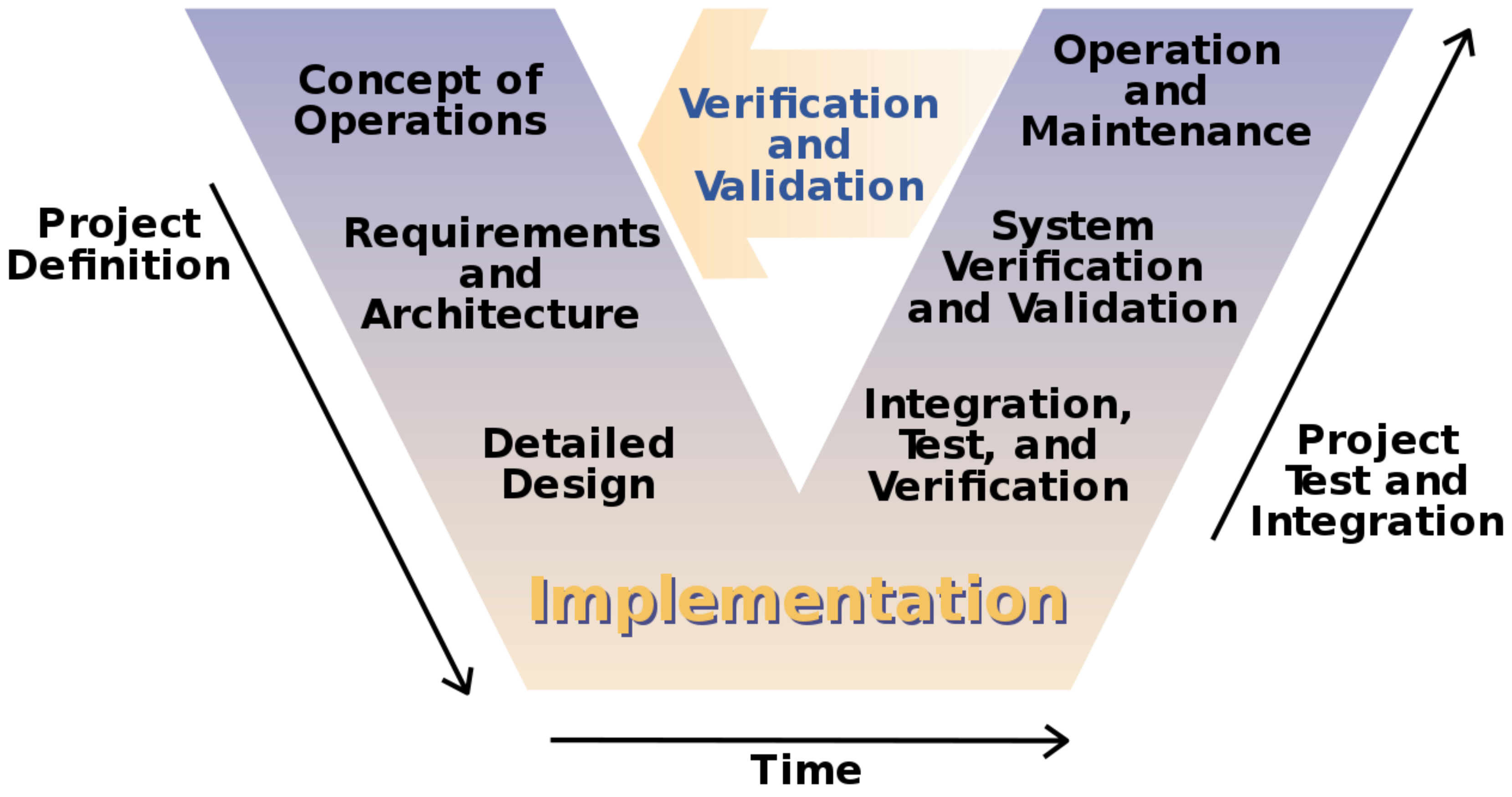
Engineering for a Changing World

A Roadmap to the Future of
Engineering Practice, Research, and Education



The Millennium Project
The University of Michigan

Systems Engineering Process

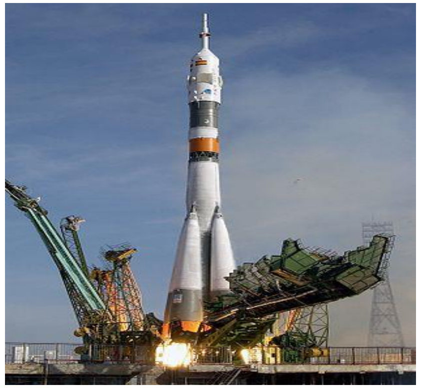


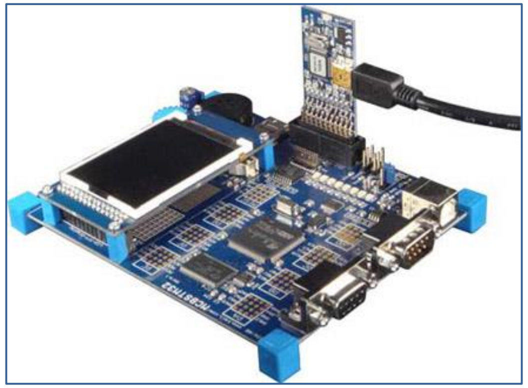
V model of the systems engineering process from:
"Systems Engineering Process II" by Osborne, Brummond et al.

The Professional Role(s) of Engineers

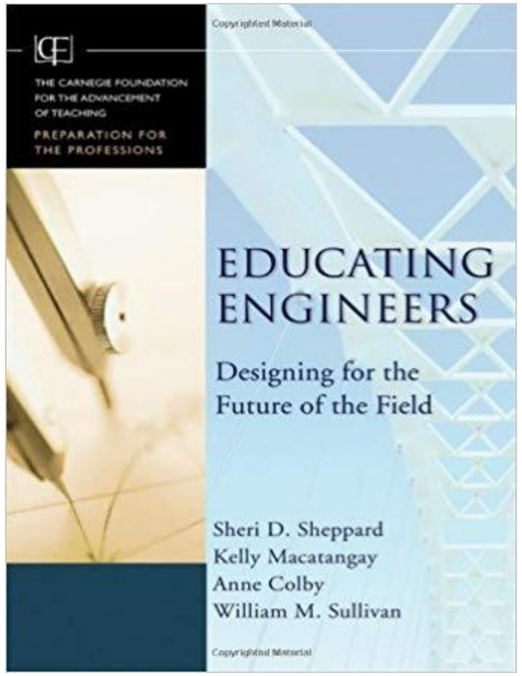
"Engineers Conceive, Design, Implement, and Operate Complex products and systems in a modern team based Engineering environment."

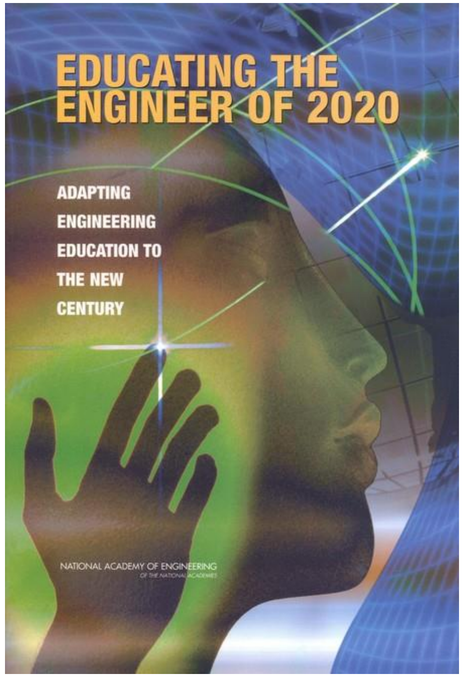
Conceive	**Form or devise (a plan or idea) in the mind.** **Form a mental representation of;** **Imagine.** **Become affected by**

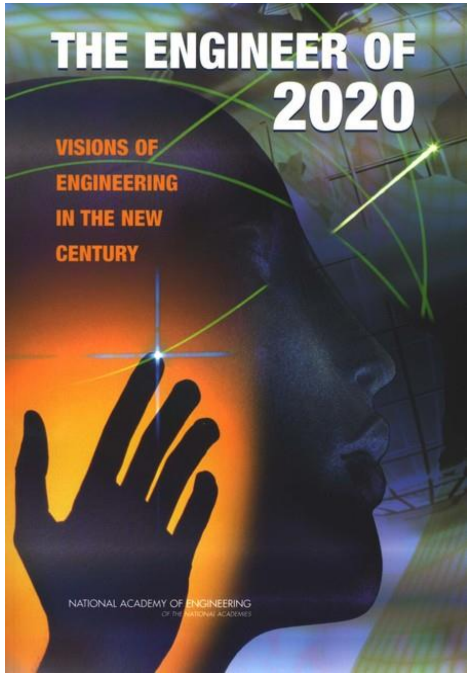


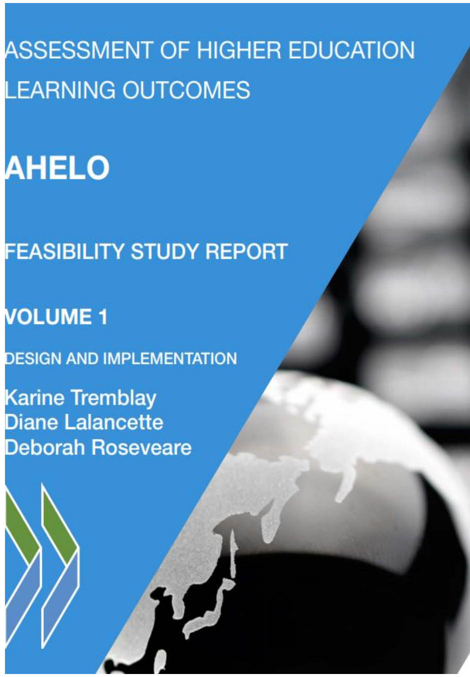


NAE



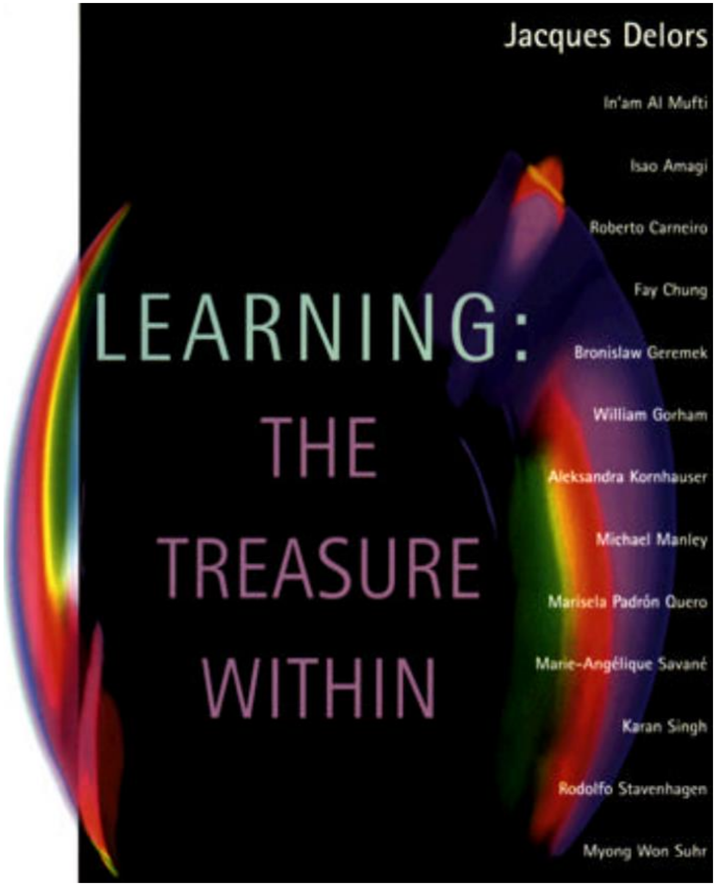






European Society for Engineering Education

Progress is impossible without change, and those who cannot change their minds cannot change anything



Tuning
Tuning Educational Structures in Europe

The TUNING Project is a project by and for Higher Education Institutions.
It started as the Universities' response to the challenge of the Bologna Process, but has evolved into a world wide Process

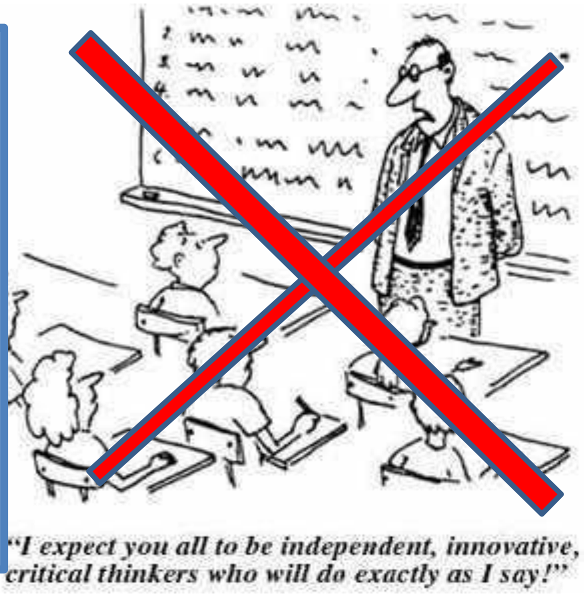
TUNING MOTTO:
Tuning of educational structures and programmes on the basis of diversity and autonomy

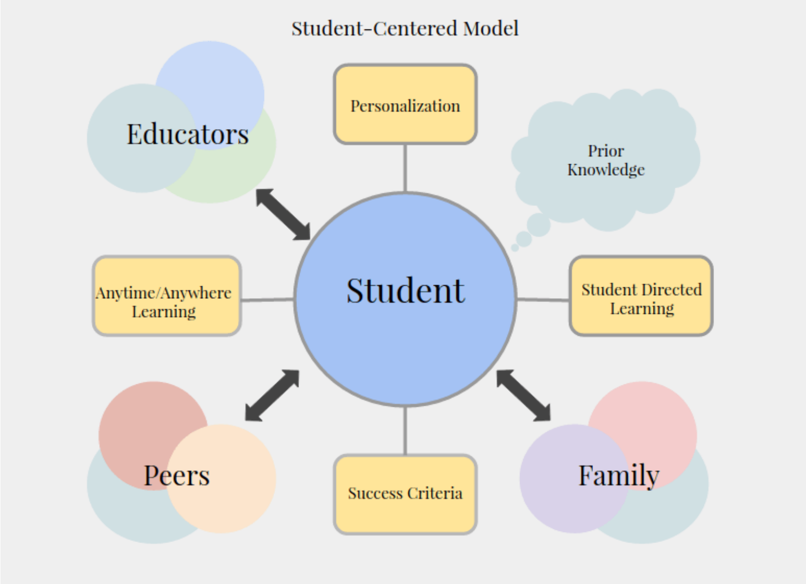
bologna
process

World declaration on higher education
For the twenty-first century: vision and action

We have to change the:

- Mission
- Content
- The Purpose
- The Methods of Delivery
- The Environment and the physical space
- The Assessment Methods
- The Roles
- The Culture and the attitude





Teaching

Research

Services

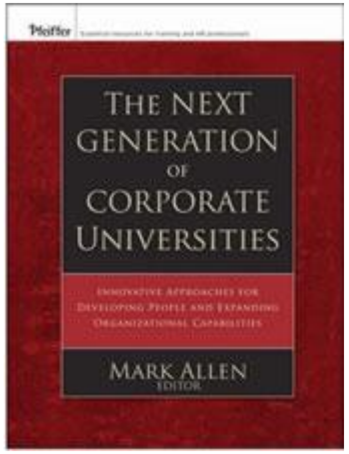
→

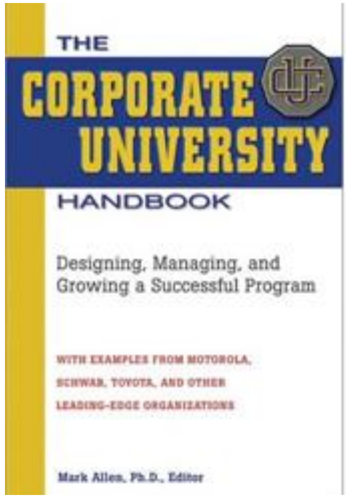
Learning

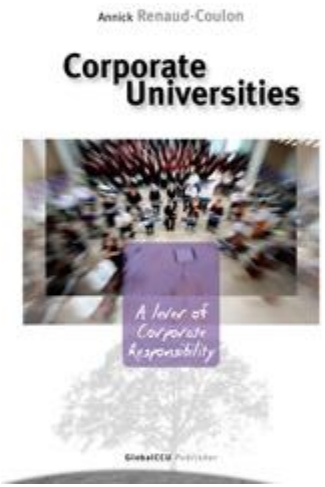
Innovation and Devlelopment

Shared Leadership

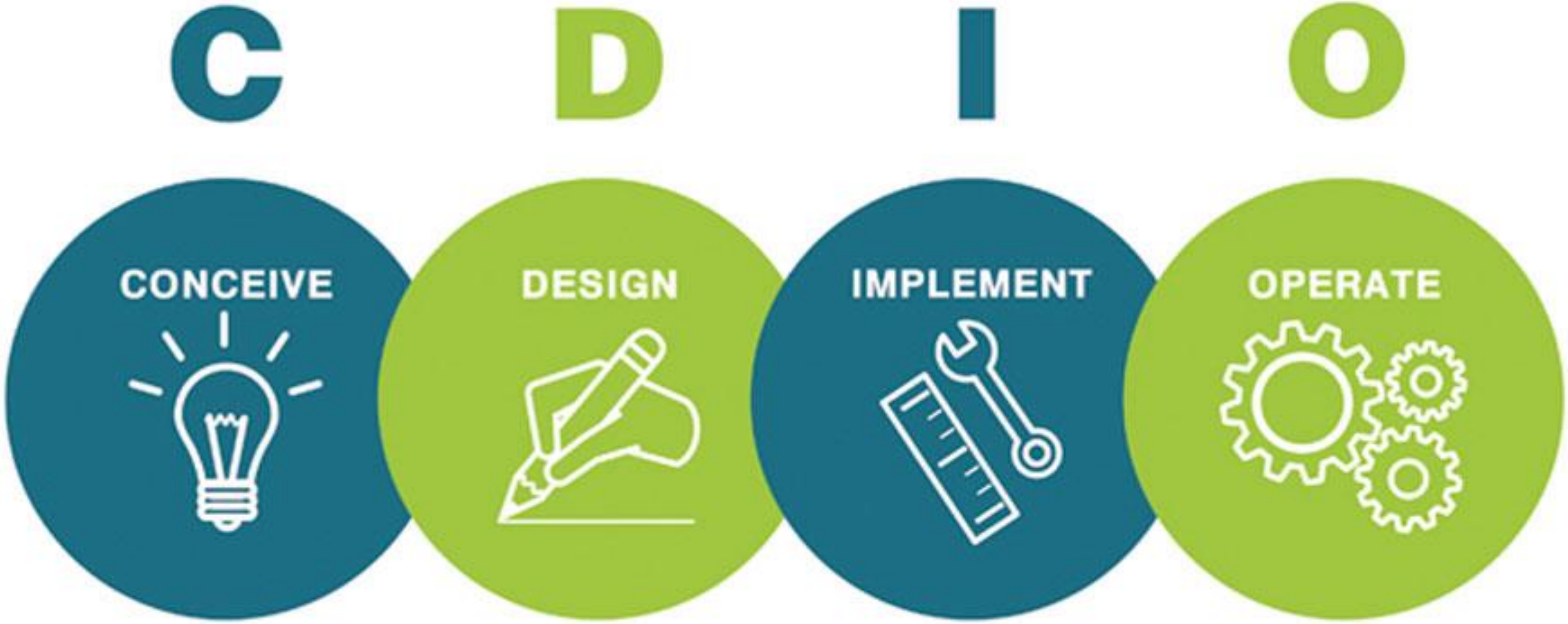
If You you don’t change
You will be changed







Initiative for Change



The Story Before CDIO: IUGREEE

Industry-university-government roundtable for enhancing engineering education (IUGREEE)

the teaching of engineering science.

- Teaching engineering practice was increasingly de-emphasized.
- As a result, industry in recent years has found that graduating students, while technically adept, lack many abilities required in real-world engineering situations. Major companies created lists of abilities they wanted their engineers to possess.
-

To encourage schools to meet real world needs and rethink their educational strategies,
ABET, listed its expectations for graduating engineerIndustry-university-government roundtable for enhancing engineering education (IUGREEE)

IUGREEE Composition (1995-1997)

Industry:

ABEWNWL
Aero Vironment
Allied Signal Aerospace
Allison Engine Company
Boeing
Boise Cascade
"Flight & Space" Magazine
GE Aircraft Engines
Hewlett-Packard
Honeywell
Hughes Electronics Company
Kaiser Aerospace
Lockheed Martin
McDonnell Douglas
Northrop Grumman
Parker Bertea Aerospace
Raytheon Aircraft Company
Rockwell International Corp.
Solar Turbines
Sundstrand Aerospace
TRW Space and Electronics Group
United Technologies Corp.
Weyerhauser
Williams International
Xerox Corp.

University:

Brigham Young University
Carnegie Mellon University
Clemson University
Duke University
Georgia Institute of Technology
Iowa State University
Johns Hopkins University
Loyola Marymount University
Massachusetts Institute of Technology
Princeton University
Purdue University
Stanford University
Texas A&M University
United States Air Force Academy
University of Arizona
University of California – Berkley
University of Florida
University of Minnesota
University of Tennessee
University of Washington
Virginia Polytechnic Institute and State University
Washington State University
Wichita State University
Worcester Polytechnic Institute

Government:

National Science Foundation (NSF)
National Aeronautics and Space Administration (NASA)
U.S. Department of Commerce
Sandia National Laboratories

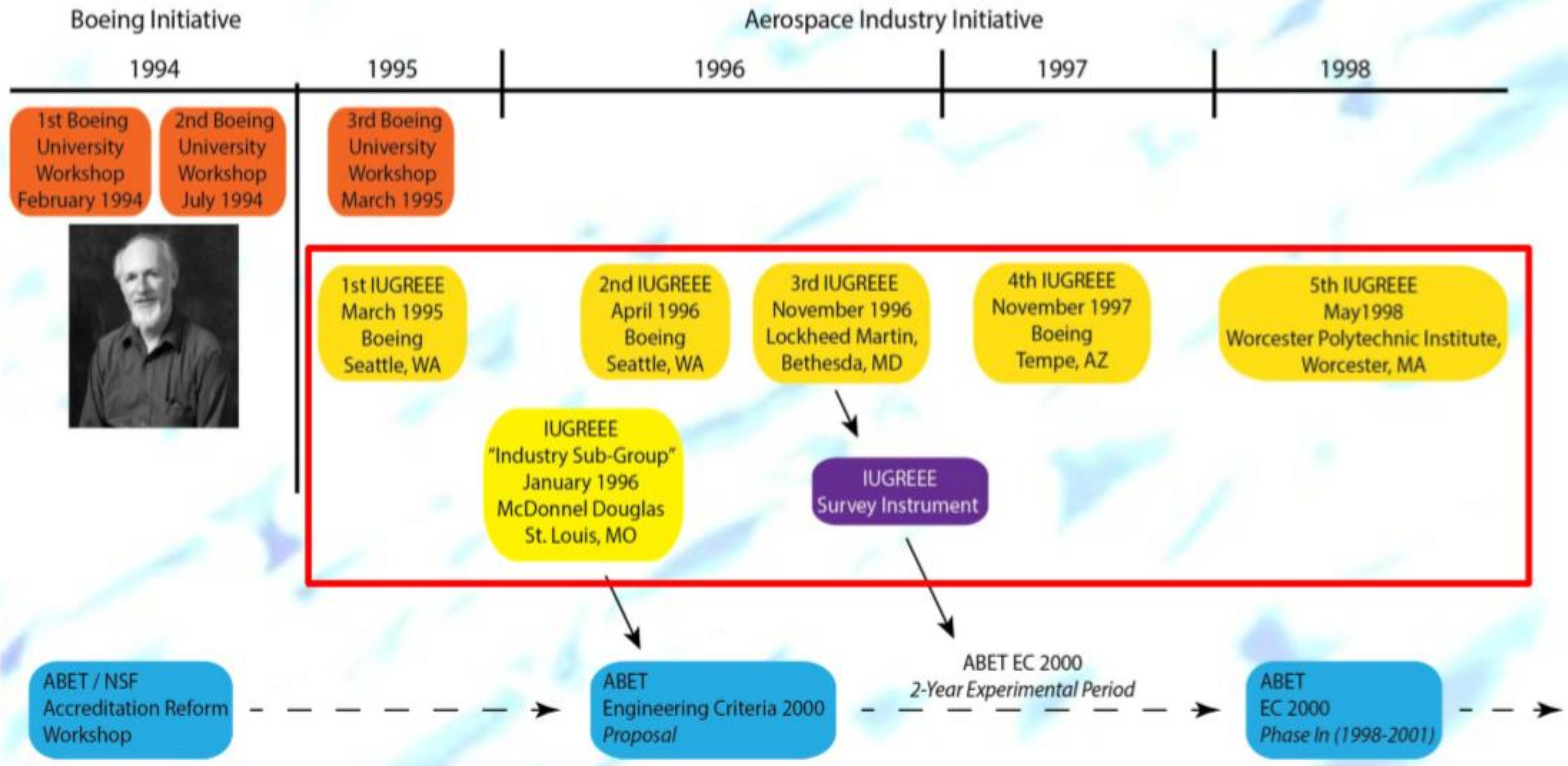
Professional Societies:

Accreditation Board for Engineering and Technology (ABET)
American Institute of Aeronautics and Astronautics (AIAA)
American Society for Engineering Education (ASEE)
American Society of Mechanical Engineers (ASME)
Institute of Electrical and Electronics Engineers (IEEE)
National Academy of Engineering (NAE)
National Academy of Sciences (NAS)
Society of Automotive Engineers (SAE)
Society of Manufacturing Engineers (SME)
Seattle Professional Engineering Employees Association (SPEEA)

Bowman, D., Lang, J., McMasters, J.H., "The Roundtable for Enhancing Engineering Education – An Update," AIAA-97-0844.

Image: Thomas Hawk

Industry-University-Government Roundtable for Enhancing Engineering Education



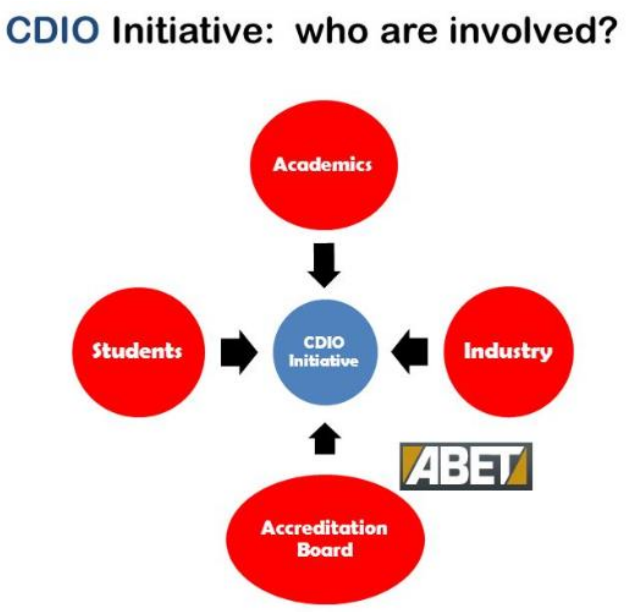
McMasters, J.H. and Matsch, L.A., "Desired attributes of an engineering graduate – an industry perspective," AIAA-96-2241.

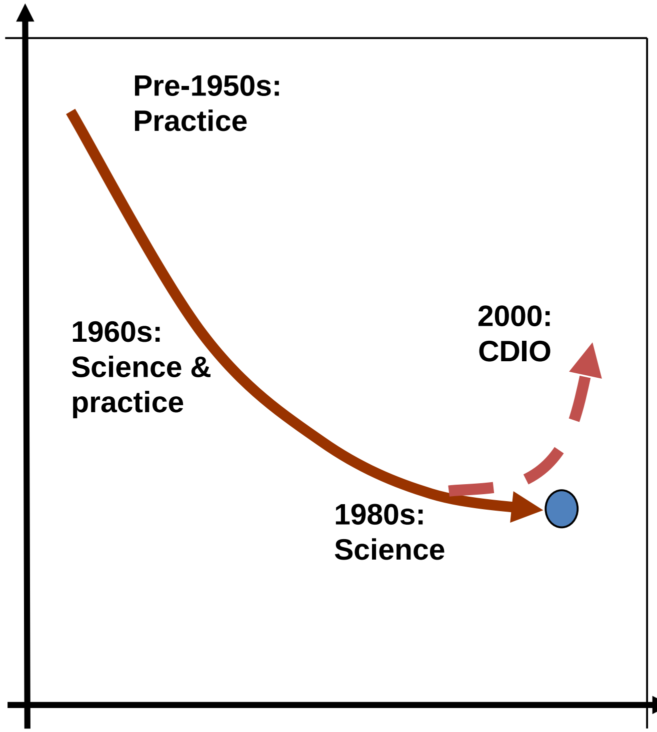
Image: Thomas Hawk

To encourage schools to meet real world needs and rethink their educational strategies, ABET, listed its expectations for graduating engineerIndustry-university-government roundtable for enhancing engineering education (IUGREEE)

The Underlying Needs For Reform

- Industry and ABET had identified the destination; it was up to educators to plan the route.
- Faced with the gap between scientific and practical engineering demands, the **professional and dedicated** educators took up the challenge to reform engineering education.
- The result of the endeavor is the worldwide CDIO Initiative to educate students who:
- Understand how to Conceive-Design-Implement-Operate





The Learning Context for Professional Practice

- **A focus on the needs of customers, clients, and patients**
- **Delivery of products, processes, and services**
- **Incorporation of inventions and new technologies**
- **Stewardship of the environment**
- **A focus on solutions, not disciplines**
- **Working with others and providing leadership in technical endeavors**
- **Communicating effectively**
- **Working efficiently, within resources, and/or profitably**

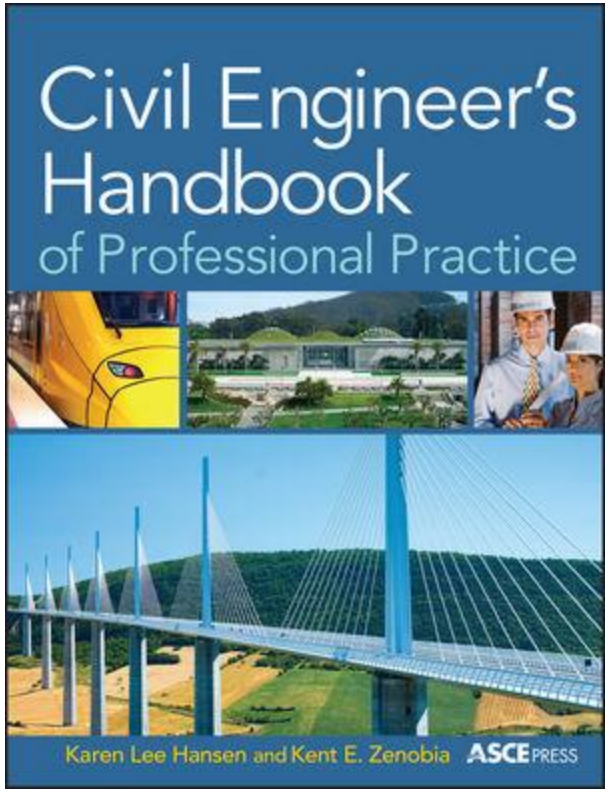
Input →

CDIO as the context of engineering education

Benefits of Learning in Ccontext

Learning in the context of professional practice:

- **Increases retention of new knowledge and skills**
- **Interconnects concepts and knowledge that build on each other**
- **Communicates the rationale and relevance of what students are learning**
- **Enables students to build their own frameworks for learning**



Context for engineering education: the C-D-I-O process

Lifecycle of a product, process, or system:

Conceive: customer needs, technology, enterprise strategy, regulations; and conceptual, technical, and business plans

Design: plans, drawings, and algorithms that describe what will be implemented

Implement: transformation of the design into the product, process, or system, including manufacturing, coding, testing and validation

Operate: the implemented product or process delivering the intended value, including maintaining, evolving and retiring the system

Conceiving Leads To:

accept	apprehend	envisage	get	suspect
assume	catch	expect	grasp	take
believe	compass	fancy	imagine	twig
perceive	comprehend	feel	judge	
realize	deem	follow	reckon	
appreciate	dig	gather	suppose	

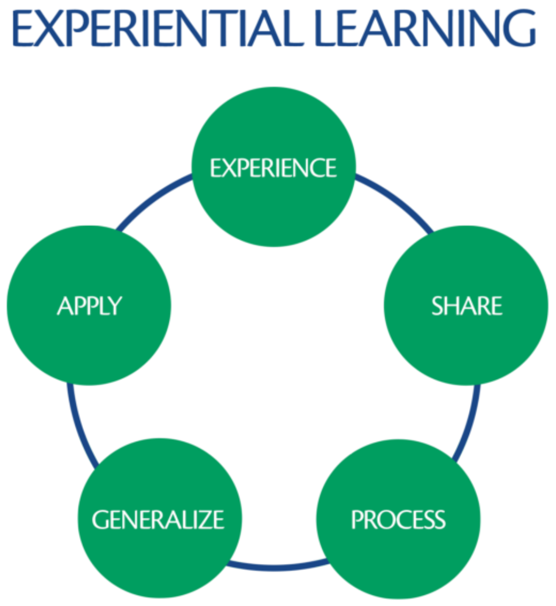
Conceive		Design		Implement		Operate	
Mission	**Conceptual Design**	**Preliminary Design**	**Detailed Design**	**Element Creation**	**Systems' Integration & Test**	**Lifecycle Support**	**Evolution**
• Business Strategy • Technology Strategy • Customer Needs • Goals • Competitors • Program Plan • Business Plan	• Requirements • Function • Concepts • Technology • Architecture • Platform Plan • Market Positioning • Regulation • Supplier Plan • Commitment	• Requirements Allocation • Model Development • System Analysis • System Decomposition • Interface Specifications	• Element Design • Requirements Verification • Failure & Contingency Analysis • Validated Design	• Hardware Manufacturing • Software Coding • Sourcing • Element Testing • Element Refinement	• System Integration • System Test • Refinement • Certification • Implementation Ramp-up • Delivery	• Sales & Distribution • Operations • Logistics • Customer Support • Maintenance & Repair • Recycling • Upgrading	• System Improvement • Product Family Expansion • Retirement

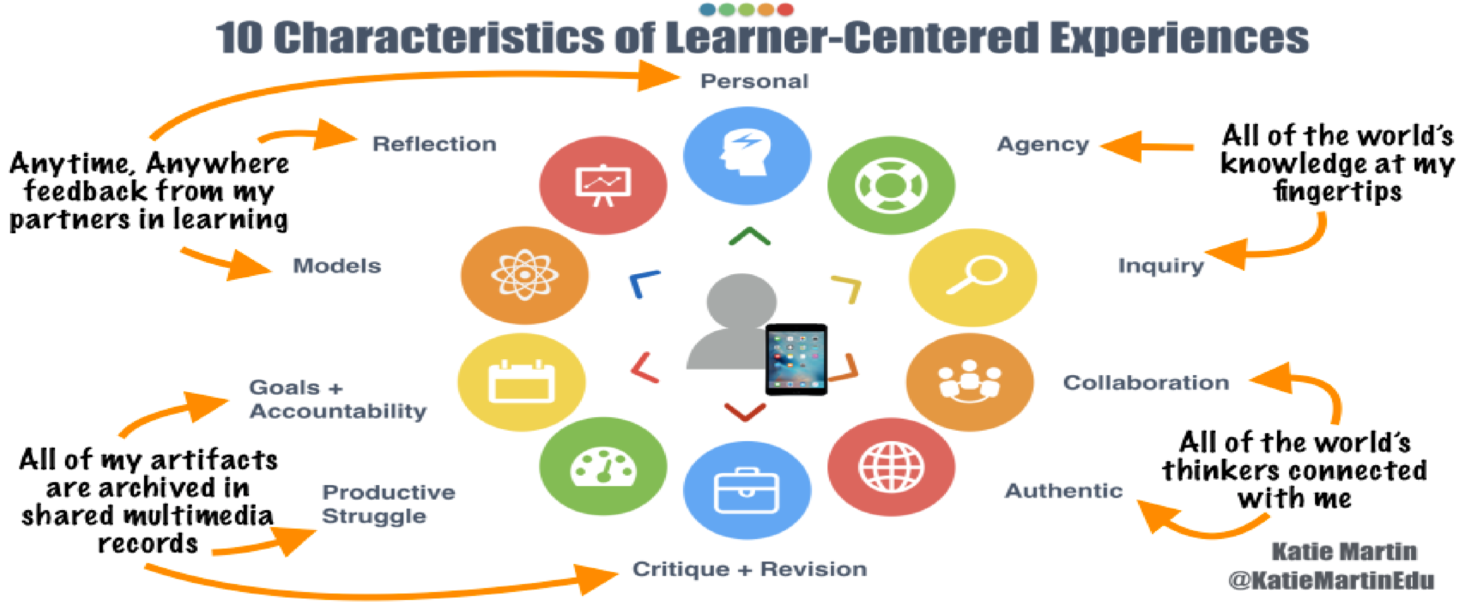
These four terms have been chosen because they are applicable to a wide range of engineering disciplines. Details of the tasks that fall into these four main activities are given

The CDIO Vision

An education that stresses disciplinary knowledge set in the context of Conceiving-Designing-Implementing-Operating products, processes, and systems

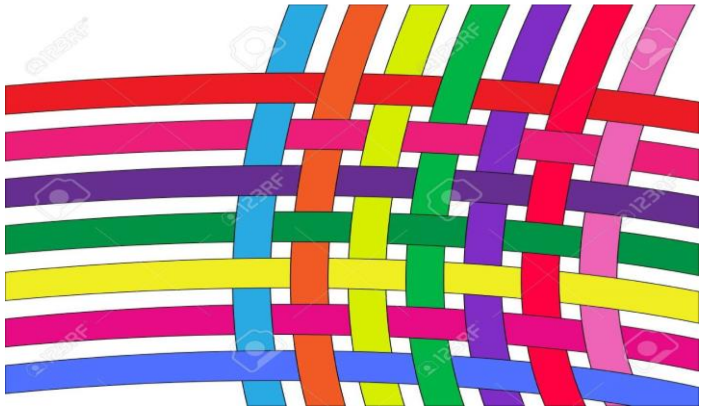
- **A curriculum that is cantered on students, multidisciplinary, and based on specified learning outcomes**
- **Featuring active and experiential learning, including a variety of project-based learning experiences**
- **Set in both classrooms and modern learning laboratories and workspaces**
- **Constantly improved through robust assessment and evaluation processes**





The salient features of the vision are that:

- **stakeholder involvement.**
- **disciplinary courses with activities interwoven that develop personal and interpersonal skills, and product, process and system building skills.**
- **Design-implement experiences set in both the classroom and in modern learning workspaces as the basis for engineering-based experiential learning.**
- **Active and experiential learning, can be incorporated into lecture-based courses.**
- **A comprehensive assessment and evaluation process**



Goals of CDIO

- To educate students to master a **deeper working knowledge** of the technical fundamentals
- To educate engineers to **lead in the creation and operation** of new products and systems
- To educate all to understand the importance and **strategic impact of research** and technological development on society
- And to attract and retain student in engineering

Deep Approach To Learning

A deep approach is encouraged by:

- **Student perceptions that deep learning is required in depth**
- **A motivational context**
- **A well-structured knowledge base**
- **Learner activity and choices**
- **Assessment based on application to new situations**
- **Interaction with others and collaboration**

Transform The Culture

CURRENT	DESIRED
Engineering Science	Engineering
R&D Context	Product Context
Reductionist	Integrative
Individual	Team

But Still Based On A Rigorous Treatment Of Engineering Fundamentals

CDIO Initiators and Collaborating Institutions

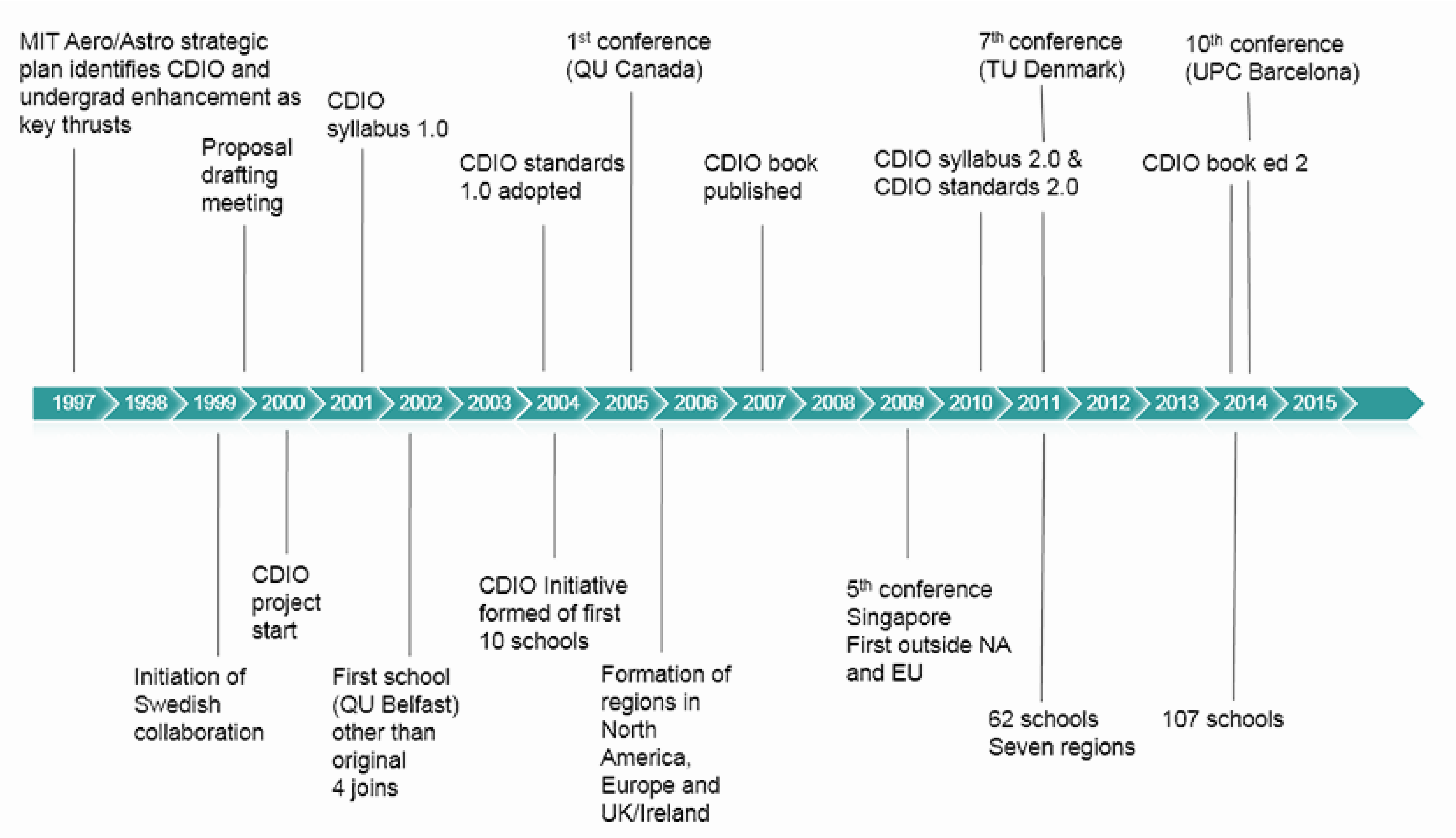
Development and implementation of the CDIO approach was initiated at one in the USA and three universities in Sweden and :

CDIO Concept late 1990

Massachusetts Institute of Technology (MIT) in Cambridge, Massachusetts, USA

CDIO Initiative 2000

- **Chalmers University of Technology (Chalmers) in Göteborg,**
- **the Royal Institute of Technology (KTH) in Stockholm,**
- **Linköping University (LiU) in Linköping**
- **Massachusetts Institute of Technology (MIT) in Cambridge, Massachusetts, USA.**


MIT Aero/Astro strategic plan identifies CDIO and undergrad enhancement as key thrusts
Proposal drafting meeting
CDIO syllabus 1.0
CDIO standards 1.0 adopted
1st conference (QU Canada)
CDIO book published
CDIO syllabus 2.0 & CDIO standards 2.0
7th conference (TU Denmark)
CDIO book ed 2
10th conference (UPC Barcelona)
1997
1998
1999
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2001
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2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Initiation of Swedish collaboration
CDIO project start
First school (QU Belfast) other than original 4 joins
CDIO Initiative formed of first 10 schools
Formation of regions in North America, Europe and UK/Ireland
5th conference Singapore First outside NA and EU
62 schools Seven regions
107 schools


CDIO Initiative - Collaborating Institutions
Atlantic Ocean
AFRICA
Pacific Ocean
Indian Ocean
Pacific Ocean
Google My Maps
Map data ©2018
Terms
5,000 km

CDIO Syllabus

- The CDIO Syllabus is a list of knowledge, skills, and attitudes desired of graduating engineers.
- What is the full set of knowledge, skills, and attitudes that engineering students should possess as they leave the university, and at what level of proficiency?
- It is rationalized against the norms of contemporary engineering practice,
- The principal value of the Syllabus is that it can be applied across a variety of programs and can serve as a model for all programs to derive specific learning outcomes

CDIO Syllabus Goals

1. The specific objective of the CDIO Syllabus is to create a clear, complete, consistent, and generalizable set of goals for undergraduate engineering education, in sufficient detail that they can be understood and implemented by engineering faculty.
2. These goals would form the basis for educational and learning outcomes, the design of curricula, as well as the basis for a comprehensive system of student learning assessment.
3. In addition, they would form the basis for effective communication, benchmarking, interuniversity sharing, and international correspondence.

CDIO Syllabus Goals

4. Is to summarize formally a set of knowledge, skills and attitudes that alumni, industry and academia desire in a future generation of young engineers
5. To define expected outcomes in terms of learning objectives of the personal, interpersonal and system building skills necessary for modern engineering practice
6. To design new educational initiatives, and it can be employed as the basis for a rigorous outcomes-based assessment process, such as that required by the Accreditation Board for Engineering Technology (ABET), and increasingly by other international accreditation processes as well

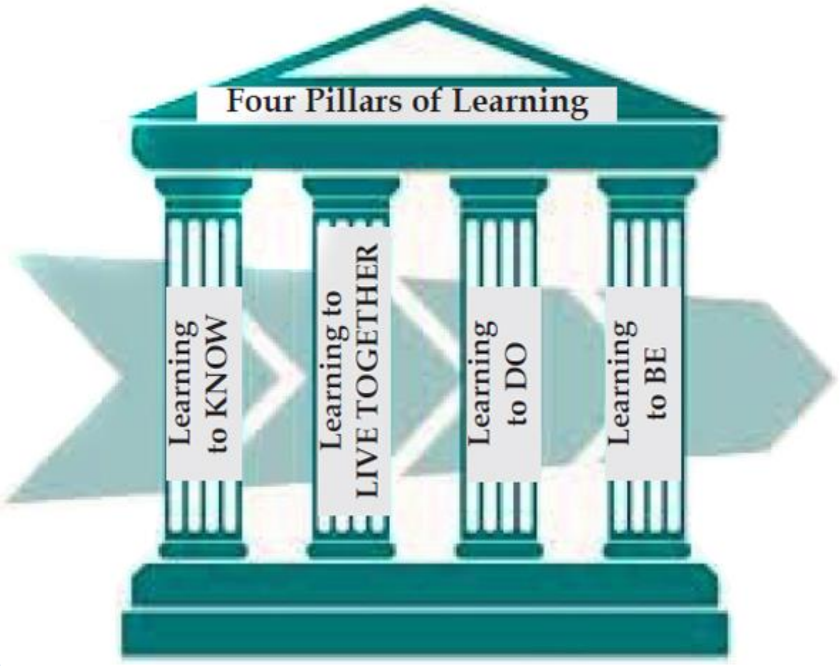
The CDIO Syllabus Characteristics

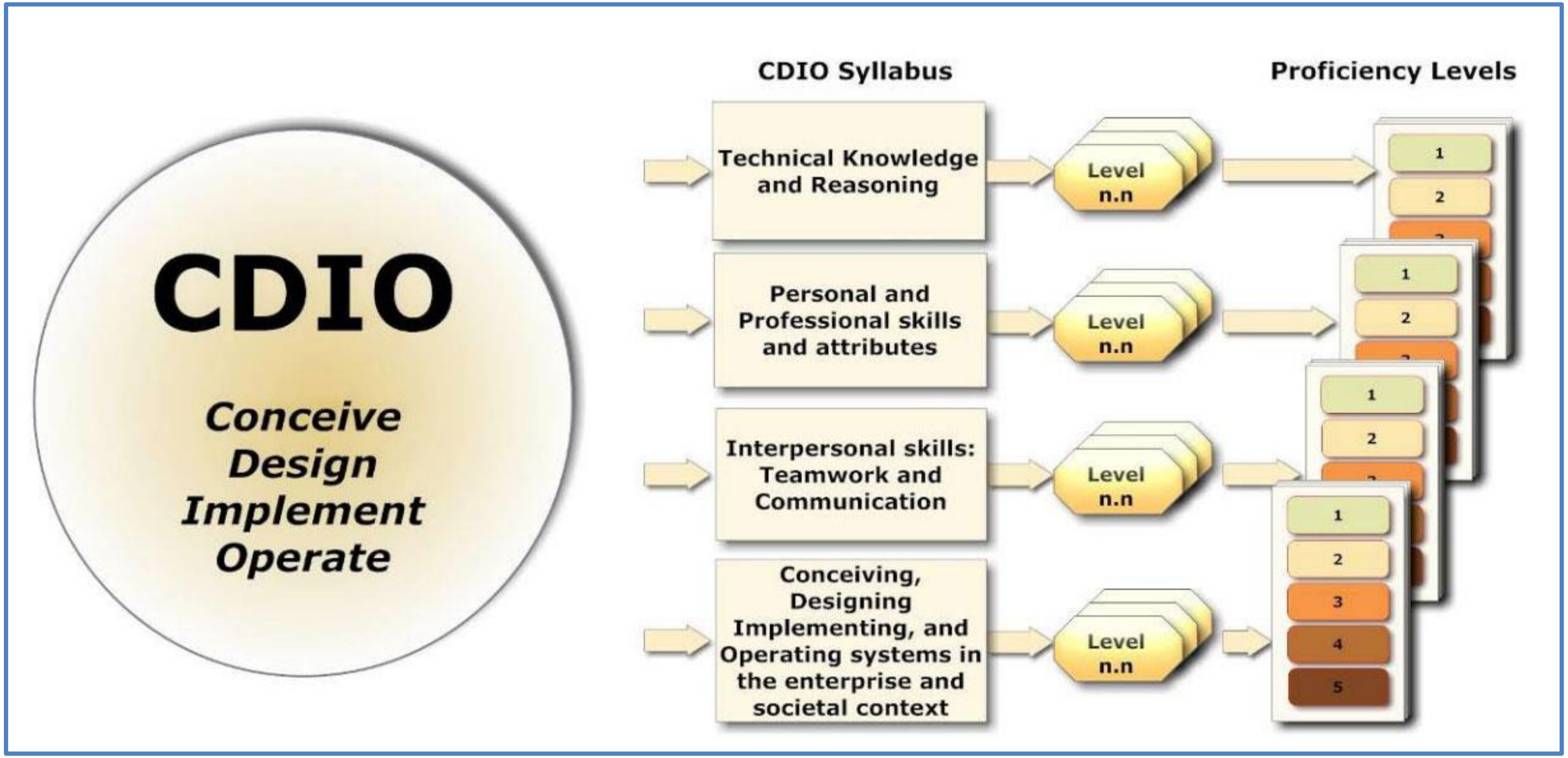
- **Comprehensive** — all relevant primary source material correlated and included
- **Prioritized by stakeholders** — extensive survey of stakeholders to determine priority and level of accomplishment
- **Reviewed by peers** — experts in each field reviewed materials and correlated with field-specific primary source material
- **Appropriate** — filtered to those aspects appropriate to university teaching and learning
- Expressed as **learning objectives or competency statements** in an appropriate taxonomy
- Basis for rigorous **curriculum design** and **assessment processes**
- **The content of each section was expanded to a second level to a third level and to a fourth level**

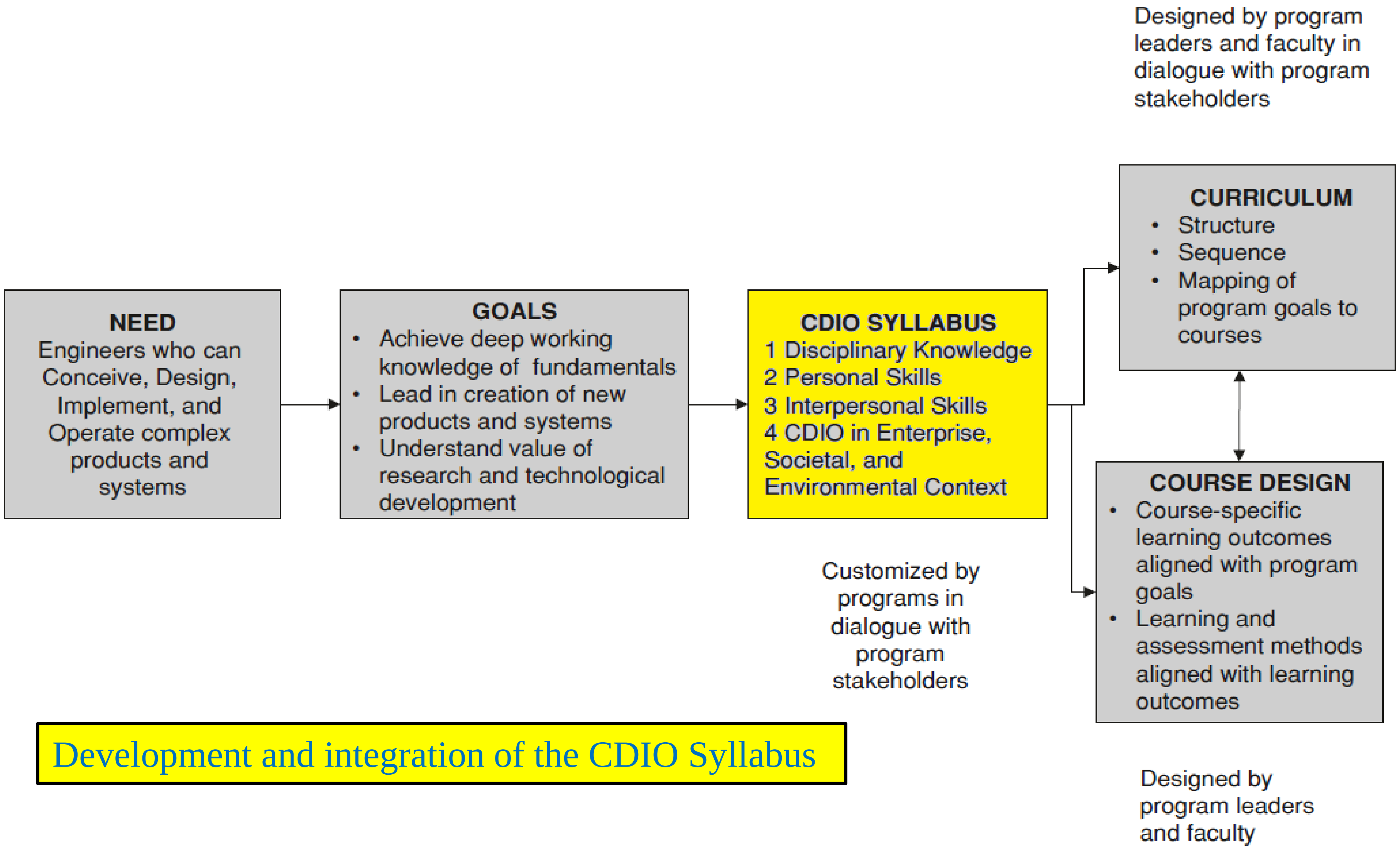
The organization of the CDIO Syllabus and the UNESCO

An independent validation of this choice is the universal educational taxonomy developed by UNESCO. They have proposed that all education should be organized around four fundamental types of learning:

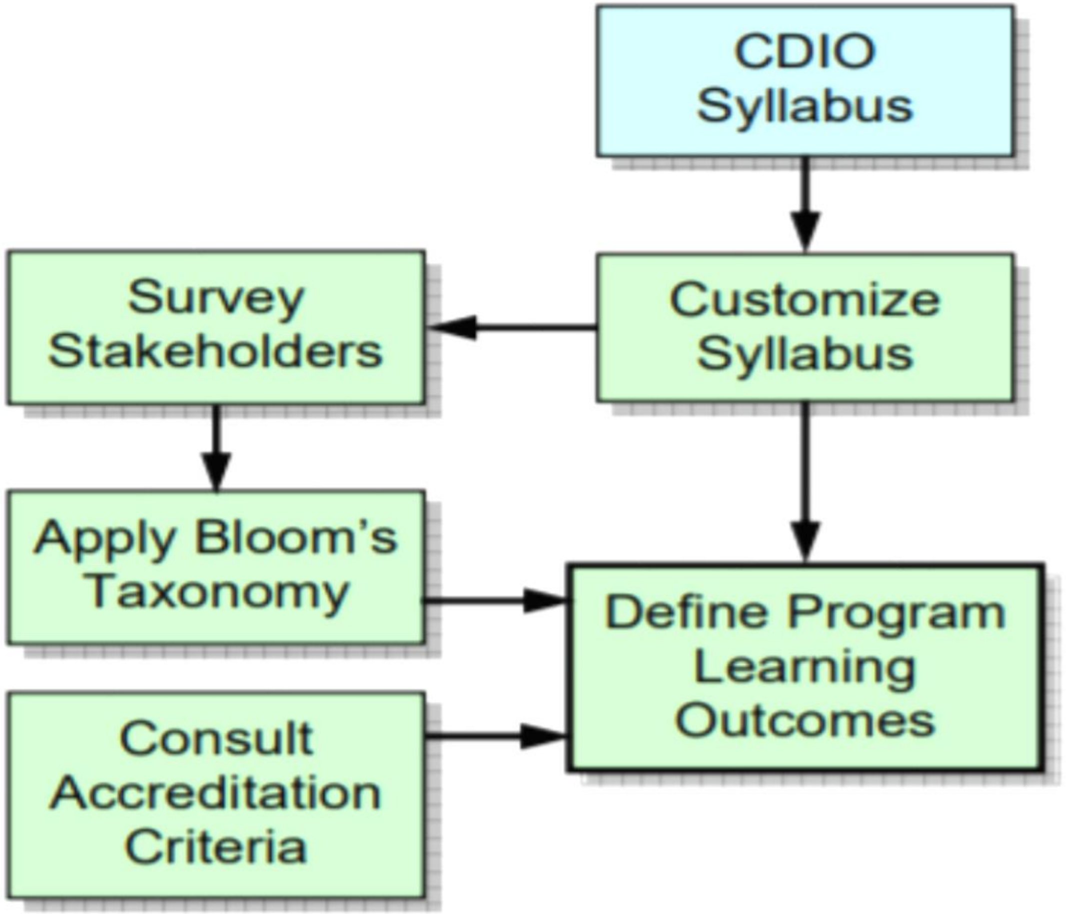
- Learning to Know, that is, acquiring the instruments of understanding
- Learning to Do, so as to be able to act creatively on one's environment
- Learning to Live Together, so as to co-operate with other people
- Learning to Be, an essential progression that proceeds from the previous three




CDIO Syllabus
Proficiency Levels
CDIO
Conceive
Design
Implement
Operate
Technical Knowledge and Reasoning
Personal and Professional skills and attributes
Interpersonal skills: Teamwork and Communication
Conceiving, Designing Implementing, and Operating systems in the enterprise and societal context
Level n.n
1
2
3
4
5



Development and integration of the CDIO Syllabus



The CDIO Methodology: Developing Program Learning Outcomes

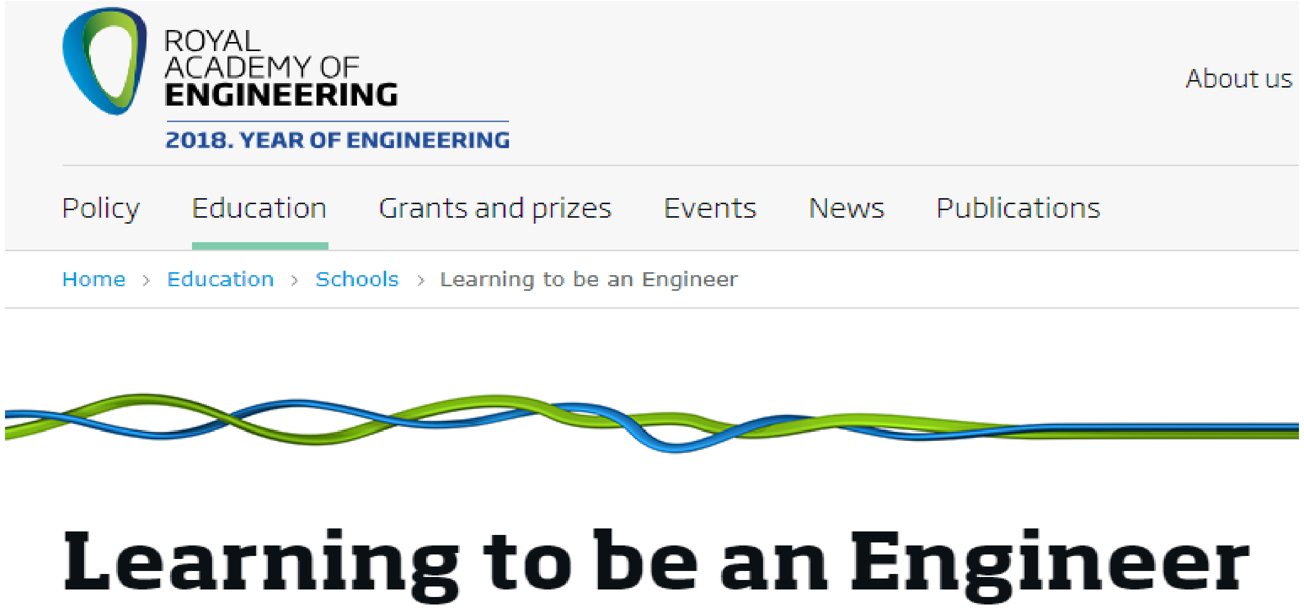
Proceedings of the 4th International CDIO Conference, Hogeschool Gent, Gent, Belgium, June 16-19, 2008

The organization of the CDIO Syllabus

The organization of the CDIO Syllabus can be described as an adaptation of the UNESCO framework to the context of engineering education.

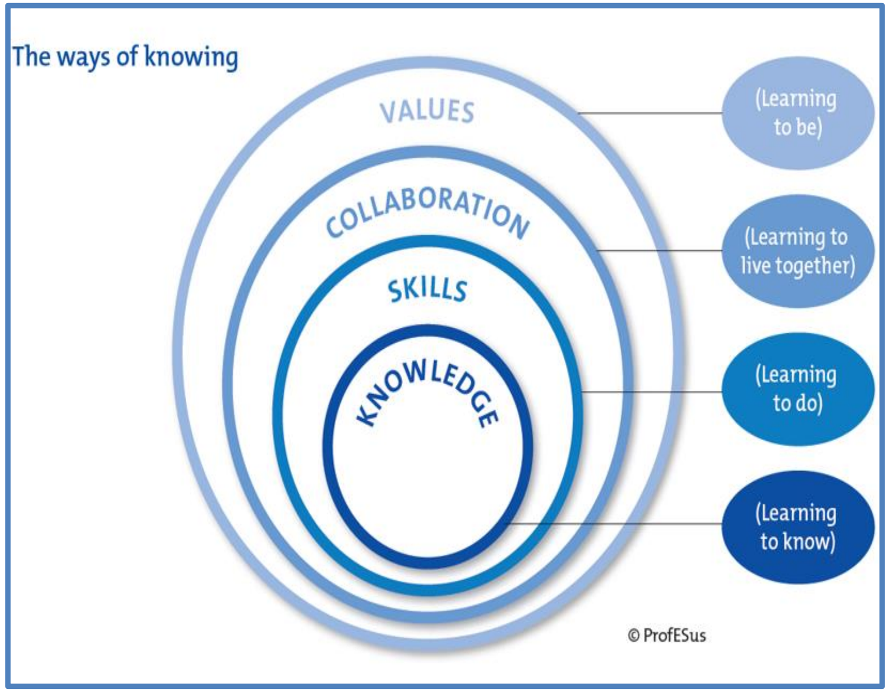
At the first level, the CDIO Syllabus is divided into four categories:

1. Technical Knowledge and Reasoning (or UNESCO Learning to Know) Section 1 of the CDIO Syllabus defines the mathematical, scientific and technical knowledge that an engineering graduate should have developed.
2. Personal and Professional Skills and Attributes (or UNESCO Learning to Be) Section 2 of the Syllabus deals with individual skills, including problem solving, ability to think creatively, critically, and systemically, and professional ethics.



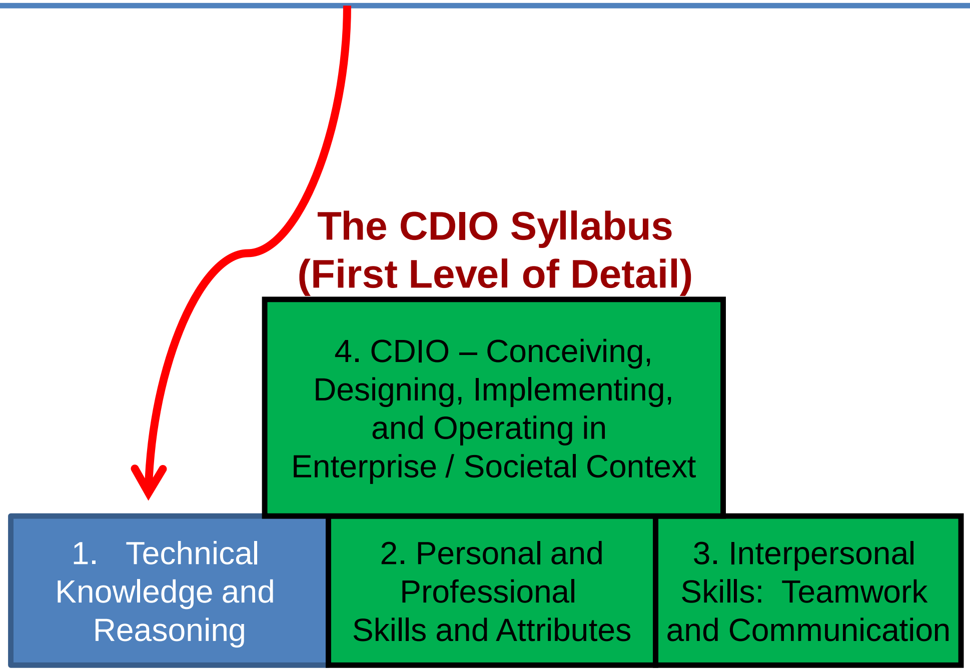
The organization of the CDIO Syllabus

3. Interpersonal Skills: Teamwork and Communication (or UNESCO Learning to Live Together) Section of the Syllabus lists skills that are needed in order to be able to work in groups and communicate effectively.
4. Conceiving, Designing, Implementing and Operating Systems in the Enterprise, Societal and Environmental Context (or UNESCO Learning to Do) Finally, Section 4 of t CDIO Syllabus is about what engineers do, that is, conceive-design-implement-operate products, processes and systems within an enterprise, societal, and environmental context.



CDIO Syllabus And The Attributes Of An Engineer Program Learning Outcomes

What is the full set of knowledge, skills and attitudes that a student should possess as they graduate from a university? At what level of proficiency? Beyond traditional engineering disciplinary knowledge



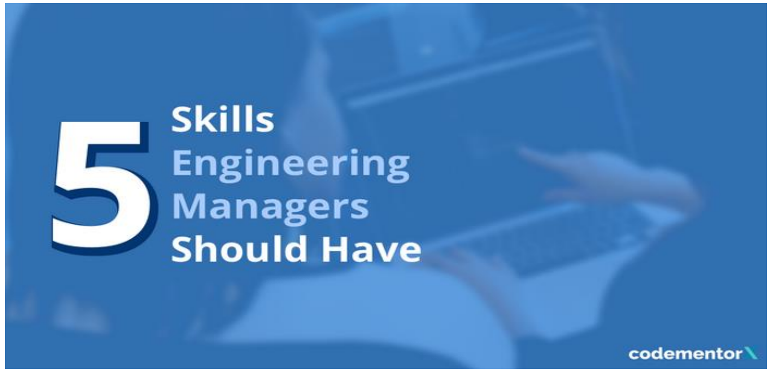
UNESCO's Four Pillars of Education

- **Learning to know (1)**
- **Learning to be (2)**
- **Learning to live together (3)**
- **Learning to do (4)**

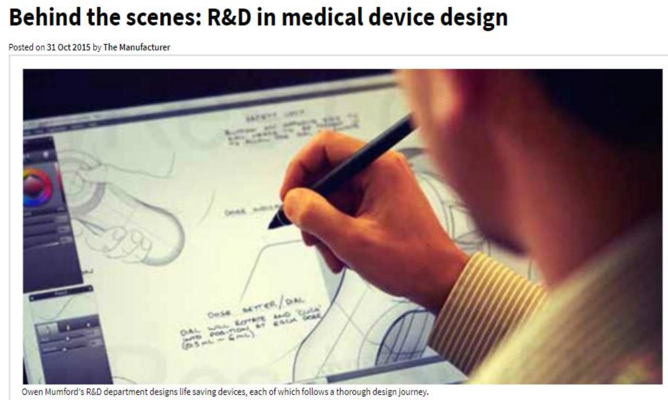
The Syllabus and The professional Tracks

There are at least five different professional tracks that engineers follow, according to their individual talents and interests. The tracks and supporting sections of the Syllabus are:

1. The Researcher : Experimentation, Investigation and Knowledge Discovery (2.2)
2. The System Designer/Engineer : Conceiving, System Engineering and Management (4.3)
3. The Device Designer/Developer : Designing (4.4), Implementing (4.5)
4. The Product Support Engineer/Operator : Operating (4.6)
5. The Entrepreneurial Engineer/Manager : Enterprise and Business Context (4.2)

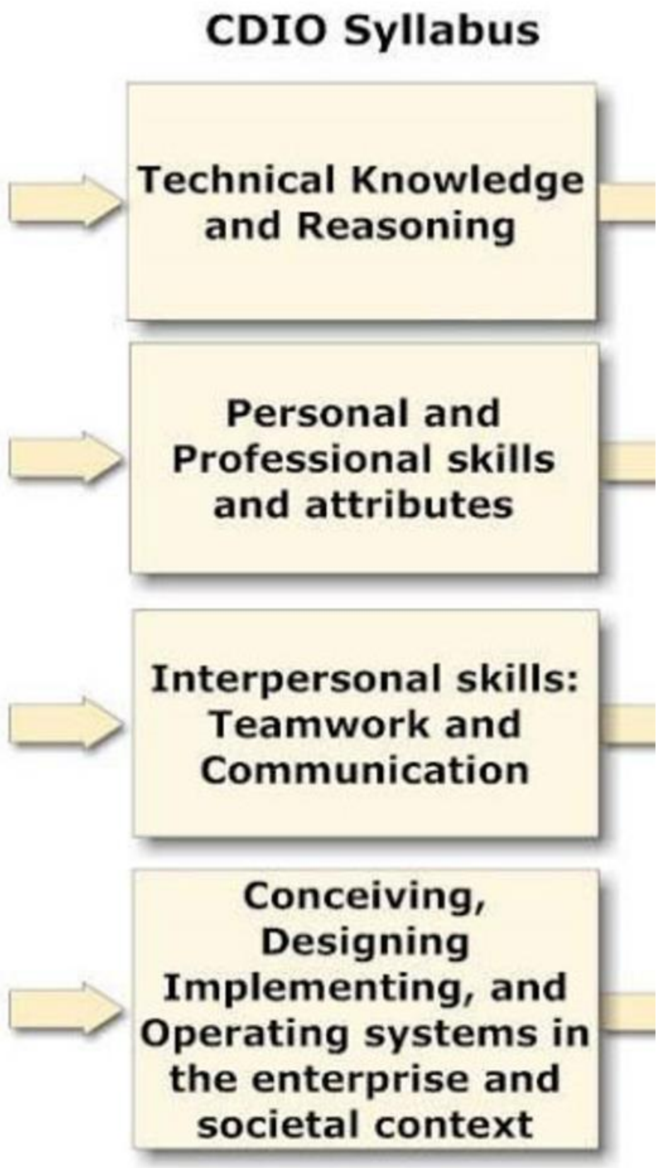


[Instructional System Designer](#)



The CDIO Syllabus
at the first level of detail

1. DISCIPLINARY KNOWLEDGE AND REASONING
2. PERSONAL AND PROFESSIONAL SKILLS AND ATTRIBUTES
3. INTERPERSONAL SKILLS: TEAMWORK AND COMMUNICATIO
4. CONCEIVING, DESIGNING, IMPLEMENTING AND OPERATING SYSTEMS IN THE ENTERPRISE, SOCIETAL AND ENVIRONMENTALCONTEXT—THE INNOVATION PROCESS



CDIO Syllabus: Second Level

1. TECHNICAL KNOWLEDGE AND REASONING
    - 1.1 KNOWLEDGE OF UNDERLYING SCIENCE
    - 1.2 CORE FUNDAMENTAL KNOWLEDGE
    - 1.3 ADVANCED FUNDAMENTAL KNOWLEDGE
2. PERSONAL AND PROFESSIONAL SKILLS AND ATTRIBUTES
    - 2.1 ANALYTIC REASONING AND PROBLEM SOLVING
    - 2.2 EXPERIMENTATION, INVISTIGATION AND KNOWLEDGE DISCOVERY
    - 2.3 SYSTEM THINKING
    - 2.4 ATTITUDES, THOUGHTS AND LEARNING
    - 2.5 ETHICS, QUALITY AND OTHER RESPONSIBILITIES

CDIO Syllabus :The Second Level

3 INTERPERSONAL SKILLS: TEAMWORK AND COMMUNICATION

- 3.1 MULTI-DISCIPLINARY TEAMWORK
- 3.2 COMMUNICATIONS
- 3.3 COMMUNICATIONS IN FOREIGN LANGUAGES

4 CONCEIVING, DESIGNING, IMPLEMENTING, AND OPERATING SYSTEMS IN THE ENTERPRISE AND SOCIETAL CONTEXT, THE INNOVATION PROCESS

- 4.1 EXTERNAL, SOCIETAL AND ENVIRONMENTAL CONTEXT
- 4.2 ENTERPRISE AND BUSINESS CONTEXT
- 4.3 CONCEIVING, SYSTEM ENGINEERING AND MANAGEMENT
- 4.4 DESIGNING
- 4.5 IMPLEMENTING
- 4.6 OPERATING
- 4.7 LEADING ENGINEERING ENDEAVORS
- 4.8 ENGINEERING ENTREPRENEURSHIP

CDIO Syllabus The Third and the Fourth Levels

2.5 ETHICS, EQUITY AND OTHER RESPONSIBILITIES [3f]

2.5.1 Ethics, Integrity and Social Responsibility

One's ethical standards and principles
The moral courage to act on principle despite adversity
The possibility of conflict between professionally ethical imperatives
A commitment to service
Truthfulness
A commitment to help others and society more broadly

2.5.2 Professional Behavior

A professional bearing
Professional courtesy
International customs and norms of interpersonal contact

2.5.3 Proactive Vision and Intention in Life

A personal vision for one's future
Aspiration to exercise his/her potentials as a leader
One's portfolio of professional skills
Considering one's contributions to society
Inspiring others

The Relevance of SYLLABUS to Engineering EDUCATION

In the past ten years, the CDIO Syllabus has played a key role in the design of curriculum, teaching, and assessment in engineering education. As a formal statement of the intended learning outcomes of an engineering program, the Syllabus was able to :

1. Capture the expressed needs of program stakeholders
2. Highlight the overall goals of an engineering program
3. used as a starting point for defining these learning outcomes at the course level
4. Provide a framework for benchmarking outcomes
5. Serve as a template for writing program objectives and outcomes
6. Provide a guide for the design of curriculum
7. Suggest appropriate teaching and learning methods
8. Provide the targets for student learning assessment
9. used in program accreditation.
10. Serve as a framework for overall program evaluation, and
11. Communicate with faculty, students, and other stakeholders about the direction and purpose of a renewed engineering education that is centered on students and focused on outcomes.

The CDIO Syllabus And The Accreditation correlated with ABET EC2010 Criterion 3

CDIO Syllabus	ABET EC2010 Criterion 3										
	a	b	c	d	e	f	g	h	i	j	k
1.1 Knowledge of Underlying Mathematics, Science	■										
1.2 Core Engineering Fundamental Knowledge	■										
1.3 Adv. Engr. Fund. Knowledge, Methods, Tools	□										■
2.1 Analytical Reasoning and Problem Solving					■						□
2.2 Exper., Investigation and Knowledge Discovery		■									
2.3 System Thinking			□								
2.4 Attitudes, Thought and Learning									■		
2.5 Ethics, Equity and Other Responsibilities						■					□
3.1 Teamwork				■							
3.2 Communications							■				
3.3 Communication in Foreign Languages											
4.1 External, Societal and Environmental Context			□					■		■	
4.2 Enterprise and Business Context			□					■			
4.3 Conceiving, Systems Engr. and Management			■								
4.4 Designing			■								
4.5 Implementing			□								
4.6 Operating			□								

■ Strong Correlation   □ Good Correlation

The CDIO Syllabus correlated with the CEAB Graduate Attributes

	CEAB Graduate Attributes Criteria 3.1											
CDIO Syllabus	1	2	3	4	5	6	7	8	9	10	11	12
1.1 Knowledge of Underlying Mathematics, Science	Strong											
1.2 Core Engineering Fundamental Knowledge	Strong											
1.3 Advanced Eng. Fundamental Knowledge, Methods, Tools	Good				Strong							
2.1 Analytical Reasoning and Problem Solving		Strong									Good	
2.2 Experimentation, Investigation and Knowledge Discovery			Strong				Good					
2.3 System Thinking												
2.4 Attitudes, Thought and Learning		Strong	Strong	Strong	Strong							Strong
2.5 Ethics, Equity and Other Responsibilities								Strong		Strong		Good
3.1 Teamwork						Strong						
3.2 Communications							Strong					
3.3 Communication in Foreign Languages												
4.1 External, Societal and Environmental Context								Strong	Strong			
4.2 Enterprise and Business Context											Strong	
4.3 Conceiving, Systems Engineering and Management				Strong					Good		Good	
4.4 Designing				Strong								
4.5 Implementing												
4.6 Operating				Good								

Strong Correlation   Good Correlation

EUR-ACE programme outcomes
- the “EUR-ACE syllabus

1 Knowledge and Understanding

1.1 Knowledge and understanding of the scientific and mathematical principles underlying their branch of engineering

1.2 A systematic understanding of the key aspects and concepts of their branch of engineering

1.3 Coherent knowledge of their branch of engineering including some at the forefront of the branch

2 Engineering Analysis

2.1 The ability to apply their knowledge and understanding to identify, formulate and solve engineering problems using established methods

2.2 The ability to apply their knowledge and understanding to analyse engineering products, processes and methods

2.3 The ability to select and apply relevant analytic and modelling methods

3 Engineering Design

3.1 The ability to apply their knowledge and understanding to develop and realise designs to meet defined and specified requirements

3.2 An understanding of design methodologies, and an ability to use them

4 Investigations

4.1 The ability to conduct searches of literature, and to use data bases and other sources of information

4.2 The ability to design and conduct appropriate experiments, interpret the data and draw

4.3 Workshop and laboratory skills

5 Engineering Practice

5.1 The ability to select and use appropriate equipment, tools and methods

5.2 The ability to combine theory and practice to solve engineering problems

5.3 An understanding of applicable techniques and methods, and of their limitations

5.4 An awareness of the non-technical implications of engineering practice

6 Transferable skills

6.1 Function effectively as an individual and as a member of a team

6.2 Use diverse methods to communicate effectively with the engineering community and with society at large

6.3 Demonstrate awareness of the health, safety and legal issues and responsibilities of engineering practice, the impact of engineering solutions in a societal and environmental context, and commit to professional ethics, responsibilities and norms of engineering practice

6.4 Demonstrate an awareness of project management and business practices, such as risk and change management, and understand their limitations

6.5 Recognise the need for, and have the ability to engage in independent, life-long learning cdio

- **How CDIO & EUR-ACE Syllabuses compare?**

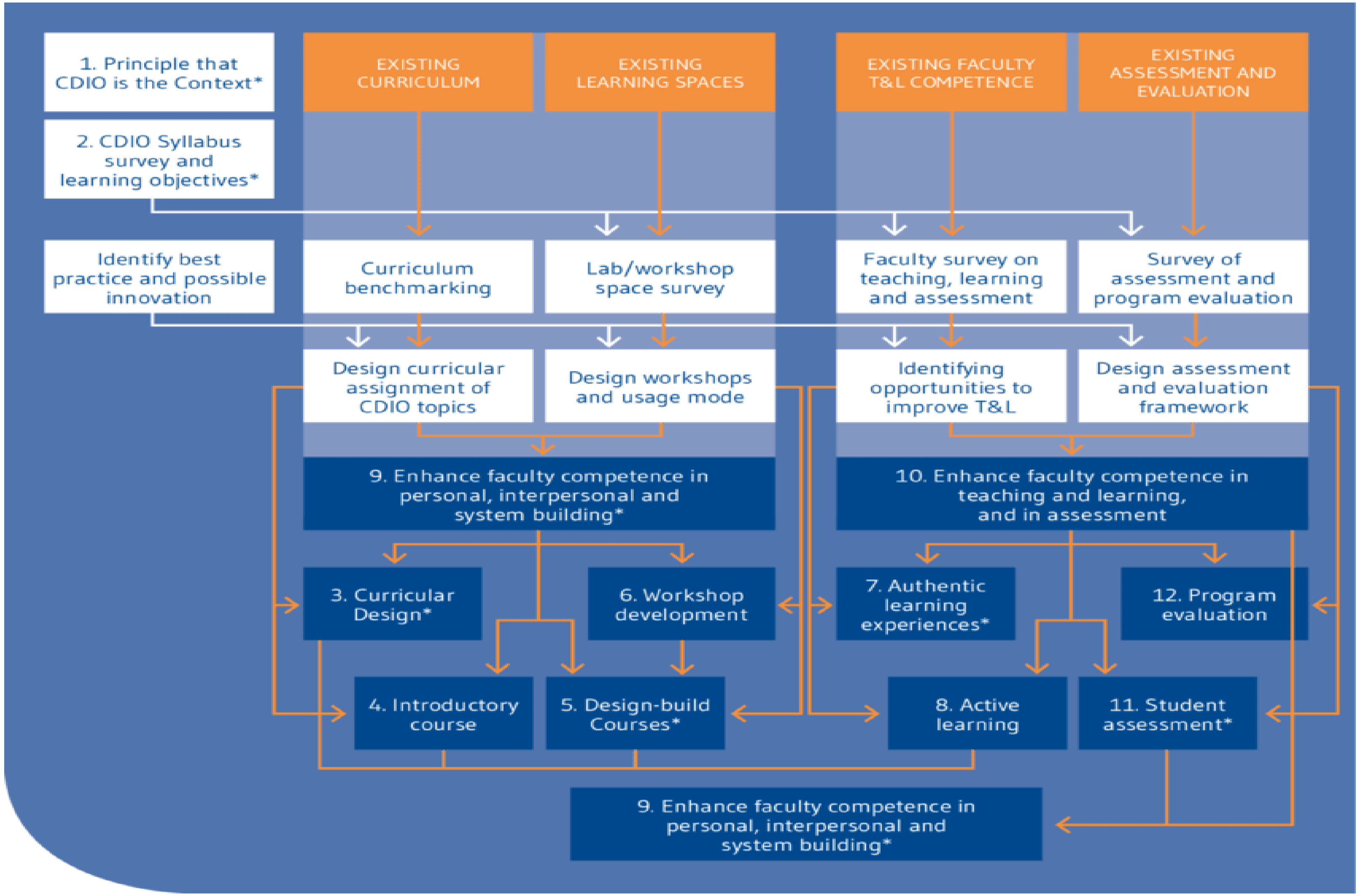
EUR-ACE syllabus, 2nd cycle	CDIO syllabus level x.x																
	1.1	1.2	1.3	2.1	2.2	2.3	2.4	2.5	3.1	3.2	3.3	4.1	4.2	4.3	4.4	4.5	4.6
1.1	x																
1.2		x															
1.3			x														
1.4						x									x		
2.1				x													
2.2				x										x	x		
2.3				x										x	x		
2.4			x	x										x	x		
3.1														x	x		
3.2							x							x	x		
3.3						x								x	x		
4.1					x												
4.2					x												
4.3					x												
4.4			x		x												
5.1		x	x	x													
5.2		x	x	x		x											
5.3		x	x	x													
5.4												x	x				
6.1									x								
6.2										x							
6.3								x				x					
6.4													x				
6.5							x										
6.6									x					x			

CDIO syllabus and EUR-ACE CRITICS LOOK

- The CDIO syllabus reflects a more encompassing view of engineering than EUR-ACE's, by considering the full product/system/process lifecycle, including the implementing and operating life phases.
- The proficiency levels of the CDIO and EUR-ACE are, however, difficult to compare.
- The EUR-ACE accreditation requirements are extensive and include elements not addressed in the CDIO framework, eg concerning financial resources and decision making.
- The CDIO standards provide "solutions" on how to work with the issues raised in a EUR-ACE accreditation.
- Four of the CDIO standards (4, 5, 7, and 8) define educational elements which are not explicitly discussed in EUR-ACE accreditation requirements.
- An evaluation process based on a rating scale, such as the CDIO self-evaluation model, is more useful for guiding a continuous improvement process than a threshold value scale, such as used in a EUR-ACE accreditation.

The CDIO Standards

- ✓ defining the distinguishing features of a CDIO program
- ✓ serving as guidelines for educational reform,
- ✓ providing a tool for continuous improvement).



4. CDIO Standards are to be used for:
    - ✓ Program design
    - ✓ Periodic program self-evaluation
    - ✓ Benchmarking, discussions and co-development with other programs
5. For each standard:
    - ✓ a description explains the meaning of the standard, highlighting reasons for setting the standard.
    - ✓ Rational explains why the standard has been selected and formulated
    - ✓ Rubrics for self-evaluation using the standards have also been developed.

The Grouping of the Standards

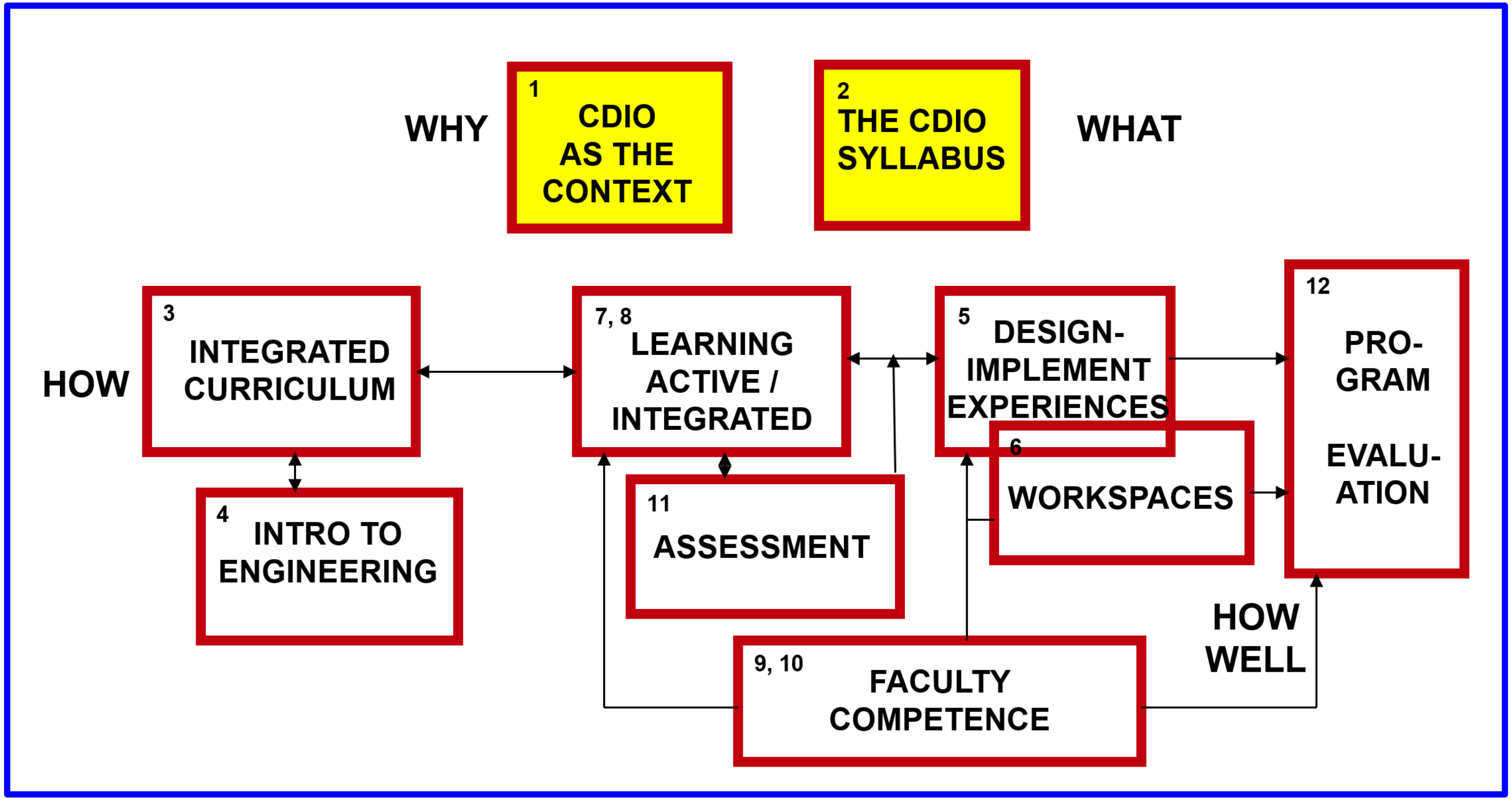
The 12 CDIO Standards address the following Issues in Engineering Education

1. The foundational principle of a lifecycle context of education (Standard 1).
2. Curriculum development (Standards 2, 3 and 4).
3. Design-implement experiences and workspaces (Standards 5 and 6).
4. Methods of teaching and learning (Standards 7 and 8).
5. Faculty development (Standards 9 and 10).
6. Assessment and evaluation (Standards 11 and 12).

CDIO Standards

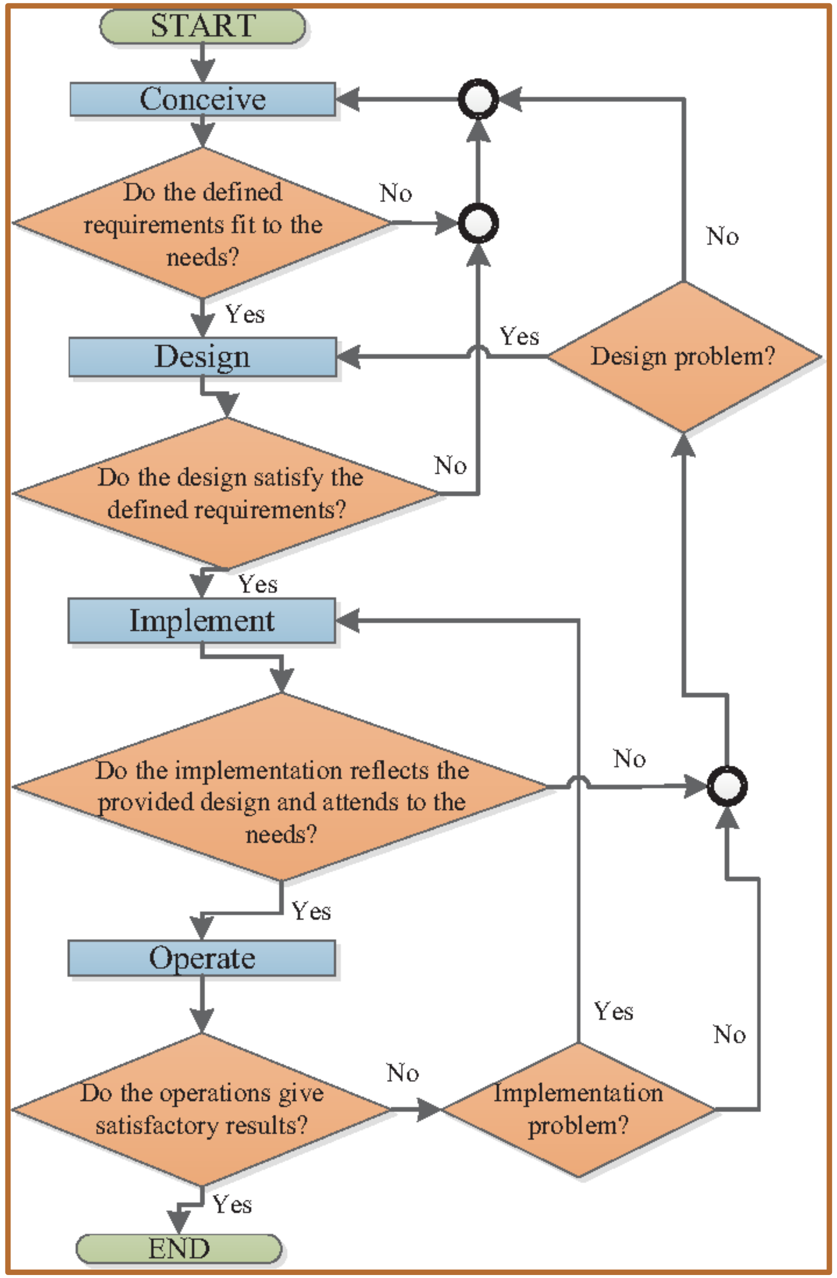
	Standard 1	CDIO as the context
Curriculum	Standard 2	CDIO Syllabus Outcomes
	Standard 3	Integrated Curriculum
	Standard 4	Introduction to Engineering
	Standard 5	Design-Build Experiences
Workspace/Labs	Standard 6	CDIO Workspaces
Teaching and Learning Methods	Standard 7	Integrated Learning Experiences
	Standard 8	Active Learning
Enhancement of Faculty Competence	Standard 9	Enhancement of Staff CDIO Skills
	Standard 10	Enhancement of Staff Teaching Skills
Assessment Methods	Standard 11	CDIO Skills Assessment
	Standard 12	CDIO Program Evaluation

The Standards Network



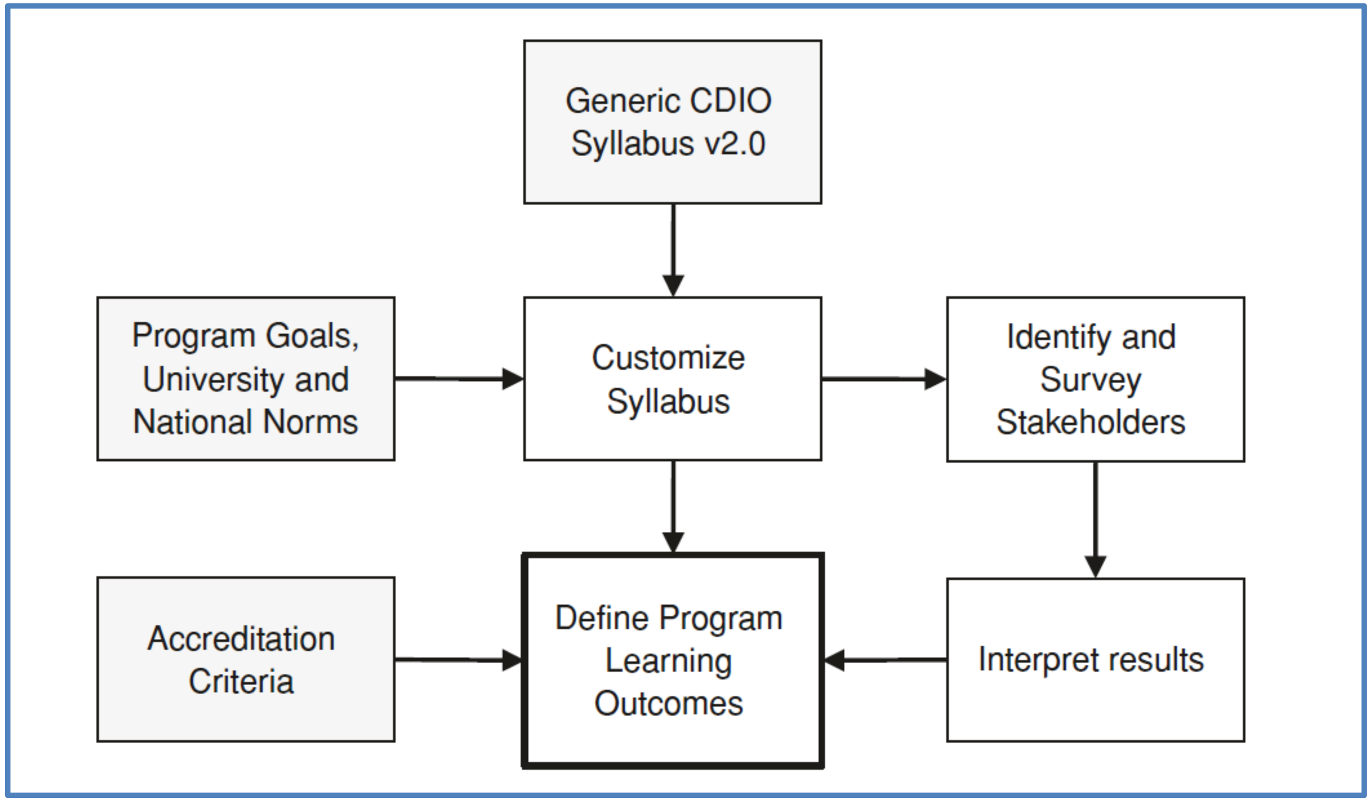
Standard 1 – The Context

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



Standard 2 – Learning Outcomes

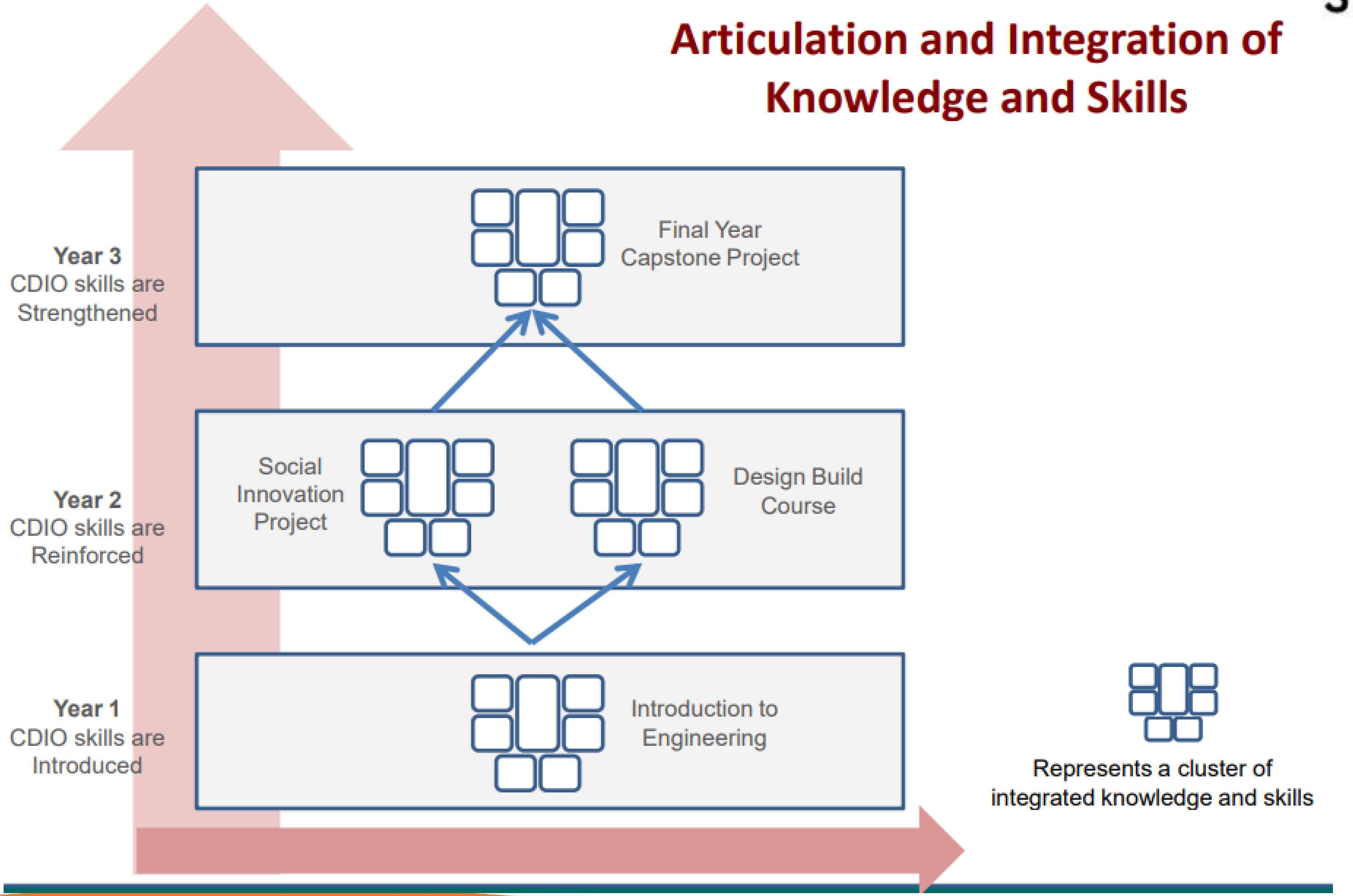
Specific, detailed learning outcomes for personal and interpersonal skills, and product, process, and system building skills, as well as disciplinary knowledge, consistent with program goals and validated by program stakeholders



Process for defining program learning outcomes based on the CDIO Syllabus

Horizontal and Vertical Articulation and Integration of Knowledge and Skills

SINGAPORE POLYTECHNIC

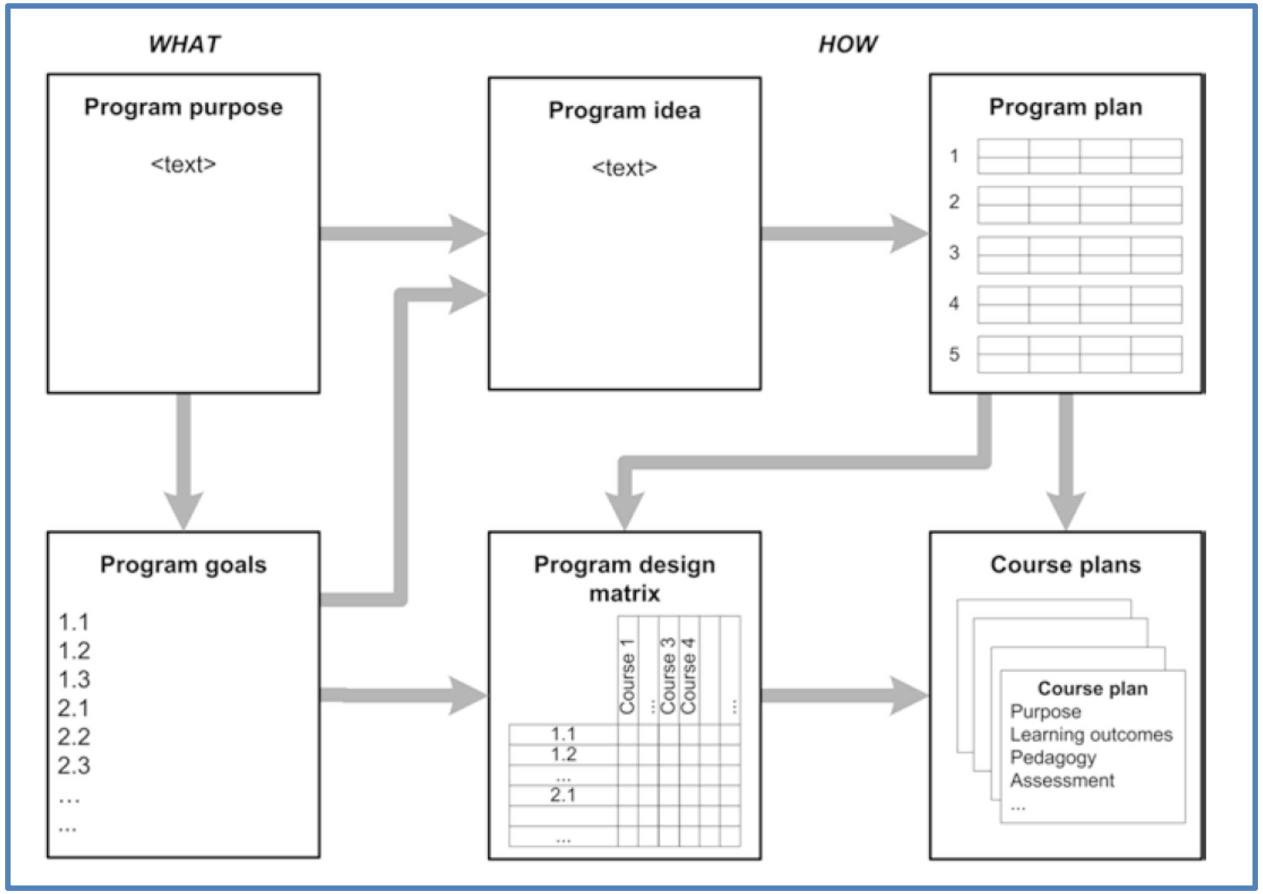


Standard 3 -- Integrated Curriculum

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

An integrated curriculum includes learning experiences that lead to the acquisition of personal and interpersonal skills, and product, process, and system building skills (Standard 2), interwoven with the learning of disciplinary knowledge and its application in professional engineering.

Disciplinary courses are mutually supporting when they make explicit connections among related and supporting content and learning outcomes. An explicit plan identifies ways in which the integration of skills and multidisciplinary connections are to be made, for example, by mapping the specified learning outcomes to courses and co-curricular activities that make up the curriculum



Sequencing the curriculum

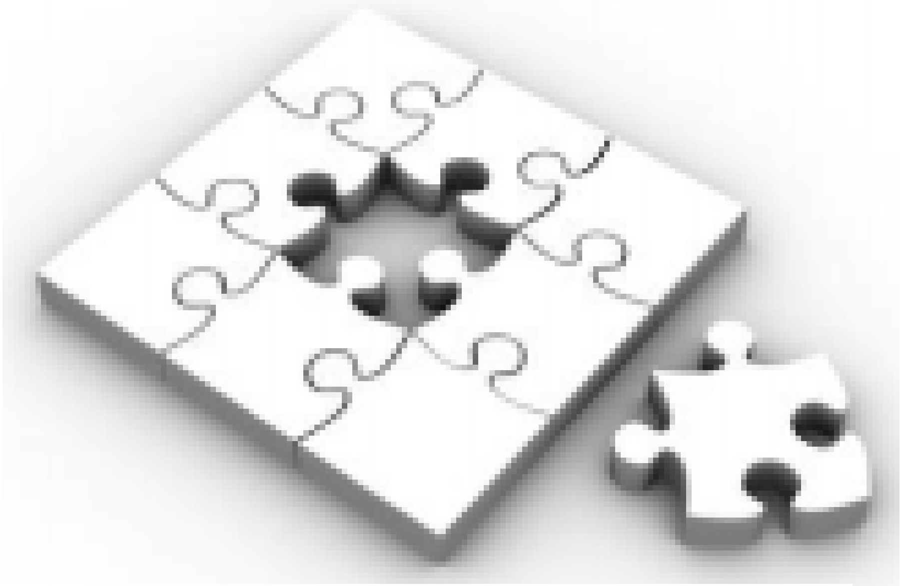
THE BLACK-BOX EXERCISE

INPUT: Previous knowledge and skills → **Course (black box)** →

OUTPUT:
- Contribution to final learning outcomes
- Input to later course
- Input to later course
- Input to later course

All courses are presented through input and output only:

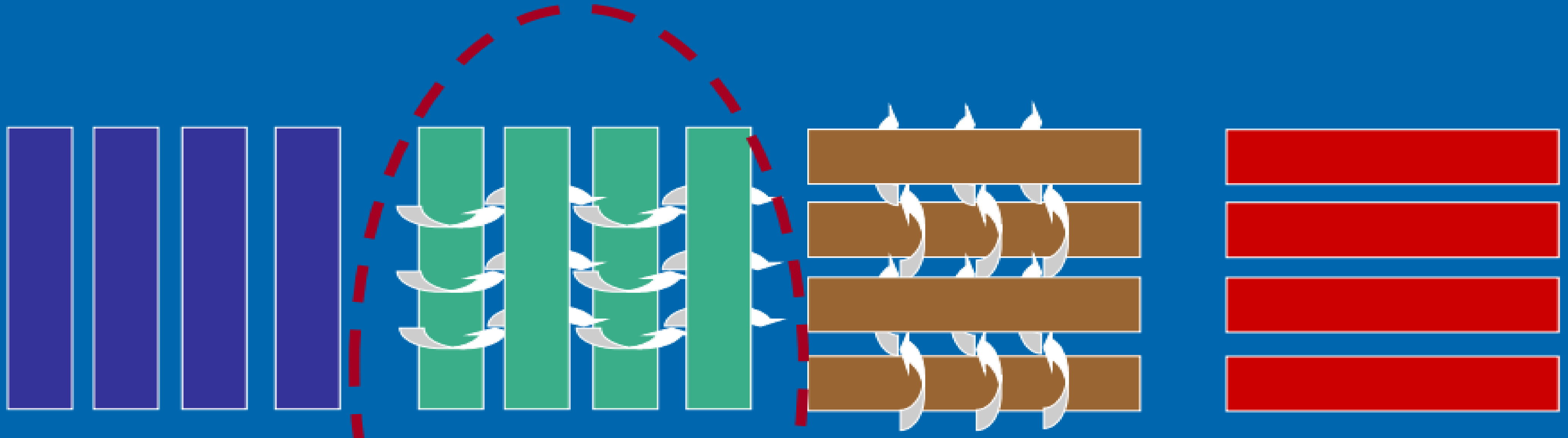
- Enables efficient discussions
- Makes connections visible (as well as lack thereof)
- Gives all faculty an overview of the program
- Serves as a basis for improving coordination
- Use for adjusting intentions in planning phase
- Use for checking existing programs



CURRICULUM MODELS

United Nations Educational, Scientific and Cultural Organization · UNESCO Chair on Cooperation between Higher Engineering Education and Industries

(Disciplines run vertically; projects and skills run horizontally.)



A strict disciplinary curriculum
Organized around disciplines, with no explicit introduction of skills

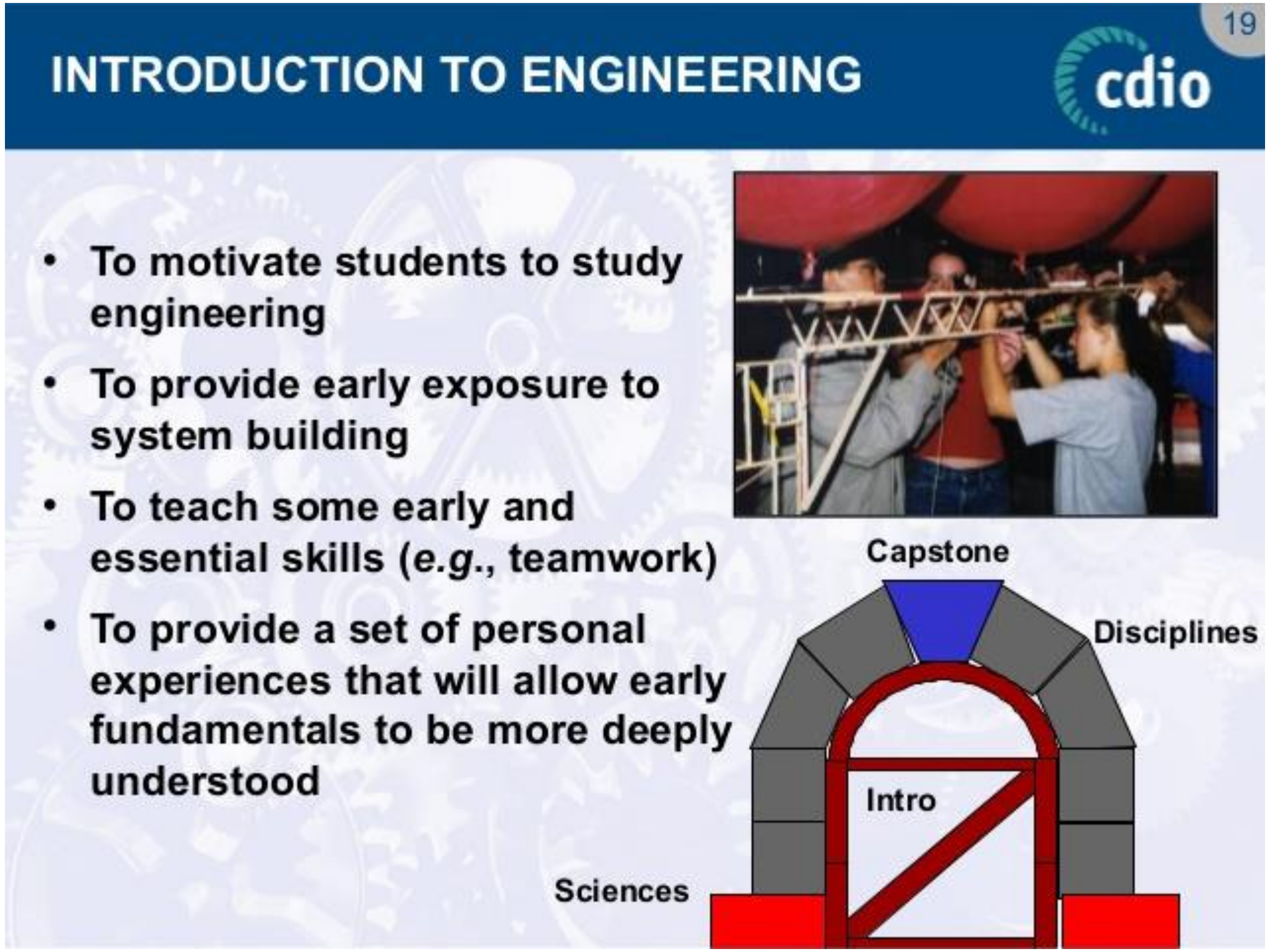
An integrated curriculum
Organized around disciplines, but with skills and projects interwoven

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

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

Standard 4 -- Introduction to Engineering

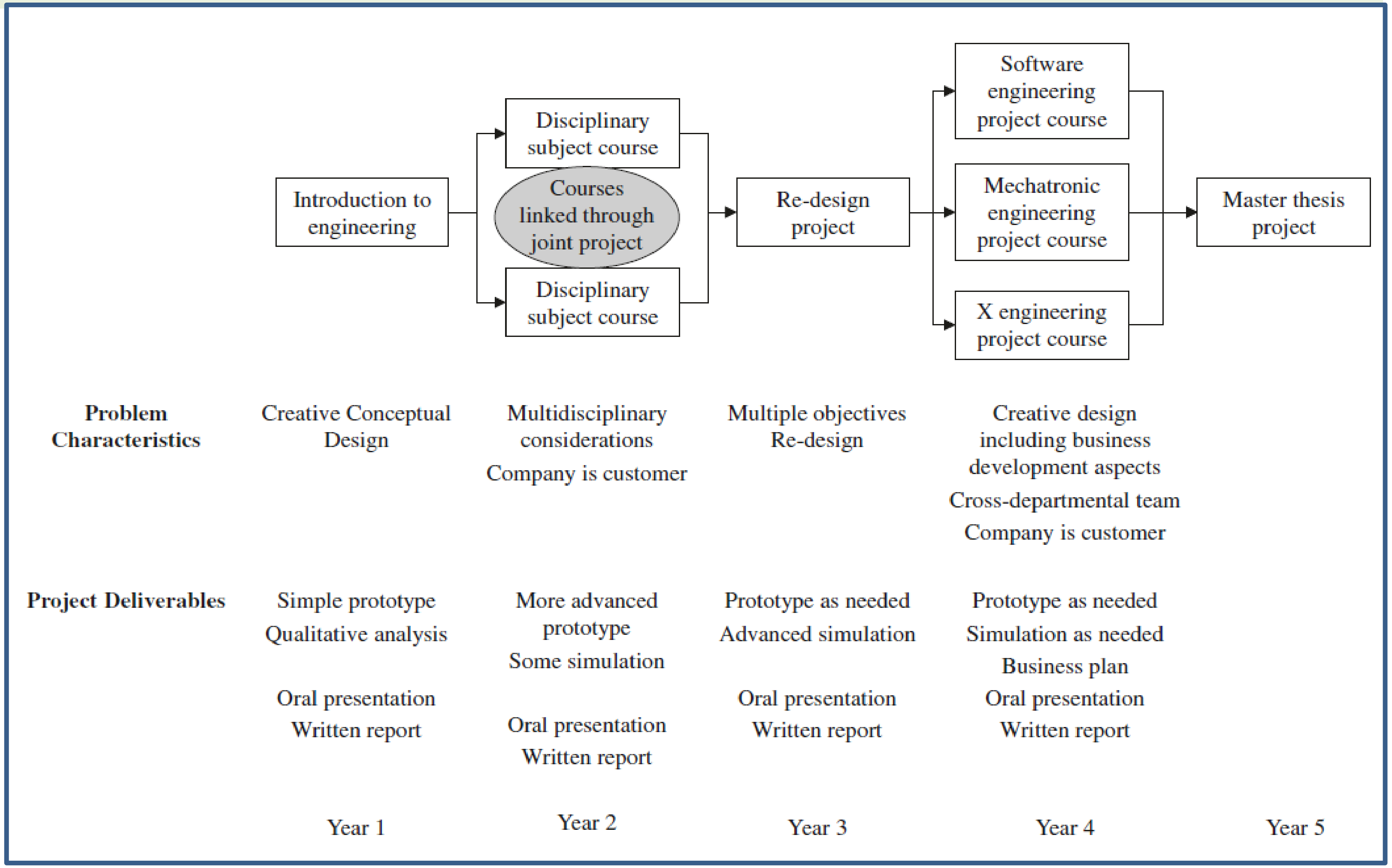
An introductory course that provides the framework for engineering practice in product, process, and system building, and introduces essential personal and interpersonal skills



Standard 5 -- Design-Implement

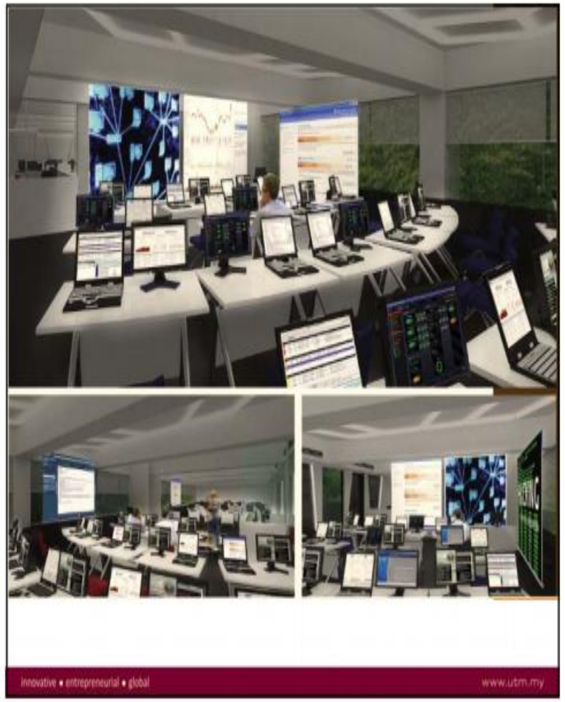
Experiences A curriculum that includes two or more design-implement experiences, including one at a basic level and one at an advanced level

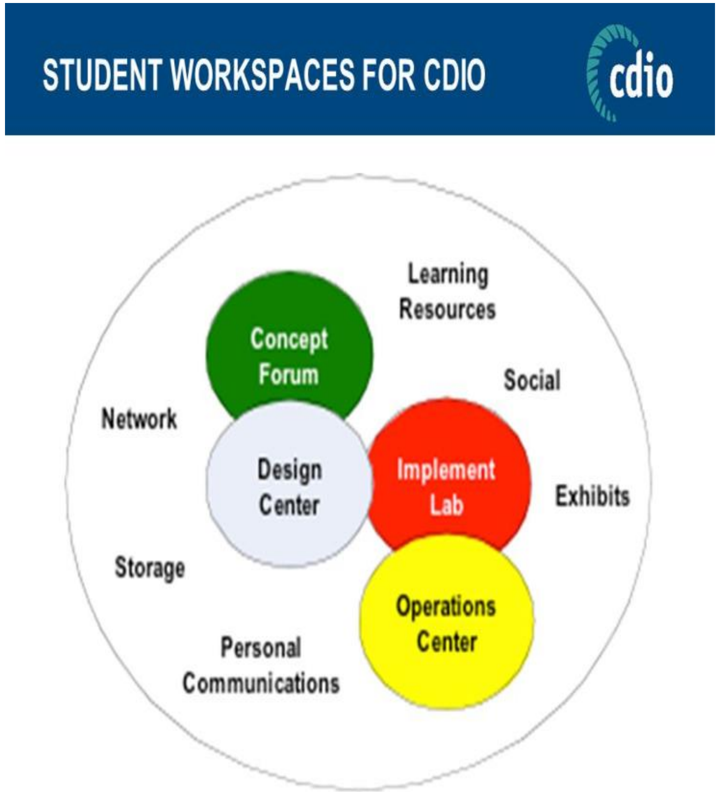
A plan to integrate design-implement experiences throughout a curriculum

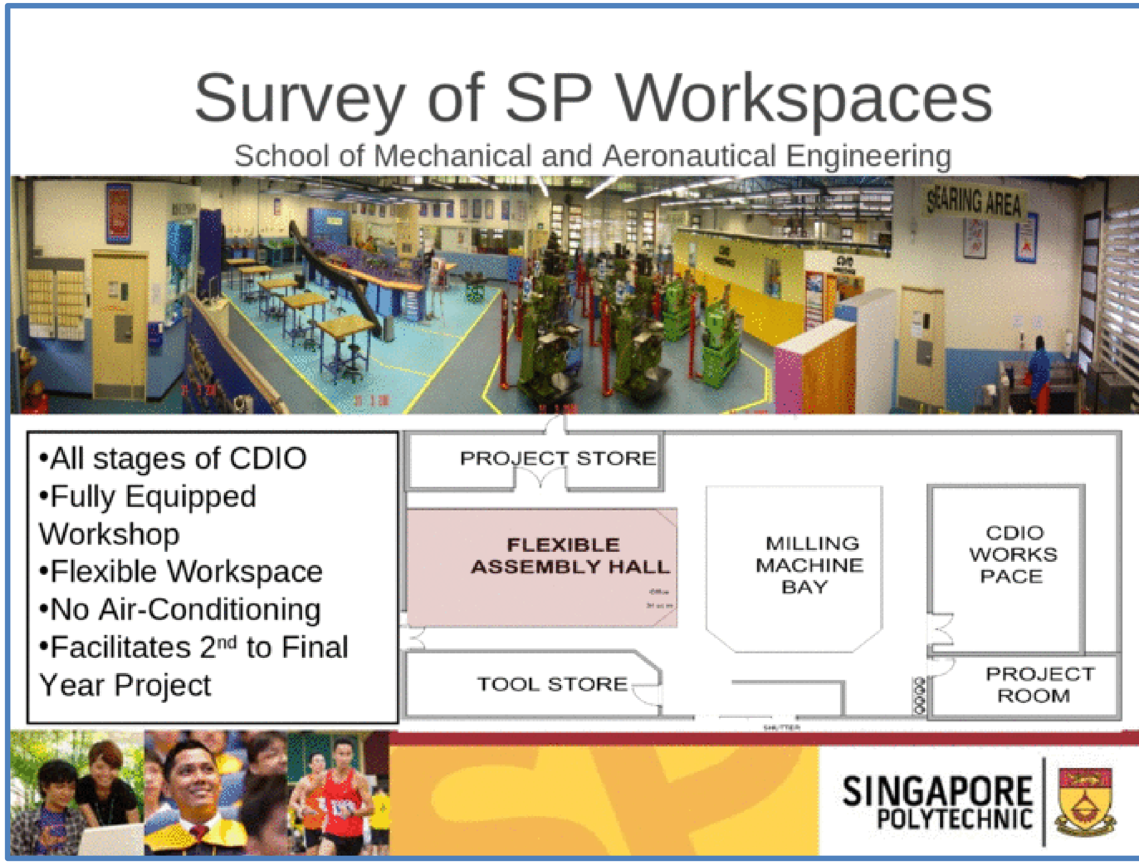


Standard 6 -- Workspaces

Engineering workspaces and laboratories that support and encourage hands-on learning of product, process, and system building, disciplinary knowledge, and social learning

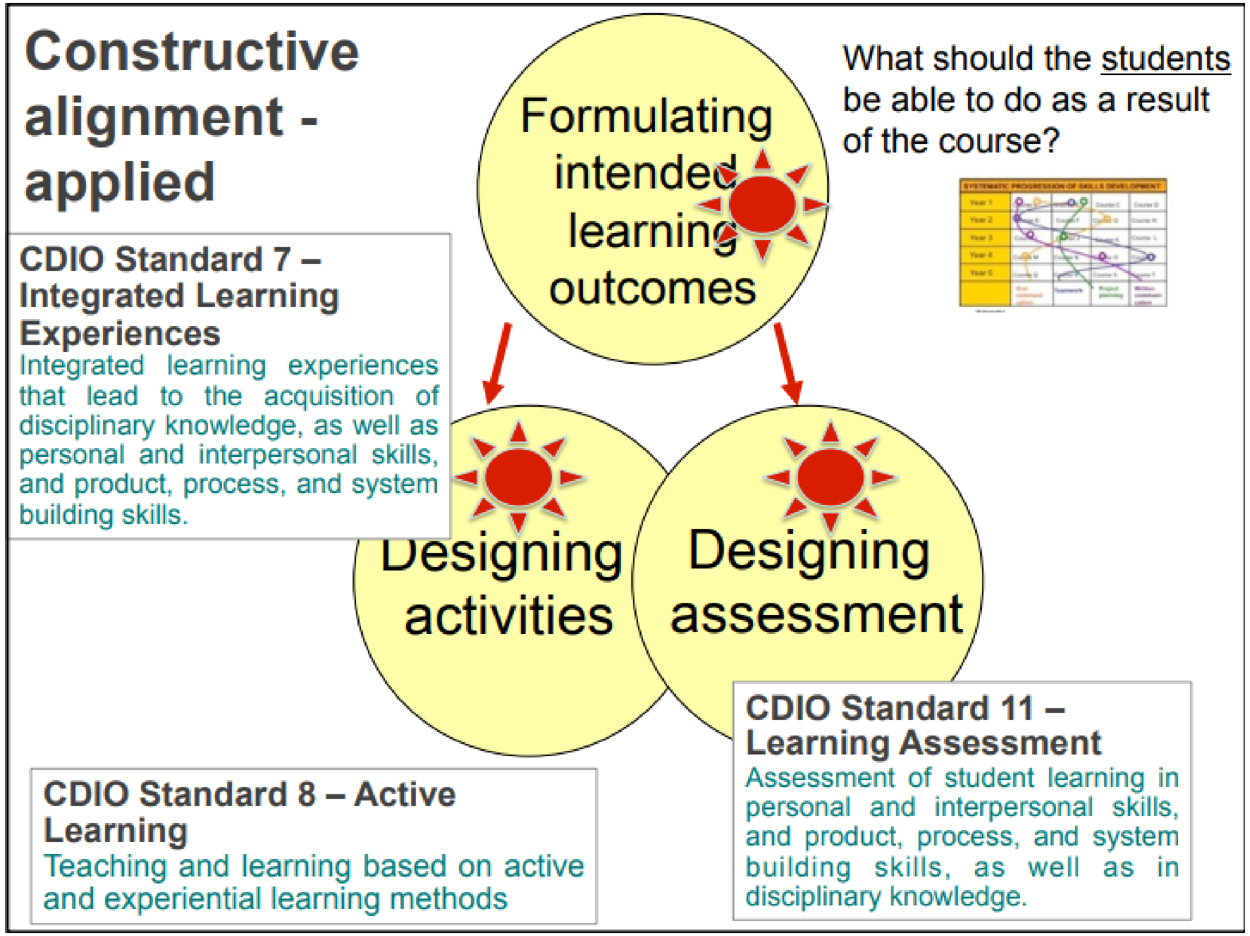






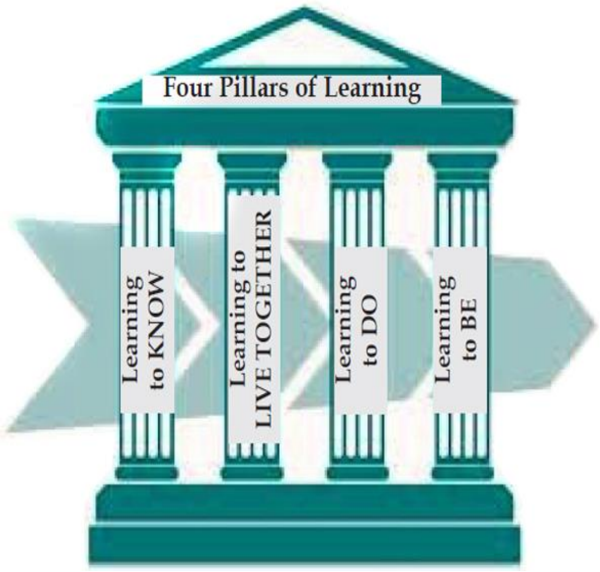
Standard 7 -- Integrated Learning Experiences

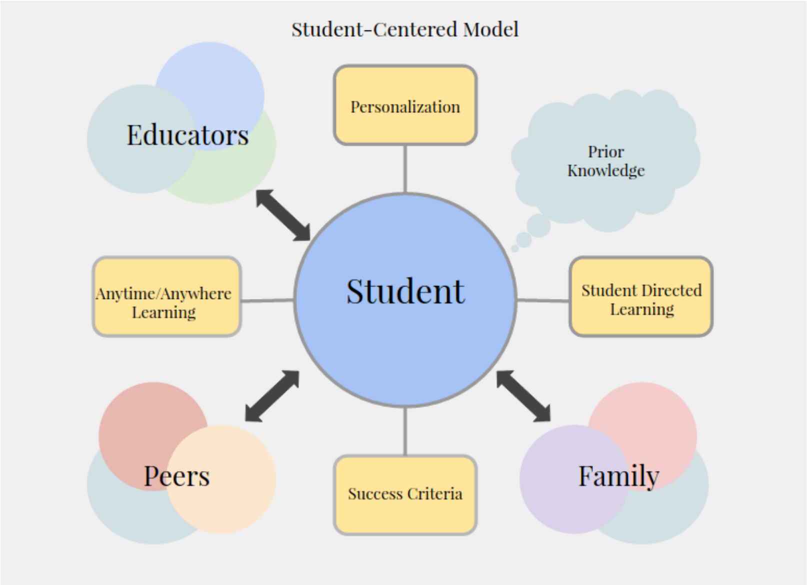
Integrated learning experiences that lead to the acquisition of disciplinary knowledge, as well as personal and interpersonal skills, and product, process, and system building skills

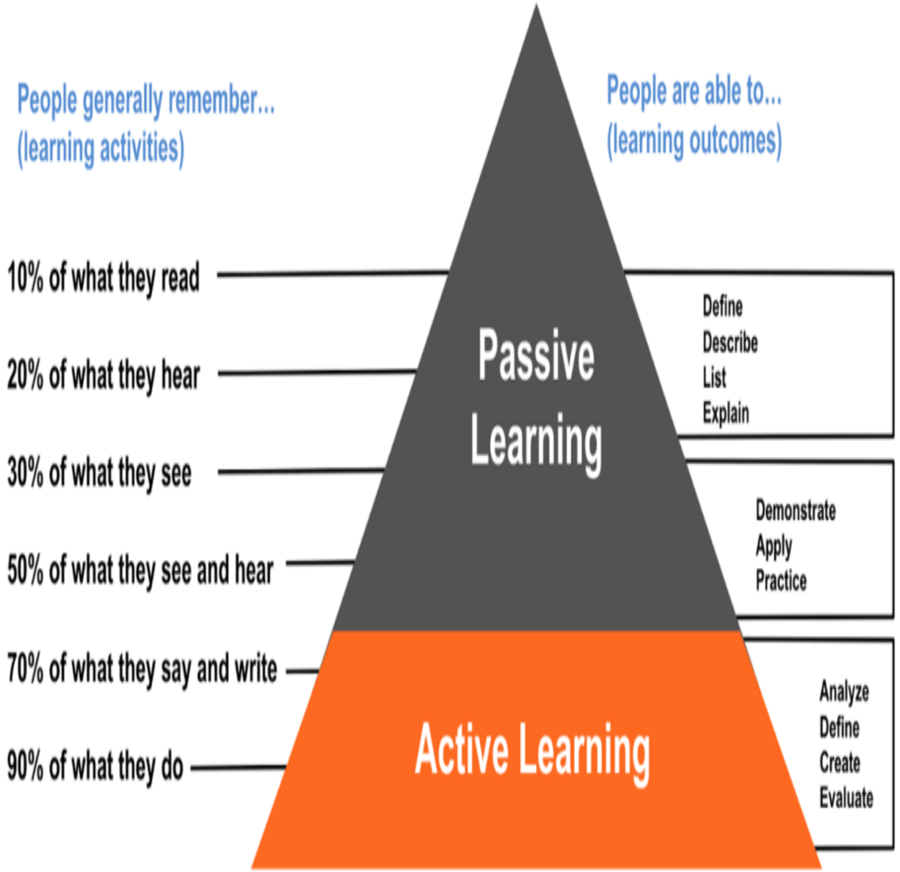


Standard 8 -- Active Learning

Teaching and learning based on active experiential learning methods







Standard 9 -- Enhancement of Faculty Competence

Actions that enhance faculty competence in personal and interpersonal skills, and product, process, and system building skills

Standard 10 -- Enhancement of Faculty Teaching Competence

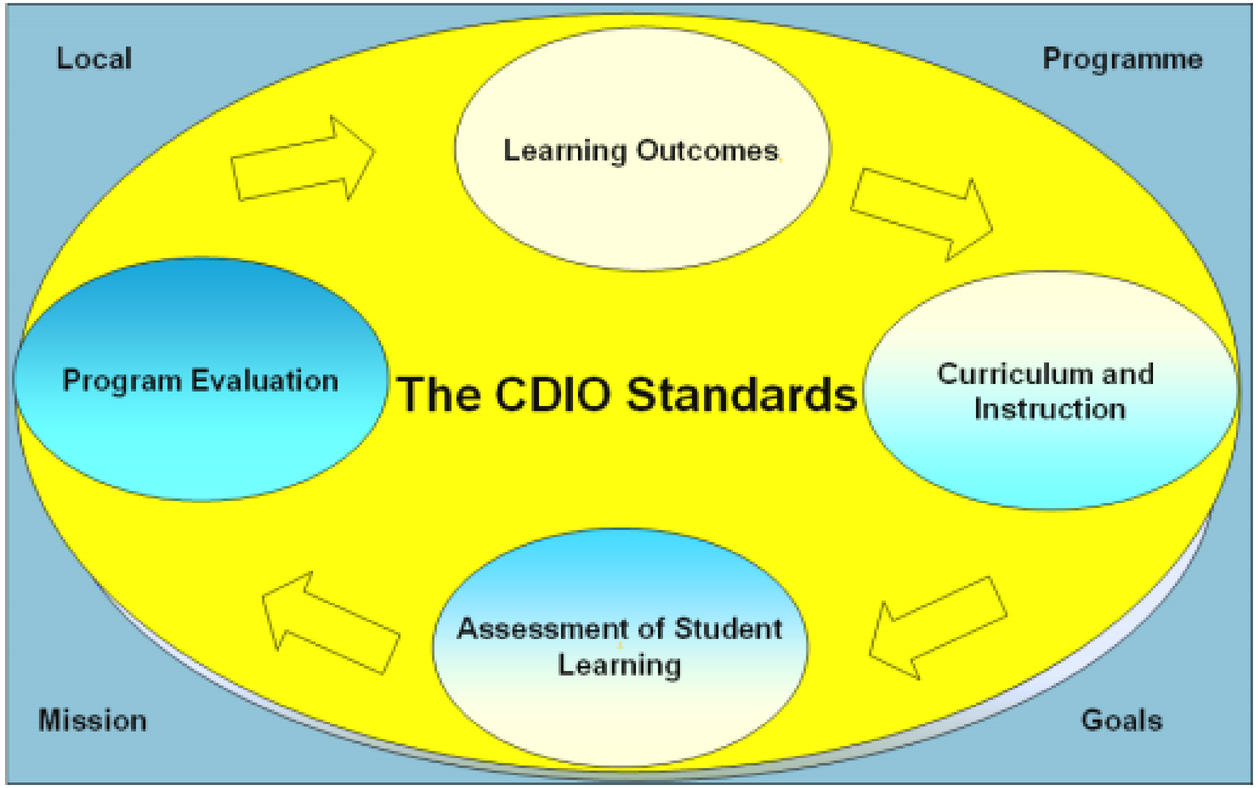
Actions that enhance faculty competence in providing integrated learning experiences, in using active experiential learning methods, and in assessing student learning

Standard 11 -- Learning Assessment

Assessment of student learning in personal and interpersonal skills, and product, process, and system building skills, as well as in disciplinary knowledge

Standard 12 -- Program Evaluation

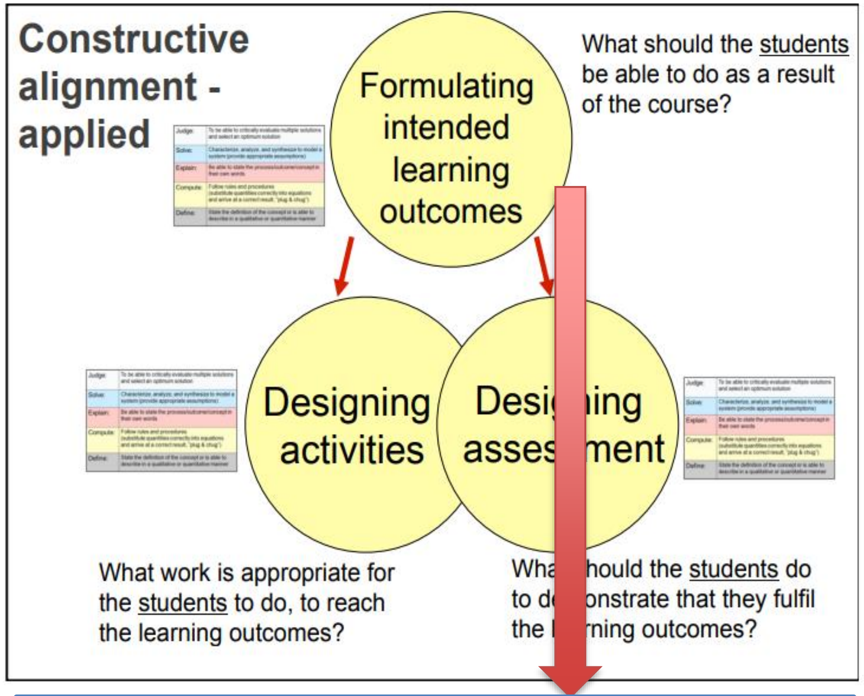
A system that evaluates programs against these twelve standards, and provides feedback to students, faculty, and other stakeholders for the purposes of continuous improvement



The Learning Assessment Process

"knowledge results from the combination of grasping experience and transforming it." Professor D.A. Kolb

- CDIO approach views assessment as learner-centered, promoting better learning in a culture where students and instructors learn together
- Assessment is learner-centered in that it is aligned with learning outcomes, uses multiple methods to gather evidence of achievement, and promotes learning in a supportive, collaborative environment.
- Assessment focuses on gathering evidence that students have developed proficiency in disciplinary knowledge, personal and interpersonal skills, and product, process, and system building skills
- This student
- learning assessment is the focus of Standard 11.



Just as different categories of learning outcomes require different teaching methods that produce different learning experiences notably active and experiential learning approaches—they also require different assessment methods to ensure the reliability and validity of the assessment data

General Rubric

Scale	Criteria
5	Evidence related to the standard is regularly reviewed and used to make improvements
4	There is documented evidence of the full implementation and impact of the standard across program components and constituents
3	Implementation of the plan to address the standard is underway across the program components and constituents
2	There is a plan in place to address the standard
1	There is an awareness of need to adopt the standard and a process is in place to address it
0	There is no documented plan or activity related to the standard

- student learning assessment in a CDIO approach uses a variety of methods to collect evidence of learning before, during, and after learning experiences to give both formative and summative views of the changes that have occurred in students' achievements and attitudes
- concept questions are effective both for learning new concepts and for giving instructors feedback on student learning
- Evidence of student learning is gathered with written and oral questions,
- performance ratings, product reviews, journals, portfolios, and other self-report instruments

https://youtu.be/RsOCnszziDA

Project Design Review at Queen's University Belfast

Project Learning Outcomes	Unsatisfactory	Satisfactory	Good	Excellent
Communicated effectively in writing, verbally, and through graphic media				
Managed time, resources, and priorities, and worked to given deadlines				
Used computers and information technology effectively				
Located and assembled information using various external resources				
Demonstrated generic problem-solving skills acquired during project				
Worked and learned independently				
Worked safely				
Communicated effectively with technicians and other support staff				

- In most engineering programs, learning assessment focuses on disciplinary content.
- While this focus continues to be important in a CDIO approach an equal emphasis needs to be placed on assessing the personal and interpersonal skills, and the product, process, and system building skills that are integrated into the curriculum
- A single assessment method will not suffice to gather evidence of the broad range of learning outcomes

Kolb's research shows mastering expertise is a continuous process of experience, reflection, conceptualisation and experimentation. These elements make up the experiential learning cycle which shows the relationship between each phase

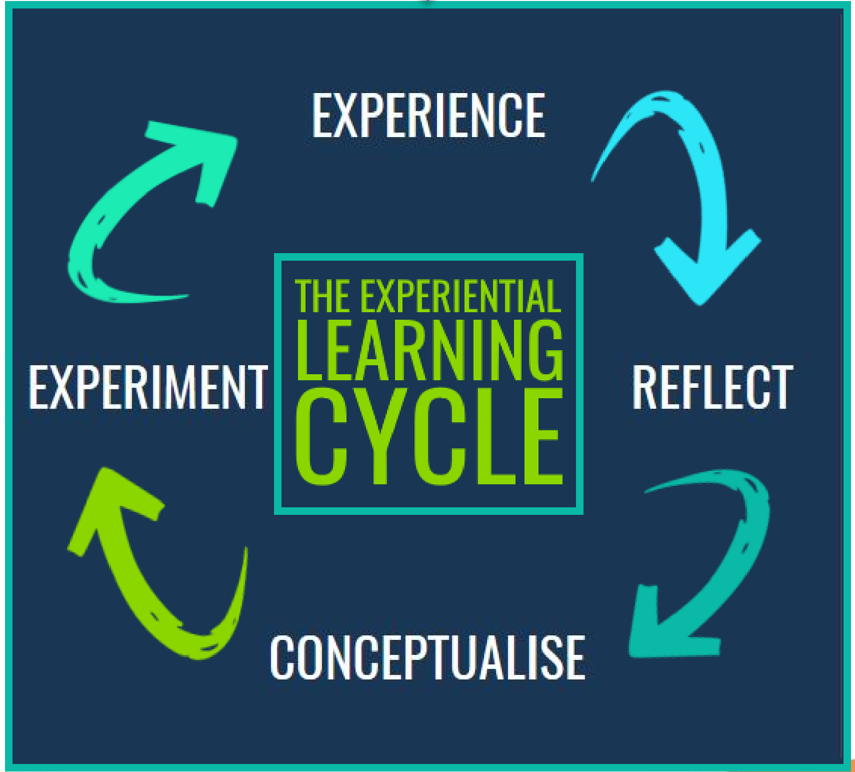


Table 7.3 Sample rubric to assess a reflective journal

Very good	Required entries are included Entries are dated and identified Observations are descriptive and detailed Interpretations are reasonable and based on evidence Shows an understanding of the engineering process Attention to format, grammar, and spelling
Good	Most required entries are included Entries are dated or identified Observations are descriptive Some reflection is evident Interpretations are reasonable Shows a basic awareness of the engineering process Attention to format, grammar, and spelling
Minimally satisfactory	More than one required entry is missing Entries are dated or identified Observations are included Reflection is insufficient or superficial Inadequate attention to format, grammar, and spelling
Must be rewritten	Little basis for judgment

Assessment Methods

Direct	Indirect
• Term Exams	• Active Leaning Participation Rate
• Oral Exams	• Number of hours students spend in learning and class participation
• Class Discussions	• Current enrolled students surveys
• Students' Presentations	• Graduating students surveys
• Research Evaluation by an assigned supervisor	• Alumni surveys
• International Exams	• Faculty surveys
• Internship	• Employers' surveys (for both Internees and Employees)
• Graduation Projects	• Faculty self-assessment
• Student Portfolio	• Graduating students interviews
• Research Projects	• Current enrolled students interviews
• Integrated Experiences portfolio	• Students' appreciation upon graduation
• Conference participation	
• Teamwork	
• Technical Interviews	
• Case study reports	
• Performance Evaluation reports	
• External Reviewers Feedback	

Indirect Assessment Methods

- Institutional and Program Surveys
  - Alumni Surveys
  - Employer Surveys
  - Graduating Seniors and Graduates Surveys
  - Student Satisfaction Surveys
- Other
  - Focus groups
  - Interviews(faculty members, graduating students, alumni)

Level of Proficiency

1	To have experienced of been exposed
2	To be able to participate in and contribute to
3	To be able to understand and explain
4	To be skilled in the practice or implementation
5	To be able to lead or innovate

2.4. PERSONAL SKILLS AND ATTITUDES	1	2	3	4	5
2.4.1. Initiative and Willingness to Take Risks					
2.4.2. Perseverance and Flexibility					
2.4.3. Creative Thinking					
2.4.4. Critical Thinking					
2.4.5. Awareness of One's Personal Knowledge, Skills, and Attitudes					
2.4.6. Curiosity and Lifelong Learning					
2.4.7. Time and Resource Management					
2.5. PROFESSIONAL SKILLS AND ATTITUDES					
2.5.1. Professional Ethics, Integrity, Responsibility and Accountability					
2.5.2. Professional Behavior					
2.5.3. Proactively Planning for One's Career					
2.5.4. Staying Current on World of profession					

CDIO Faculty Development Program

- The implementation of CDIO in curriculum and course design requires supporting the faculty members to understand the concepts and methodologies of CDIO.
- Taking a cue from different faculty training activities carried out across the CDIO community, the CDIO faculty development course was organized in a modular framework.
- Using the learning objectives as a basis for course design, the CDIO faculty development course was organized in 3 modules.
- Each module is mapped to the learning objectives and the content is further mapped to the modules.
- The course is typically delivered using seminar presentations, case study presentations, workshops, active discussions, and laboratory & workspace tours.

List of Learning Objectives for CDIO Faculty Development Course

L1 Explain the rationale of the CDIO approach to engineering education.

L2 Apply the CDIO methodology to curriculum development, including

a) Formulating learning outcomes on the program level
b) Devising a curriculum to integrate disciplinary fundamentals with personal and professional skills and attitudes, in particular business and entrepreneurship skills
c) Giving examples of strategies to enable and drive program-driven course development

L3 Apply the CDIO methodology to course development, including

a) Formulating learning outcomes on the course level
b) Developing appropriate learning activities for discipline-led learning and for problem based/project organized learning
c) Developing appropriate assessment methods aligned with the intended learning outcomes
d) Suggesting ways to address business and entrepreneurship skills on the course level

Faculty Development Program

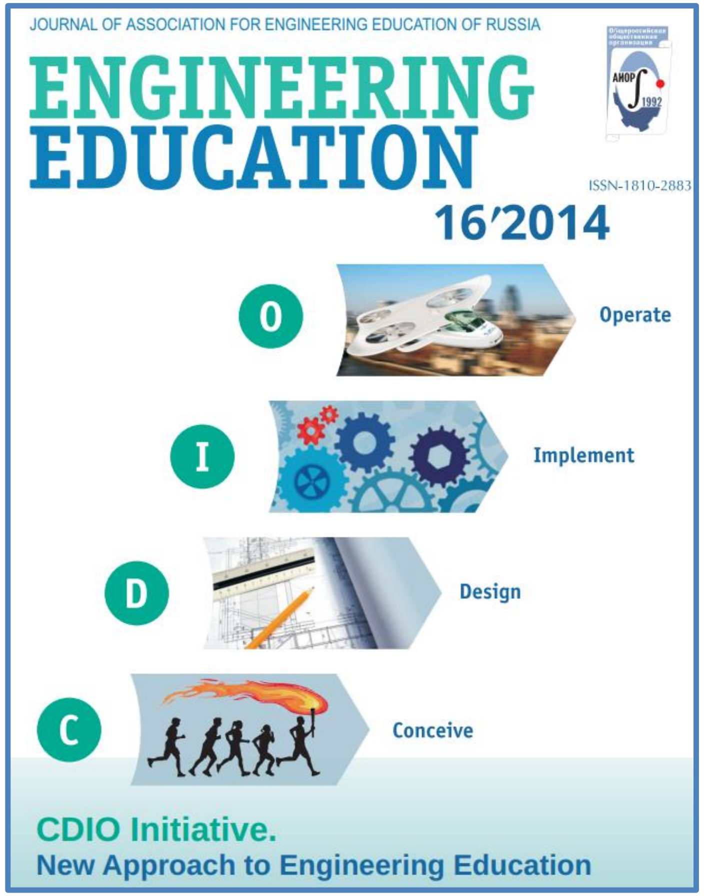
1. ability to apply CDIO philosophy adopting the principle that product, process, and system lifecycle development and deployment -- Conceiving, Designing, Implementing and Operating -- are the context for engineering education (Standard 1 CDIO);
2. ability to plan specific, detailed learning outcomes for personal and interpersonal skills, and product, process, and system building skills, as well as disciplinary knowledge (Standard 2 CDIO);
3. ability to develop an integrated curriculum, designed with mutually supporting disciplinary courses, with an explicit plan to integrate personal and interpersonal skills, and product, process, and system building skills (Standard 3 CDIO);
4. ability to develop and implement an introductory course within the integrated curriculum, that provides the framework for practice in product, process, and system building, and introduces essential personal and interpersonal skills of graduates (Standard 4 CDIO)

Faculty Development Program

5. ability to organize design-built activities of students through the implementation in an integrated curriculum of at least two or more design-implement experiences at a basic and advanced levels (Standard 5 CDIO);
6. ability to create engineering workspaces and laboratories that support and encourage hands on learning of product, process, and system building, disciplinary knowledge, and social learning (Standard 6 CDIO);
7. ability to ensure integrated learning experiences that lead to the acquisition of disciplinary knowledge, as well as personal and interpersonal skills, and product, process, and system building skills (Standard 7 CDIO);
8. ability to apply active learning methods (team work, case-study, games, problem based learning, context learning) improving the quality of training and enhancing the level of acquired learning outcomes (Standard 8 CDIO);

Faculty Development Program

9. ability for actions that enhance faculty competence in personal and interpersonal skills, and product, process, and system building skills (Standard 9 CDIO);
10. ability for actions that enhance faculty competence in providing integrated learning experiences, in using active experiential learning methods, and in assessing student learning (Standard 10 CDIO);
11. ability to assess student learning in personal and interpersonal skills, and product, process, and system building skills, as well as in disciplinary knowledge (Standard 11 CDIO);
12. ability to evaluate educational program against all CDIO standards, and provide feedback to students, faculty, and other stakeholders for the purposes of continuous improvement (Standard 12 CDIO).



Modernization of Engineering Education Based on International CDIO Standards
Association for Engineering Education of Russia,
National Research Tomsk Polytechnic University, A.I. Chuchalin

Module 1 (M1)

Train and create awareness of CDIO initiative and how to implement CDIO in raw material related program and course development.

a) CDIO Introduction, History L1
b) CDIO Syllabus and Standards L1
c) Methods for curriculum design L2 - a, b

Methods for course design L3 - a, b, c

Module 2 (M2)

Show examples and case studies to give ideas and inspiration to the practitioner to implement CDIO both at program level and course level.

Case study on curriculum design L2 - c

Case study on course design L3 - a, b, c

Case study on involvement of Business and Entrepreneurship in Engineering L3 – d

CHALMERS
UNIVERSITY OF TECHNOLOGY

CDIO Faculty Development Course

Implement the CDIO approach in your course

Date: **29th-30th October** 2018

Location: **VDL**, Department of Industrial and Materials Science at Chalmers University of Technology

eit RawMaterials Connecting matters

cdio

This activity has received funding from the European Institute of Innovation and Technology (EIT). This body of the European Union receives support from the European Union's Horizon 2020 research and innovation programme

Module 3 (M3)

Developing CDIO based curriculum, courses and projects for the specific programs and courses related to the field of raw materials including mining and metallurgy aspects with industrial involvement.

a. Workshop on curriculum design L2 - a, b, c

b. Workshop on course design L3 – a, b, c, d

Kanishk Bhadani, Erik Hulthén, Johan Malmqvist, Chalmers University of Technology, Sweden
Catrin Edelbro,Luleå University of Technology, Sweden
Alan Ryan, David Tanner, Lisa O'Donoghue, University of Limerick, Ireland
Kristina Edström, KTH Royal Institute of Technology, SwedenProceedings of the 13th International CDIO Conference, University of Calgary, Calgary, Canada, June 18-22, 2017

cdio
CONCEIVE DESIGN IMPLEMENT OPERATE™

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CDIO Academy and CDIO Award

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    - CDIO Academy 2016
    - Previous winners of the CDIO Academy

What is the CDIO Academy?

The CDIO Academy is an opportunity for engineering students that are active at CDIO institutions, to showcase their design-implement projects, meet their peers from engineering programs around the world, and participate in workshops and plenary sessions presented by prominent leaders in engineering education.

The CDIO Academy takes places alongside with the CDIO conference and there is a specific program for the participants of the CDIO Academy.

What is the CDIO Academy about?

The CDIO conference runs from the June 25^{th} to 27^{th} and has the overall title CHANGE.

For the CDIO Academy the headline is *Change the Business – Change the world*. The idea is that the participants in the Academy work with the basic resource WATER in accordance to the overall CHANGE agenda.

The CDIO Academy is a challenge

Aarhus University invites 40 students from all over the world to participate in the CDIO Academy. The students will be put in teams with other students from different corners of the world and with different engineering backgrounds.

How to participate

The CDIO Academy is held each year at the international CDIO conference and it is a student challenge within the larger conference, with presentations, design-implement experiences, and a juried design project exhibit.

The CDIO Academy invites teams of engineering students to participate in the challenge and to submit innovative design projects to the competition.

Competition Criteria

Project areas are provided by cutting-edge companies, and maybe an innovative design of a product, process, or system.

The projects have to meet the following selection criteria:

- Relevant to the design project theme
- Demonstrates a design-implement product, process, or system
- Demonstrates two or more phases of the Conceive, Design, Implement and Operate approach
- Has the potential for practical application
- Demonstrates knowledge of the context to which the project applies
- Provides evidence of effective teamwork

CDIO Academy 2017

University of Calgary

June 18-21, 2017

CDIO Academy 2017

Welcome to the CDIO Academy, taking place at the University of Calgary in Calgary, Canada from June 18 – 21, 2017.
50 undergraduate engineering students from all over the world will work together to research, design, and pitch their answer to a question that is strongly related to the conference theme, Engineering Education in the Digital Age.
The question being asked at the 2017 CDIO Academy is:

What is the biggest challenge facing autonomous vehicles, and what may a solution be?

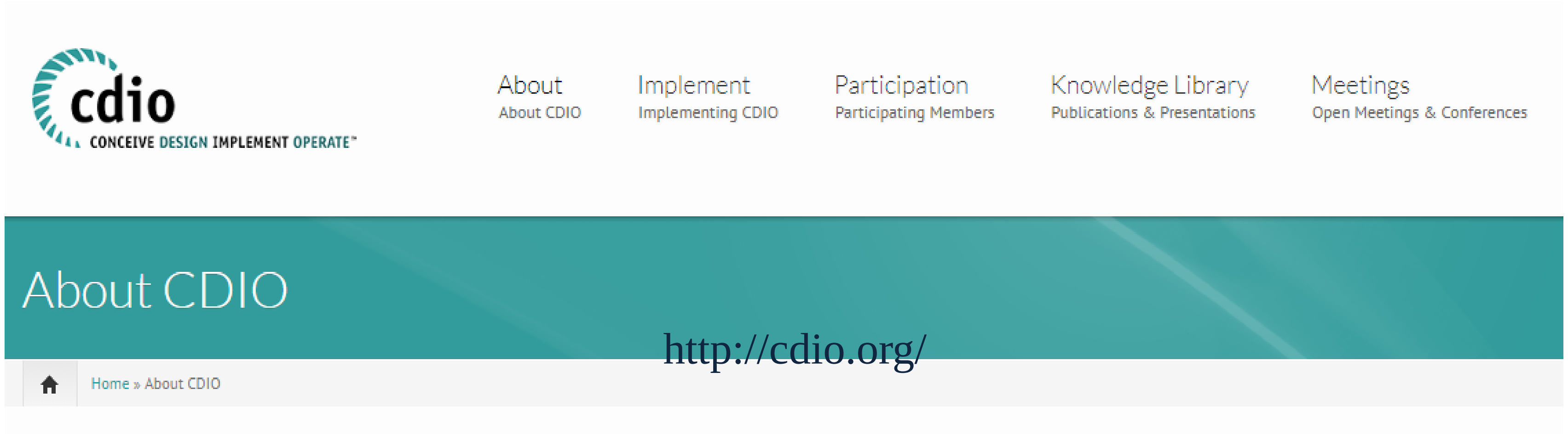
Project introduction and competition information can be found here.

Get Started

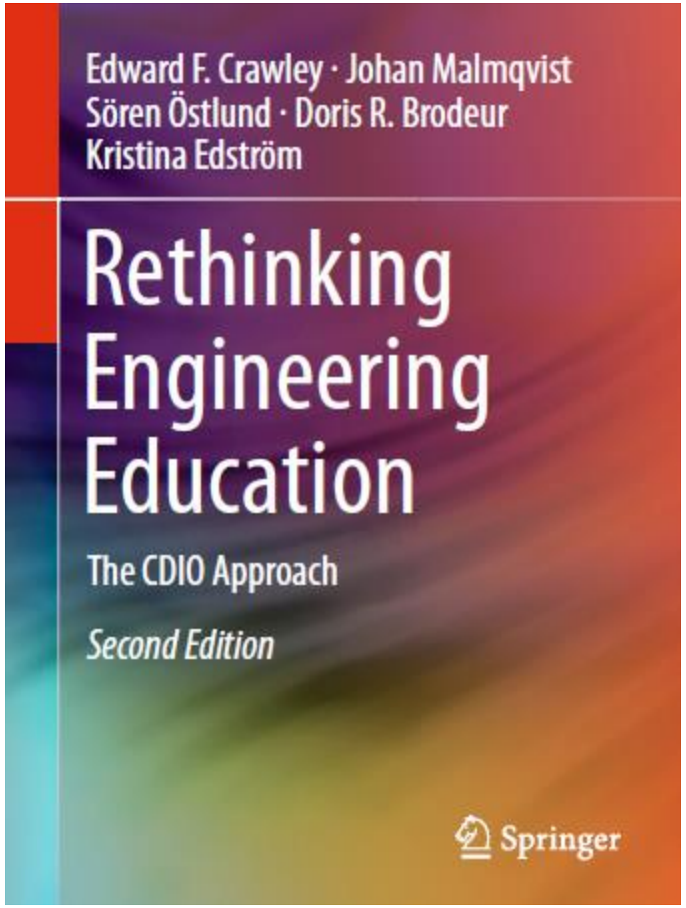
Here are some suggestions to get started:

- ✓ Read the first two or three chapters of the book:

  Rethinking Engineering Education – The CDIO Approach
- ✓ Read the section of this website on "Startup Advice"
- ✓ Read the section of this website on "Early Successes"
- ✓ Attend an Introductory CDIO Workshop (See the schedule of upcoming CDIO meetings)
- ✓ Visit another university that has implemented CDIO
- ✓ Invite a leader of a CDIO program at another university to meet with you and your colleagues
- ✓ Read through the materials in the iKit



http://cdio.org/



Thank You

For Your Interest And Patience