Welcome to the
CDIO Europe-UK & Ireland Regional Meeting 2021

Session 1: CDIO - an introduction for newcomers

Today

13: 00 - 13:35	**Informal welcome & session 1**
	13:00 Welcome
	13:10 Session 1: CDIO - an introduction for newcomers
	Reidar Lyng, NTNU, Norway

| 13:35 - 13:45 | **Break** |

13:45 - 14:50	**Session 2: CDIO as an idea, a methodology for program development, and a community**
	Kristina Edström, KTH, Sweden
	More about session 2

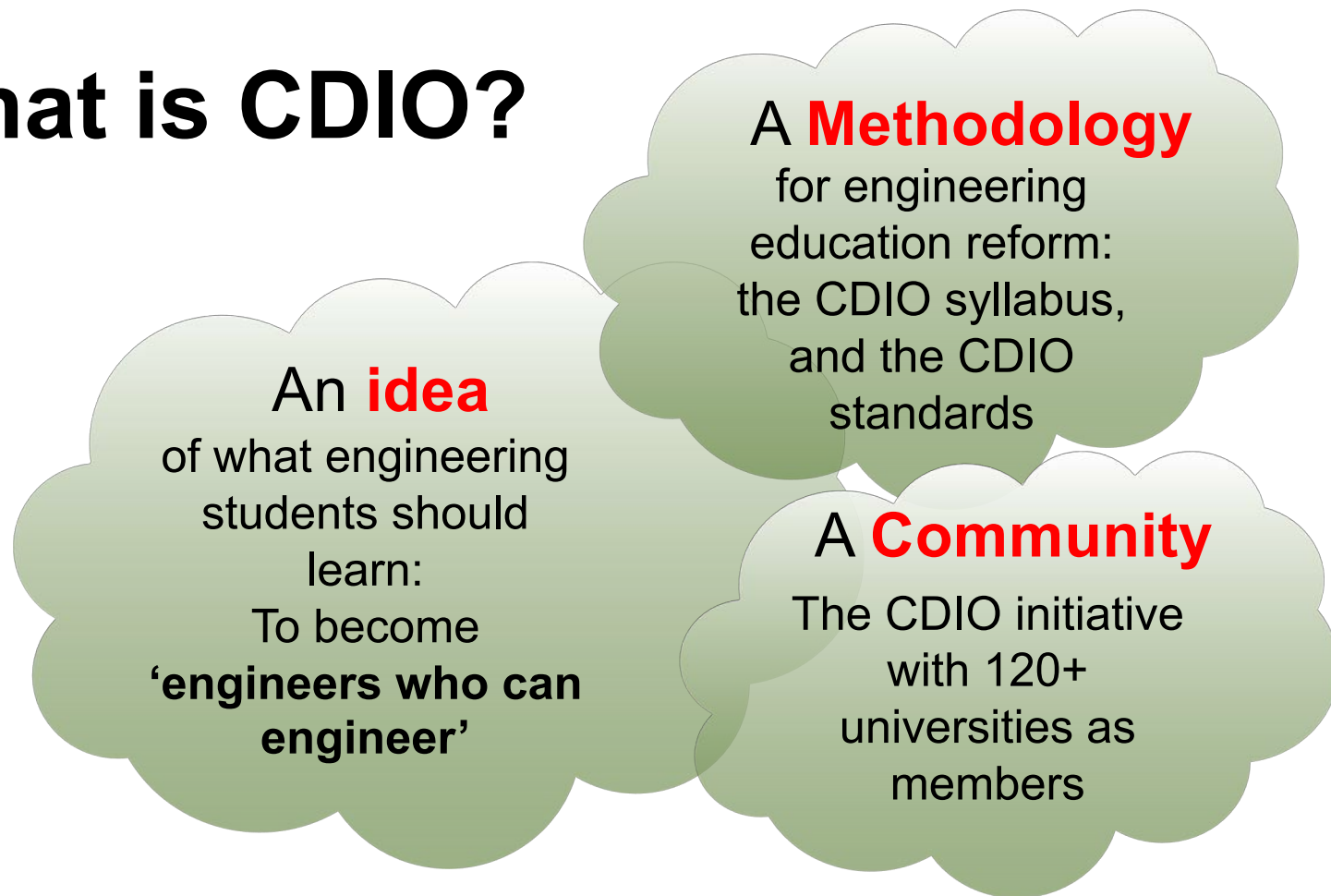| 14:50 - 15:00 | **Break** |

15:00 - 16:30	**Session 3: CDIO Standards - a learning exercise on CDIO Standards**
	Matt Murphy, University of Liverpool, UK
	Juha Kontio, Turku University of Applied Sciences, Finland

What is CDIO?

A **Methodology**
for engineering
education reform:
the CDIO syllabus,
and the CDIO
standards

An **idea**
of what engineering
students should
learn:
To become
**'engineers who can
engineer'**

A **Community**

The CDIO initiative
with 120+
universities as
members

An engineering approach to engineering education

C D I O - R

Conceiving--Designing--Implementing--Operating

a model of the entire product, process, and system lifecycle – *"from idea to ashes (or re-purposing)"*

- **Conceiving** - defining the need and technology, considering the enterprise strategy and regulations, developing the concept, architecture, and business case - deciding what you will design.

- **Designing** - creating the design, i.e. the information artifact (plans, drawings, algorithms, etc) which describes what you will implement.

- **Implementing** - transforming the information artifact - the design - into the product you deliver (manufacturing/coding, test and validation)

- **Operating** - using the implemented product to deliver the intended value, including maintaining, evolving and retiring the system.

- **R** – Re-cycling, re-using and re-purposoing

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THE IDEA IS MORE THAN THE ABBREVIATION
The initials tells us where the idea originated – not what we should make of it!

The CDIO initiative provides a framework that must be adapted to local cultures, rules and circumstances.

It is not normative.

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The idea: **Needs**

Desired Attributes of an Engineering Graduate

- Understanding of fundamentals
- Understanding of design and manufacturing process
- Possess a multi-disciplinary system perspective
- Good communication skills
- High ethical standards, sustainability competencies, etc.

Underlying Need

Educate students who:

- …are able to conceive-design-implement-operate
- …can work with complex value-added engineering systems…
- …in a modern team-based, cross-disciplinary, environment

... but still based on a rigorous treatment of engineering fundamentals

We have adopted CDIO as the engineering context of our education

The idea: **the Context**

The product, process, and system lifecycle...

- …is considered to be <u>the</u> <u>context</u> for engineering education.

the context is **the cultural framework, or environment, in which technical knowledge and other skills are taught, practiced and learned.**

cdio.org

The idea: **Engineers who can engineer**

Competence is insufficiently covered in subject courses,
but *central to the students' learning goals*

- Analysis of problems and desired solutions
  - Open and wicked problems
- Need to negotiate and collaborate with all actors and interests in society
- Oral and written communication

Professional competencies – not soft skills

Methodology:

- **Stakeholder analysis**
  - What are the desired competencies of the graduate?

- **CDIO Syllabus**
  - What are the corresponding required program learning outcomes?
  - How should curriculum be designed to achieve this?

- **CDIO Standards**
  - *Define* the distinguishing features of a CDIO program
  - Serve as *guidelines* for educational program reform and evaluation
  - Create *benchmarks* and goals with worldwide application
  - Provide a *framework* for continuous improvement.

Methodology: **Stakeholder analysis**

Stakeholders are

- Society at large,
- Employers and industry,
- Students and alumni themselves,
- Universities, researchers and teachers.

What are the desired competencies of the graduate?

Remember: Knowledge is necessary for competence, but competence is never guaranteed by knowledge

Methodology: **CDIO Syllabus**

– What should the required program learning outcomes be?

– How should the curriculum be designed to achieve this?

4. CDIO Competence

| 1. Technical competence based on knowledge and reasoning skills | 2. Personal and Professional skills | 3. Interpersonal skills |

Necessary components for a curriculum fostering competence in an enterprise and societal context
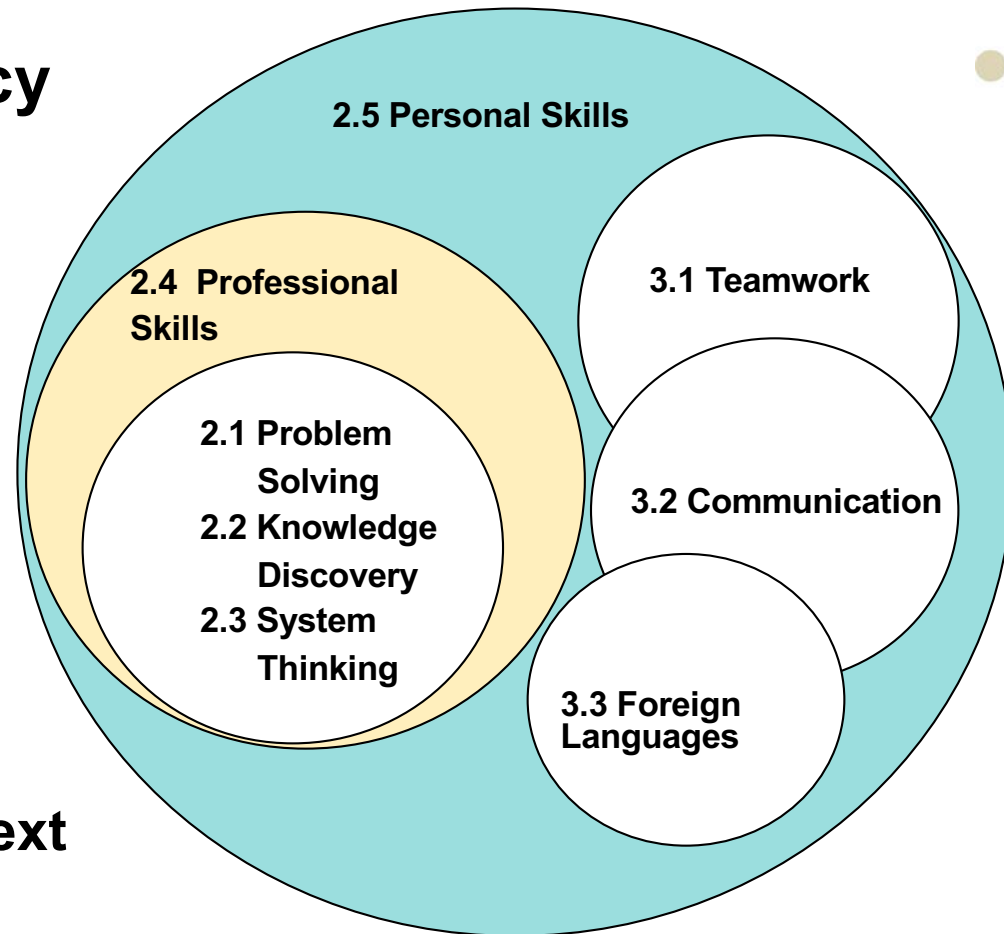
Methodology: **CDIO Syllabus**
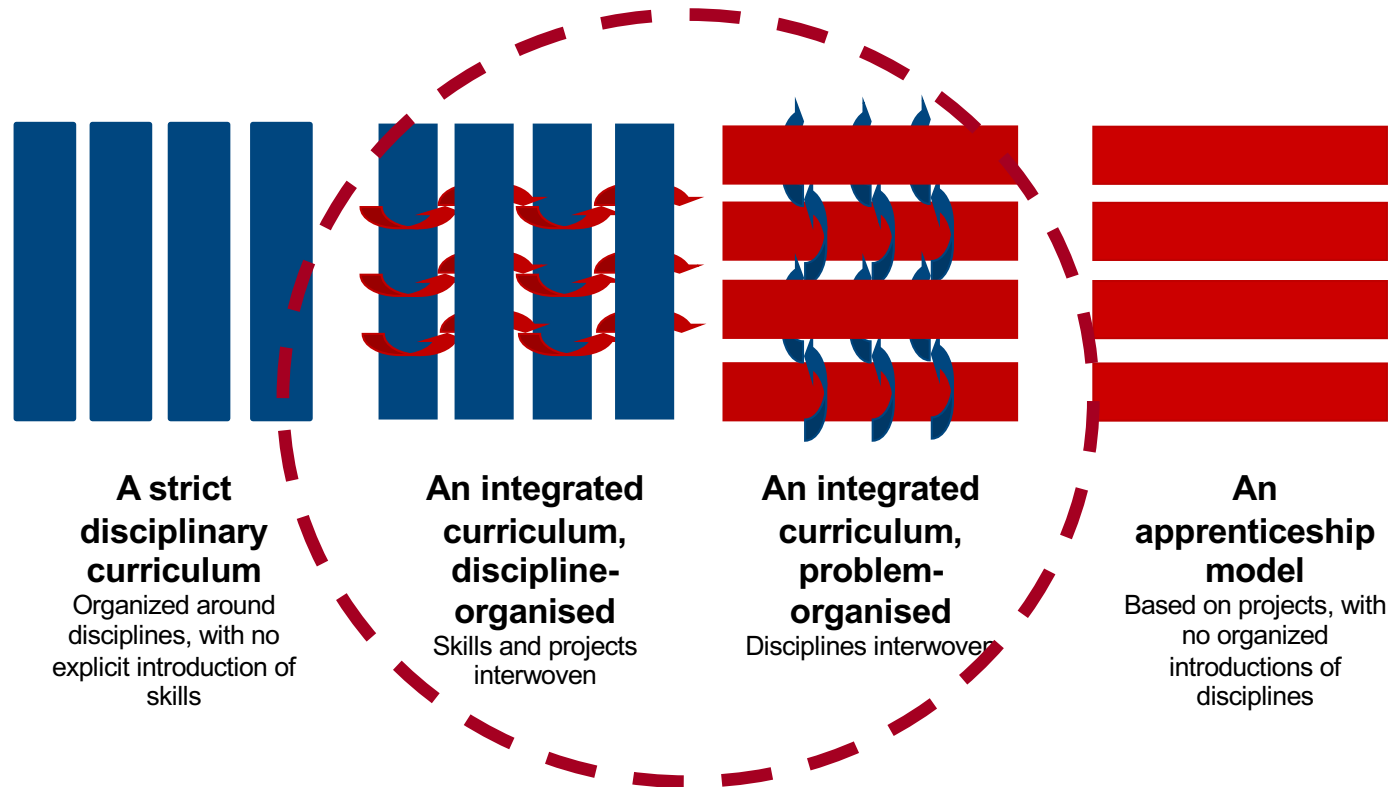
Embedded competency

The ability to apply learning outside the context where you have learnt it is a major challenge.

Developing competence requires learning knowledge in context - to learn to apply the knowledge and develop skills.

Learning by doing in context

2.5 Personal Skills

2.4 Professional Skills

2.1 Problem Solving
2.2 Knowledge Discovery
2.3 System Thinking

3.1 Teamwork

3.2 Communication

3.3 Foreign Languages

Curriculum models

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

An integrated curriculum, discipline-organised
Skills and projects interwoven

An integrated curriculum, problem-organised
Disciplines interwoven

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

Methodology: **CDIO Standards**

Program philosophy

> 1. The context

Curriculum development

> 2. Learning outcomes
> 3. Integrated curriculum
> 4. Introduction to engineering

Experiences & workspaces

> 5. Design-Implement experiences
> 6. Engineering workspaces

Developing & establishing new teaching-learning approaches

> 7. Integrated learning experiences
> 8. Active learning

Faculty development

> 9. Enhancement of faculty competence
> 10. Enhancement of faculty teaching competence

Assessment & Evaluation

> 11. Learning assessment
> 12. Program evaluation

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Methodology: **CDIO Standards**

15:00 - 16:30 | **Session 3: CDIO Standards - a learning exercise on CDIO Standards**

CDIO Standards – an *Active Learning* exercise

Europe-UK & Ireland Regional Meeting 2021

Dr Matt Murphy
Director of Education
Department of Mechanical, Materials &
Aerospace Engineering
University of Liverpool, UK

CDIO Council Member-at-Large

Dr. Sc. Juha Kontio
Dean
Faculty of Engineering and Business
Turku University of Applied Sciences
Finland

CDIO Council Member-at-Large

Methodology:
New optional Standards (2020)

> 1. **Sustainable development**
>
> 2. **Simulation-based mathematics**
>
> 3. **Engineering entrepreneurship**
>
> 4. **Internationalization & mobility**

http://cdio.org/content/cdio-optional-standards-30

Methodology: **Education design**

Our approach is to *design* (in the engineering sense) an improved educational model.

- Analyze needs, and set a clear, complete and consistent set of goals

- Create "models" through research and development efforts

- Design and prototype in parallel programs with partner universities

- Compare results, iterate and converge on improved integrated educational model

Experiences and findings are shared in the CDIO-community

CDIO - A Community for sharing

JUNE 21-23, 2021

THE 17th CDIO INTERNATIONAL CONFERENCE

Chulalongkorn University, Bangkok, Thailand