IMT Atlantique Bretagne-Pays de la Loire École Mines-Télécom CDIO standards for continuous improvement of engineering educational programmes

> Les Modèles de Référence du CDIO ... comme approche systémique pour l'amélioration continue des formations d'ingénieurs

Siegfried Rouvrais Enseignant-chercheur IMT Atlantique

www.tinyurl/rouvrais http://recherche.imt-atlantique.fr/tree/ CDIO EU/UK Regional Conference, January 2019

La Rochelle



WHAT ABOUT YOUR CONTEXT?

Références et lignes directrices pour l'assurance qualité dans l'espace européen de l'enseignement supérieur (ESG)





Accreditation, labels and evaluation processes ...

At your programme level:

- 1. Are your accredited (nat. or intl.)?
- 2. Do you have labels related to educational quality?
- 3. Do you have specific quality assurance models in pla

Kristina Edström: « Progression »

28/01/2019



S. ROUVRAIS, MEETING JANVIER 2019

PROGRAMME OUTCOMES & GRADUATE OUTCOMES MAPPING

Table 2. CDIO Syllabus v2.0 at the Second Level of Detail Concerve Design IMPLEMENT OPERATE"

3

4

- 1 DISCIPLINARY KNOWLEDGE AND REASONING
- 1.1 KNOWLEDGE OF UNDERLYING MATHEMATICS AND SCIENCE
- 1.2 CORE FUNDAMENTAL KNOWLEDGE OF ENGINEERING
- 1.3 ADVANCED ENGINEERING FUNDAMENTAL KNOWLEDGE, METHODS AND TOOLS
- 2 PERSONAL AND PROFESSIONAL SKILLS AND ATTRIBUTES
- ANALYTICAL REASONING AND PROBLEM 2.1 SOLVING
- 2.2 EXPERIMENTATION, INVESTIGATION AND KNOWLEDGE DISCOVERY
- 2.3 SYSTEM THINKING

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- 2.4 ATTITUDES, THOUGH AND LEARNING
- 2.5 ETHICS, EQUITY AND OTHER RESPONSIBILITIES

- INTERPERSONAL SKILLS: TEAMWORK AND COMMUNICATION
- 3.1 TEAMWORK
- 3.2 COMMUNICATIONS
- 3.3 COMMUNICATIONS IN FOREIGN LANGUAGES
 - CONCEIVING, DESIGNING, IMPLEMENTING, AND OPERATING SYSTEMS IN THE ENTERPRISE, SOCIETAL AND ENVIRONMENTAL CONTEXT
- 4.1 EXTERNAL, SOCIETAL AND ENVIRONMENTAL CONTEXT
- 4.2 ENTERPRISE AND BUSINESS CONTEXT 4.3 CONCEIVING, SYSTEMS ENGINEERING AND MANAGEMENT
- DESIGNING 4.4
- 4.5 IMPLEMENTING
- 4.6 OPERATING

Not Prescriptive



La CTI définit ci-dessous sans à priori de hiérarchisation, de phase d'acquisition ou de mode pédagogique un ensemble de 14 acquis

d'apprentissage constituant un référentiel générique de toute formation d'ingénieur

VALIDATION AGAINST NATIONAL **ACCREDITATION FRAMEWORKS**

- The CDIO syllabus has been compared national accreditations in many countries
- Same pattern:
 - The CDIO Svilabus states outcomes for engineering education that reflect a broader view of the engineering profession
 - Its greater levels of detail facilitate program and course development.
 - A program whose design is based on the CDIO Svilabus will also satisfy its national requirements for specified program outcomes.



Accredited

Engineering

Canadian Engineering Accreditation Board Bureau canadien d'agrément des programmes de génie







CEAB (CANADA)

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CDIO Sylladium	4	P.	1	1	Į.	1		P.	p.	38.	11	P
2 Core Engineering Contempted Knowledge												
3 Advanced Eng. Fundamental Knowledge, Nethority, Tools,												
2.1 Analytical Neonamic and Problem Trabena												г
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2.3 System Training					_							Е
A Addusters. Throught sold Learning											-	н
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2	CDIO syllation level a.a																
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CDIO AMELIORATION CONTINUE S. ROUVRAIS, MEETING JANVIER 2019

Le Syllabus ICRE

Énoncé des objectifs de la formation du premier cycle en ingénierie

(Conceive-Design-Implement-Operate)

EDWARD F. CRAWLEY

Afin d'en présenter clairement la logique, notre approche a été de baser le Syllabus ICRE sur les fonctions essentielles du génie :

Les ingénieurs diplômés devraient être en mesure d'Imaginer-Conccevoir-Réaliser-Exploiter

des systèmes complexes d'ingénierie à valeur ajoutée dans un environnement moderne de travail en équipe.

hal-01016400, version 1

Boundaries and Bridges: a French Translation of the CDIO Syllabus

Alison Gourvès-Hayward ¹, Christophe Morace ² Détails **1** LCI - Département Langues et Culture Internationale

2 CRF - Centre de recherche sur la formation



TAB. 1 - Premier et second niveau de l'organisation du Syllabus ICRE

- 1. Connaissances techniques et raisonnement
 - 1.1. Connaissance des sciences de base
 - 1.2. Connaissance des principes fondamentaux de l'ingénierie
 - 1.3. Niveau de connaissances avancé en ingénierie
- 2. Compétences et habiletés professionnelles et personnelles
 - 2.1. Raisonnement technique et résolution de problèmes
 - 2.2. Expérimentation et découverte scientifique
 - 2.3. Raisonnement de systèmes
 - 2.4. Habiletés et attributs personnelles
 - 2.5. Habiletés et compétences professionnelles
- 3. Habiletés interpersonnelles : travail d'équipe et communication
 - 3.1. Travail d'équipe
 - 3.2. Communication
- 4. Imaginer, concevoir, réaliser, exploiter des systèmes dans un contexte sociétal et d'entreprise
 - 4.1. Contexte externe et sociétal
 - 4.2. Contexte commercial et d'entreprise
 - 4.3. Imaginer des systèmes
 - 4.4. Concevoir
 - 4.5. Réaliser
- 4.6. Exploiter

QUALITY: ... NOT ONLY A QUESTION OF LEARNING OUTCOMES



Accreditation Criteria, Guidelines and Procedures

2. STANDARDS FOR THE ACCREDITATION OF ENGINEERING PROGRAMMES [within applicant HEI]

A. MISSION AND ORGANISATION OF THE HEI

A.1. Management structure, strategy and autonomy

A.1.1. Management structure

A.1.2. Strategy

A.1.3. Autonomy

A.2. Engineering education policy and objectives

A.3. Organization and management of the engineering school



A.3.1. Stakeholder participation	31	C12 approval of new programmes	3
A.3.2. Governance	31	c.2. Programme outcomes and learning outcomes	3
A.3.3. Organization	31	C.2.1. Learning outcomes approach	3
A.3.4. Management	31	C.2.2. Programme level and graduate profile	3
A.4. Promotion of the engineering programme	32	C.2.3. Consistency of educational objectives	3
A.5. Human and physical resources	32	C.2.4. Programme outcomes for accreditation	3
A.5.1. Human resources	32	C.3. Programme content	3
A.5.2. Physical resources and facilities	33	C.3.1. Coherence with the expected programme outcomes	3
A.5.3. Financial resources	33	C.3.2. Curriculum and syllabus content	3
B. EXTERNAL LINKS AND PARTNERSHIPS	33	C.4. Programme delivery	3
B.1. Industry links	33	C.4.1. Description of the curriculum	3
B.2. Research and innovation links	33	C.4.2. Learning process	3
B.2.1. Research links	33	C.4.2.1. Delivery modes and practical elements	3
B.2.2. Innovation and knowledge transfer	34	C.4.2.2. Work load	4
B.3. International links	34	C.4.2.0. Mormation technology and terchang methodology	4
B.3.1. International strategy	34	C.4.3. Assessment of learning outcomes	4
B.3.2. Organization and internationalization	35	C.4.4. Student follow-up and tutoring	4
B.3.3. Partnerships and international networks	35	C.5. International dimension of the programme	4
B.3.4. Joint and double degrees	35	C.5.1. Expected outcomes	4
B.4. Links at national level	36	C.5.2. Cultural background and language skills	4
B.5. Links at the lovel	36	C.5.3. Outbound mobility	4
C. EDUCATIONAL PROCESS AND PROGRAMME	36	C.5.4. Inbound mobility	4
C.1. Design and updating of the programme	36	C.6. Industry and research internships	4
L.n. Communication with stakeholders	37	C.7. Student life	4
C.1.2. Analysis of future needs	37	C.8. Engineering qualification certificate	4

L'école doit satisfaire aux exigences majeures de ce référentiel (R&O Livre 1)

30 30

31

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- Les critères sont ordonnés en six champs :
- Champ A : Mission et organisation (formation / école / établissement)
- Champ B : Ouvertures et partenariat
- Champ C : Formation des élèves ingénieurs
- Champ D : Recrutement des élèves ingénieurs
- Champ E : Emploi des ingénieurs diplômés
- Champ F : Démarche qualité et amélioration continue

... AND QUALITY ASSURANCE

48 48

48

48 48

49

<mark>49</mark> 49

D. STUDENT SELECTION AND ADMISSION
D.1. Selection and admission strategy
D.2. Student selection and admission organization
D.3. Sources of admission and attention to diversity
D.4. Admission criteria
E. GRADUATE EMPLOYMENT
E.1. Graduate employment surveys
E.2. Career information and counseling
E.3. Graduete employability analysis
E.4. Employer satisfaction
7.5. Alumni relationship
F. QUALITY ASSURANCE
F.1. Internal quality assurance policy
F.2. Internal quality assurance implementation
F.2.1. Management team involvement
F.2.2. Internal quality management
F.2.3. Stakeholder involvement
F.2.4. External communication and transparency
F.3. Guiding principles
F.3.1. Consideration of national and international regulations and guidelines
F.3.2. Accountability
F.3.3. Internal management
F.4. Continuous improvement cycle
F.4.1. Identification and formalization of processes
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CDIO AMELIORATION CONTINUE

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F.4.2. Systematic evaluation of academic performance	49
F.4.3. SWOC analysis	49
F.4.4. Strategy for improvement	49
F.4.5. Action plan	50
F.4.6. Impact measurement and communication	50
F.5. External quality occurence	50
F.5.1 External quality assurance initiatives	50
F.5.2. Incorporation of external quality assurance results into the continuous improvement cycle	50
3. DOCUMENTS AND PROCEDURES	54
3.1. APPLYING FOR CTI ACCREDITATION	54
3.2. RELEVANT DOCUMENTS FOR THE EVALUATION PHASE	55
3.3. DOCUMENTS AND PROCEDURES FOR THE ON	

Annex: List of engineering branches [OE



Accreditation Criteria, Guidelines and Procedures

WITHIN CDIO: 12 REFERENCE MODELS, FLEXIBLE

THE CDIO STANDARDS: EFFECTIVE PRACTICE FRAMWORK

cdio

1. CDIO as Context*

1st key

entries

Adoption of the principle that product and system lifecycle development and deployment are the context for engineering education

2. CDIO Syllabus Outcomes*

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

3. Integrated Curriculum*

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

4. Introduction to Engineering

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

5. Design-Build Experiences*

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

6. CDIO Workspaces

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



7. Integrated Learning Experiences*

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

8. Active Learning

Teaching and learning based on active experiential learning methods

9. Enhancement of Faculty CDIO Skills*

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

10. Enhancement of Faculty Teaching Skills

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

11. CDIO Skills Assessment*

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

12. CDIO Program Evaluation

A system that evaluates programs against these 12 standards, and provides feedback to students, faculty, and other stakeholders for the purposes of continuous improvement

*essential



EXAMPLE: EUR-ACE VS CDIO REFERENCE MODELS

EUR-ACE Guidelines	European A Ergeditation of Englineering Programmes EUR-ACE®	CDIO Standards	CDIO Coverage	
1. Needs, Objectives and (Outcomes	1 , 2 , 4	Total	
2. Educational Process		3, 5, 7, 8, 11	Total	
3. Resources and Partners	hips	6, 9 , 10	Partial	
4. Assessment of Educational Process		12	Total	oio 🦻
5. Management System		12	Partial	

CDIO as a Foundation for Program Accreditation/Certification in Portugal June 2010, Rocha, Costa & Martins

norme <u>ISO 21001</u>, 2018: « directive <u>ESG</u> selon laquelle la politique d'assurance qualité doit se mettre en pratique par une grande **variété de processus d'assurance qualité internes**: standard spécifiquement dédié aux **systèmes de management des établissements d'enseignement supérieu**r (CTI champ F) »

ABET General Criteria	CDIO Standards	CDIO Coverage	
1. Students	11	Partial	
2. Program Educational Objectives	1	Total	
3. Student Outcomes	2, 5	Total	
4. Continuous Improvement	12	Total	
5. Curriculum	3, 4, 7	Total	
6. Faculty	8, 9 , 10	Total	
7. Facilities	6	Partial	
8. Institutional Support		None	





La CTI définit ci-dessous sans à priori de hiérarchisation, de phase d'acquisition ou de mode pédagogique un ensemble de 14 acquis d'apprentissage constituant un référentiel générique de toute formation d'ingénieur

QUALITY ASSURANCE IN ACCREDITATION: A SHIFT TO QUALITY ENHANCEMENT





Collaborative Quality Enhancement in Engineering Education: an Overview of Operational Models at a Programme Level. Bennedsen, J., Rouvrais, S., Roslof, J., Kontio, J., and McCartan C.D. EJEE European Journal of Engineering Education, 2018.



MATURITY FOR QUALITY ENHANCEMENT... OVER THE YEARS

Rating	Meaning	Level of Achievement	
N	Not achieved	0 % to ≤ 15 %	
Р	Partially achieved	> 15 % to ≤ 50 %	
L	Largely achieved	> 50 % to ≤ 85 %	
F	Fully achieved	> 85 % to ≤ 100 %	

Rating	Meaning	Level of Achievement
Ρ-	Partially achieved -	> 15 % to ≤ 32.5 %
P +	Partially achieved +	> 32.5 % to ≤ 50 %
L-	Largely achieved -	> 50 % to ≤ 67.5 %
L+	Largely achieved +	> 67.5 % to ≤ 85 %

What about your own context?

At a programme level, what about your **maturity**?

- Learning outcomes (#2)
- Integrated curriculum (#3)
- Active learning (#8)

. . .

- Student assessments (#11)
- Faculty competence (#10)



GENERALITIES ON MATURITY LEVELS

ISO/IEC 33020:2015 - A process measurement framework

Supports the assessment of process capability, in accordance with requirements

- Can be used to construct a Process Assessment Model
- Process capability is a process quality characteristic related to the ability of a process to consistently meet current or projected goals
 - facilitates self-assessment
 - provides a basis for use in **process improvement** and process quality determination,
 - applicable across various application domains and sizes of organization
 - produces a set of process (capability) attribute ratings (process profile)
 - derives a process capability level



CDIO AMELIORATION CONTINUE S. ROUVRAIS, MEETING JANVIER 2019 An Assessment Framework for Engineering Education Systems. Rouvrais, S. and Lassudrie, C. In Proceedings of the 14th intl. SPICE Conference. 4-6 November 2014, Vilnius University, Springer CCIS series, 447. A. Mitasiunas et al. (Eds.), pp. 250--255.

6 LEVELS OF MATURITY

ISO/IEC Measurement Scale



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GENERIC CDIO MATURITY LEVELS (SO CALLED 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 in place to address it
0	There is no documented plan or activity related to the standard



STAKEHOLDERS IN PROGRAMME EVALUATIONS



At a programme level:

- Deans
- Programme leaders
- ► Staff, faculty
- QA managers
- Students
- Alumni
- Industrial partners
- Professional bodies
- Accreditation bodies
- ► A.s.o

Managing the Continuous Improvement Loop of Educational Systems: **Students** as key actors in program evaluation. Lassudrie, C., Kontio, J., and Rouvrais, S. In Proceedings of the 9th intl. CDIO Conference: "Engineering Leadership in Innovation and Design". 9-13 June, 2013, MIT & Harvard School of Engineering and Applied Sciences, Cambridge, MA, USA.



EXAMPLE ON STANDARD 2: SYLLABUS

Scale	Criteria
5	Evaluation groups regularly review and revise program learning outcomes, based on changes in stakeholder needs.
4	Program learning outcomes are aligned with institutional vision and mission, and levels of proficiency are set for each outcome.
3	Program learning outcomes are validated with key program stakeholders, including faculty, students, alumni, and industry representatives.
2	A plan to incorporate explicit statements of program learning outcomes is established.
1	The need to create or modify program learning outcomes is recognized and such a process has been initiated.
0	There are no explicit program learning outcomes that cover knowledge, personal and interpersonal skills, and product, process and system building skills.

Learning outcomes are reviewed and validated by key stakeholders, that is, groups who share an interest in the graduates of engineering programs, for **consistency** with program goals and relevance to engineering practice. Programs are encouraged to customize the CDIO Syllabus to their respective programs. In addition, stakeholders help to determine the expected level of proficiency, or

standard of achievement, for each learning outcome.



EXAMPLE ON STANDARD 3: INTEGRATED CURRICULUM

Scale	Criteria
5	Stakeholders regularly review the integrated curriculum and make recommendations and adjustments as needed.
4	There is evidence that personal, interpersonal, product, process, and system building skills are addressed in all courses responsible for their implementation.
3	Personal, interpersonal, product, process, and system building skills are integrated into one or more years in the curriculum.
2	A curriculum plan that integrates disciplinary learning, personal, interpersonal, product, process, and system building skills is approved by appropriate groups.
1	The need to analyze the curriculum is recognized and initial mapping of disciplinary and skills learning outcomes is underway.
0	There is no integration of skills or mutually supporting disciplines in the program.

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.



EXAMPLE ON STANDARD 11: STUDENT ASSESSMENT

Scale	Criteria
5	Evaluation groups regularly review the use of learning assessment methods and make recommendations for continuous improvement.
4	Learning assessment methods are used effectively in courses across the curriculum.
3	Learning assessment methods are implemented across the curriculum.
2	There is a plan to incorporate learning assessment methods across the curriculum.
1	The need for the improvement of learning assessment methods is recognized and benchmarking of their current use is in process.
0	Learning assessment methods are inadequate or inappropriate.

Assessment of student learning is the measure of the extent to which each student achieves specified learning outcomes.

Instructors usually conduct this assessment within their respective courses. Effective learning assessment uses a variety of methods matched appropriately to learning outcomes that address disciplinary knowledge, as well as personal and interpersonal skills, and product, process, and system building skills, as described in Standard 2.

These methods may include written and oral tests, observations of student performance, rating scales, student reflections, journals, portfolios, and peer and self-assessment.



ACTION PLANS PER REFERENCE MODELS

		DATING	ACTIONS
CDIO STANDARD	EVIDENCE OF COMPLIANCE	KATING	ACTIONS
Adoption of the principle that product and			
system lifecycle development and deployment			
– Conceiving, Designing, Implementing and			
Operating - are the context for engineering			
education			
CDIO Syllabus Outcomes			
Specific, detailed learning outcomes for			
personal, interpersonal and product and system			
building skills, consistent with program goals			
and validated by program stakeholders			
Integrated Curriculum			
A curriculum designed with mutually			
supporting disciplinary subjects, with an			
explicit plan to integrate personal,			
interpersonal and product and system building			
skills			
Introduction to Engineering			
An introductory course that provides the			
framework for engineering practice in product			
and system building, and introduces essential			
personal and interpersonal skills			



OTHER POTENTIAL REFERENCE MODELS FOR YOUR OWN CONTEXT (À LA QAEMP)

- A holistic view of learning is taken
- Appropriate learning outcomes are identified
- (developed from required competences)
- An integrated curriculum has been developed
- A sound subject foundation is created
- Active learning approaches are used
- Appropriate workspaces (and equipment) are available
- Personal and interpersonal skills development are embedded
- Faculty development takes place (knowledge and teaching)
- Appropriate assessment is employed (type, level and amount)
- Programme evaluation to promote continuous improvement is undertaken.
- The profession is introduced to students
- Links to employability are made throughout
- Projects are executed in teams (collaboration)
- Support for learning is provided

Finding Good Friends to Learn from and to Inspire. Bennedsen, J., and Rouvrais, S.

In Proceedings of the 46th Annual Frontiers in Education (FIE) IEEE Conference. "The Crossroads of Engineering and Business", October 12-15, Erie, PA, USA, 2016





- Technology is used to promote a blended approach to learning
- Feedback is timely, appropriate and formative
- Research is used in teaching
- Student participation in programme review and development
- Wider stakeholder input to programme developmer e.g. Industry Advisory Board and Benchmark Statements
- Student retention and progression is monitored
- Work placements are promoted
- Problem solving opportunities (links to the research process)
- Design projects are integrated throughout the programme
- Equality, diversity and equal opportunity considerations
- Consideration for international students
- Professional attributes and topical considerations e.g. sustainability, ethical behaviour, global awareness etc
- Evidence of educational scholarship by faculty
- Effectiveness of communication with students.

INSTITUTIONALIZING THE CDIO REFERENCE MODELS



What about IMTA experience?

21



« INSERTION / EN-TÊTE ET PIED DE PAGE »

Resistance to Change in Institutionalizing the CDIO Standards: From a Waterfall to and Agile Improvement Model. Rouvrais, S. and Landrac, G. In Proceedings of the 8th International CDIO Conference, Queensland

University of Technology, Brisbane, July 1-4, 2012.

THE FRENCH FLEXIBILITY IN PUBLIC INSTITUTIONS?

Educational system transformation and improvement:

- Difficulties of French public-style as faculty/staff often prefer to navigate in a flexible manner... keep the pace
- ► There is a comfort zone of "business as usual in education"
 - Keep energy for scientific research, contracts, and quest of excellence for research evaluation of laboratories and individuals (CNRS Labs)
 - Recognition of educational involvement starts slowly to be also taken into account for the promotion of Assistant, A/Prof to Professor status
- But CTI largely recognized by faculty (e.g. programme outcomes)
 Somehow hard to institutionalize the CDIO standards: "yet one more QA system"
 - Aim: to be prepared for a more agile model for continuous improvement
 - Towards a progressive introduction of some of the CDIO standards
 - managing several models at a time ?



CDIO IN 2008 AT TELECOM BRETAGNE



A prestigious graduate engineering school and international research centre in the field of information technologies

Aboutus	Academic Programmes	Research	Campus Life

Academic Programmes	Telecom Bretagne is an associate member of CDIO™			
Overview	Initiative			
French Education System				
Master of Engineering	 Since 2008, Telecom Bretagne has been an associate member of <u>CDIO ™ Initiative</u>, created in the late 1990s by <u>MIT</u>. 			
Master of Science - MSc				
PhD Programmes	Telecom Bretagne is organising the CDIO Annual Meeting from 23 to 25 October			
Post-Master Certificates				
Erasmus Programme	2012. To participate or obtain more information, follow this link:			
EIT Digital Programme	http://conferences.telecom-bretagne.eu/cdiofallmeeting2012/.			
Overseas Programmes				
MMW Summer Shool				
NAI-IoT Summer School	Ine UDIU IM Initiative is an international collaborative process of reflection and improvement of engineering education; it aims to reflect the training of engineers around			
Testimonials	the activities currently carried out by engineers in a professional situation (Conceive			

Docian Implement Operate)



To be continuously prepared for national or international formal accreditations,

Telecom Bretagne has chosen in 2008 to use the CDIO standards as a dynamic tool

- We decided to take CDIO standards one step at a time, at a slow pace:
 - to support peace among educational managers, program developers and teaching staff
- Industrial partners and students used as strong change agents

FIRST A CASCADE CYCLE... WITH A DEMING ELLIPSE





25

For both programs (FISE & FISA)

The CDIO standard #1 (CDIO as a context) has first been elected by the board of directors as a driver of our educational strategy

The CDIO syllabus standard #2 has been gently and progressively disclosed to key program designers and ultimately teaching members (levels 2 then level 3)

cf HTML syllabus CDIO

Nevertheless, at the beginning, detailed CDIO standards were not communicated to most of the teaching staff considering the large scope and alarming complexity of the former



THE CDIO STANDARDS: cdio **EFFECTIVE PRACTICE FRAMWORK** 1. CDIO as Context 7. Integrated Learning Experiences Adoption of the principle that product and system Integrated learning experiences that lead to the acquisition of disciplinary knowledge, as well as ifecvcle development and deployment are the context ering education personal, interpersonal, and product and system 2 CDIO Svilabus Outcomes building skills Specific, detailed learning outcomes for personal, 8. Active Learning interpersonal, and product and system building skills, Teaching and learning based on active experiential consistent with program goals and validated by learning methods rogram stakeholder 9. Enhancement of Faculty CDIO Skills* 3. Integrated Curriculum Actions that enhance faculty competence in personal A curriculum designed with mutually supporting internersonal and product and system building skills disciplinary subjects, with an explicit plan to integrate 10. Enhancement of Faculty Teaching Skills personal interpersonal and product and system Actions that enhance faculty competence in providing building skills integrated learning experiences in using active experiential learning methods, and in assessing student 4. Introduction to Engineering An introductory course that provides the framework for learning engineering practice in product and system building. 11 CDIO Skills Assessment and introduces essential personal and interpersonal Assessment of student learning in personal, skills interpersonal, and product and system building skills, 5. Design-Build Experiences* as well as in disciplinary knowledge A curriculum that includes two or more design-build 12. CDIO Program Evaluation experiences, including one at a basic level and one at A system that evaluates programs against these 12 an advanced level standards and provides feedback to students faculty 6. CDIO Workspaces and other stakeholders for the purposes of continuous Workspaces and laboratories that support and improvement encourage hands-on learning of product and system

building, disciplinary knowledge, and social learning

- From that point, standards #3, 4, 5, 7 and 8 relating to educational contents and pedagogical methods were investigated for other courses (done for projects)
- The focus was then on standards #6, 9 and 10 (i.e. workspaces and faculty skills)
- Approximately 15% of the teaching staff is confident with all the CDIO standards and details
 - 40% are aware on the broad lines, mainly standard #2
- Before further exploring standard #11 (i.e. skills assessment, proficiency matrixes)





ADVICE FOR FUTURE CDIO ADOPTERS





At a programme level:

- Evaluate your program
- What are your strengths and weaknesses with respect to the CDIO Standards?
- Identify some early successes
- Generate buy-in from faculty/staff
- Elaborate action plans & prioritize
- Be ready to assess changes
- Identify resources needed before you embark on large changes
- Learn and get inspired from others



ADVICE FOR FUTURE CDIO INCOMING MEMBERS

L e tr C a d d

Networking to share with others:

Inspire others

La Commission des titres d'ingénieur renouvelle la démarche de recueil et d'analyse des pratiques entreprises par les écoles d'ingénieurs sur des thématiques ciblées nouvelles, peu évaluées sur le fond, transversales ou qu'il conviendrait de revisiter.

Cette démarche, appelée « FOCUS d'audit », vise à faire le point, à repérer des pratiques remarquables ainsi que des angles morts, à dégager des visions communes, à tirer des enseignements, sur la base de ce qui est réalisé et présenté par un nombre significatif d'écoles. Cette analyse est restituée à l'ensemble des écoles.



Trois thématiques sont retenues pour la campagne d'accréditation 2018-2019

٠	Innovation et entrepreneuriat (I&E)	р 5-6
•	Développement durable et responsabilité sociétale (DD&RS)	р7
٠	Santé et sécurité au travail (S&ST)	p 8-9

Objet : mise en place des FOCUS d'audit de la campagne d'accréditation 2018-2019

- En complément du chapitre « I.2.4 Les consultations de réseaux » du Livre 1 R&O 2016
- Considérant les propositions du Bureau de la CTI, le 14 décembre 2017

Finding Good Friends to Learn from and to Inspire. Bennedsen, J., and Rouvrais, S.



QUALITY ASSURANCE AND ENHANCEMENT MARKETPLACE FOR HIGHER EDUCATION INSTITUTIONS

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In Proceedings of the 46th Annual Frontiers in Education (FIE) IEEE Conference. "The Crossroads of Engineering and Business", October 12-15, Erie, PA, USA, 2016

