CDIO contributions to EUR-ACE accreditation at ISEP

Outline

1. School
2. Context
3. Case Study
4. Accreditation in Europe
5. EUR-ACE Experience
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School

- A 160 years old public engineering school
  - Located in Porto, Portugal
  - Approx. 6750 students, 430 teachers and 130 staff
  - Joined the CDIO consortium in 2008
  - In 2012-2013 lectures
    - 11 first cycle engineering 3-year programs (bachelor)
    - 10 second cycle engineering 2-year programs (master)
  - EUR-ACE in 2012
    - Accreditation of a 2nd cycle (IE) and application of another 3 until the end of the year
    - Application of a 1st cycle (IE) – National pilot

Context (CDIO Initiative)

Contribute to educate students who:
- Understand how to conceive-design-implement-operate
- Complex value-added engineering systems
- In a modern team-based engineering environment
Case study (IE)

- Informatics Engineering (IE) at ISEP
  - History
    - 1st cycle started in 1986 (one of the first in Portugal)
    - 2nd cycle started in 1999
    - Redesigned in 2006 (Bologna process)
      - 1st cycle, 1158 students in 2012/2013
      - 2nd cycle, 385 students in 2012/2013
      - Major redesign of both programs based on ACM Computing Curricula and CDIO
    - CDIO practice
      - Over 10 presentations on CDIO conferences since 2008

Case study (IE)

- A professional oriented 1st cycle program - LEI

![Course Structure Diagram]

- 1st year
  - 1st sem.: Mat. Analysis 5 ECTU, Discrete Mat. 5 ECTU, Comput. Mat. 5 ECTU, Prog. Paradig. 6 ECTU, Comp. Princ. 6 ECTU
  - 2nd sem.: Software Eng. 6 ECTU, Applied Phys. 5 ECTU, Comp. Arch. 5 ECTU, Inform. Struc. 6 ECTU, Databases 6 ECTU

- 2nd year
  - 3rd sem.: Comp. Netw. 6 ECTU, Comp. Sist. 6 ECTU, Lang. & Prog. 6 ECTU, Appl. Eng. 6 ECTU, Sist. Arch. 5 ECTU

- 3rd year
  - 5th sem.: Management 4 ECTU, Sist. Admin. 5 ECTU, Adv. Algorit. 5 ECTU, Gr. Sist. & Int. 5 ECTU, Lab./Proj. V 6 ECTU
  - 6th sem.: Project/Internship 18 ECTU, Personal Skills Team Project 1, Lab./Proj. II 8 ECTU, Lab./Proj. III 8 ECTU, Lab./Proj. IV 6 ECTU, Lab./Proj. V 6 ECTU

Most students choose an internship (18 ECTU)
Case study (IE)

• Specialized master program (3 tracks) - MEI

![Diagram showing course structure]

OE EUR-ACE Accreditation in 2012

Case study (IE)

• CDIO main contributions (standards and practices)
  – Hands-on approach to informatics engineering [S1]
  – A process for the definition of program outcomes [S2]
  – Integration of several types of soft/hard skills [S3]
  – Introductory course to informatics engineering [S4]
  – “Design-build” courses [S5, S7]
  – Balance between “science”, “management” and “engineering” courses [CDIO + ACM Comp. Curricula]
  – Relevant contributions to faculty, assessment, etc.
Case study (IE)

- State of LEI and MEI in 2009 and 2012
  - Substantial progress achieved since 2009

<table>
<thead>
<tr>
<th>CDIO Standards Implementation at ISEP (0-5 scale)</th>
<th>LEI 2009</th>
<th>LEI 2012</th>
<th>LEI+ MEI 2012</th>
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<tbody>
<tr>
<td>1 The Context</td>
<td>3</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>2 Learning Outcomes</td>
<td>2</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>3 Integrated Curriculum</td>
<td>3</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>4 Introduction to Engineering</td>
<td>3</td>
<td>4</td>
<td>4</td>
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<tr>
<td>5 Design-Implement Experiences</td>
<td>4</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>6 Engineering Workspace</td>
<td>3</td>
<td>4</td>
<td>4</td>
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<tr>
<td>7 Integrated Learning Experiences</td>
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<td>4</td>
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<tr>
<td>8 Active Learning</td>
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<td>4</td>
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<tr>
<td>9 Enhancement of Faculty Skills Competence</td>
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<tr>
<td>10 Enhancement of Faculty Teaching Competence</td>
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<td>2</td>
</tr>
<tr>
<td>11 Learning Assessment</td>
<td>2</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>12 Program Evaluation</td>
<td>1</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

Case study (IE)

- A new graduate grading system (1st cycle)
  - Competence/Skills/Knowledge qualitative grading

Competence / Skills / Knowledge Descriptor Based Grades (A - Excellent; B - Very Good; C - Good; D - Sufficient)
Case study (IE)

• Accreditation and certification roadmap
  – National accreditation required for public funding
  – EUR-ACE® Quality Seal by ENAEE
    • Apply master programs after running for at least 4 years
    • Informatics Engineering achieved EUR-ACE in April 2012

Accreditation in Europe

• “Expected outcomes” based accreditation
  – High-level (general) frameworks
    • European Qualification Framework (EQF)
    • Bologna Process (adopted the Dublin Descriptors)
    • Most national/European accreditation agencies
  – Engineering (sectorial) frameworks
    • CDIO: explicit syllabus within “12 Principles/Standards”
    • EUR-ACE/ENAEE: implicit syllabus within “5 Guidelines”
    • ABET: implicit syllabus within “8 General Criteria”
  – Content (specific) frameworks
    • ACM/IEEE Computing Curricula for “Computer Science”, etc.
EUR-ACE Experience (IE)

- Has CDIO been helpful on the EUR-ACE process?
  - CDIO does not prescribe a management system
  - But it is excellent for outcomes, curriculum and learning process
  - And addresses faculty professional and teaching skills

<table>
<thead>
<tr>
<th>EUR-ACE Guidelines</th>
<th>CDIO Standards</th>
<th>CDIO Coverage</th>
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<tbody>
<tr>
<td>1. Needs, Objectives and Outcomes</td>
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<td>2. Educational Process</td>
<td>3, 5, 7, 8, 11</td>
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<td>3. Resources and Partnerships</td>
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<td>4. Assessment of Educational Process</td>
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<td>5. Management System</td>
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* ISEP perspective

Worldwide Accreditation

- ABET process
  - ABET vision for accreditation is of world leadership
  - How CDIO Standards cover ABET General Criteria?*

<table>
<thead>
<tr>
<th>ABET General Criteria</th>
<th>CDIO Standards</th>
<th>CDIO Coverage</th>
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<td>1. Students</td>
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<td>2. Program Educational Objectives</td>
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<td>3. Student Outcomes</td>
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<td>4. Continuous Improvement</td>
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<td>5. Curriculum</td>
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<tr>
<td>6. Faculty</td>
<td>8, 9, 10</td>
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<td>7. Facilities</td>
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<td>Partial</td>
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<td>8. Institutional Support</td>
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* ISEP perspective
Conclusions

• Has CDIO has been good for our business?
  – Real evidence gathered after CDIO adoption in 2006
    • First option student applications have increased
    • Student dropout in both programs has been reduced
    • The completion rate of both programs has increased
    • More industry contacts with program directors for recruiting
    • Industry shows interest in cooperation with the programs
    • Recognition from accreditation/certification agencies, IT academies, industry, alumni, media, etc.
    • Teachers embracing active pedagogical methods in classes
    • The high quality of many LEI capstone project solutions
    • The high quality of many MEI thesis/project solutions

Conclusions

• Future
  – In Europe
    • Optimize the public expenditure in higher education
    • Improve graduate mobility in Europe and periphery
    • Shift from outcomes accreditation to quality assurance
  – In Portugal
    • Consolidate the offer in engineering programs
    • Operate “quality assurance systems” until 2015
  – Threats and risks in Europe
    • Shortage of students due to demographic problems
    • Migration of graduates from south to center/north/outside
Thank you...