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Analyzing Curriculum Structure in Industrial and Management Engineering Courses:
Implications for Teaching and Learning

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Outline

- Introduction

- Context of the Study

- Methodology

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Introduction

- **Purpose of the study**

  - to analyze the structure and rationale of curricula in Industrial and Management Engineering (IME) courses

    - PhD. Project - to analyze the curricula elements and employability competences in the Engineering Courses, in order to contribute to the improvement of the quality of the training program in engineering courses

    - Case Study - Integrated Master Degree of Industrial and Management Engineering (MIEGI) at University of Minho

Context of the Study
Higher Education

- **BOLOGNA PROCESS**

  - **Main Goal:** harmonization of higher education systems in European Higher Education Area (EHEA)

  - **Demands:** new structures and tools, quality assurance, social dimension, student mobility, lifelong learning and employability

  - **Implications:** strong impact on policies and practices in the universities and implies an educational reorganization

- **EDUCATIONAL REORGANIZATION**

  - More flexible curriculum

  - A distinct organization of teachers and students

  - The adoption of schemes of tutorial support

  - New ways of teaching and assessment

  - New calendars evaluation procedures

  - Greater coordination between research and teaching

  - Smaller classes

Context of the Study
Higher Education

- **CHANGES IN CURRICULA**

  - **Student centered curricula** require changes in educational activities, assessment tasks and strategies, and a change in the organization of learning

  - Importance of the **development of technical and also transversal competencies**, which allow students to communicate what they know and to use their knowledge in many different ways

- the most significant changes, with a clear impact on teaching and learning methodologies, occurred at two levels:

  - Assessment methods

  - **Adjustment of graduate study programs**

1st Cycle: BSc 180 ECTS – 3 years	2nd Cycle : MSc 120 ECTS – 2 years	3rd Cycle: PhD. 180 ECTS – 3 years

Methodology

- **Research Questions:**
  - How is the curriculum is structured?
  - What are the key areas that are promoted in each curriculum course?
  - What kind of professional profile is defined?

- **Document Analysis:**
  - Industrial and Management Engineering programs (IME)
  - through an online directory, a list of Higher Education institutions
    http://europe.2graduate.com/

- **IME programs:**
  - 127 programs from universities and polytechnics in Europe

    (Germany, Spain, Russia, UK, Sweden, The Netherlands, Poland, Norway, Italy, Ireland, Greece, France, Denmark, Finland, Austria and Portugal)

  - identify European trends
  - only universities were chosen for this analysis – **80 programs | 1st and 2nd cycles**

Findings

- Most of programs' designation is different in each university, However, all programs are related to IME area because this is the main criterion for the analysis

  - Engineering Design and Production | Industrial Engineering | Industrial Management | Manufacturing Engineering Management | Industrial Project Management

- The curriculum organization shows that all programs have **Math** and **Physics** in year 1 - Basic Sciences in Engineering

  - In some countries the first cycle of study for Engineering is common. Only in the second cycle students have a specialization of knowledge (e.g. Mechanical, Computer Science, Production, etc.).

- The programs selected are different in their length

  - A few programs are open and flexible, where student choose the courses that he/she want to do.

Conclusions

- *What are the implications for teaching and learning in Higher Education?*

  - European Network for Accreditation of Engineering Education
    - **EUR-ACE®:** the European quality label for engineering degree programmes at Bachelor and Master level

  - Is aligned with Bologna Process orientations
    - **FQ EHEA:** Framework of Qualifications for the European Higher Education Area (for all areas of knowledge)

Conclusions

- **EUR-ACE -** Framework Standards for the Accreditation of Engineering Programmes

Knowledge and Understanding	The underpinning knowledge and understanding of science, mathematics and engineering fundamentals are essential to satisfying the other programme outcomes. Graduates should demonstrate their knowledge and understanding of their engineering specialisation, and also of the wider context of engineering.	✓

Conclusions

Engineering Analysis	Graduates should be able to solve engineering problems consistent with their level of **knowledge and understanding,** and which may involve considerations from outside their field of specialisation.	✓ depends on: what kind of **learning methodologies** are implemented?

Conclusions

Engineering Design	Graduates should be able to realise engineering designs consistent with their level of **knowledge and understanding,** working in cooperation with engineers and non-engineers.	✔ depends on: what kind of **learning methodologies** are implemented?

Conclusions

Investigations	Graduates should be able to use appropriate methods to pursue research or other detailed investigations of technical issues consistent with their level of **knowledge and understanding**.	✔ depends on: what kind of **learning methodologies** are implemented?

Conclusions

Engineering Practice	Graduates should be able to apply their **knowledge and understanding** to developing practical skills for solving problems, conducting investigations, and designing engineering devices and processes.	✓ depends on: what kind of **learning methodologies** are implemented?

Conclusions

Transferable Skills [transversal competencies]	The skills necessary for the practice of engineering, and which are applicable more widely, should be developed within the program.	**X** depends on: what kind of **learning methodologies** are implemented?

Conclusions

- **IME programs reveals:**
  - (+) knowledge and understanding
  - (-) transversal competencies

- **Depends on learning approach:**
  - methodologies related to active learning
  - teachers' role – facilitator, communicator and innovator
  - formative assessment
  - (…)

The formal curriculum just shows the organization of the contents, not the processes related with students' learning environment.

Discussion

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