
First ENAEE Conference
Porto, 12 and 13 November 2012



**Focusing the Gap Between Teaching Profile
and Professional Skills**

Elisa Guberti & Giampaolo Manfreda
Claudio Borri, Michele Betti and Marcantonio Catelani.
School of Engineering, University of Firenze, Italy



Università degli Studi di Firenze



...Framework (EUR-ACE/ITALY)

In February 2012, the School of Engineering in Firenze has decided to propose two curricula for International Accreditation using the EUR-ACE framework:

- ***Undergraduate course in Civil, Building/Construction and Environmental Engineering (CEA)***
- ***Postgraduate course in Engineering for preservation of the Environment (ITAT)***

The Agency in charge for EUR-ACE in Italy is QUACING (<http://www.quacing.it>), an agency which has adapted the CRUI national model to conformity to EUR-ACE standards.

Experimentation on application of the CRUI/EUR-ACE Italian model has started in 2011.

The model is highly structured and fulfils the fundamental requirements of most advanced models for quality evaluation and accreditation of university courses in the area of Engineering.



...Framework (EUR-ACE/ITALY)

The two courses proposed for international certification (CEA and ITAT) have defined the internal working groups and started examining critical issues associated with application of the CRUI/EUR-ACE quality model.

Among the critical issues, it was evident that a **detailed decomposition of the learning outcomes/technical skills** in the knowledge area of civil engineering was necessary (current models apply Dublin descriptors which are very general);

Moreover, it was necessary to implement the survey of the **graduates' opinion on the level of training** in the different technical and non-technical areas, comparing the teaching profile with the actual needs of the professional working environment.

3



EUR-ACE Learning Objectives

As CEA is a new course, reflecting however a layout generated in 2001 (Bologna agreement- DM509IT) and revised in 2008 (DM270IT), the fundamental skills were inherited by these courses. They were reformulated as **EUR-ACE learning objectives**, and have been mapped against the **Dublin descriptors** which have been used up to now).

The teaching/learning profile was the same (with different levels in specific areas) for Civil and Environmental engineering; a specific set was defined for Building/Construction Engineering.

4



...Layout of Survey

The Survey was run on the graduates from 2008 to 2012. The subdivision among the three fields (Civil, Environmental, Building/Construction) and Graduate/Postgraduate is:

	Graduate	Postgraduate	
Civil	8	14	
Environmental	34	32	
Building/Construction	33	22	Overall
Overall	75	68	143

The survey was designed to avoid overlapping with questions which are already present in the ALMA Laurea questionnaire. Rather we focused on motivation and correspondence between learning profile and working technical/professional skills.

5



...Civil /Environmental Engineering

- 1) Scientific fundamentals (Mathematics/Physics/Chemistry)
- 2) **Civil/Structural Engineering (Geotechnics/Structural Mechanics/Theory of structures)**
- 3) Hydraulic Engineering (Fluid Mechanics/Hydrology/Sanitary Engineering)
- 4) **Land Representation Engineering (GIS, Topography)**
- 5) General-purpose SW (Operating systems/spreadsheets/scientific simulation)
- 6) Specific SW (CAD/specific SW packages such as Finite Elements, thermodynamics/heat transfer,...)
- 7) **Materials Engineering**
- 8) **Electrical Engineering (plants, electric machines and power electronics)**
- 9) **Energy Engineering (Thermodynamics/Heat Transfer)**
- 10) Capability of data gathering (experimental research, field data surveys, including data validation and reduction by statistical methods)
- 11) Attitude to project work (project organization, civil/environmental engineering)

In Red/Blue (Env/Civil): Learning skills evaluated less or close to 2 (average) on a scale from 1 to 4

6



...Civil/Environmental Engineering

- 12) Attitude to group working (teamworking/project study groups)
- 13) Capability of writing technical reports
- 14) Fundamentals of economics evaluation and finance tools
- 15) Professional expertise in quality, safety and environment
- 16) Interdisciplinary engineering skills (different from Civil/Environmental)
- 17) Capability of lifelong learning (self-organisation)
- 18) Principles of Ethics in engineering practice (seminars, part of specific courses)
- 19) Language skills and capability of working in an international panorama
- 20) Capability of assessing the environmental performance of a process or of a product (environmental synthesis)
- 21) Capability of data and information retrieval (from scientific/technical/standards literature; from data bases;...)
- 22) Capability of running simulations and/or experiments and result assessment
- 23) Hydraulic construction works

In Red/Blue (Env/Civil): Learning skills evaluated less or close to 2 (average) on a scale from 1 to 4

7



...Building/Construction Engineering

- 1) Scientific fundamentals (Mathematics/Physics/Chemistry)
- 2) Civil/Structural Engineering (Geotechnics/Structural mechanics/Theory of structures)
- 3) Building design (Technical architecture and Architectural detailing, Architectural Design and Composition)
- 4) Construction management, safety and quality assessment
- 5) General-purpose SW (Operating systems/spreadsheets/scientific simulation tools such as Matlab)
- 6) Specific SW (CAD/specific SW packages such as those referred to Finite Elements, thermodynamics/heat transfer,...)
- 7) Materials engineering
- 8) Construction control and management
- 9) Urban analysis and urban planning
- 10) Capability of gathering data (experimental research, field data surveys including data validation and reduction with statistical methods)
- 11) Development of project work attitude (project management, civil/environmental engineering)
- 12) Development of team work attitude
- 13) Capability of writing technical reports
- 14) Energy and fluid distribution systems engineering for buildings

In Red: Learning skills evaluated less or close to 2 (average) on a scale from 1 to 4

8



...Building/Construction Engineering

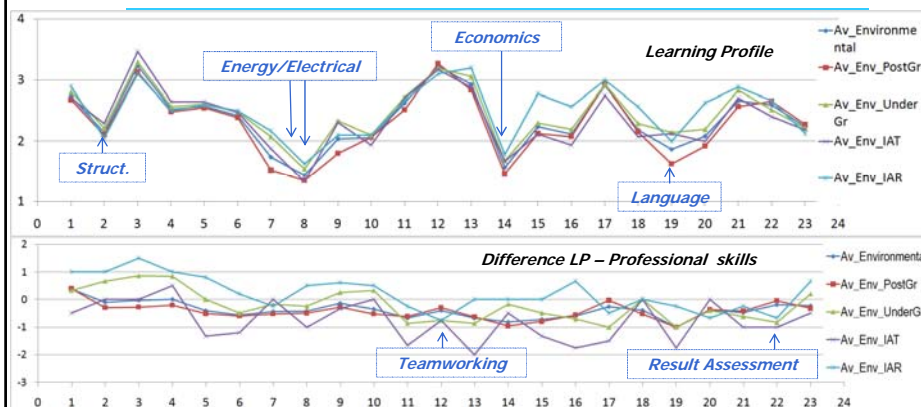
- 15) Professional expertise in quality, safety and environment
- 16) Interdisciplinary engineering skills (different from Civil/Environmental)
- 17) Capability of lifelong learning (self-organization)
- 18) Principles of Ethics in engineering practice (seminars, part of specific courses)
- 19) Language skills and capability of working in an international panorama
- 20) Capability to evaluate the performance of the building and its components
- 21) Capability of data and information retrieval (from scientific/technical/standards literature; from data bases;...)
- 22) Capability of running simulations and/or experiments and result assessment
- 23) Environmental Sanitary Engineering
- 24) Graphical Information Systems (GIS)
- 25) Hydraulic engineering (Fluid Mechanics/Hydrology)
- 26) Land expertise (Topography)
- 27) Electrical engineering
- 28) Energy engineering (Thermodynamics/Heat Transfer)

In Red: Learning skills evaluated less or close to 2 (average) on a scale from 1 to 4

9



...Environmental Engineering



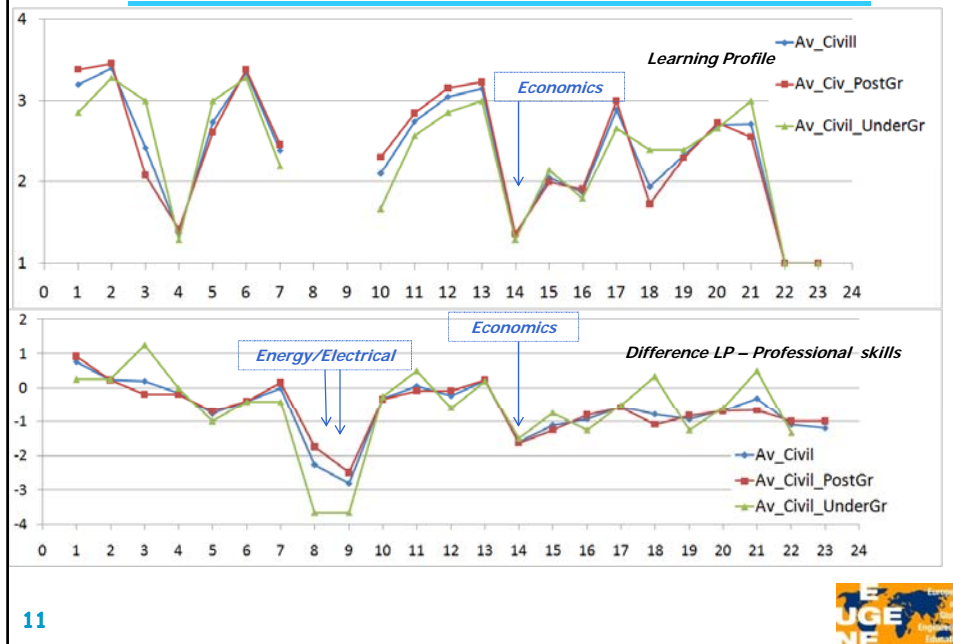
The learning profile finds a good correspondance with the professional skills, with special reference to the average (G+PG).

The fact that some skills have a difference score close to -1 (Capability of running simulations and/or experiments and result assessment ; Development of team work attitude) is a normal outcome, with special reference to the undergraduate learning profile.

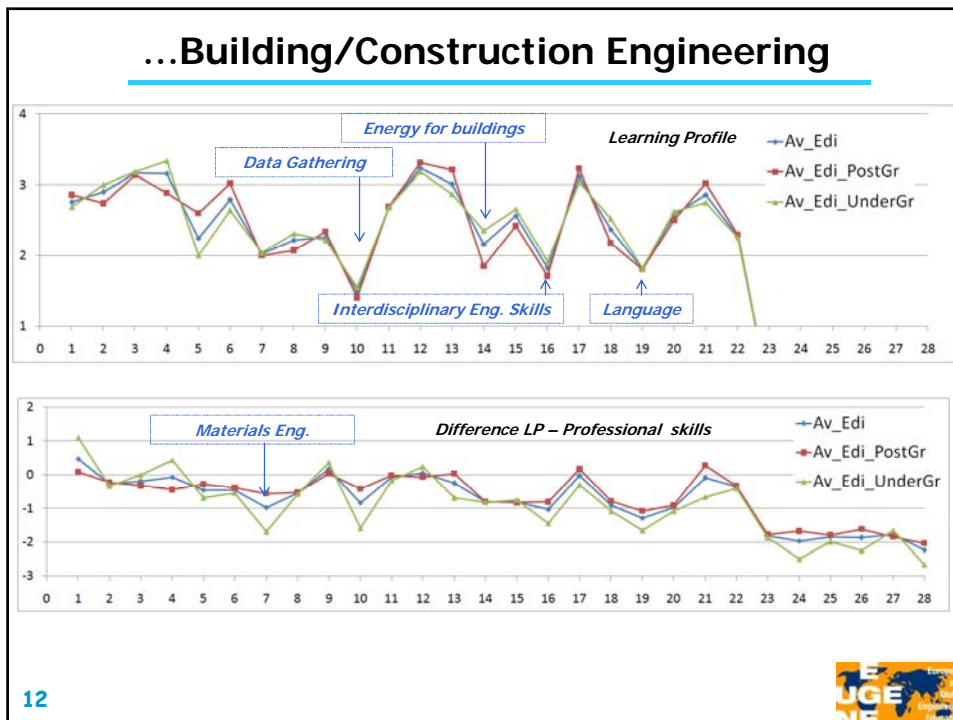
10



...Civil Engineering



...Building/Construction Engineering



...Attractiveness/Motivation

The survey inquired about the **reasons for starting the specific university studies (G/PG)** and the **potential reasons for looking for a different job opportunity.**

Attractiveness/Motivation to:	University		Job Change		University		Job Change		University		Job Change	
	EnvG	EnvPG	EnvG	EnvPG	CivG	CivPG	CivG	CivPG	EtiG	EtiPG	EtiG	EtiPG
Possibility of improving professional skills	21%	31%	4%	22%	25%	50%	13%	31%	6%	50%	24%	18%
Economic Revenues	0%	3%	0%	16%	13%	0%	13%	0%	0%	5%	12%	32%
Career perspective	3%	6%	4%	16%	13%	7%	13%	31%	3%	5%	21%	27%
Opening to international mobility	15%	0%	4%	3%	0%	7%	13%	8%	3%	0%	6%	5%
Attraction to specific skills (e.g. env. prot.)	3%	38%	4%	6%	0%	7%	0%	0%	3%	23%	6%	0%
Access to a reliable work position	3%	0%	0%	16%	0%	0%	13%	0%	3%	9%	6%	0%
Attractiveness of workplace environment	0%	9%	0%	0%	0%	0%	0%	0%	0%	9%	0%	5%
Others	3%	6%	4%	0%	25%	21%	0%	8%	6%	0%	0%	0%
Response score	47%	94%	19%	78%	75%	93%	63%	77%	24%	100%	76%	86%
Counts	34	32	34	32	8	13	8	13	33	22	33	22

The responses were quite different for the two levels (G/PG); for the two categories (Starting University studies/Changing Job); and for the three areas considered (Civ/Eti/Env)

In the table we have underscored in **red** what we consider positive indicators, and in **blue** what deserves specific analysis or can probably be identified as a negative condition.

13



...Difficulties

The survey also inquired about difficulties encountered in the first impact with the work environment after University studies:

Difficulties	EnvG	EnvPG	CivG	CivPG	EtiG	EtiPG
No difficulty	9%	9%	25%	14%	15%	27%
Workplace environment	9%	19%	13%	36%	6%	23%
Insufficient language skills	12%	6%	0%	0%	6%	0%
Lack of technical knowhow	6%	13%	38%	14%	18%	32%
Lack of fundamental (scientific) knowledge	3%	0%	0%	0%	3%	5%
Lack of preparation on codes and standards	15%	28%	13%	0%	9%	5%
Others	3%	13%	0%	29%	24%	9%
Response score	56%	88%	88%	93%	82%	100%
Counts	34	32	8	13	33	22

In the table we have underscored in **red** what we consider positive indicators, and in **blue** what deserves specific analysis or can probably be identified as a negative condition.

14



...Concluding Remarks

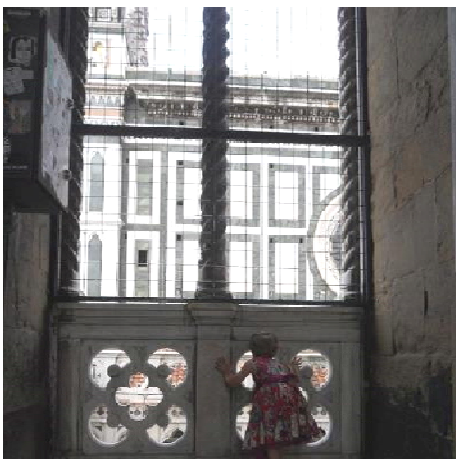
- We have shown how it is possible to **plan and run a survey investigating correspondence between teaching profile and professional skills**
- The results are promising and confirm a **satisfactory teaching profile** under the **several design constraints**
- Data gathering and interpretation is still on the way
- The results will be used for **tuning the teaching profile and adjusting it to the professional skills**
- It is **necessary to present and discuss the outcomes with professional associations, industrial and «political» shareholders**
- In progress: **improvement of the survey ...**

15



Thank you for your Attention!

Elisa Guberti
Head of the
International Relations Office
School of Engineering
Università di Firenze
intreling@unifi.it



Florence: The Cathedral of Santa Maria del Fiore from Giotto's belltower

