

About global models for engineering education

Why should educators in search of quality and excellence look beyond learning outcomes and refer to global models?

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Introductory words about CEFI (and about me)

- CEFI is a French based resource centre on engineering education and employment, backed by engineering institutions (CNISF) >> *see Web site*
- My personal background
 - now working full time at CEFI after a career as administrator in some large engineering schools (Mines Nancy, École polytechnique) and a stay in Administration
 - An engineering background with a permanent and partly atavistic interest for education
- This presentation is originated from an European project (QUESTE-VET) whose aim was to define an original methodology to rank engineering institutions and programs (with the idea that there are several ways for excellence...)

In the last 10 years, mainly under the pressure of accreditation bodies (as ABET), more and more attention has been borne to learning outcomes, which are now the backbone of any curriculum development in engineering education.

The emphasis put on L.O. is the expression of a logical bond between professional activities and education
(upstream logic)

Jobs >> Tasks >> Competencies >> L.O. >>

..... >> L.O >> lectures and educational activities

The new place given to learning outcomes has had positive consequences and demonstrates several clear advantages.

Use of L.O. corrects some EE weaknesses

- More transverse competencies (communication, team working ...)
- Emphasis put on design methodology
- A greater attention to the context

It has also the advantage

- to facilitate a positive dialogue (with better mutual comprehension) between corporate circles and the academic world
- to ensure a better understanding by students of courses final objectives: graduates get an idea of what they will be actually able to do
- to enable easier internal trade-offs...hopefully!

Beyond this idealistic view, learning outcomes demonstrate limits

- In the implementation of the educational process
 - There is no obvious correspondence between educational activities and outcomes (no diagonal matrix, or no matrix at all!)
 - Most outcomes are difficult to assess in a classical way
- Critics may be developed on step further
 - L.O. foster an analytic approach of engineering qualifications (general aptitude appears as simple sum of qualities)
 - L.O. put emphasis on defined tasks and pay less attention to open missions in uncertain contexts...
 - L.O. implies a functional view of efficiency focused on best local solution, which does not well fit with complex problems
 - Little attention, if any, is given to individual attributes

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It appears there is a place (and even a need) for a broader and deeper model

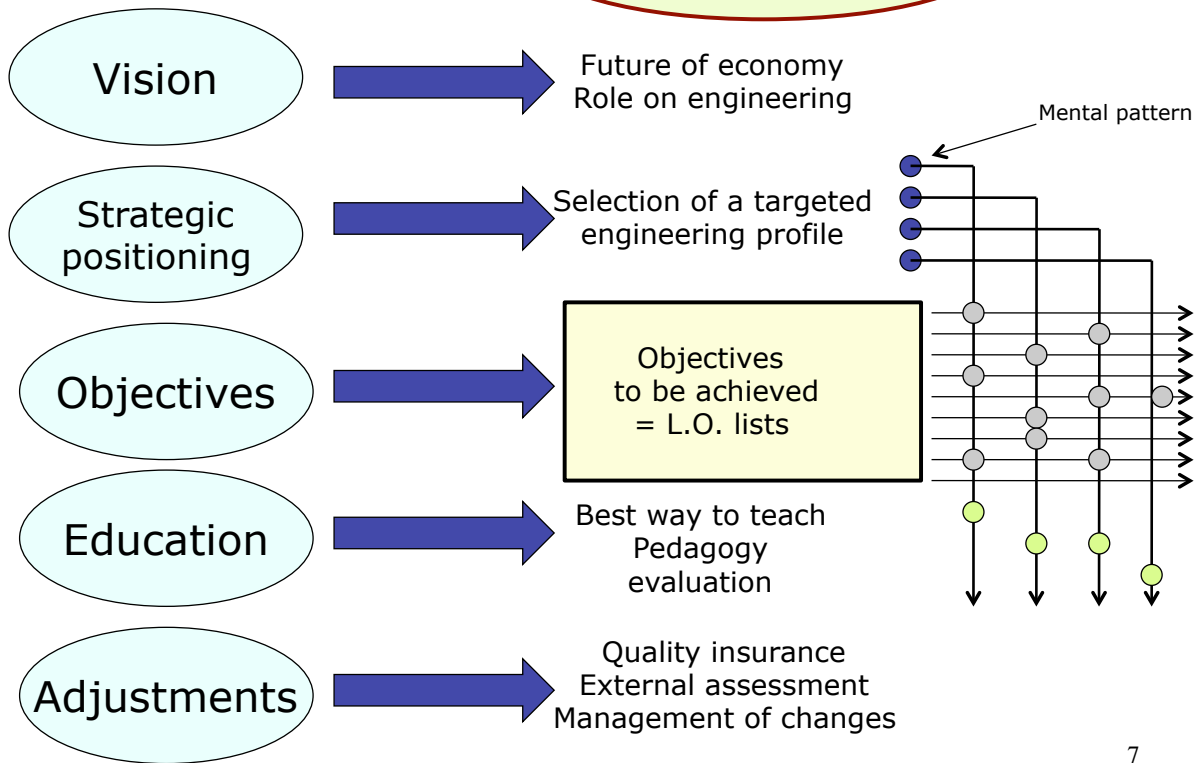
1. To better point out the role of the institution
 - As a community with values (cultural dimension)
 - As the support of a strategy in engineering education
2. To consider a more realistic view of efficiency
 - **Efficiency is collective**
 - Collective performance = competencies \times attitudes (individual involvement) \times management (strategy)
 - To face complex situations key mental patterns are expected at four main levels (which underlie competencies and learning outcomes)
 - Identification (>> good vision)
 - Decision making (>> right judgment)
 - Engineering (>> smart design)
 - Implementation (>> practical know-how)

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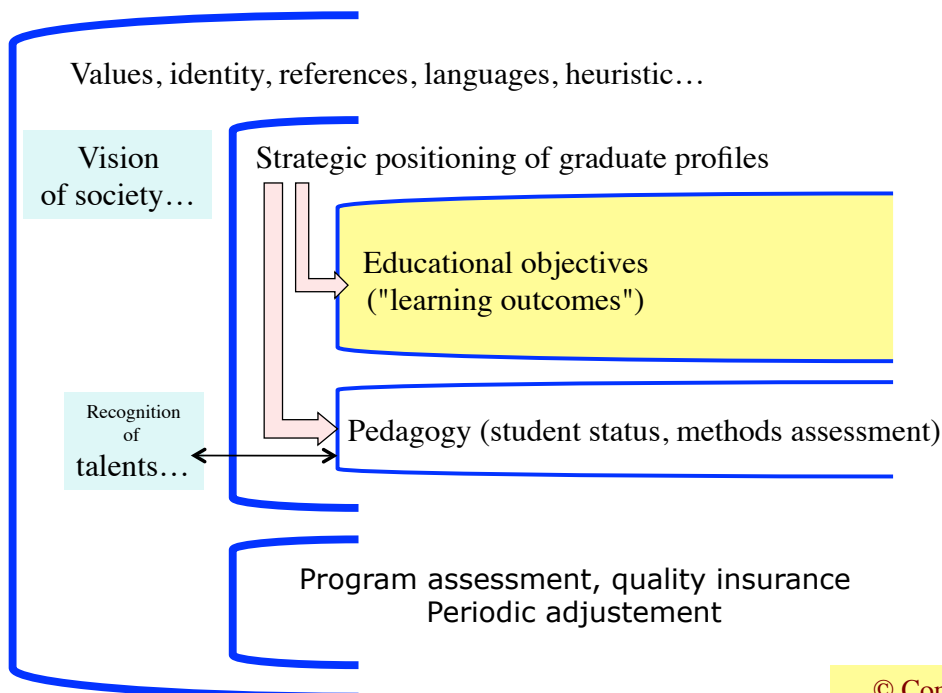
What is a model ?

Identity
Belief in science, in talents...

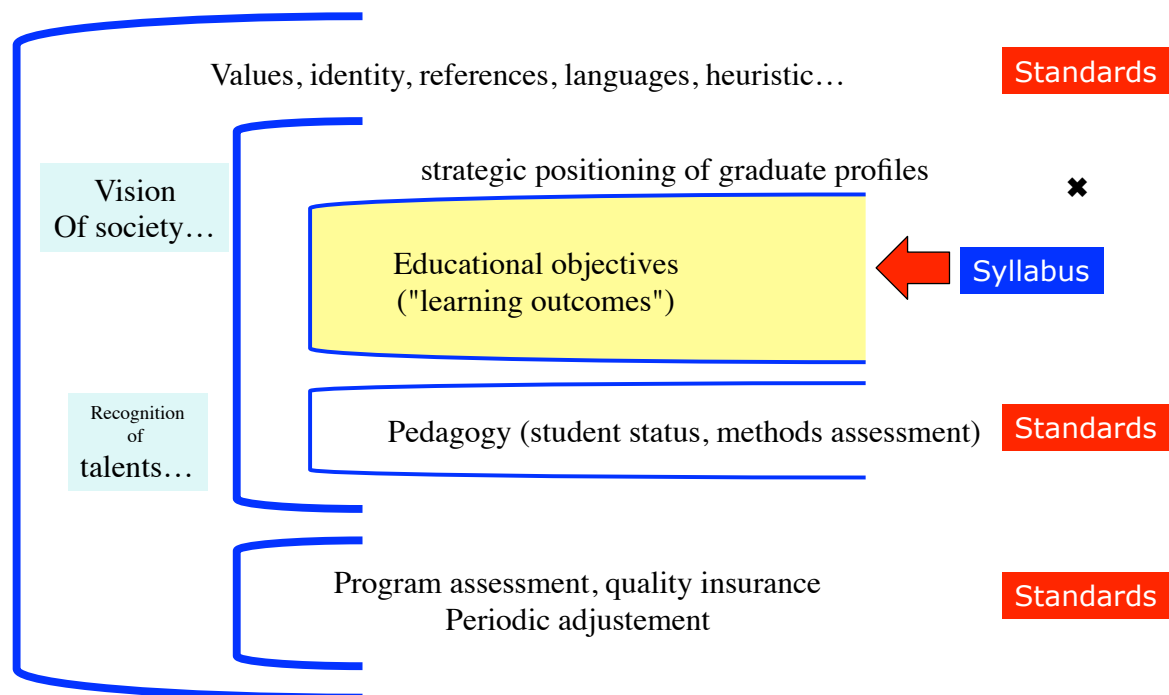
Stable



A model may be understood as a "Russian dolls framework"



CDIO appears as a model

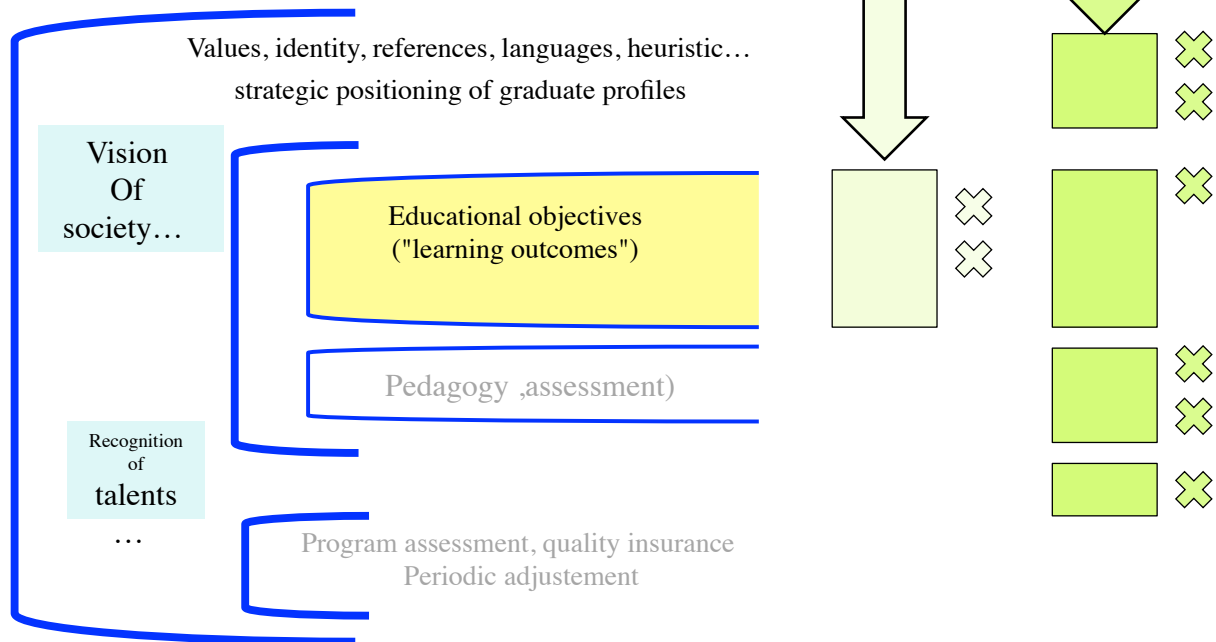


Is a model more than a formal representation...?

- Its give a pleasant "helicopter" view, but what more?
1. It underlines the role of the **cultural context** which is the base of the institution identity and recall its responsibility in the transmission of value.
 2. It points out the **active role** of the institution through its strategic positioning in terms of targeted profile (beyond its concerns to meet industry expectation)
 3. It gives a clearer place to **personal attributes** and brings back the stake to develop talents
 4. It provides a better appropriate framework to address external challenges, such as
 - Graduates with an innovative spirit
 - Graduates aware of sustainable development

Little time left to present two quick illustrations

How to get innovative engineers?



Strategic positioning of profiles

