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## Sustainability Symposium

# ECO EFFICIENCY CONCEPTS AND SOCIAL RESPONSIBILITY IN ENGINEERING CURRICULA BRAZILIAN CASES

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# Engineers Profile - CHANGES OVER THE YEARS



## In the 80's

- appreciation of the professional was fixed only on technical knowledge



## In the 90's

- Technical Knowledge
- skills in communication, teamwork, leadership, foreign languages, etc.



## 2000's

- Technical knowledge + skills in social science and humanity
- Familiarity with environmental issues



# Establishment of a New Engineer Profile in Brazil

## 2002: Act of the Ministry of Education

Guidelines for  
Engineering  
Education

Graduate's  
profile

An engineer with a general, humanistic, critical and reflexive education, that is able to absorb and to develop new technologies. He/she should also be able to identify and to solve problems, considering their political, economical, social, environmental and cultural aspects, in order to attend societies demands.

# Recomendations of the Brazilian National Guidelines



To integrate contents from different courses and areas of knowledge in the curriculum.



To focus the students evaluation on the whole engineer profile (established by the course program) and not on isolated subjects.



To stimulate the activities outside the classroom.

# Recomendations of the Brazilian Guidelines (cont.)



To emphasize social and human contents in the curriculum, attending the demand for an engineer with a broad profile.



To integrate environmental issues in the curriculum.



To focus education on the: “learn to learn” process, continuous learning, development of creativity , pro-active and ethical attitudes.

# UNESCO's Guidelines for the Decade of Education for Sustainable Development (2005 – 2014)



**Interdisciplinary and holistic education:** learning for sustainable development embedded in the whole curriculum, not as a separate subject.



**Critical thinking and problem solving:** leading to confidence in addressing the challenges of sustainable development.



**Participatory decision-making:** students participating in the decision on how they will learn;



**Applicability:** learning experiences are integrated in day to day personal and professional life;  
**Locally relevant:** addressing local as well as global issues.



**GREAT SIMILARITY BETWEEN BRAZILIAN GUIDELINES FOR ENGINEERING EDUCATION AND THE UNESCO GUIDELINES FOR ESD.**

# Different ways to insert environmental and social issues in the engineering programs



## Model Adopted by UFMG (1998)

### **Assumptions:**

Technical contents are essential;  
Social responsibility is not necessarily taught as a course in the curriculum;  
All engineers, regardless of ability, should meet the environmental and social impacts of their activities and must be prepared to act on them.

### **Challenge:**

How to integrate environmental and social issues in the curriculum without:  
overextending students stay in the undergraduate program .

### **Solution adopted:**

**Insertion of these issues into traditional technical courses.**

**Gain in parallel with the use of this model: technical contents became supported by sustainability concepts.**

# Case Study - Civil Engineering Course at UFMG



It was implemented three mandatory courses, distributed over the 5 years of the program. These courses are characterized by the development of a project that:

integrates different subjects that were taught

applies sustainability concepts



## Students Practicing the social responsibility of civil engineers



Tutorial program in towns with low Index of Human Development (IHD) where students develop infrastructure projects for the local municipality and empowered the community on sanitation and environmental issues.

## Federal University of Juiz de Fora (Minas Gerais State)



- Students of Electrical Engineering Course developed a toolkit that allows some experiments in chemistry and physics within the classroom.
- The toolkit is available for public high schools that are poor in laboratories infrastructure.

# Mining Engineering Education at UFMG



Since 2013 it is in a changing process

- Commission responsible by the new curriculum:
  - Professors representing each area of knowledge
  - Students representatives.

## Main Changes

- Integration of sustainability concepts in various mining and mineral processing courses, with:
- Focus on clean technologies (reduced of water and energy consumption, less generation of waste and CO2 emission, etc);
- Focus on social gains brought by mining activity;
- Focus on mining closure: actions to be done in order to prepare communities to deal with the economic losses after mining closure.

# HOW?



**Project Courses** Mining projects addressing solutions to environmental problems.

**Project Courses** Mining projects, addressing solutions to the demands of the communities surrounding the mining site.

**Project Course** Development of projects including social, economical and environmental aspects of mining closure.

**Social Practice:** Technical and Administrative Support to Artisanal and Small Scale Mining

# Conclusions



The introduction of sustainability concepts in the engineering curriculum is a mandatory question, in response to the behavioral changes occurred in the world over the past 50 years.

It is not a simple question, because:

- it demands an interdisciplinary and integrated knowledge, which makes it dependent on the environment offered by the university for its practice;
- it depends, strongly, on how well sustainable concepts are internalized in teachers.

# Conclusions



In Brazil, several undergraduate engineering courses, including those directly related to mineral area, offer contents addressing environmental science and social science.

- However, few are those that provide students with an integrated view of technical contents supported by sustainability concepts.

To graduate an engineer able to identify and to solve problems, from the perspective of sustainability, should be the goal of all engineering programs, particularly those related to the mining area.

- Otherwise, ever more mining activity will have difficulty in implementing their projects, in getting the environmental and social license to operate.

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