Bologna Revisited – more relevant than 16 years ago

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OUTLINE

Concepts and models of Today, concerning Higher Education

① Life Today – Changes in Society – The Young Generation, the ‘Millenials’

② TRUST, cooperation and mobility in the EHEA - European Higher Education Area
   ② The concept of a three-layer Qualifications Frameworks for engineering education

③ Directions for Education
   ③ ‘Education/Learning without boundaries and without walls’ - tools in the information age, in the era of communications
LIFE TODAY - GLOBALISATION
A MIX OF CHALLENGES, THREATS AND OPPORTUNITIES (I)

- Major political changes in the World, the Fall of the Berlin Wall, on 9 November 1989
- Disruptive Advances in Science and Technology, by the end of the XX Century
  - The Computer and Communications era - dramatic changes of the concepts of time and space
  - Advances in Life Sciences - The increase of Expectation of Life
- Expectation of Life vs. Social sustainability – work longer years
- The decrease of knowledge half-time – Study longer years
- For all these reasons – Lifelong Learning, a requirement for development

LIFE TODAY - GLOBALISATION
A MIX OF CHALLENGES, THREATS AND OPPORTUNITIES (II)

- The global market economy - driving today’s Societies
  - Sharp increase in standards and competition Worldwide
  - Volatility of jobs
  - Job market and opportunities, wider than ever
- Very significant changes in the concept of individual career management, mainly for Young People
- Very significant changes in the concepts of education
- An evolution that we have to understand and support, mainly by adapting the STRUCTURE AND THE SUBSTANCE OF THE OFFER OF EDUCATION
LIFE TODAY - PRODUCTION MOVES EAST
GEOGRAPHIC BREAKDOWN OF WORLD CHEMICALS SALES - 2004

World chemicals sales in 2004 is estimated at €1736 billion
The EU accounts for 33% of the total

Source: Cefic
Definition: Rest of Europe** = Switzerland, Norway, and other Central & Eastern Europe (excluding the new EU 10 countries)
Other*** including Canada, Mexico, Africa & Oceania

LIFE TODAY - PRODUCTION MOVES EAST
GEOGRAPHIC BREAKDOWN OF WORLD CHEMICALS SALES - 2007

World chemicals sales in 2007 are valued at €1820 billion
The EU accounts for 29.5% of the total

Source: Cefic Chemdata International
Others*** = Oceania and Africa
Rest of Europe**** = Switzerland, Norway and other Central & Eastern Europe (excluding the new EU 12 countries)
LIFE TODAY - PRODUCTION MOVES EAST
GEOGRAPHIC BREAKDOWN OF WORLD CHEMICALS SALES - 2011

Source - Mary Meeker (KPCB), Internet Trends 2015
(Code conference: http://goo.gl/gjWrTG)
Today, as in the past, the issue is to train and widen the scope of thinking of young people.

BUT, just some major differences from the past and a major difference for the future are that 'millenials':

- will live longer
- will work longer
- will have to study longer
- more and more will have to work away from the original home
- indeed will have to think global, just to the dimension of Earth (... or even beyond...)

A global World living in and with a new paradigm of coexistence

- COOPETITION = COOPERATION + COMPETITION

The need to understand other cultures and backgrounds

The need to think global, namely in large global companies, – 24/7 – when Asia goes to sleep we start our work, when we go to sleep America start their work

The need to promote mobility and cooperation, by promoting trust

- Develop comparable qualifications frameworks
- Apply quality assurance procedures that are recognised and accepted by all stakeholders
**LIFE TODAY**  
**ESSENTIAL INSTRUMENTS AND POLICIES FOR THE FUTURE**

封建，我们需要
- 新的管理及国际合作政策
- 一个新的教育文化 paradigm - 终身学习
- 促进学生和专业人士的流动性

封建，由此要求
- 认可学术和专业资格的政策和工具
- 政治愿景和决心

**AND, HOW DID EUROPE REACT TO THIS CHALLENGE?**
**THE EUROPEAN AREA OF... KNOWLEDGE...**
**LAUNCHED ON 11-12 MARCH 2010, IN BUDAPEST-VIENNA – STILL UNDER CONSTRUCTION... TILL 2020...**

- European Area of Knowledge
- European Area of R&D&I
- European Area of Education
- European Higher Education Area
- European Area of Lifelong Learning

2014, ... ? Horizon 2020

In 2020...?
FROM BOLOGNA (1999) TO YEREVAN (2015)... AND BEYOND
CHARACTERIZING THE PROCESS TODAY

- See the Bologna Process in three dimensions
  - Political, academic, economical

- Policy areas
  - Including great concern with the challenge of ‘Education without Boundaries’... Which is already massively with us!!!

- The Structure - organization issues

- The Substance – academic issues

FROM BOLOGNA TO YEREVAN ... AND BEYOND
THE STRUCTURE - ACTION LINES AND INSTRUMENTS FOR ACTION

- Degree Structure –
  - Based on recognised QUALIFICATIONS FRAMEWORKS

- A System to measure work and OUTCOMES
  - The ECTS credit and accumulation system, reviewed in 2015

- A way of documenting qualifications
  - The DIPLOMA SUPPLEMENT

- A System to guarantee transparence, reviewed in 2015
  - Building accepted QUALITY ASSURANCE procedures

- A System for recognition of qualifications
  - OVERCOMING DIFFICULTIES posed by the diversity of ‘recognition cultures’
FROM BOLOGNA TO YEREVAN... AND BEYOND
THE SUBSTANCE - THE LATECOMER IN THE BOLOGNA PROCESS...

- Changes in slow progress...
  - New contents... new competences closer to more immediate Societal concerns
  - New programme structures, linked to a concept of lifelong Learning
  - New Methods – change from
    - Teacher-Centred to Student-Centred methodologies
    - Teaching based on Teacher Inputs to Learning Centred in well defined objectives – Learning Outcomes
    - Digital repository support systems to Digital Collaborative and Cooperative Systems

- New tools for distance and cooperative learning
- The third wave – Pedagogical qualification of ‘Faculty’

QUALIFICATIONS FRAMEWORKS - A THREE LAYER VISION
I – META FRAMEWORKS: QF-EHEA AND EQF-LL

- High level descriptors – Meta Frameworks
  - Characterized at institutional level of governments and stakeholders
  - They represent the ‘legal crust’ and the basis for National Qualifications Frameworks

① The QF-EHEA – Framework for Qualifications of the European Higher Education Area
  - Launched in 2005, within the Bologna Process, with 3 main cycles

② The EQF-LL – European Qualifications Framework for Lifelong Learning
  - A vertical framework, with 8 levels, from basic secondary to higher education, approved at EU level on April 23, 2008
  - Establishes a link of compatibility with the Framework for Qualifications of the European Higher Education Area
Curricular reform will thus be an ongoing process leading to high quality, flexible and more individually tailored education paths.

Academics, in close cooperation with student and employer representatives, will continue to develop learning outcomes and international reference points for a growing number of subject areas.

- Sectoral Frameworks develop sectoral descriptors
  - By area and specialty
  - In close cooperation with higher education institutions and professional associations
  - In transnational cooperation
  - They represent Bologna in practice

① Case-study - A few Sectoral Frameworks proposals for Engineering Education

② The EUR-ACE Framework and Accreditation System
  - The European System for Qualification of Engineering Education programmes
QUALIFICATIONS FRAMEWORKS - A THREE LAYER VISION
III – DESCRIPTORS AT BRANCH LEVEL

Sectoral Frameworks should be complemented by descriptors at branch level

- Typically developed in Education Working parties and Academic Consortia, at European Level, or within regulatory bodies at national level
- They are the basis for credibility of the whole system

This concept is largely employed informally, but has not yet received formal recognition

- CORE branch level descriptors are most relevant, BUT:
  ✓ We still have to overcome concerns about the possibility of falling into a too prescriptive path that might damage ‘autonomy, diversity and innovation’....

DESCRIPTORS AT BRANCH/PROGRAMME LEVEL
THE CASE STUDY OF CHEMICAL ENGINEERING

RECOMMENDATIONS OF THE WORKING PARTY ON EDUCATION OF THE EUROPEAN FEDERATION OF CHEMICAL ENGINEERING (PUBLISHED IN 2010)

These recommendations cover

- Learning outcomes
  ✓ Adopting the EUR-ACE Framework Standards for Accreditation of Engineering Education
- Achieving the learning outcomes
  ✓ Core curriculum, leaving large room for diversity
  ✓ Teaching and learning
  ✓ Industrial experience
  ✓ Review of the educational process
  ✓ Student assessment
NEW DIRECTIONS FOR EDUCATION
GENERAL GUIDELINES ON HOW TO PROCEED (I)

★ Revisit and modernize the programme
  ➢ Bring in new topics – raise the awareness of new topics
  ➢ Incorporate new Knowledge, Skills and Competences

★ Bring in new methods for learning – adapted to the available tools and to the cultural evolution of society

★ Develop within the institution an International Dimension (not only European) and Culture of Quality through mobility and academic cooperation and interchange
  ➢ Prepare programmes for cooperation – Joint Degrees

★ Prepare programmes to attract new publics – Lifelong Learning

NEW DIRECTIONS FOR EDUCATION
GENERAL GUIDELINES ON HOW TO PROCEED (II)

★ Make recognition of qualifications easy
  ➢ Re-design curricula with reference to agreed recommendations or descriptors of learning outcomes at high level, sectoral level and branch level
  ➢ Perform internal quality assurance exercises, following agreed guidelines
  ➢ Submit the programme to recognized external quality assurance agencies
NEW DIRECTIONS FOR EDUCATION
INCORPORATE NEW KNOWLEDGE, COMPETENCES AND SKILLS

Programmes are of course directed to raise scientific and technical knowledge – fundamentals should represent the core

BUT

Must bring in the development of attitude, skills and competences valued by Industry and Society in general

- Skills and competencies for innovation and entrepreneurship
- Job related skills
  - Teamwork, Communication, Leadership
- Competencies (How tasks are done)
  - Holistic thinking, self-management, achievement of objectives.

TOOLS IN THE INFORMATION AGE, IN THE ERA OF COMMUNICATIONS

- The ‘good old days of Moodle’?
  - Moodle is indeed and essentially a digital repository system with some capacity for interchange

- Google Apps (or equivalent tools...) for education?
  - Google Apps are indeed tools for collaborative study and learning
  - A growing number of universities are going ‘Google Apps’

- MOOCs – Massive Open Online Courses – Coursera, EdX...
  - Tools and means for learning through cooperative learning
  - They challenge the educational model... the concept /paradigm of ‘constant time - variable learning’
  - Indeed platforms for education without boundaries – a political issue
TECHNOLOGIES & TRANSFORMATIVE LEARNING: VIA COLLABORATIVE TOOLS (E.G. GOOGLE APPS)

9. Consider the following protocol of authentication, where $R_1$ and $R_2$ are identifiers of "team-in-a-dish" (room). What are the following affirmations are valid?

a. The protocol is vulnerable to attacks by robots
b. The protocol is vulnerable to attacks by replay of messages in groups

c. The protocol is based on a hash function

d. The protocol is vulnerable because the first message is encrypted.

10. In the properties ACID, what of the following definitions is not valid (AT12 - 60):

a. Atomic: when a transaction cannot be completed either through the operations, some of these operations will be executed on the opposite order

b. Consistent: the transactions do not affect the integrity of the structure of data

c. Isolated: if two or more transactions are to be executed at the same time, the result is the same as the result of each transaction executed sequentially

d. Lasting: If all the effects of a transaction are executed in a subsequent (commit) and permanent

TECHNOLOGIES & TRANSFORMATIVE LEARNING: VIA CONTENTS (E.G. MOOCS)

3.091x: Introduction to Solid State Chemistry

ABOUT THIS COURSE

This course is a first-year course where chemical principles are explicated by examination of the properties of materials. The electronic structure and chemical bonding of materials is related to applications and engineering systems throughout the course. The on-campus version of the course has been taught for over thirty five years and is one of the largest classes at MIT. The course will cover the relationship between electronic structures, chemical bonding, and atomic order, and characterization of atomic arrangements in crystalline and amorphous solids: metals, ceramics, semiconductors, and polymers (including proteins). There will be topical coverage of organochemistry, solution chemistry, solid-state equilibria, electrochemistry, biochemistry, chemical dynamics, diffusion, and phase diagrams. Examples will be drawn from industrial practice (including the environmental impact of chemical processes), from energy generation and storage (e.g. batteries and fuel cells), and from emerging technologies (e.g. photonic and biomedical devices). For the Fall 2012 class, eXtensible registration and course materials are free.
Millennials’ Most Valued Work Benefits = 1) Training & Development 2) Flexible Hours 3) Cash Bonuses

Which Three Benefits Would You Most Value From an Employer? % Ranking Each 1st Place, Global

1. Training and Development: 22%
2. Flexible Working Hours: 19%
3. Cash Bonuses: 14%
4. Free Private Healthcare: 8%
5. Pension Scheme or Other Retirement Funding: 6%
6. Greater Vacation Allowance: 6%
7. Financial Assistance with Housing: 5%
8. Company Car: 4%
9. Assistance in Clearing Debts Incurred While Studying: 3%
10. Maternity / Paternity Benefits: 3%
11. Subsidized Travel Costs: 2%
12. Free Child Care: 2%
13. Access to Low Interest Loans / Borrowing Options: 2%
14. Time Off to Do Community / Charity Work: 1%
15. I’d Prefer No Benefits and Higher Wages: 4%

BACK TO MILLENNIALS!!!


Training & Development People>> Companies>> Technologies

Mobile, on-demand
Scalable and collaborative
Flexible, easy to use
Cost effective
Rich, multimedia experience
Skill-based, practical and engaging

CORPORATE MOOCS

Promote employee engagement
Enable anyone, anywhere to create content
Allow training to be tailored to organizations
Enhance relevance of learning content

Source: Dennis Yang & Dan Chou, Revolutionizing Corporate Workplace Training with MOOCs, 2014 (http://goo.gl/Imq19a)
IN ALL – YOUNG PEOPLE FEEL THE GLOBAL!
SOCRATES/ERASMUS /ERASMUS + STUDENTS IN AND OUT

Bologna represents the European effort to adapt to a tough challenging time...

Third-parties see the Bologna Process as a major movement that they want to see in their regions, with the due adaptations

The academic issues, linked to the ‘political’ issues raised by the threat and opportunities of Education without Boundaries will dominate the next developments

Despite the strong winds that are blowing in Europe, or because of such winds, the way for the future requires global vision, the global cultural vision that the Bologna Process promotes