



What has changed?

An international perspective on teaching and learning in the engineering sciences

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Facts and figures



Started in 1425

- >40.000 students
 - > 6.000 international students
- >18.000 personnel
 - 7.000 researchers: 1.500 sr + 5.500 jr
- Research:
 - 365 million euro
 - 625 doctoral degrees
 - 98 spin-off companies
- Education:
 - 55 Ba, 133 Ma and 48 advanced Ma programmes (in Dutch)
 - 2 Ba, 48 Ma, 27 advanced Ma programmes in English
 - 2 Ma programmes in French, 1 advanced Ma programme in Spanish
 - > 2.000 courses taught in English
 - 8 Erasmus Mundus programmes



What is SEFI?

Société Européenne pour la Formation des
Ingénieurs

European Society for Engineering Education
Europäische Gesellschaft für Ingenieurausbildung

*an international non-profit organisation
founded in 1973*



Members

■ Institutional members

- Institutions of a high level (post secondary) that offer a complete curriculum leading to an academic engineering degree.

■ Individual members

- Typically teachers of science or engineering + People engaged in international relations. Students / Retired engineers....

■ Industrial and corporate members

- Any industrial company, public administration or other organisation having an interest in supporting European Engineering Education.

■ Associate members

- Professional societies or other organisations interested in initial or continuing education of engineers. Student organisations.

SEFI receives the support of its corporate partners:



MathWorks®

SIEMENS



GRANTA
MATERIAL INSPIRATION

@ BEKAERT

better together

KU LEUVEN



Mission of SEFI

Support and promote European Engineering Education

- by linking Engineering Education institutions and educators,
- by providing services to its members,
- by serving as an international forum,
- by representing the European Engineering Education Community



Objectives

- to contribute to the **development** and to the **improvement** of EE;
- to provide appropriate **services** and information about HEE;
- to improve **communication** and **exchanges** between teachers, researchers and students;
- to promote **cooperation** between industry and those engaged in EE;
- to act as a **link** between its members and other societies or international organisations;
- to promote the **European Dimension** in EE;
- to contribute to the **recruitment** of good students in EE;
- to **promote the position of EE** and engineering professionals in society.



How?

PRIORITIES

- ✓ Attractiveness of EE
- ✓ Sustainability and Ethics
- ✓ Bologna process and accreditation
- ✓ Lifelong learning
- ✓ Gender and diversity
- ✓ Curriculum development
- ✓ ICT
- ✓ Engineering education research & teaching and learning methods
- ✓ Cooperation with the corporates
- ✓ Cooperation with the students

TOOLS

- ✓ Working groups
- ✓ Annual conferences
- ✓ Deans ' Conventions
- ✓ Support to the EEDC
- ✓ Ad hoc workshops and seminars
- ✓ Publications
- ✓ Projects
- ✓ Position Papers

Position Papers

- On the Bologna Process, prepared jointly with CESAER (2005)
- On the creation of the European Institute of Technology by the European Union (2006)
- On the Doctorate in the Bologna Process (2007)
- On the Bologna Process and the Education of the Engineers, in cooperation with IGIP (2009)
- On Quality Assurance and Accreditation (2012)
- On Engineering Education and the Bologna Process, in cooperation with BEST (2012)



Annual Conferences

- ...
- Achieving and Assessing Quality of EE (Luleå 1993)
- The First Five Years of the New East-West Partnership (Prague 1994)
- EE for Innovation (Compiègne 1995)
- Educating the Engineer for Lifelong Learning (Vienna, 1996)
- Humanities and Arts in a Balanced EE (Cracow 1997)
- Entrepreneurship, Management and EE (Helsinki 1998)
- Re-discovering the Centre (Winterthur/Zürich 1999)
- The International Education of Engineers (Paris 2000)
- New Engineering Competences - Changing the Paradigm (Copenhagen 2001)
- The Engineer of the Renaissance (Florence 2002)
- The Global Engineer: Education and Training for Mobility (Porto 2003)
- The Golden Opportunity for Engineering Education? (Valencia 2004)
- The Engineering Education at the Cross Roads of Civilizations (Ankara 2005)
- Engineering Education and Active Students (Uppsala 2006)
- Joining Forces in Engineering Education towards Excellence (Miskolc 2007)
- Quality Assurance, Employability and Innovation (Aalborg 2008)
- Attracting Young People in Engineering. Engineering is fun! (Rotterdam 2009)
- Diversity Unifies- Diversity in Engineering Education (Trnava 2010)
- Global Engineering Recognition, Sustainability and Mobility (Lisboa 2011)
- Engineering Education 2020: Meet the future (Thessaloniki 2012)
- Engineering Fast Forward (Leuven 2013)
- ...

Some trends



Learners say: “Challenge us!”



What a boring program... Let's switch to another channel...

Millennium student characteristics

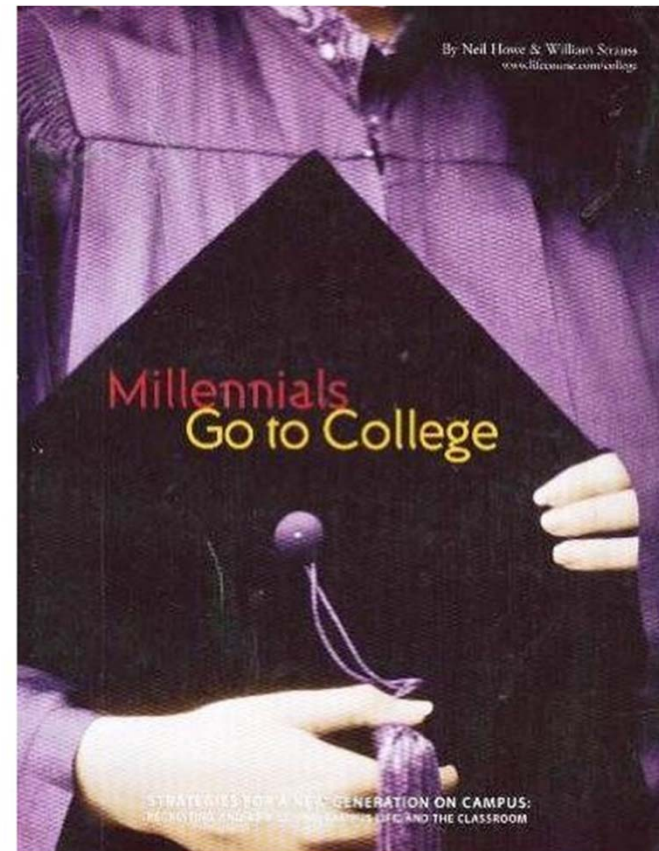


- ICT-minded
- Multitasking
- Media literate
- A-linear, a-synchronous
- Explorative, interactive
- With a positive attitude
- Target oriented
- Social, connected
- As partners with educators
- ...

Cf. *New Millennium, New Student*, M. Moonen, MSc Thesis, KU Leuven, 2012

Millennium student characteristics (II)

- Special
- Sheltered
- Confident
- Team-oriented
- Pressured
- Achieving
- Conventional
- ...



Cf. *Millennials Go to College*, N. Howe and W. Strauss, 2003

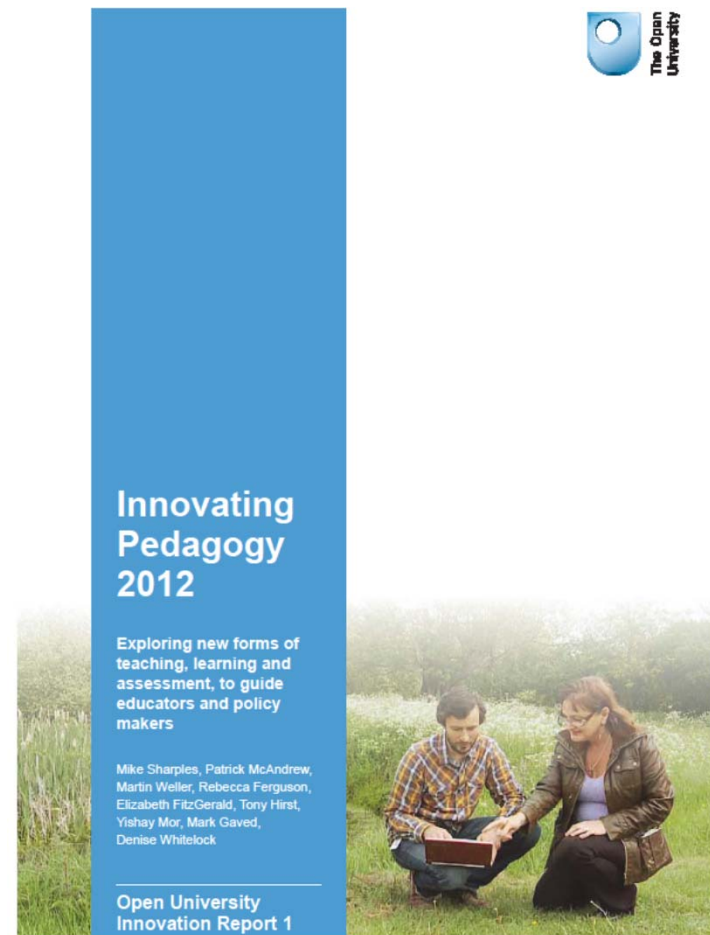
Technology trends



- **Time-to-Adoption Horizon: <1 Year**
 - **Mobile Apps**
 - **Tablet Computing**
- **Time-to-Adoption Horizon: 2-3 Years**
 - **Game-Based Learning**
 - **Learning Analytics**
- **Time-to-Adoption Horizon: 4-5 Years**
 - **Gesture-Based Computing**
 - **Internet of Things**

Innovating Pedagogy

- New pedagogy for e-books
- Publisher-led short courses
- Assessment for learning
- Badges to accredit learning
- MOOCs
- Rebirth of academic publishing
- Seamless learning
- Learning analytics
- Personal inquiry learning
- Rhizomatic learning



Different ways of learning

F2F learning

E-learning

Networked learning

Distributed learning

Game-based learning

Tele-learning

Online learning

Virtual learning

Mobile learning

Computer-assisted learning

Distance learning

Technology-enhanced learning

Blended learning

...

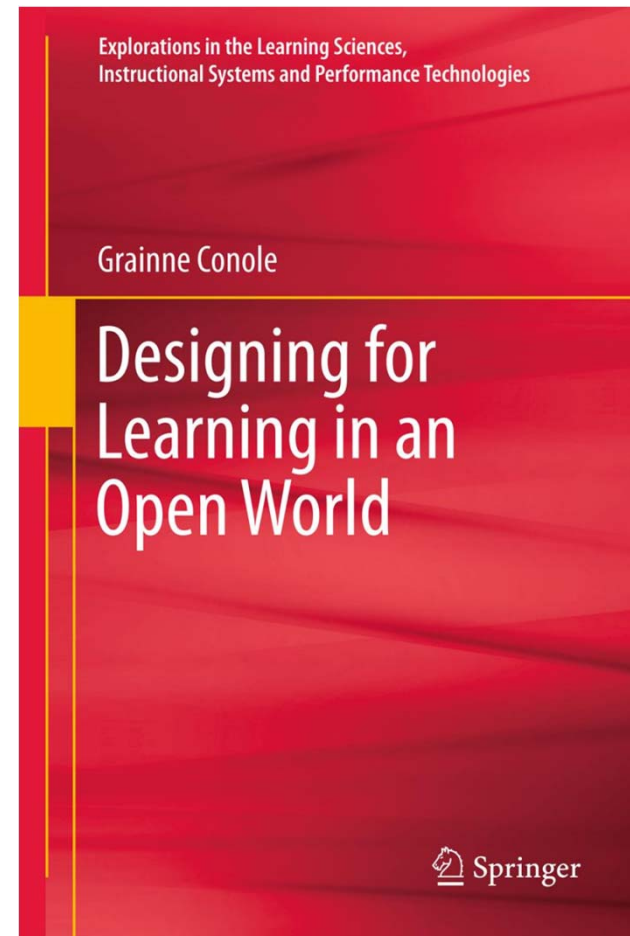
A word cloud of various learning-related terms. The most prominent words are 'elearning', 'Networked', and 'learning'. Other visible words include 'Community-based', 'Social', 'Computer-assisted', 'Technology-enhanced', 'Distance', 'Internet', 'Game-based', 'Mobile', 'Collaborative', 'Web based', 'Virtual', 'Tele-learning', 'Distributed', and 'Online'.

Community-based Social
Computer-assisted
Technology-enhanced
Distance
Internet
Game-based
Mobile
Collaborative
Web based
Virtual
Tele-learning
Distributed
Online

elearning
Networked
learning

Instructional (co-)design

Designing for Learning in an Open World proposes new, innovative learning pathways, created to empower learners to blend formal educational offerings with free resources and services. The new approach and new pathways suggested by the author force readers to rethink the entire instructional design process, enabling both teachers **and learners** to take into account a blended learning context, now the norm in our modern educational environment.



Setting the scene in Europe



Europe 2020



Smart Growth

developing an economy based on knowledge and innovation



Sustainable Growth

more efficient, greener and more competitive economy



Inclusive Growth

fostering a high-employment economy delivering social and territorial cohesion

Innovation

« Innovation Union »

Climate, energy and mobility

« Resource efficient Europe »

Employment and skills

« An agenda for new skills and jobs »

Education

« Youth on the move »

Competitiveness

« An industrial policy for the globalisation era »

Fighting poverty

« European platform against poverty »

Digital society

« A digital agenda for Europe »

Modernisation of Europe's Higher Education

-  Education is at the heart of the Europe 2020 strategy. The Commission's proposal for the next multiannual EU budget (2014-2020) includes substantial increases for education, training and youth (+73%), and for research (+46%), in recognition of their pivotal role in supporting growth. The reform agenda for modernising higher education will guide the spending priorities of EU programmes in support of reforms.
-  These financial guidelines do not, however, guarantee the targeted outcomes and added value.
-  At the Commission level the action seems to be on Innovation Union and Regional Policy, not within the units of Education.



Need for reforms

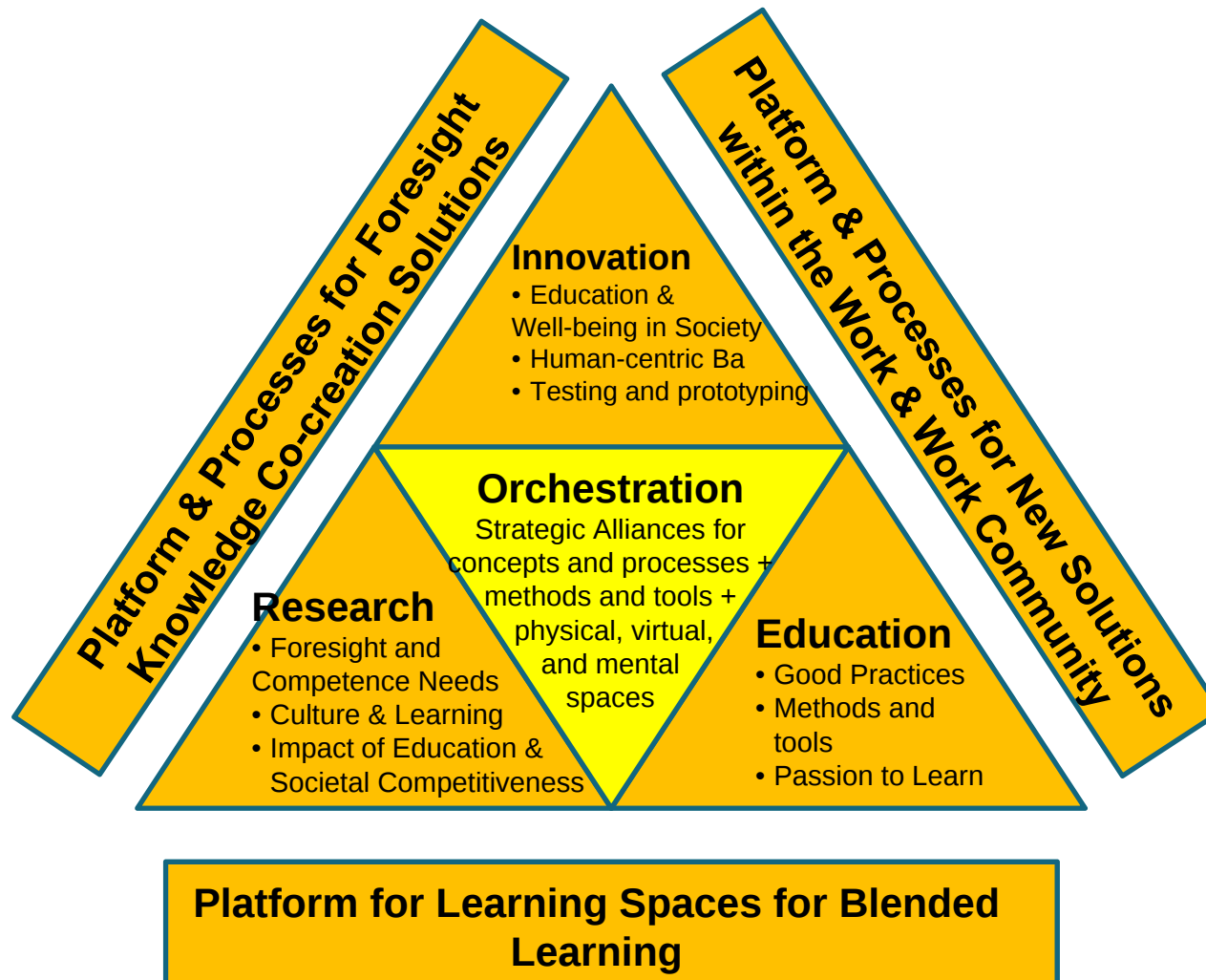
1. The work environment today has changed into technologically supported diverse and distributed working environments with changing roles, products, procedures and objectives, emphasizing new competence needs and collaborative ways of working.
2. Working places and universities need to encourage and enable continuous personal lifelong learning that takes place in the context of work after finishing the formal education.

Starting Point: Why Knowledge Triangle?

1. European higher education institutions should play a central role in the knowledge triangle interactions by creating and disseminating knowledge valuable for society and businesses as well as by linking education, research and innovation through collaboration with the wider community.
2. The concept of the knowledge triangle relates to the need for improving the impact of investments in the three activities – education, research and innovation by systemic and continuous interaction. Higher education institutions must be given a central role in building a Europe where the impact of knowledge building can be measured in terms of social and economic progress.

The key statements of the Swedish EU Presidency Conference "Knowledge Triangle Shaping the Future Europe" (organised in Gothenburg Sweden 31 August–2 September 2009)

Knowledge Triangle



Knowledge Triangle

1. To ensure a successful implementation and to create more synergy between research, education and innovation, the activities need to be seen and created from different perspectives.
2. To increase synergy, each of the three basic missions (research, education and innovation) has different key content areas to focus on. For example, the role of research is especially to produce more foresight knowledge to be used in education and in innovation. Based on that, as an example, teaching and learning get better understanding of competence needs.
3. Based on these three different perspectives (approaches) there is a need to define and establish three different concepts for platforms and processes to help the implementation of KT concepts.
4. As an example in increasing the interaction between research and innovation, the processes and the content of the activities need to be strongly based on foresight and with the help of that KT brings considerable added value, especially for increasing multidisciplinary real life and real case approach as strength of the university.
5. The whole KT concept cannot reach the desired outcomes and impact through traditional university management and leadership practices. Orchestration plays a crucial role in making KT a reality.

Research & Education & Innovation

Research & Education & Innovation

Research & Education & Innovation

Social, Cultural & Economic Impact

Need of:

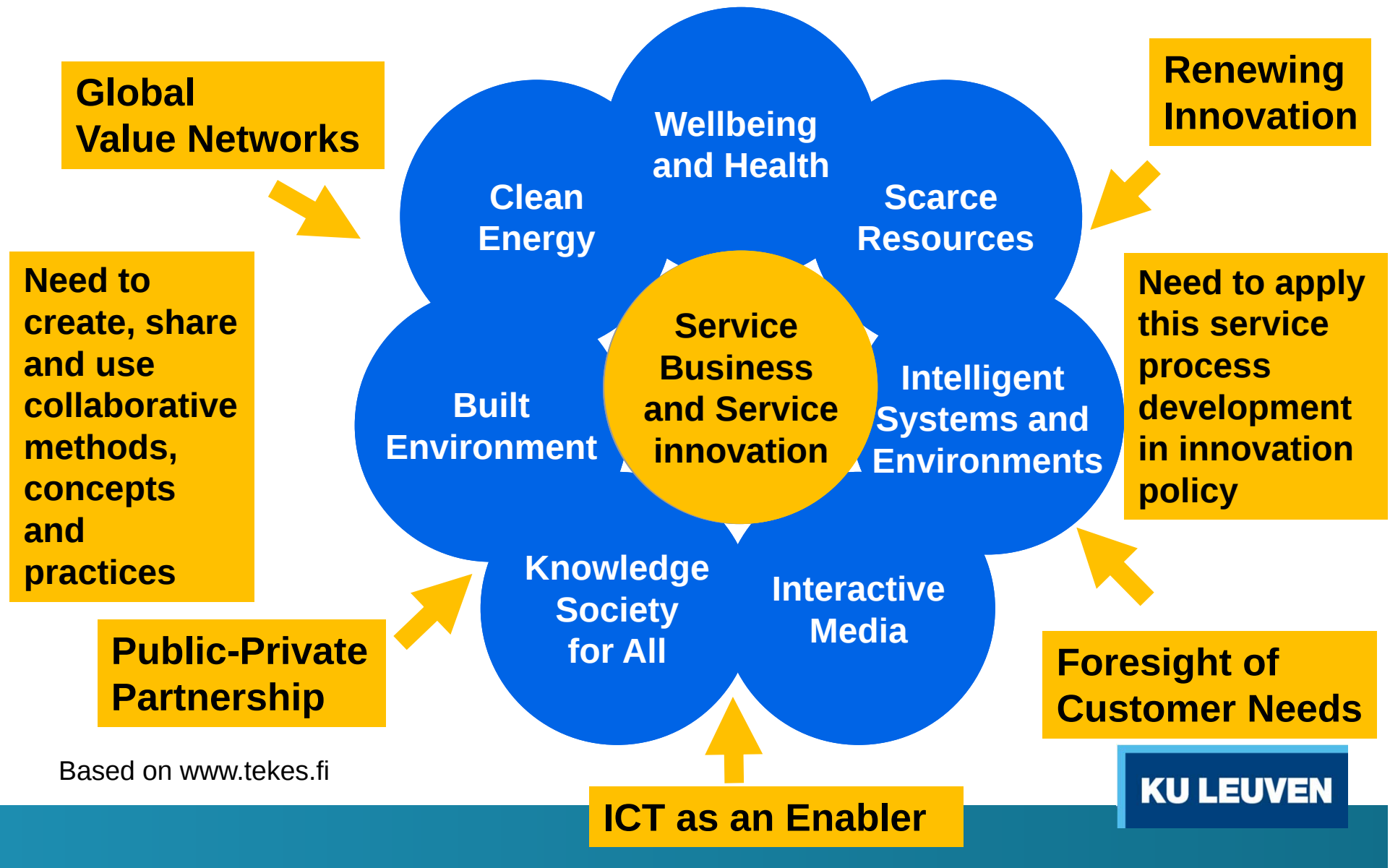
**R&D to be more focused on Innovation
Concepts, Processes and Practices**

**R&D to be more focused on Lifelong Learning
Concepts, Processes and Practices**

**R&D to be more focused on Foresight Aspects of
Multidisciplinary Research**

Research & Education & Innovation

Ecosystems creating Synergy





Mindset & Scalability

There is a **huge gap** between the latest research knowledge and real life practice. What do we need to do to fill it?

1. Lifelong learning and the **full use of ICT** are cornerstones for this **change of mindset towards entrepreneurship and innovation.**
2. We need the dynamic understanding of **regional innovation ecosystems** where public, private and third sector learn to operate together. **Modernize Triple Helix.**
3. We need methodologies to mobilize public private partnerships and encourage especially people participations: **user-driven open innovation & living labs.**
4. We need to **speed up the change by scalability & implementation.**

Modernizing HE – Guidelines by the Commission: Better Links to Research, Education, Innovation and the World of Work → Universities to Become Learning Organizations

Are there new openings?

- EU Expert Group on New Skills for New Jobs put it: "education and training can be effective and innovative only, if the institutions themselves are innovative, learning organisations open to interactions with the world of business and work".
- The Commission has launched the University-Business Forum, a platform on European level for a structured dialogue between the stakeholders.
- The Commission launched a pilot action called "knowledge alliances".



More Innovativeness in Learning & Teaching Processes & Methods

1. Learning Based on Real Cases

- Contents more by market demands with focus on abilities to solve complex problems
- Modernization and development of new teaching laboratories with industrial partners

2. PBL and other Similar Methods

- Students migrate towards self-directed learning experiences
- Learning-by-Cooperation : Project Based Learning (PjBL) and Problem Based Learning (PBL)

3. Learner Centricity

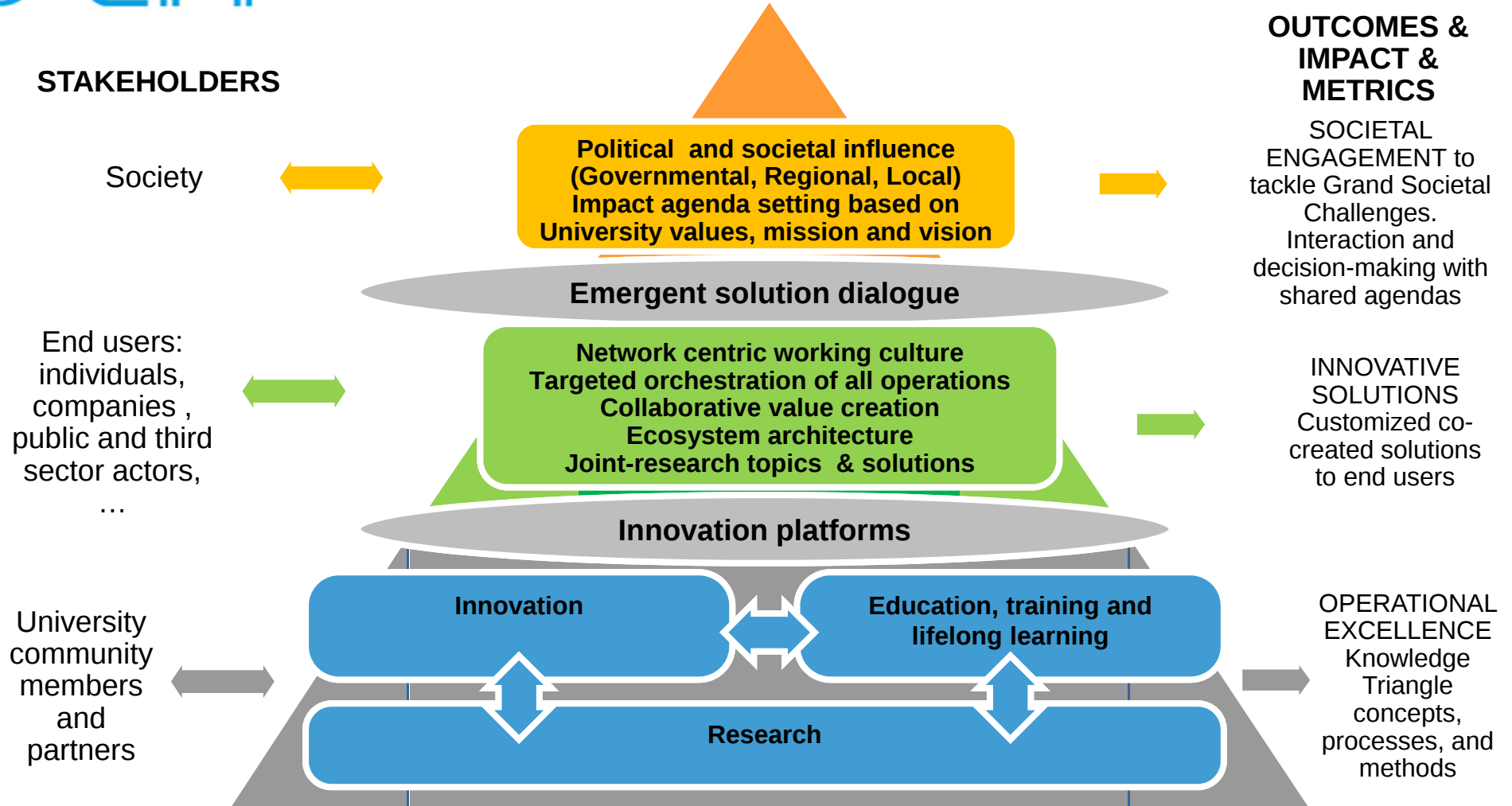
- Also how to become an innovator and entrepreneur
- To cope with all challenges related with the global learning revolution: broad use of ICT

4. Methods

- Formal and informal teaching via seminars, workshops and other course components
- Simulations, demonstration of different experiments

5. Leadership of Change

- Orchestrating systems between learners, learning task providers, and training providers



Some personal observations



Learning in a changing world



Sorry, no I cannot
deliver your pizzas
in an attachment,
but I am learning to

**From
learning
to
e-learning,
m-learning,
u-learning
learning 2.0,...
back to
learning**

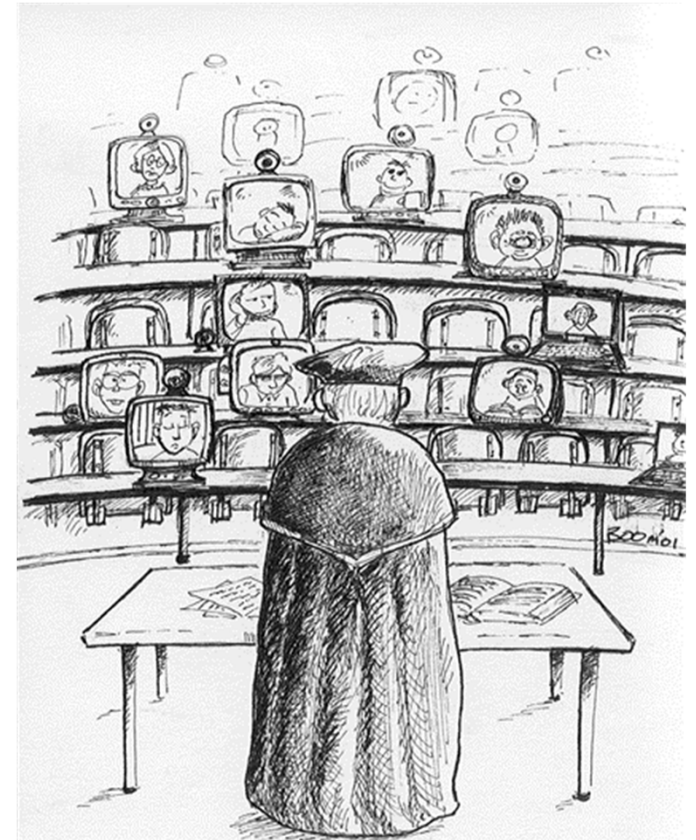
Vision on teaching and learning

- The University community as a whole is involved in education
- A stimulating educational culture ensures the quality of education
- Academically trained students can play a responsible role in society
- The programmes on offer are defined by research and social relevance
- Students, lecturers and teaching support staff are partners in education
- The University community fosters openness and solidarity



New type of universities?

**Distance teaching
universities embrace
face-to-face,
synchronous learning
activities, while
traditional campus
universities introduce
more and more
distance learning
activities**



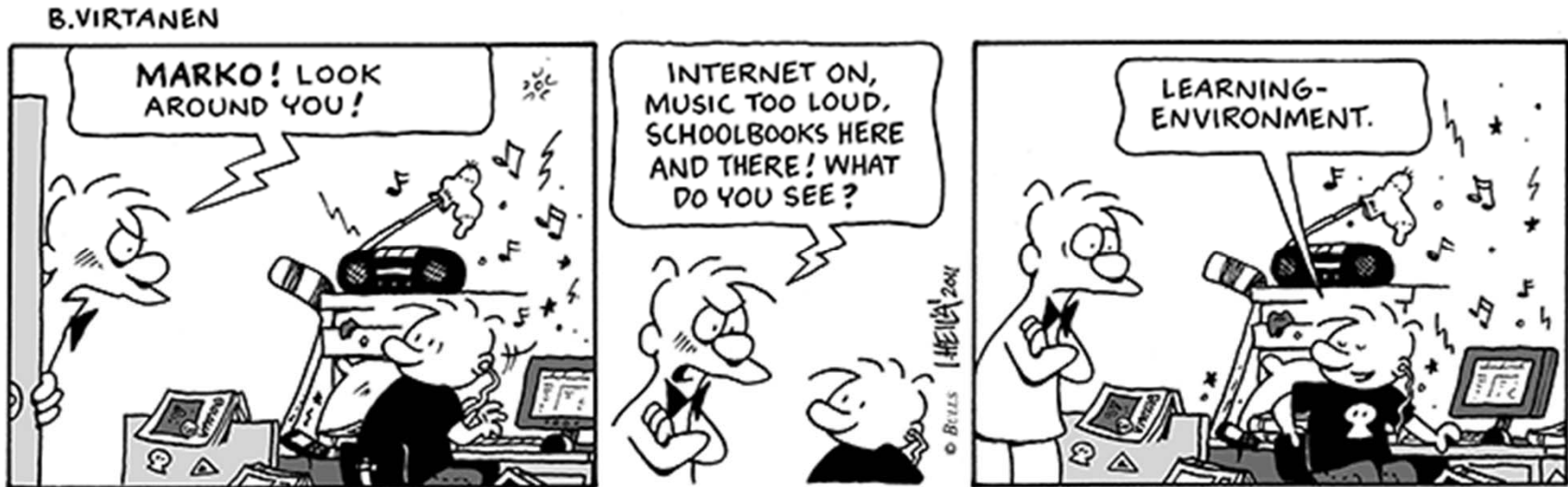
Association KU Leuven: Multicampus



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Across borders

**The real, physical learning environment
is merging together with
the virtual, digital learning environment**



Two worlds in one



Uppsala Learning Center



Helsinki Learning Center

iLearning



Photo credit: [Kiyoshi Takahase Segundo](#)

**Higher education
is *international*,
intercultural,
intergenerational,
interdisciplinary,**

...

**thanks to
(or despite?)
new educational technologies**

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Intercultural competence

Intercultural competence is about the ability to understand and respond to cultural difference in increasingly sophisticated ways.

This ability shows itself in three aspects: it is about the changes of an individual's **knowledge** (cognition), **attitudes** (emotions) and **skills** (behaviour) in order to enable a positive and effective interaction with members of other cultures, both abroad and at home.



To contact us

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Mrs. Françoise CÔME

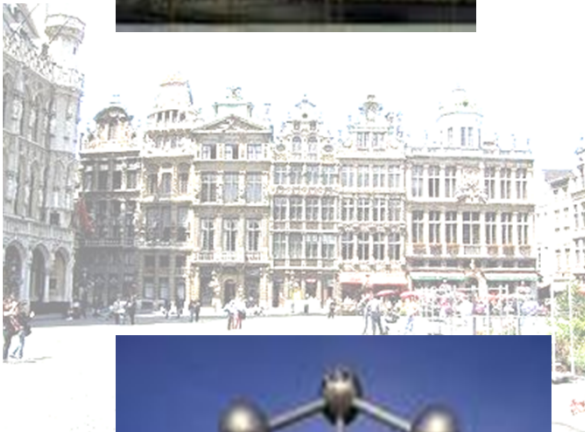
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Questions? Suggestions?

