PERSPECTIVES FOR KETS SKILLS IN EUROPE

Advanced Materials

KETs HLG - WG 7 - KETs Skills and Education
Workshop on “Perspectives for KETs Skills in Europe”
Brussels, June 10th 2014

Josep A. Planell
President UOC

Advanced Materials have a leading role to play in most of the Horizon 2020 societal challenges

- Health, demographic change and well-being;
- Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bioeconomy;
- Secure, clean and efficient energy;
- Smart, green and integrated transport;
- Climate action, environment, resource efficiency and raw materials;
- Europe in a changing world - inclusive, innovative and reflective societies;
- Secure societies – protecting freedom and security of Europe and its citizens

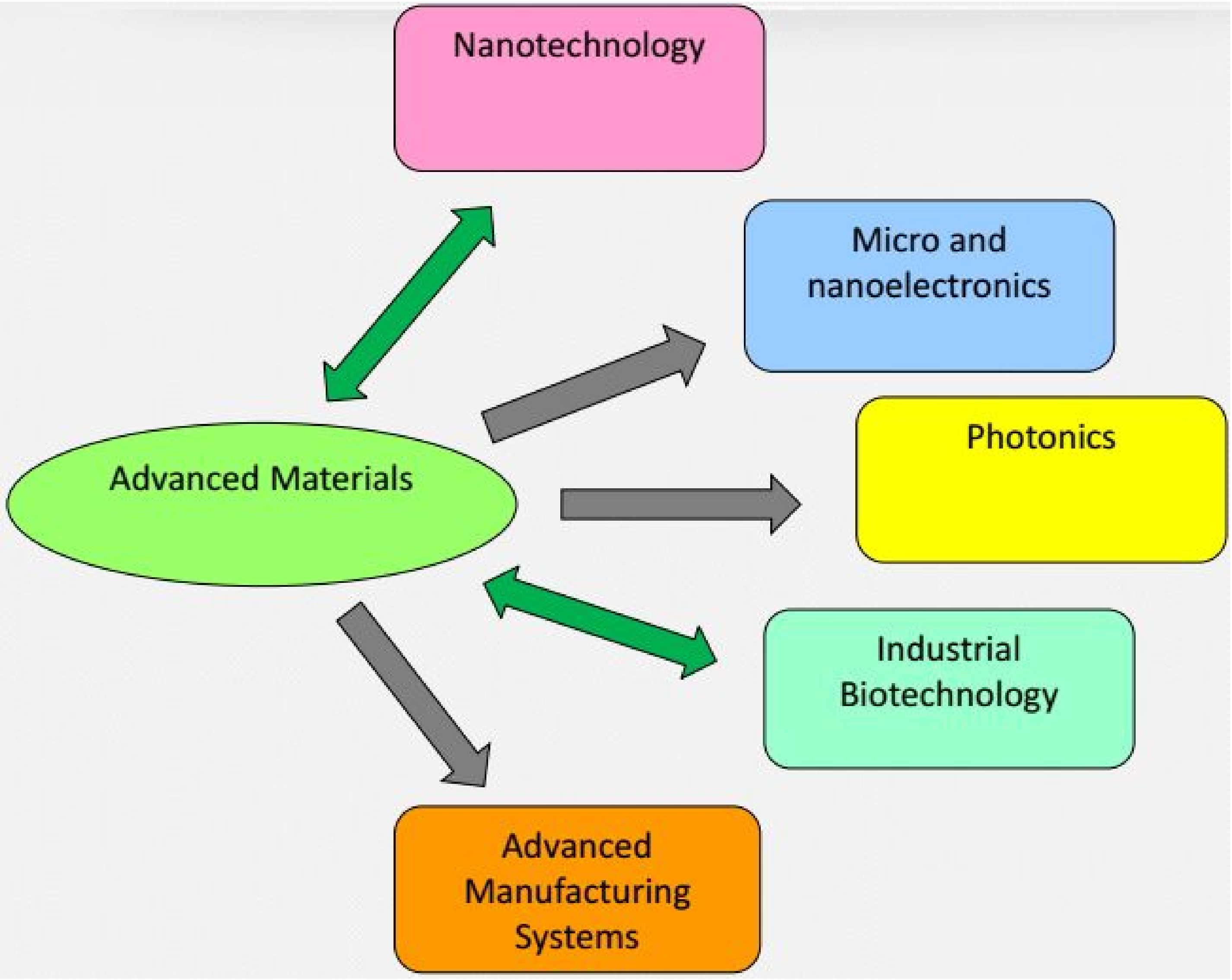
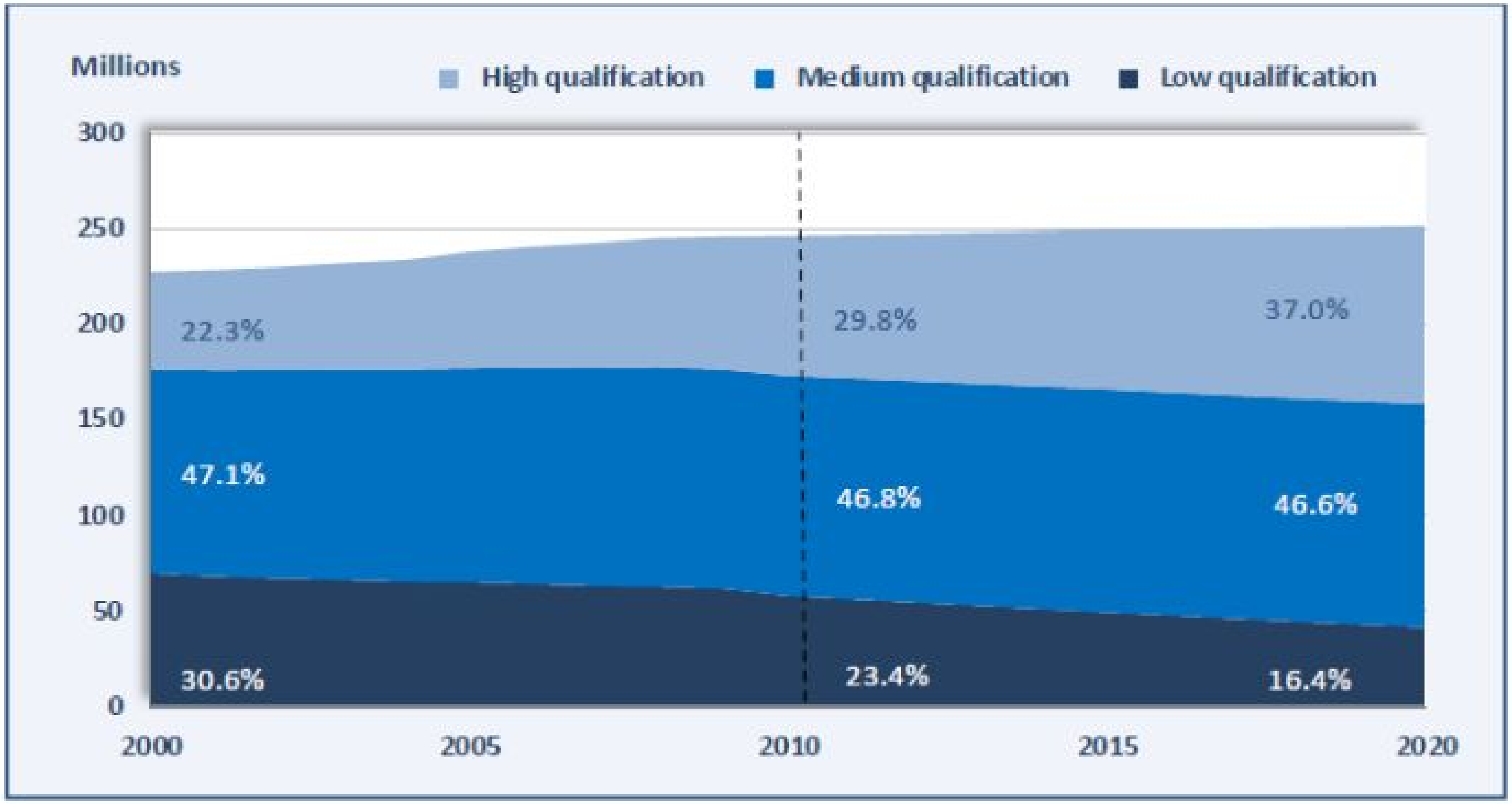
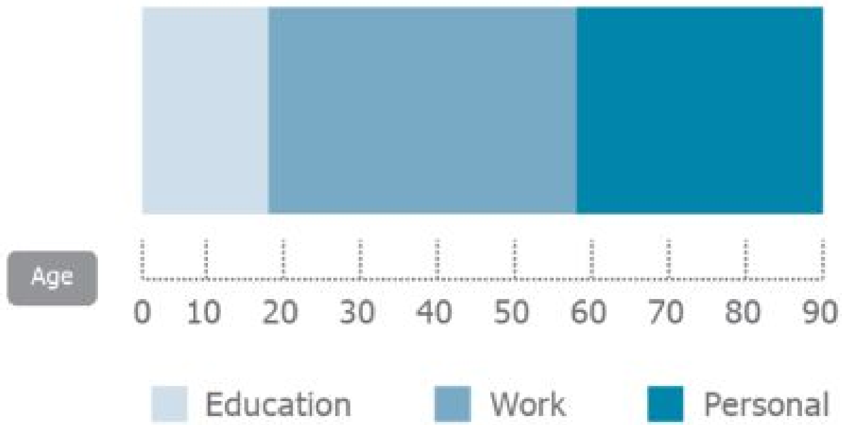

Nanotechnology
Micro and nanoelectronics
Photonics
Advanced Materials
Industrial Biotechnology
Advanced Manufacturing Systems

Figure d Labour force by level of qualification, 2000-20, EU-27+

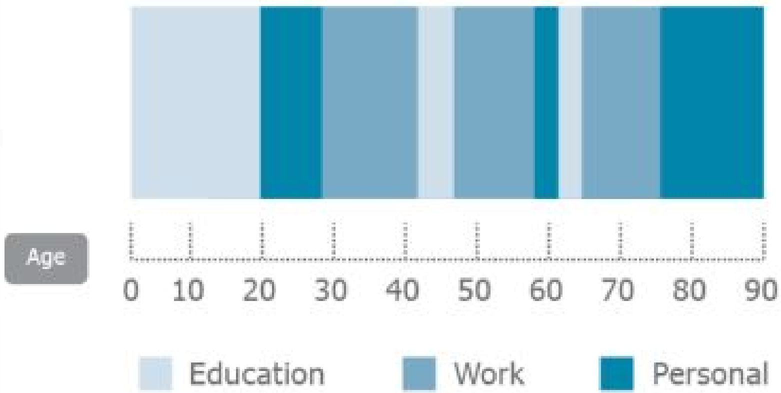


Source: Cedefop (IER estimates).

20^{th} Century is Outdated



21^{st} Century Transformation to Life, Work and Society




I AM A DIGITAL IMMIGRANT
I AM A DIGITAL NATIVE

“The leaders of EU should recognize that high quality instruction is as medular for universities as pioneering research. While they coincide that researchers require a wide and long training, there is the prevalent hypothesis that great teachers are just born as such, and that high quality education just happens: such vision causes difficulties in education at all levels”

Mary McAleese, Ireland past-president and president of the High Level Group on Modernization of Higher Education of the EU

(La Vanguardia, 15th February 2014)

It is usually taken for granted that a group of students sitting in an amphitheater, in front of a professor with high expertise in the matter, and teaching his own knowledge, is sufficient warranty for high quality education.

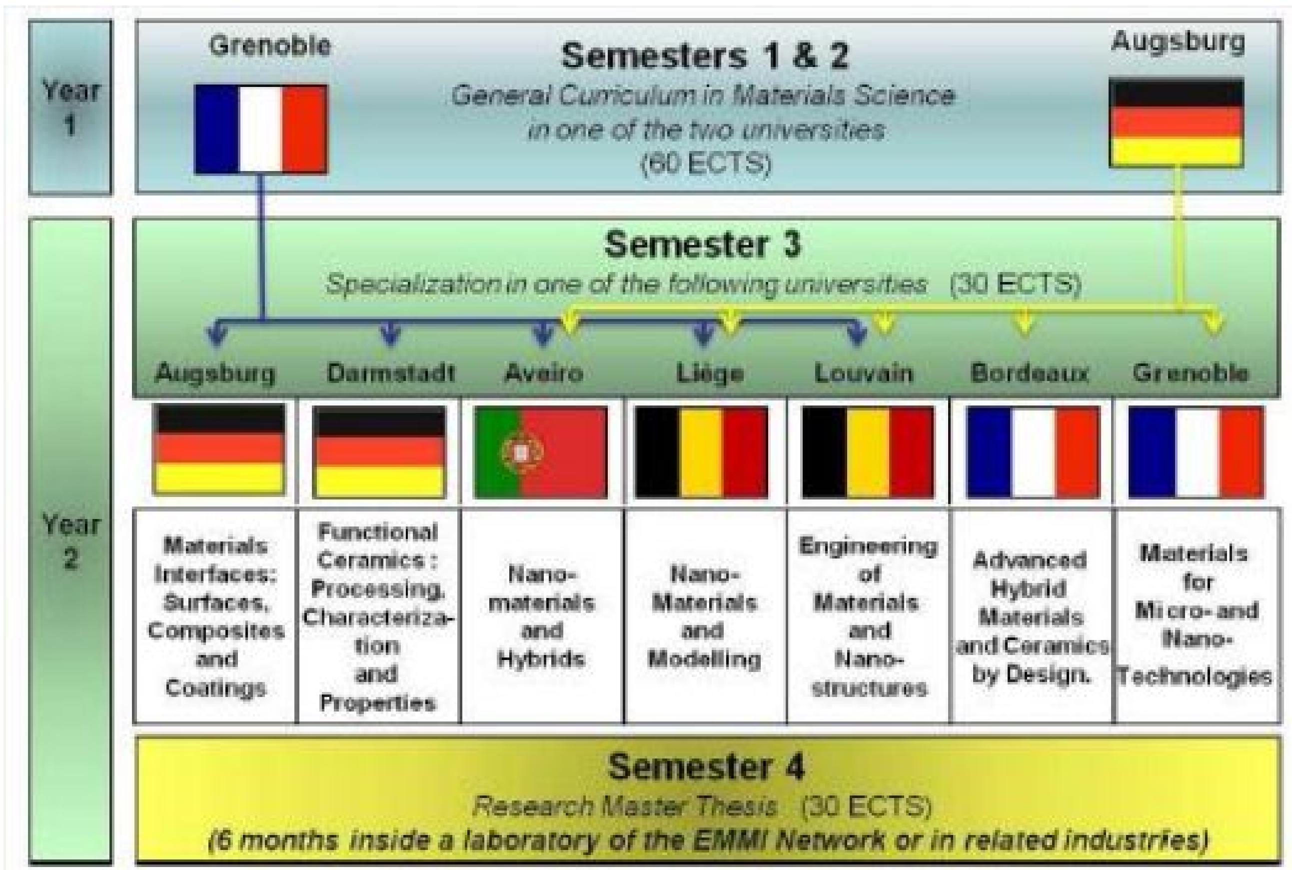
- Are universities the only knowledge providers?
- Universities hold the monopoly to award “official” or accredited degrees that play a useful role as a lower filter in the selection processes of companies.
- Should universities provide disciplinary contents or training and competences or skills to solve problems?
- Do universities satisfy employability requirements from the point of view of the demand?

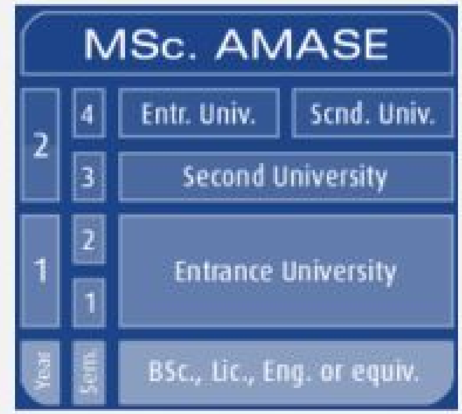
- Internet plays a disruptive role in the future of face to face universities
- Internet provides services while universities provide products (degrees)
- Does a long-life learner care for a training product or a service?
- Academic Professors (strong in research and disciplinary contents holders) or “activities” instructors?

Imperial College London

	Course Title	Code	ECTS
Compulsory	Material Characterisation	MSE 302	6
	Materials Modelling	MSE 317	6
Research	The Art of Research/ Research Teaching		3
	Research Essay		8
	Research Project		37
Options	Ceramic and Glasses	MSE308	6
	Electronic Structure and Optoelectronic Behaviour	MSE310	6
	Electroceramics	MSE411	6
	Metals Processing	MSE305	6
	Engineering Alloys	MSE307	6
	Polymers and Composites	MSE309	6
	High Performance Alloys	MSE409	6
	Advanced Strucral Ceramics	MSE413	6
	Surfaces and Interfaces	MSE415	6
	Nanomaterials I	MSE312	6
	Nanomaterials II	MSE412	6
	Nuclear Materials	MSE414	6
	Biomaterials	MSE315	6
	Advanced Biomaterials	MSE417	6
	Tissue Engineering	MSE418	6
	Advanced Thin Film Manufacturing Technologies	MSE410	6
	Equilibrium in materials	DTC	6
	Transformations of matter	DTC	6
	Electronic structure of materials	DTC	6

Table 1 Summary of compulsory, research based and options courses available for 2012-2013.


Year 1
Grenoble
Semesters 1 & 2
General Curriculum in Materials Science
in one of the two universities
(60 ECTS)
Augsburg
Year 2
Semester 3
Specialization in one of the following universities (30 ECTS)
Augsburg
Darmstadt
Aveiro
Liège
Louvain
Bordeaux
Grenoble
Materials Interfaces: Surfaces, Composites and Coatings
Functional Ceramics : Processing, Characteriza-tion and Properties
Nano-materials and Hybrids
Nano-Materials and Modelling
Engineering of Materials and Nano-structures
Advanced Hybrid Materials and Ceramics by Design.
Materials for Micro- and Nano-Technologies
Semester 4
Research Master Thesis (30 ECTS)
(6 months inside a laboratory of the EMMI Network or in related industries)



UdS - Saarland University, Germany
LTU - Luleå Technical University, Sweden
UPC - BarcelonaTech, Spain
UL - Université de Lorraine, France

LUNDS UNIVERSITET
fysicum

Materials Science

Required programme courses (7,5 ECTS credits):
FYSN11: Physics experiments in research and society
FYSN15: Experimental tools
FYSN17: Quantum mechanics
FYST19: Physics and chemistry of surfaces
FYST20: Spectroscopy and the quantum description of matter

Programme elective courses (15 ECTS credits)
FYSN14: Lasers
FYST21: Light-matter interaction
FYST42: Scanning probe microscopy
FYST24 Physics of low-dimensional systems
FYST25: Solid-state theory
FYST35: Crystal growth and semiconductor epitaxi
FYST39: Nanoelectronics
FYST40: Nanomaterials- thermodynamics and kinematics
FYST42: Scanning probe microscopy
KEMM37: Scattering methods
KEMM17: Magnetic resonance – spectroscopy and imaging.
KEMM28: Molecular quantum mechanics
KOO 095: Functional Materials
KOO 045: Materials Chemistry
KOO 105: Materials Analysis at the Nanoscale
FYST31: Advanced Processing of Nanostructures
MAXM06: Introduction to synchrotron based science
MAXM16: Experimental methods and instrumentation for synchrotron radiation research

Programme elective courses (15 ECTS credits)
KEMM07: Surface and colloid chemistry – advanced course
KEMM09: Optical methods in molecular spectroscopy

Master's Programme in Physics of Advanced Materials

Study curriculum
Studies in the programme consist of six modules, for a total of 120 ECTS credits:
1. Advanced module in Materials (20 cr)
2. Advanced module in Engineering Physics (20 cr)
3. Special module (20 cr)
4. Methodological principles (10 cr)
5. Elective studies (credits to obtain the total of 120 cr)
6. Master's thesis (30 cr)

In modules F330-3 and F331-3 each student focuses on either theoretical/computational or experimental research.
The study modules are presented in detail below.

F330-3 Advanced Module in Materials A3 (20 cr)
Of the special assignments, one is to be done during the summer after the 1st year.
Tfy-3.4311 Materials physics II (5 cr), periods I-II
Tfy-3.4361 Advanced statistical physics (5 cr) (NB: not lectured in fall 2013)
Tfy-3.4343 Nanophysics (5 cr) (NB: not lectured in fall 2013)
Tfy-3.4331 Surface physics (5 cr), periods III-IV
Tfy-125.4313 Microscopy of nanomaterials (5 cr), periods III-IV
Tfy-125.4314 Microscopy of nanomaterials, laboratory course (5 cr), period IV
Tfy-105.5111 Special assignment, computational physics (10 cr)
Tfy-125.5111 Special assignment, physics (10 cr)

F331-3 Advanced Module in Engineering Physics A3 (20 cr)
The module contains studies that provide background in physical sciences. The course selection allows to focus either on a theoretical or experimental track.
Tfy-3.4411 Experimental methods in physics (5 cr), periods I-II
S-104.3610 Nanotechnology (5 cr), period II
Tfy-3.4323 Quantum physics (5 cr), periods III-IV
Tfy-3.4423 Computational physics (5 cr), periods III-IV
Tfy-3.5111 Special assignment, physics (10 cr)

F300-C Special Module in Engineering Physics (20 cr)
This module may contain courses in mathematics, computer science, and various aspects of materials research. An individual study plan will be made with the supervisor.
See also the list of special courses lecture in 2012-2013.

F901-M Methodological Principles (10 cr)
The module contains a selection of methodological courses related to the theme of the programme. These include:
Tfy-0.4800 Physics research seminar (4 cr)
Tfy-3.4510 Special course in physics (3-10 cr)
Tfy-3.4520 Special course in theoretical physics (3-10 cr)

F901-W Elective Studies
Any Kie-98.xx language courses that fulfill the requirements for obligatory foreign language studies for a total of 3 ECTS credits, including both oral and written skills. In addition, the student
can select any Aalto University courses to complete 20 ECTS credits. The course choices may contain courses relevant for eventual PhD studies.
See also the list of special courses lecture in 2012-2013.

F901-D Master's Thesis (30 cr)
The Master's thesis is a written report of a 6-month independent research project on a topic related to the programme. The topic of the thesis is agreed upon by the student and the
supervising professor. The work is carried out as full-time research in either one of the groups at the Department of Applied Physics, in a research group collaborating with one the groups
at the department or in an industrial company whose field of operation is related to the programme.
sep 02, 2013

Institute-wide Task Force on the Future of MIT Education

Preliminary Report November 21, 2013

Figure 1. Unbundling of education

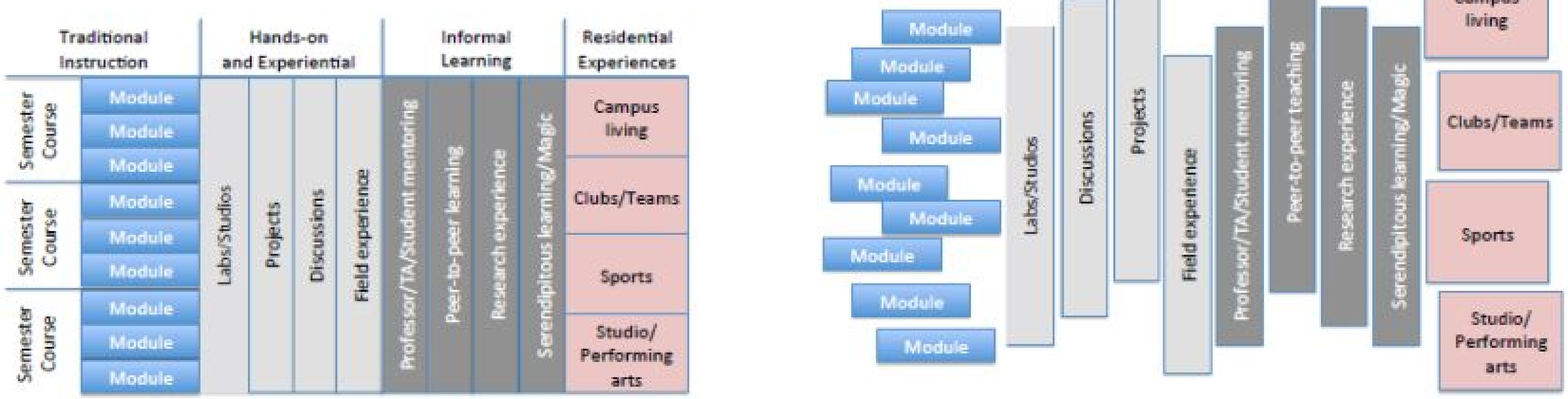


Figure 8a. Student takes a class for personal edification

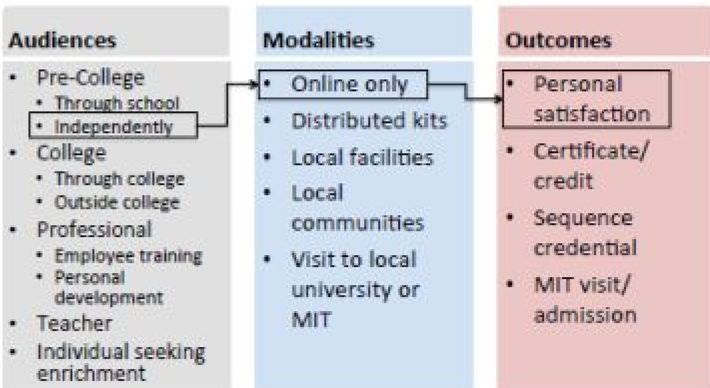


Figure 8d. Student takes a class in SPOC form while embedded in institution

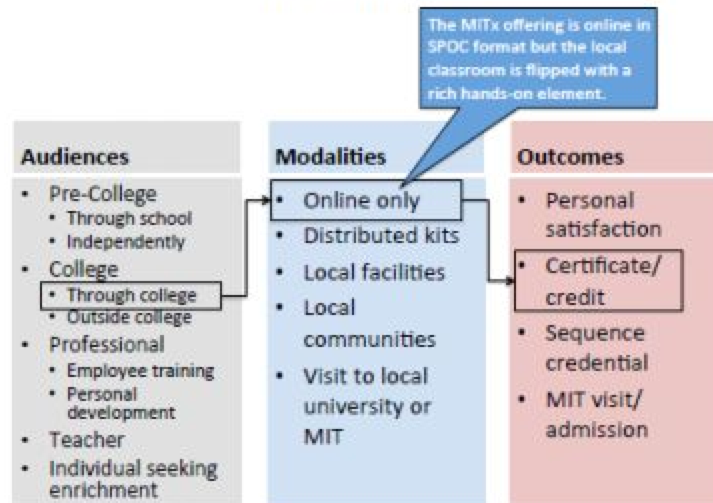
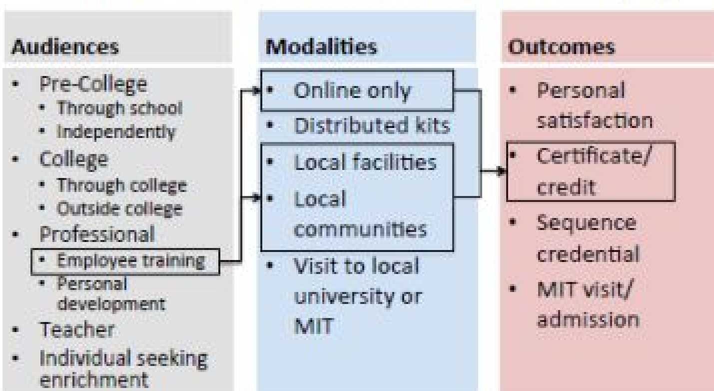


Figure 8f. Professional takes a class while embedded in a company



Some ideas for discussion

- Advanced Materials skills should probably be provided by the knowledge generators (associated to universities looking for accreditation?).
- Universities should probably create enterprise/industrial advisory committees in order to improve employability of their egressed learners.
- On-line learning is probably the most convenient educational approach for long-life learners. (MOOCs experience to be considered).
- On-line learning can personalize education and provide the service that the long-life learner is looking for.
- KETs training, both at the vocational an the higher educational levels, could be provided on-line, blended with face-to-face experimental training wherever knowledge is generated.

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