POLITECNICO
MILANO 1863

The Teaching and Learning Innovation Program of Politecnico di Milano

Lamberto Duò

Rector's Delegate for
Education and Counselling

Como, 11th of September 2019

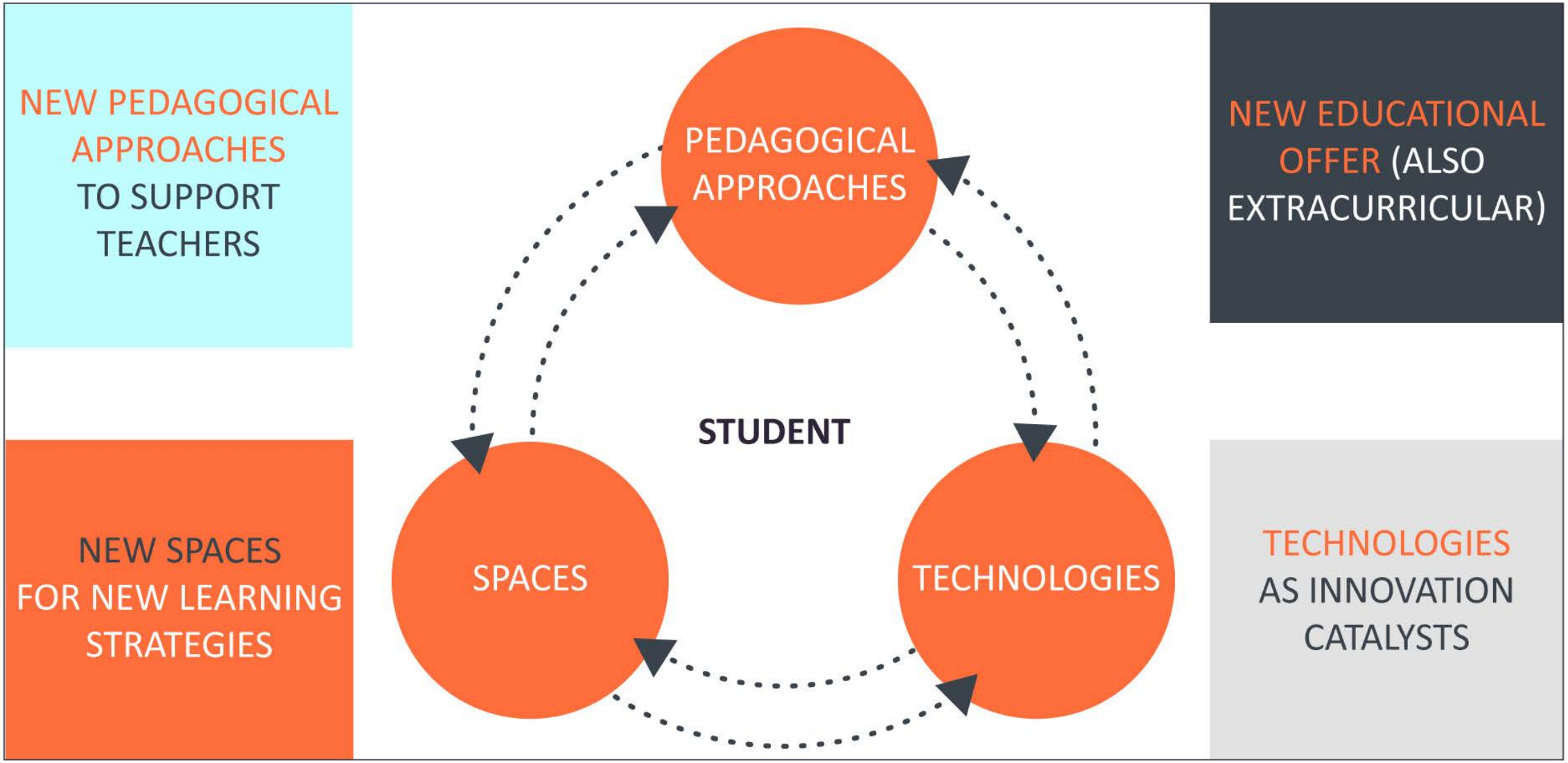
Erst dum und blöde
jetzt klug wie Göthe
das hat vollbracht
des Trichters Macht

The World is changing.

We need to change our approaches to support the development of new skills to succeed in the face of new and unknown challenges.

Spaces, techonologies and methods for teaching and learning innovation

METID re-elaboration, source: Radcliffe, 2009, p.13



METID

Innovative Methods and Technologies for Teaching and Learning

Design and testing of methods and tools to support **teaching and learning innovation** and **faculty development** within the strategic framework of Politecnico di Milano

Teaching and Learning Innovation

MOOCs - *Massive Open Online Courses*

National and international projects

1 three-year program (2017-2019) with 3 MLN € to support teaching and learning innovation

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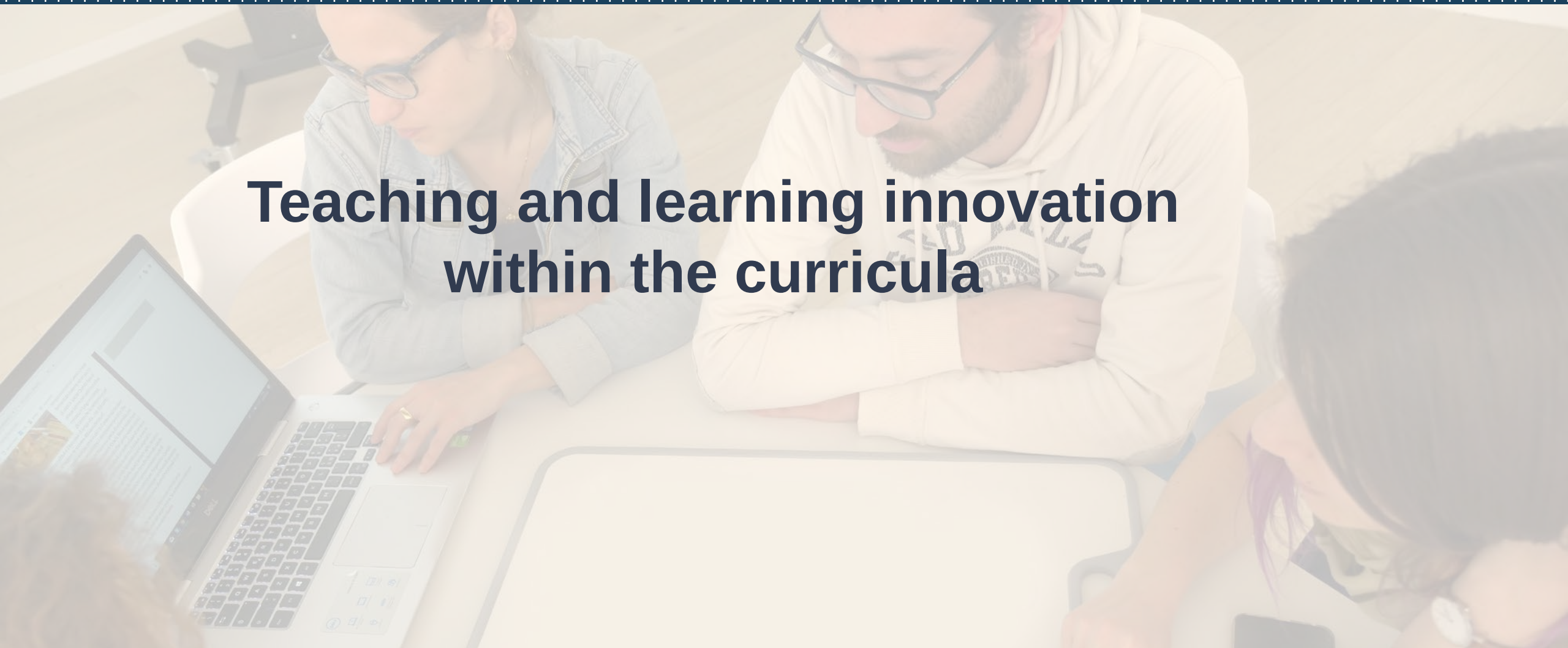


Teaching and learning innovation within the curricula

ACTION 1: ay 2018/2019

322 courses with learning innovation (10,4% Poli courses)

868 CFU of learning innovation (3,7% Poli courses)

ACTION 1: ay 2019/2020

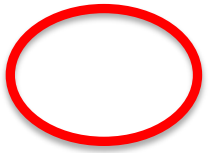
581 courses with learning innovation (18,2% Poli courses)

1.447 CFU of learning innovation (6,1% Poli courses)

159 courses	BLENDED/FLIPPED	336 courses
34 courses	MOOCS	47 courses
71 courses	COTUTELA	118 courses
114 courses	SOFT SKILLS	169 courses

N.B. more than one innovative tipology for course

Manifesto



Course Page

Course Details

Context

Academic Year	2019/2020
School	School of Industrial and Information Engineering
Name	(Bachelor of Science degree)(ord. 270) - MI (347) Chemical Engineering
Track	N1L - Ingegneria Chimica
Programme Year	1

Course Details

ID Code	054264
Course Title	GENERAL CHEMISTRY
Course Type	Mono-Disciplinary Course
Credits (CFU / ECTS)	10.0
Semester	First Semester
Course Description	General chemistry involving structure of atoms and atomic nuclei - necleogenesis and nuclear energy - bonding theory - valence bond, molecular orbital treatment of diatomic and polyatomic molecules - trends in the periodic table. Chemical reactions: acid-base, ox-red and ligand transfer - mass and energy balances (stoichiometry). Ideal gas laws, thermochemistry and thermodynamics - chemical kinetics. Atomic structure and trends - covalent bonding and molecular structure. Molecular and ionic equilibria. Intermolecular and ionic bonding, d-block and coordination chemistry. Heterogeneous equilibria and phase diagrams - Colligative properties. conductance, EMF and surface chemistry. Solid state chemistry - packing of metal atoms and ions in solids, typical AX, AX2 and selected crystal structures - lattice defects. Laboratory work - experiments involving qualitative analysis, introductory titrimetric analysis, gravimetric analysis, spectrophotometric analysis, measurement of rates of inorganic reactions, experiments in purification and separation techniques, chemical and ionic equilibria and buffer systems and pH, electrochemistry.

Scientific-Disciplinary Sector (SSD)

Educational activities	SSD Code	SSD Description	CFU
A	CHIM/07	PRINCIPLES OF CHEMISTRY FOR APPLIED TECHNOLOGIES	10.0

Innovative teaching

The course includes **1.0** credits in Innovative Teaching as follows:

- Blended Learning & Flipped Classroom

Details | Class schedule planning

Alphabetical group		Professor	Language	Course details
From (included)	To (excluded)			
A	DB	Sebastiano Roberto		
DB	MI	Resnati Giuseppe		
MI	ZZZZ	Galimberti Maurizio Stefano		

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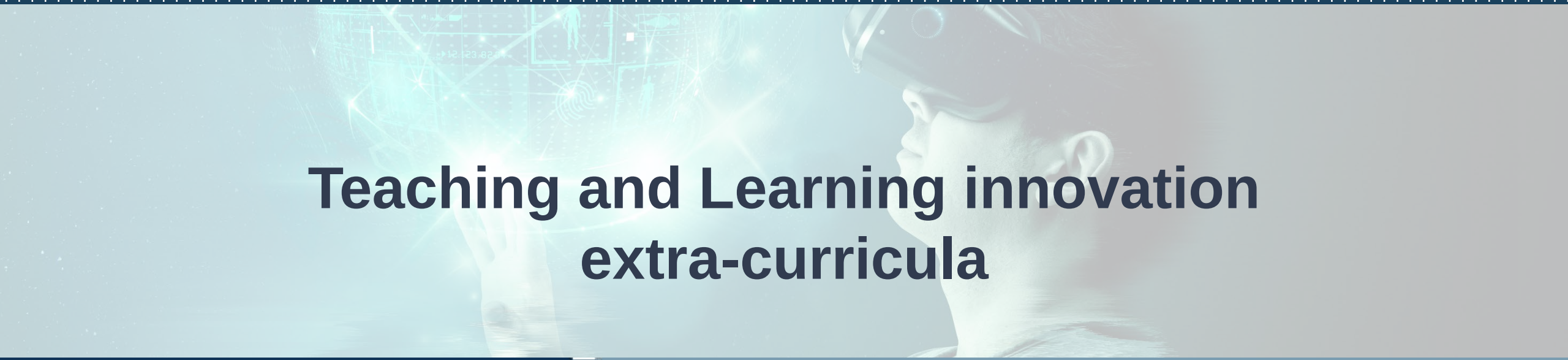


Teaching and Learning innovation extra-curricula

Developing passions of our students valuing those of our teachers

PASSION IN ACTION

ACTION 2 PASSION IN ACTION October 2018/June 2019

Opportunities to enhance passions and attitudes of the students, transversally and outside of curricular activities

5,700 enrollment requests

3,900 attendances confirmed

1,900 validated activities

Traceable courses in students career (Diploma supplement)

Badge
(a.a. 2018/19 Scuole Ingegnerie)

72,000 website visualisations

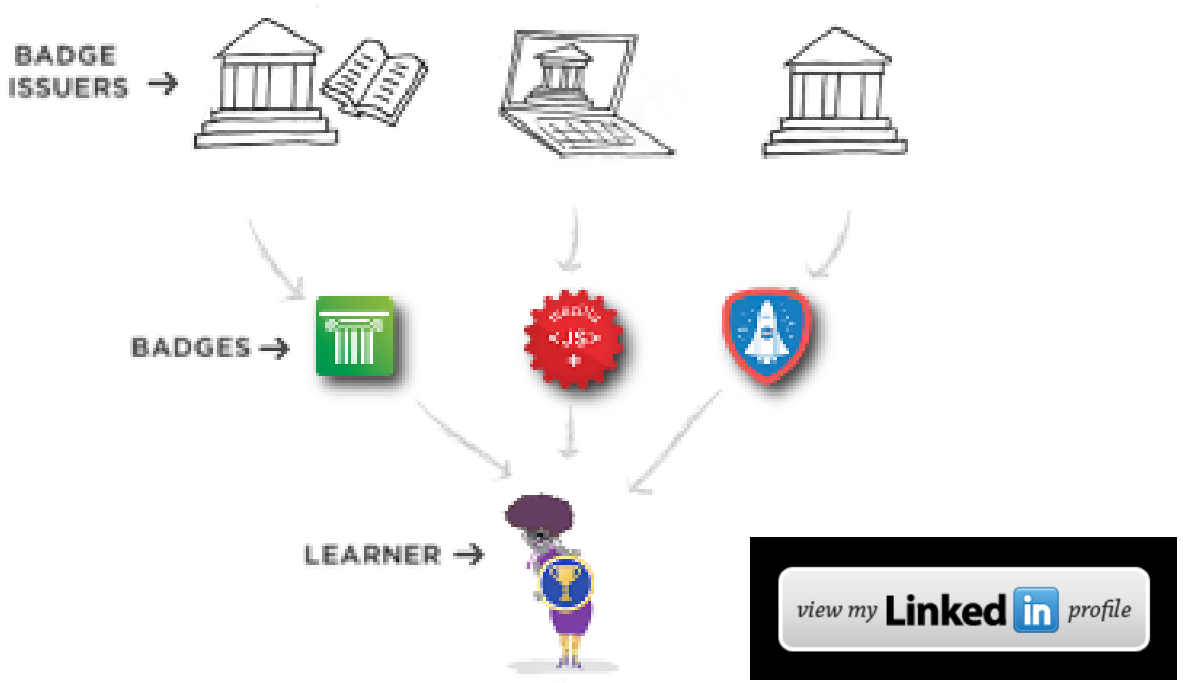
(60,000 ita - 12,000 en)

92,000 visualisations activities

Badges

In addition to the «Diploma Supplement» certification

Sherable Certification of the accomplishment of a «Passion in Action» course



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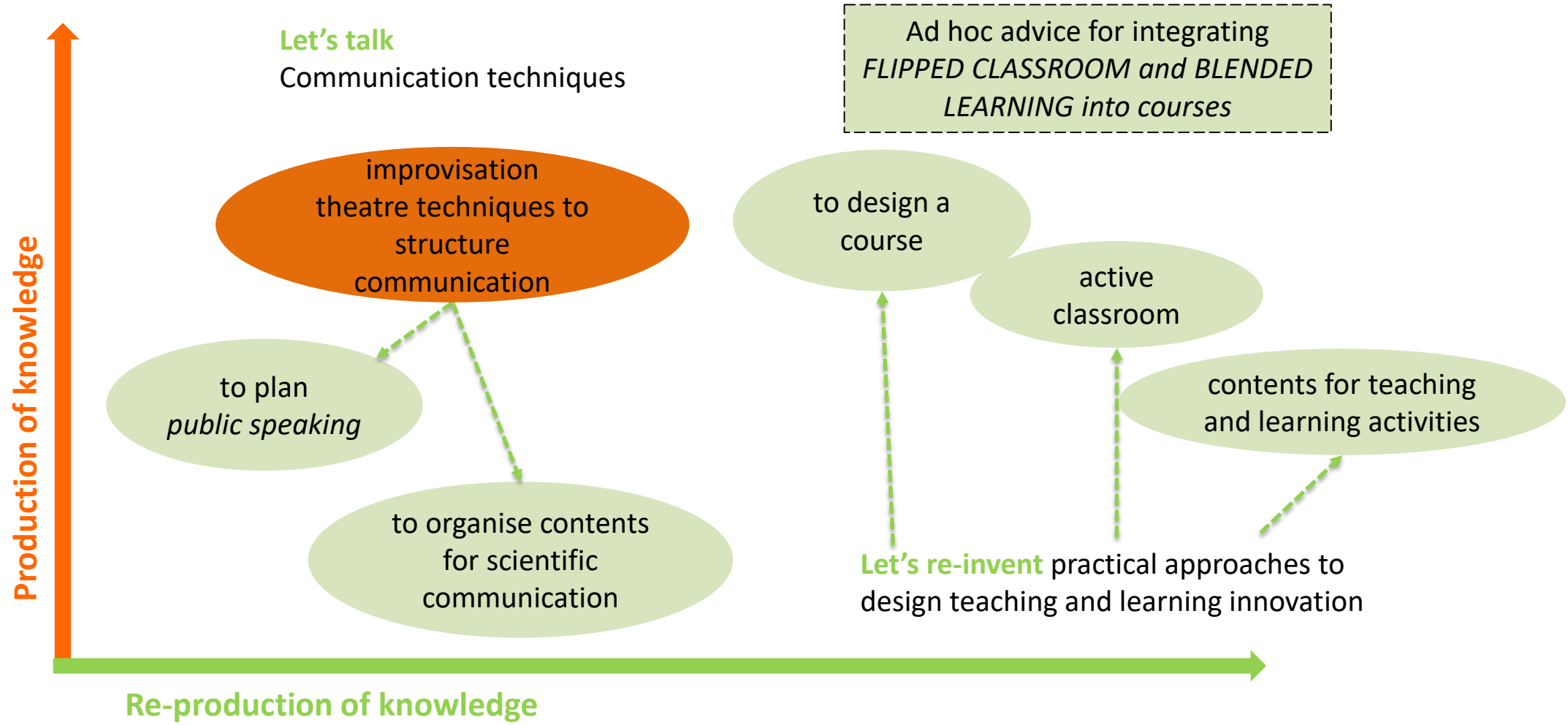
Faculty development FOR Innovation WITH innovation (METID-ARUO)

Faculty development first ideas: (re-) production of knowledge



Faculty development strategy

WORKSHOP for FACULTY

Training paths for POLIMI teaching staff
Number of teachers trained (2018/2019):
290 (20%) → (strategic plan target for 2019: 30%)

- Practical approaches to teaching and learning design
- Communication techniques
- Public speaking
- Teaching and learning effectiveness in multicultural classrooms

dimento» si basa

Faculty development Strategy

10 seminars with international guests (~200 participants)

- Hokkaido University
- Universitat de Barcelona
- Western Switzerland University of Applied Sciences
- Manchester Metropolitan University
- Stanford University
- MIT
- Université catholique de Louvain
- Creative Commons
- Class Central
- University of Twente

Faculty development Strategy

BeeP

-

Content HUB
Online platform
to gather
all the materials

beep.polimi.it

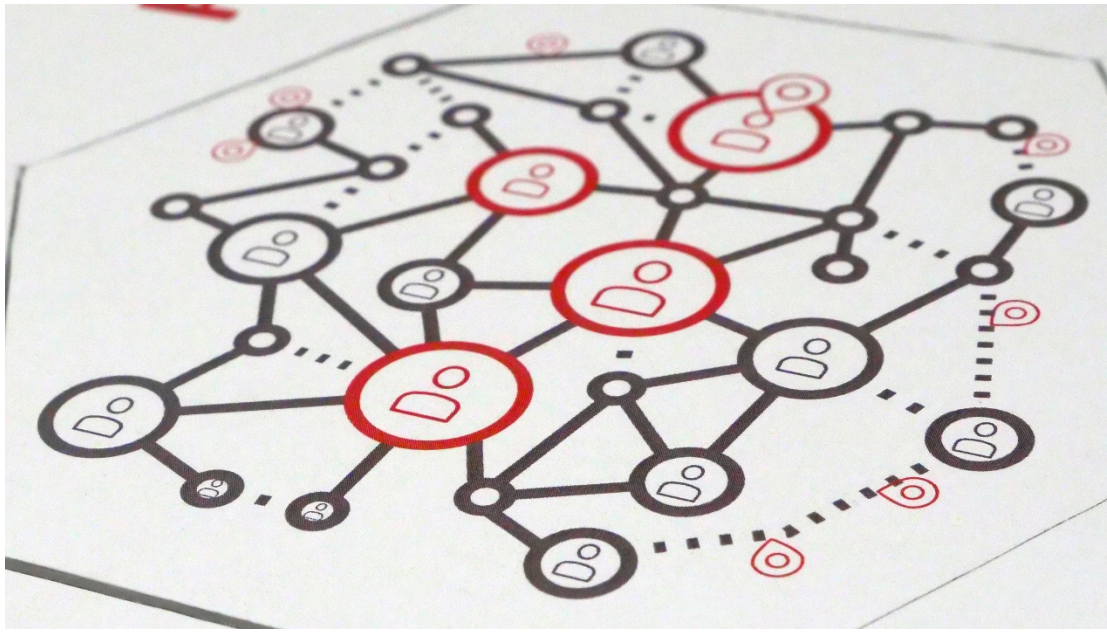
Faculty development Strategy

MOOCS *FOR TEACHERS*

7 MOOCs supporting teacher training

- Progettare l'Innovazione Didattica (IT)

- *To Flip or not to Flip*
- *Open Educational Resources*
- *Engaging Students in Active Learning*
- *New Assessment Strategies*
- *Action Learning for Inclusion*
- *Universities Strategies for the Digital Age*



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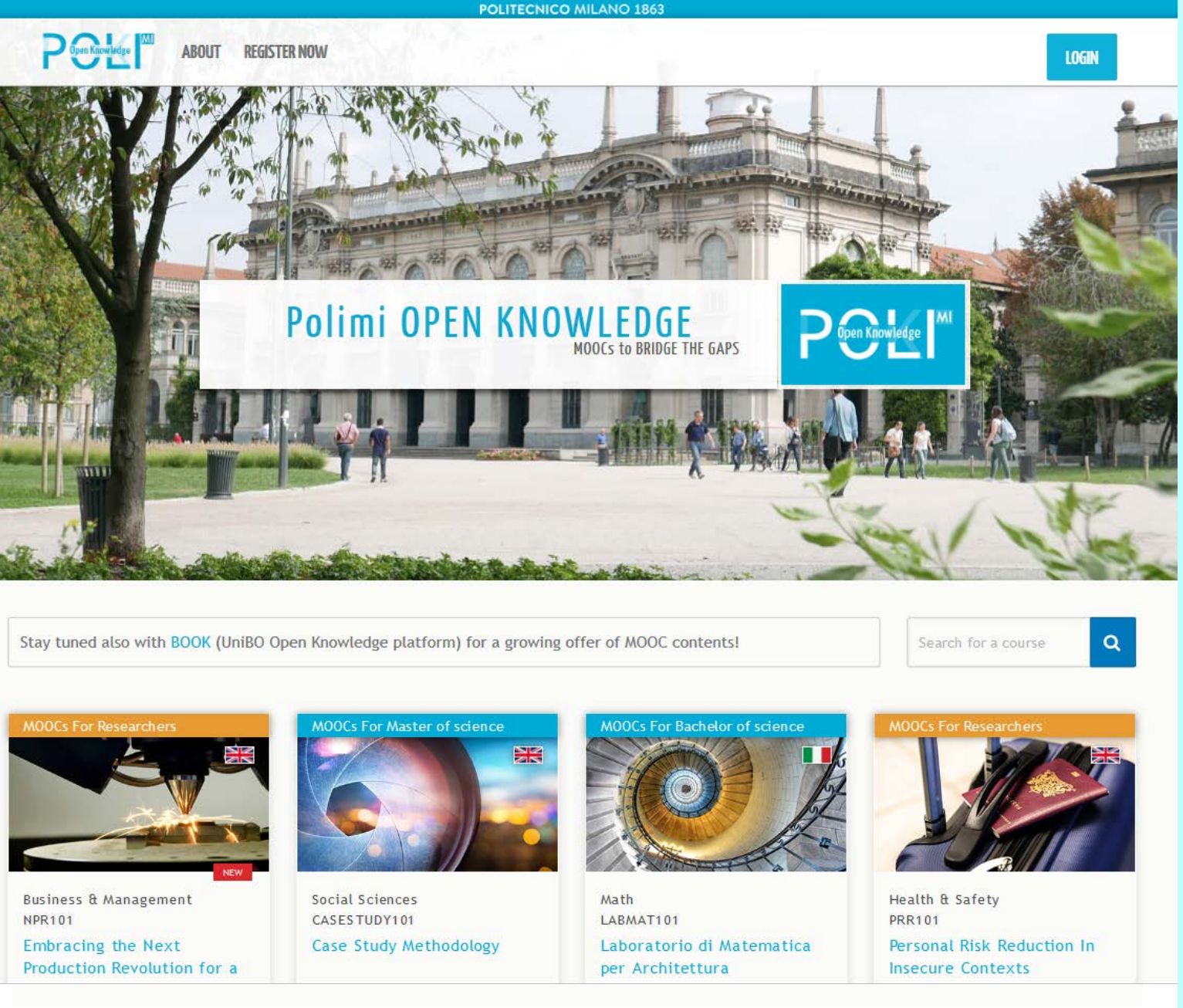
Action 1 – Best practices

Methodological approach: **transferability**

- High-impact **MOOC initiatives**
- **Blended learning/flipped classroom**: Active Classroom
- **Subjects taught jointly with companies or organizations**: integration of external competencies
- **Soft Skills**: integration between technology and humanities



123,000 Enrollments

-

POK leading MOOC platform in Italy

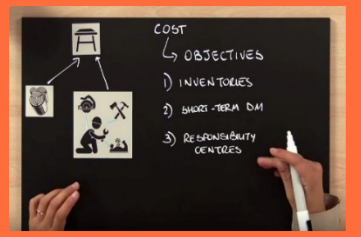
www.pok.polimi.it

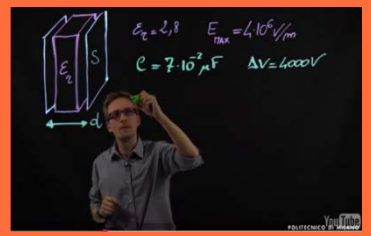
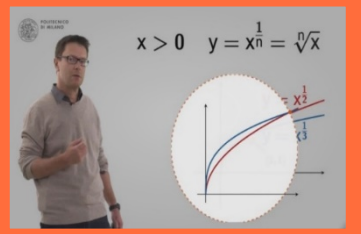
High-level online courses accessible to all…

POK in numbers

48 MOOCs
2,000 videos
77,000 total users
123,000 enrollments
34,700 YouTube subscriptions

VIDEO FORMAT

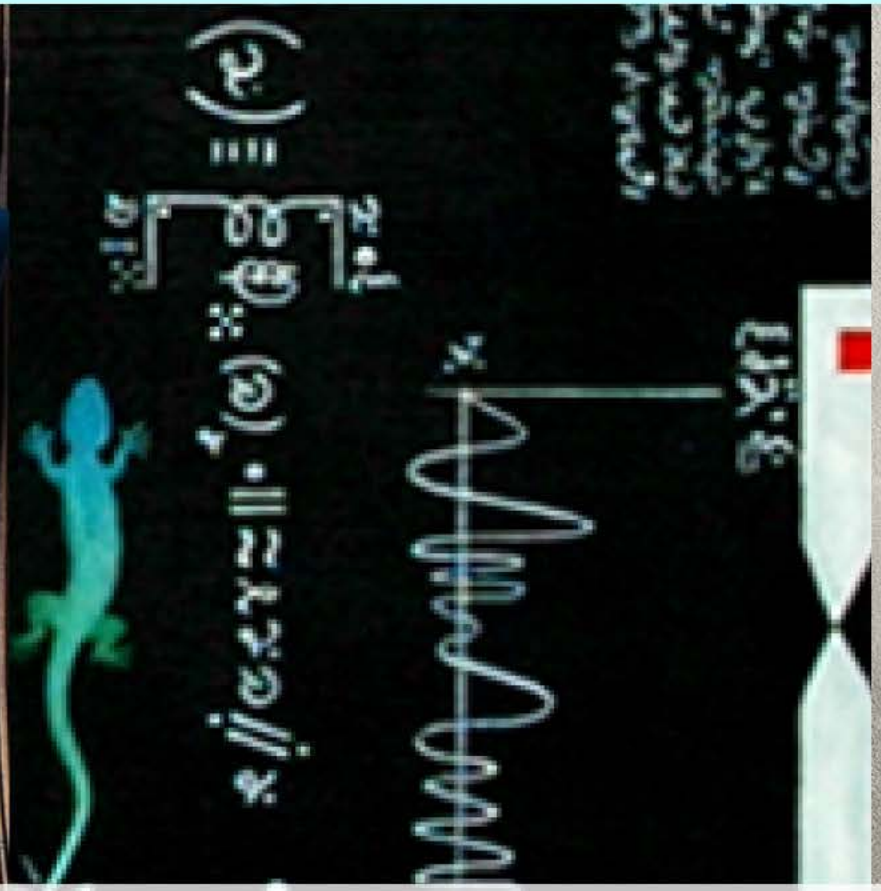


→ **…but also Curricular Courses for our students**

HIGH IMPACT MOOCS INITIATIVES

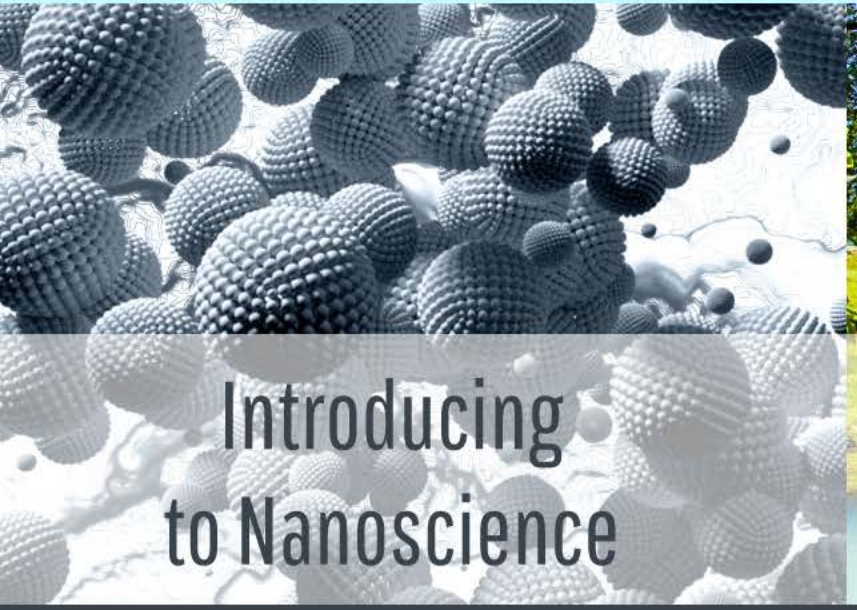
5 MOOCS SERIES:
Introducing to Management Engineering



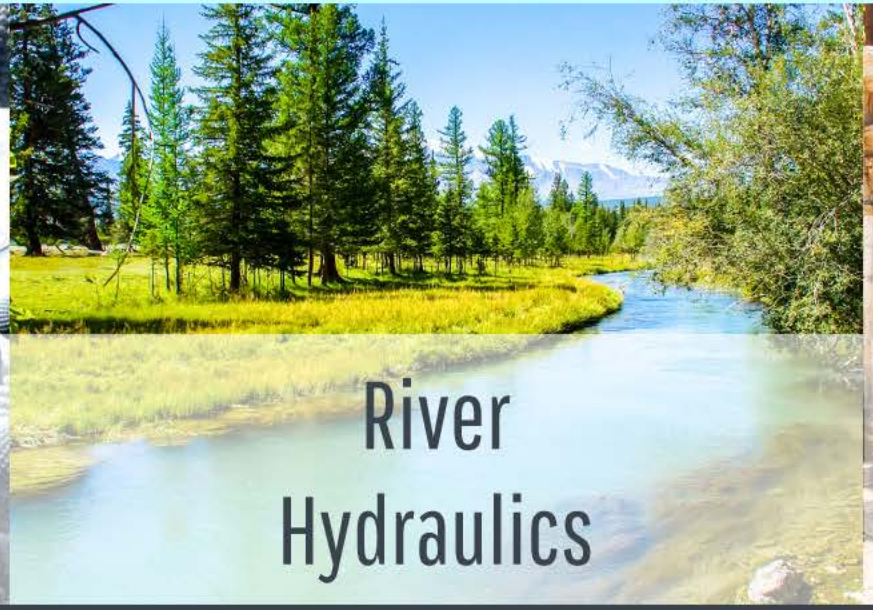
Equazioni differenziali lineari del secondo ordine

Introducing Metadesign

BLENDED/FLIPPED CLASSROOM: ACTIVE CLASSROOM



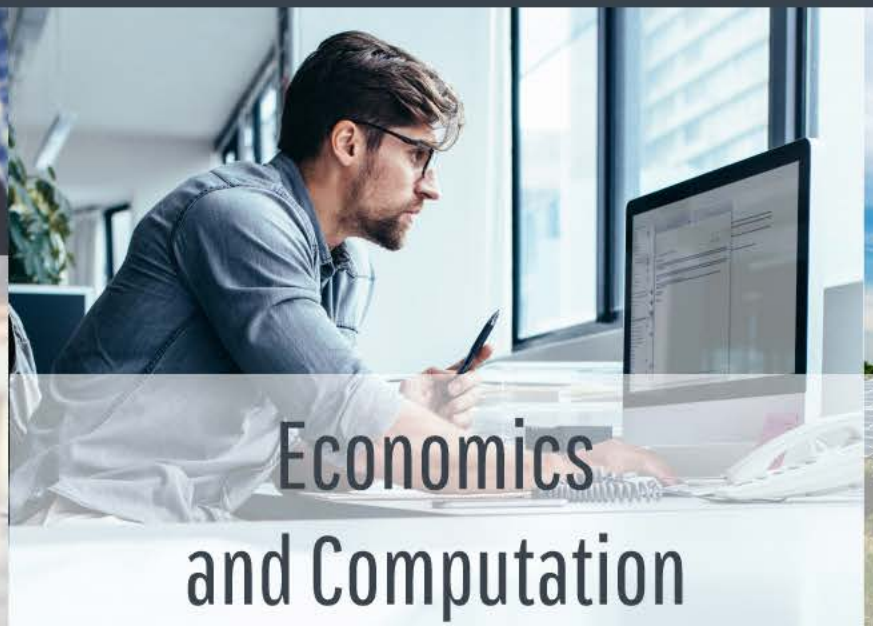
Introducing
to Nanoscience



River
Hydraulics

Laboratorio
di Conservazione
dell'Edilizia Storica

Sustainable
Multidisciplinary
Design Process



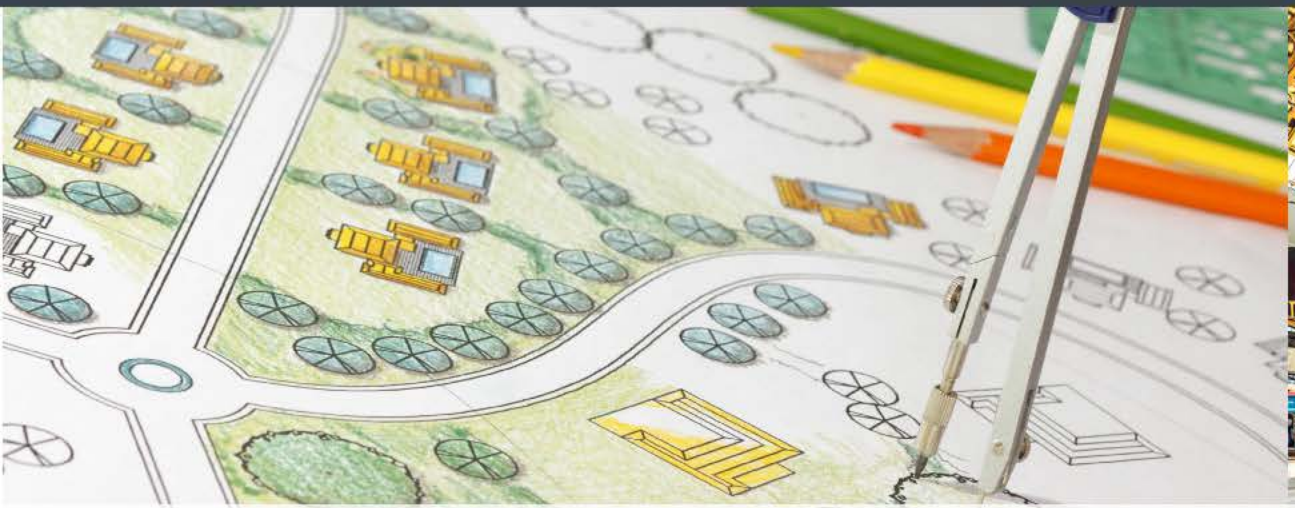
Economics
and Computation

Strategie
per le Sfide Ambientali

CO-TUTELA: INTEGRATION OF EXTERNAL EXPERTISE

PepsiCo Design & Innovation Workshop

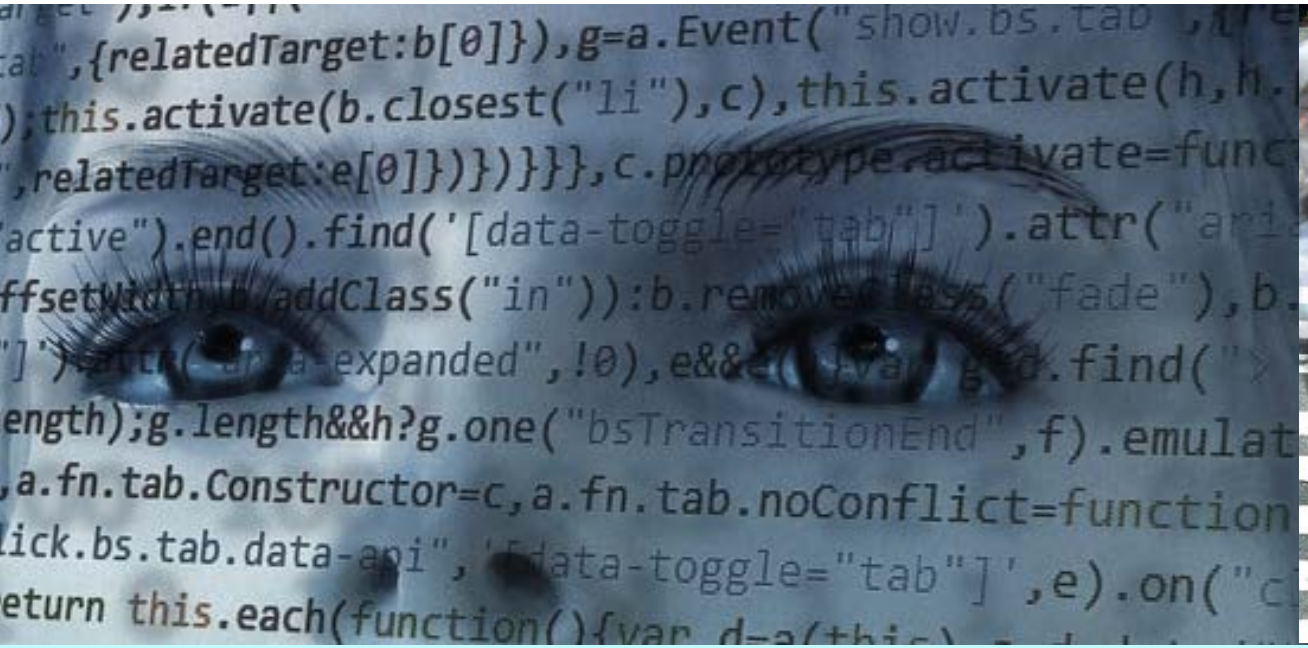
Project Work



Landscape Architecture

Mobility: Infrastructure and Services

Soft skills: integration between technologies and humanities



Ethic courses for engineers

META SOCIAL SCIENCES AND HUMANITIES FOR SCIENCE AND TECHNOLOGY

- Ethics for technology
- Computer ethics
- Ethics for transportation

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Next steps

Educafé-METID: new space for Teaching and Learning Innovation

- *Testing teaching and learning experiences* for big, medium and small size classrooms

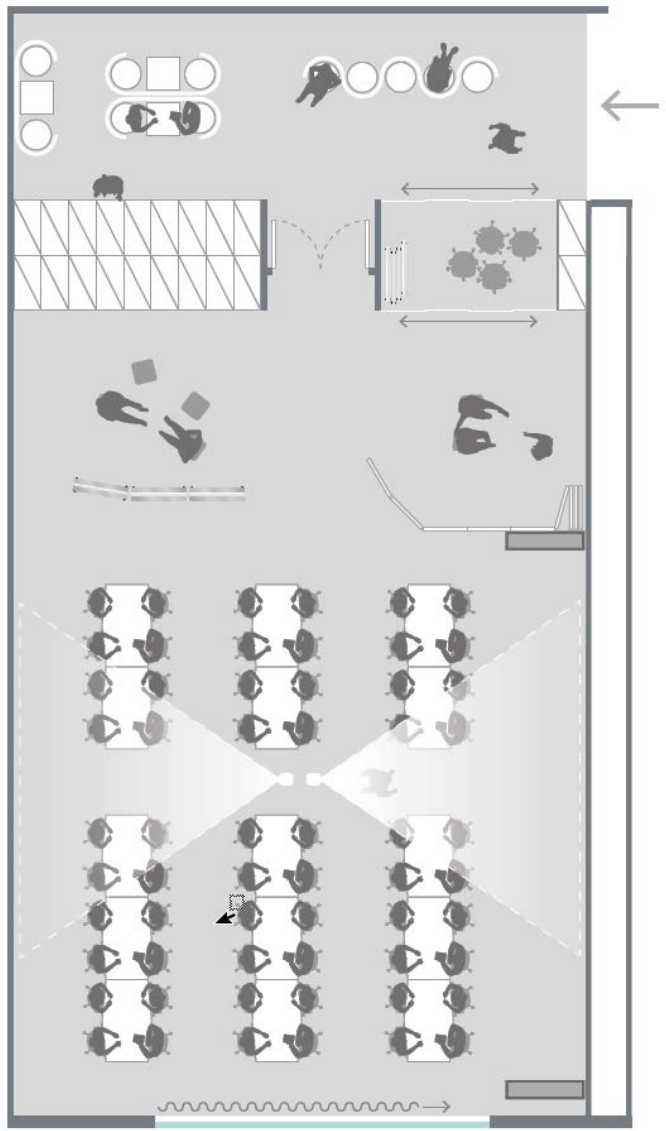
EDU café
METID learning innovation

Innovative teaching and learning spaces (classrooms)

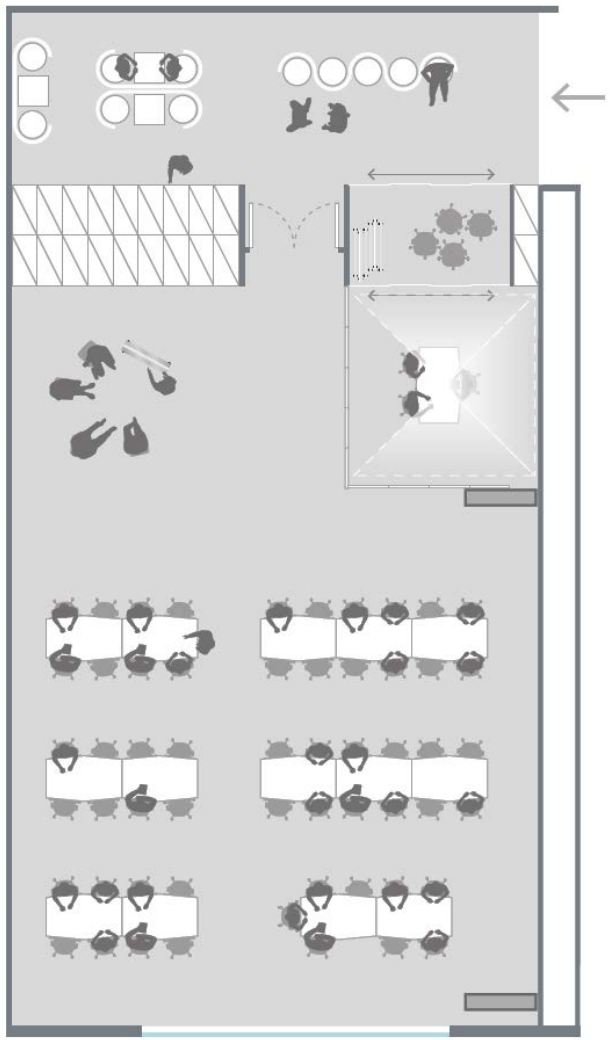
Space renovation (budget: 900,000 €):

- 2 flexible university classrooms (Campus Leonardo + Campus Bovisa)
- 2 School classrooms/laboratories (Architecture L. + Design B.)
- 2 School of Engineering classrooms/laboratories (Virtual and Augmented Reality – Leonardo + Bovisa)

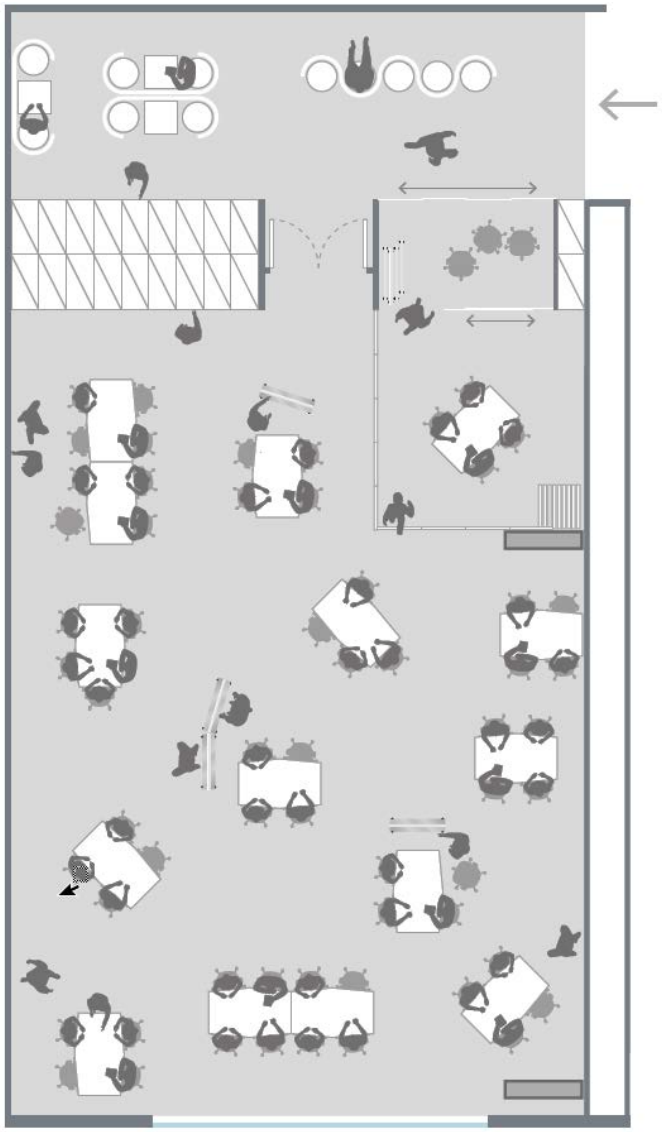
Taditional Lecture



Active Learning



Collaborative Activities



Training to all researchers with a fixed-term contract A+B (2019-20)

EDUTONIC

Il blog di innovazione didattica @polimi

EDUTONIC+Newsletter

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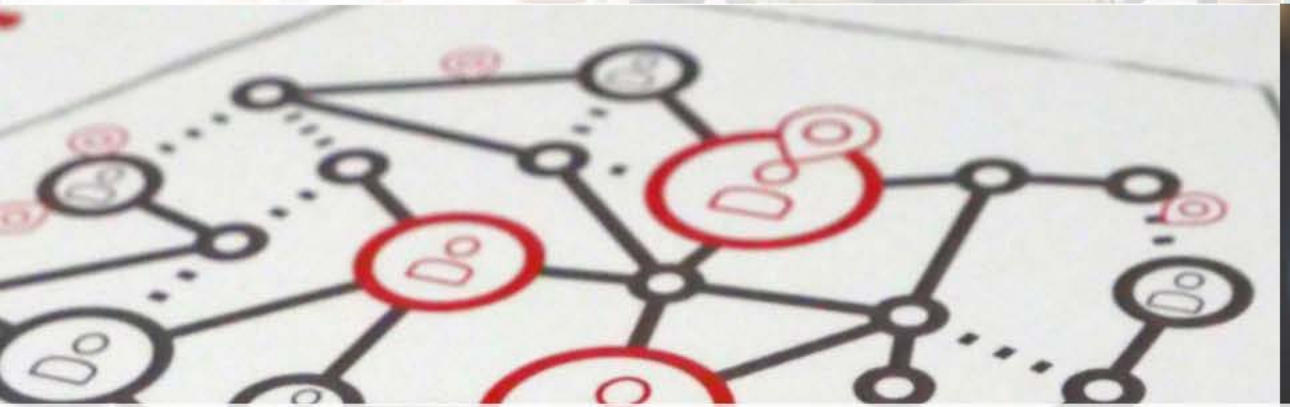
METID LEARNING INNOVATION



MOOC "Progettare l'Innovazione Didattica"

Applications to support the Learning Innovation - campus licences

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Let’s dig deeper …

METID – Structure and Staff

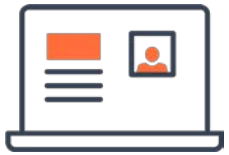
- **Internal staff: 18**
- **External experts: 8**

Project Manager

Visual Designer

Content Manager

Community Manager



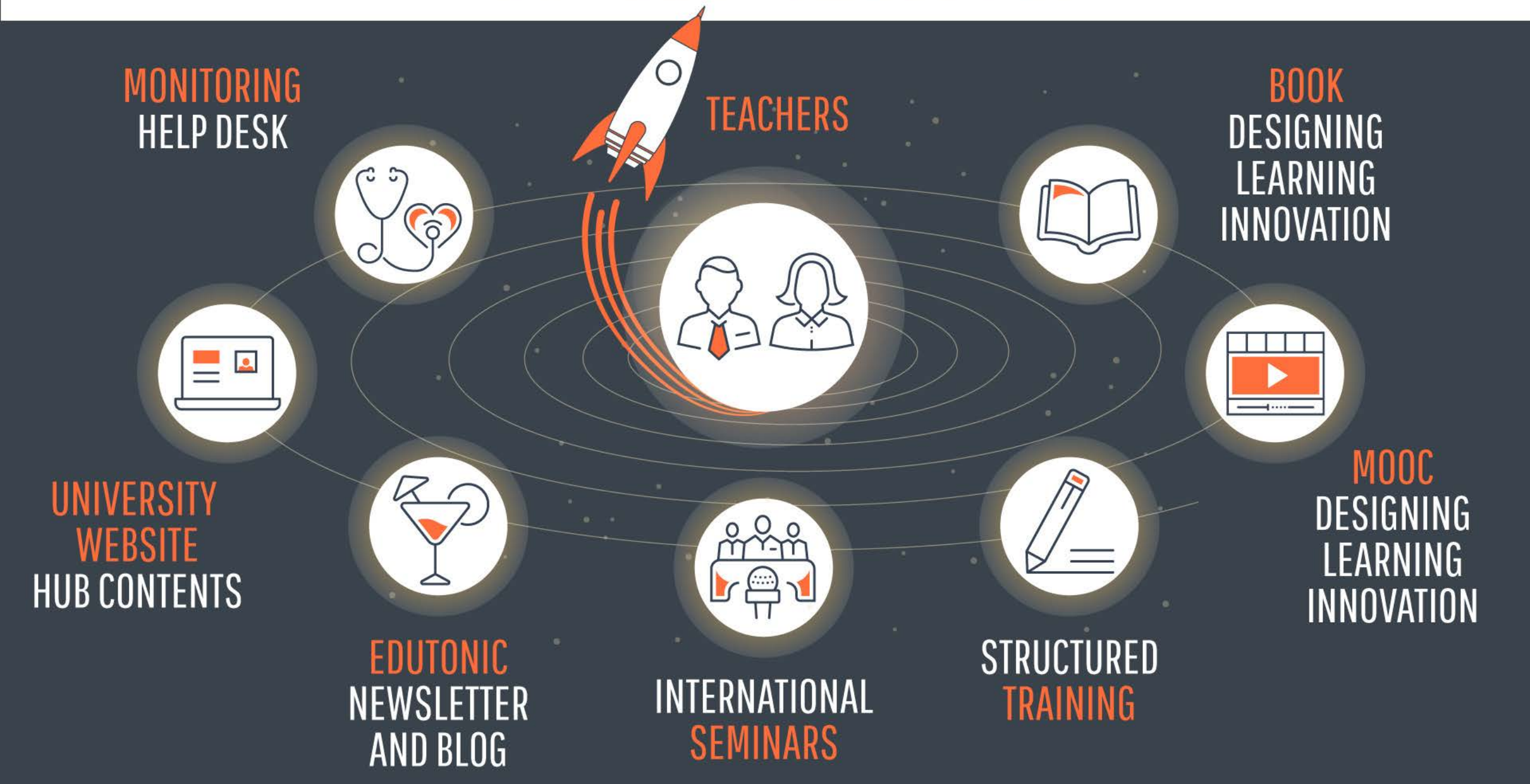
IT Experts

Administrative Staff

METID – Projects

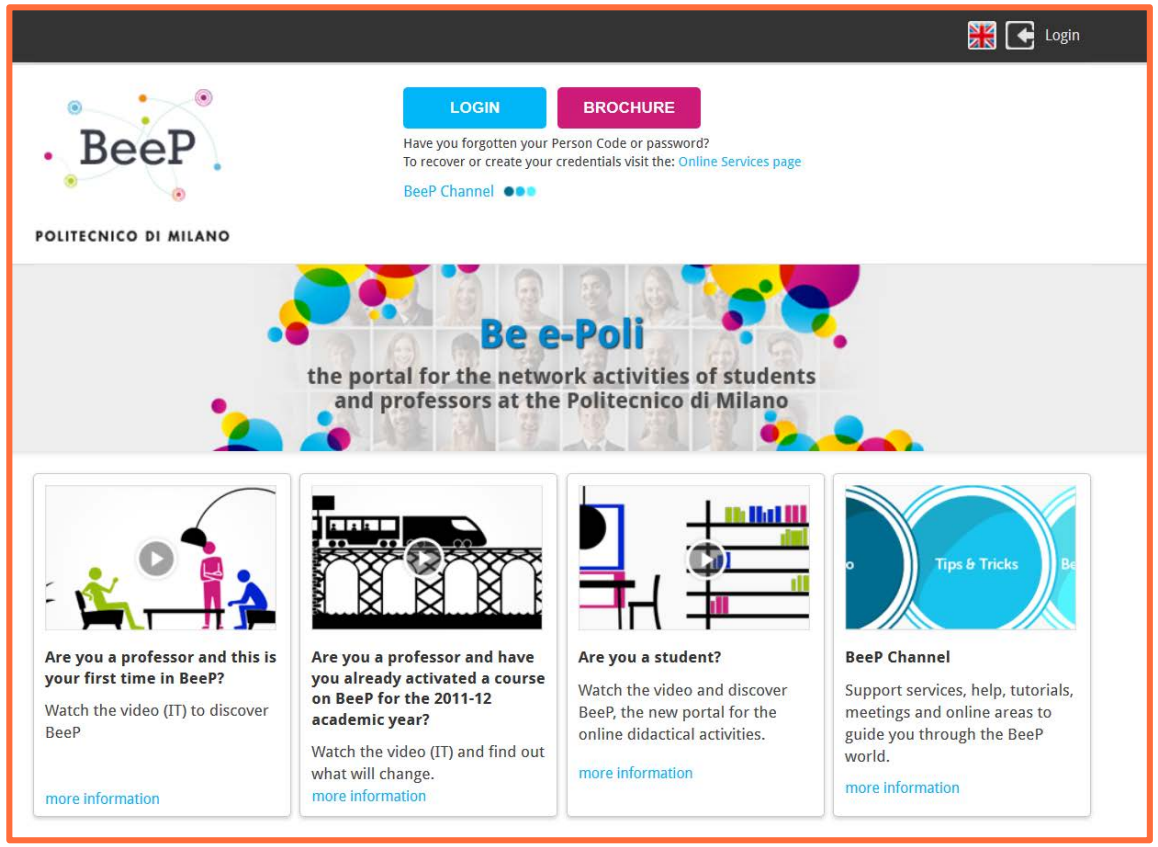
- National
- International

FACULTY DEVELOPMENT ECOSYSTEM



BeeP

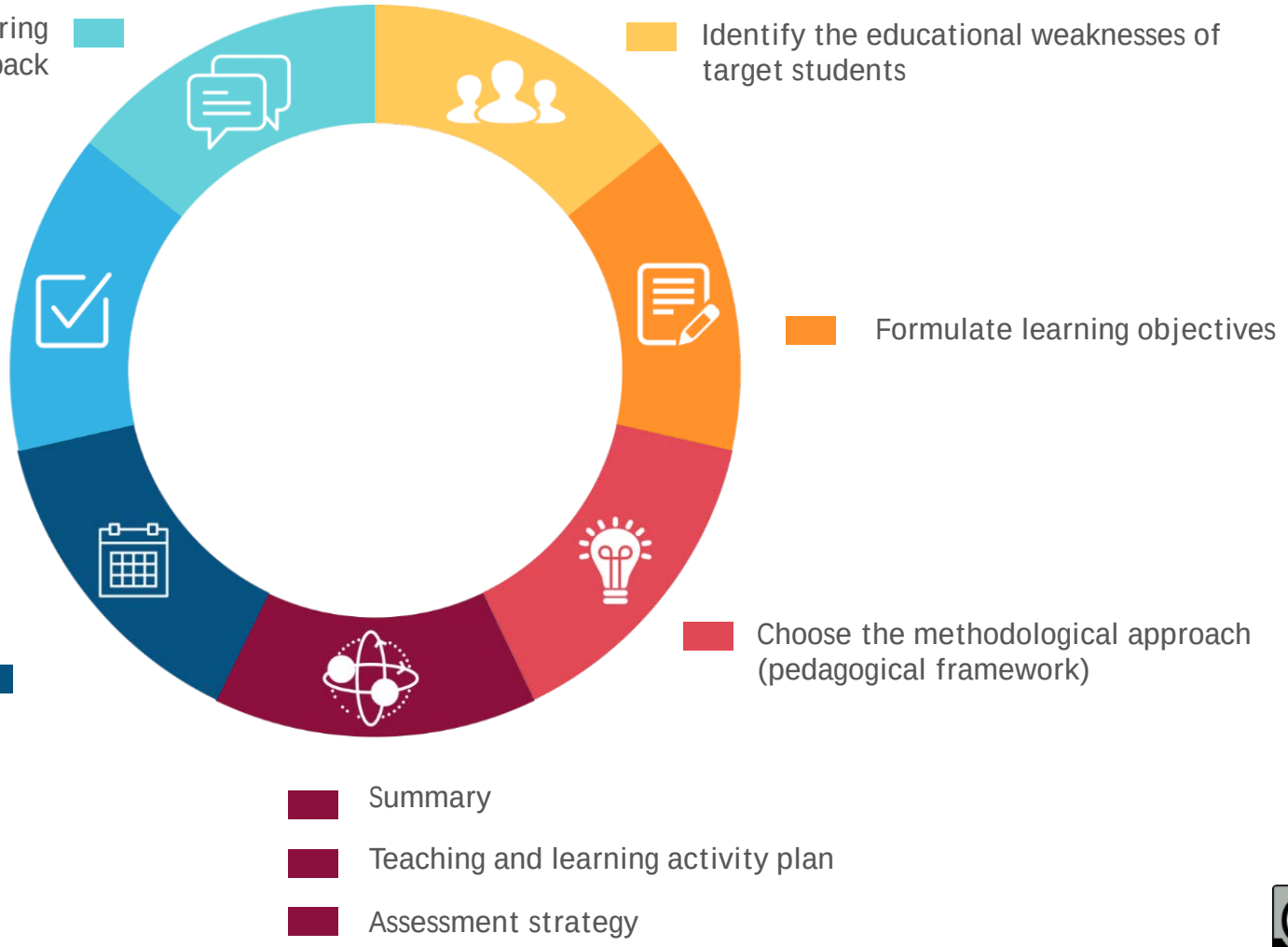
Portal for students' and teachers' online activities



- 50,000 **students**
- 13,000 **courses**
- **Sessions**

  Since 2011: 45,000,000
  a.y. 2018/2019: 8,000,000
  Daily accesses:
  15,000-20,000 (max 48,000)
  Simultaneous accesses:
  300-500 (max 800)

Key steps to design and implement a MOOC



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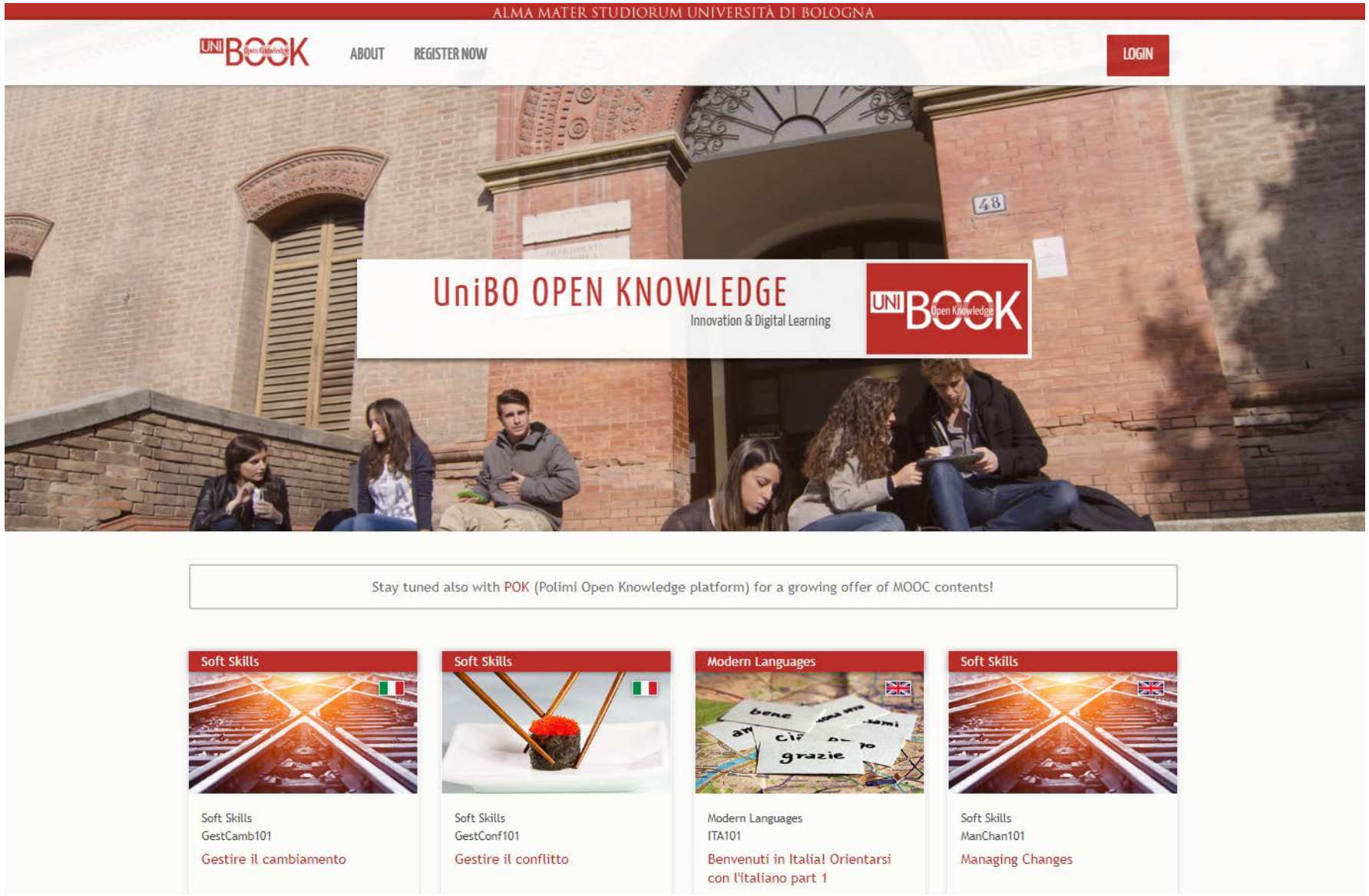
UniBOOK – Alma Mater Bologna



Coursera

coursera Explore politecnico di milano For Enterprise Daniela

Primary Languages

- Italian 3
- English 2

Subtitle Languages

- Spanish 1

All Topics

- Physical Science and Engineering 3
- Arts and Humanities 1
- Computer Science 1

Courses & Specializations

Archaeoastronomy

Course · Politecnico di Milano

FPGA computing systems: Background knowledge and introductory materials

Course · Politecnico di Milano

Introduzione alla Storia dell'Architettura Contemporanea

Course · Politecnico di Milano

Introduzione alla fisica sperimentale: elettromagnetismo, ottica, fisica moderna

Course · Politecnico di Milano

Online Degree in Computer Engineering - www.laureaonline.polimi.it

180 students
(AY 2017-2018)
230 graduates

MOOC SERIES: Introduction to Management Engineering

FINANCIAL AND MANAGEMENT ACCOUNTING

FUNDAMENTALS OF STRATEGY

ECONOMICS Polimi + MIT OpenCourseWare

FUNDAMENTALS OF ORGANIZATION

FUNDAMENTALS OF OPERATIONS

MOOCS FOR THE ALIGNMENT OF ENTRY SKILLS

Requirement to pass specific MOOCs
for students from other degrees
or from other universities

Certificate check of the assigned MOOCs
to be able to access some courses' exams

5,000 students enrolled (from May 2018 to May 2019)

+220 videos (23 h)

1,800 certificates

MOOC SUPPORTING THE FLIPPED CLASSROOM

COURSE STRUCTURE

FIRST PART	
week 1	week 2
week 3	week 4

SECOND PART	
week 1	week 2
week 3	week 4

THIRD PART	
week 1	week 2
week 3	week 4

FOURTH PART	
week 1	week 2
week 3	week 4

FLIPPED CLASSROOM

AT HOME

week 1 - 2

STUDENTS:

- Study the materials
- Do the quizzes

IN CLASS

week 3

TEACHER:

- Gets back to the topics and answers the question

IN CLASS

week 4

STUDENTS:

1/4 exam

- 30’ written exam
- 2h competition in teams

STRUTTURA DEL CORSO

THEORETICAL LESSONS

Renato Mazzoncini

PROJECT WORK TRANSDISCIPLINARY

GROUPS OF 3 — mechanical eng. +management eng. +electrical eng.

PROJECTS TUTORS — 2 researchers

13 COMPANIES — Confrontation with technicians, Company tours

FINAL PRESENTATIONS

THEMATIC DEEPENINGS

WEEK 1 Company manager 1

THEMATIC DEEPENINGS

WEEK 2 Company manager 2

THEMATIC DEEPENINGS

WEEK 3 Company manager 3

THEMATIC DEEPENINGS

WEEK 4 Company manager 4

Raising Awareness of OER

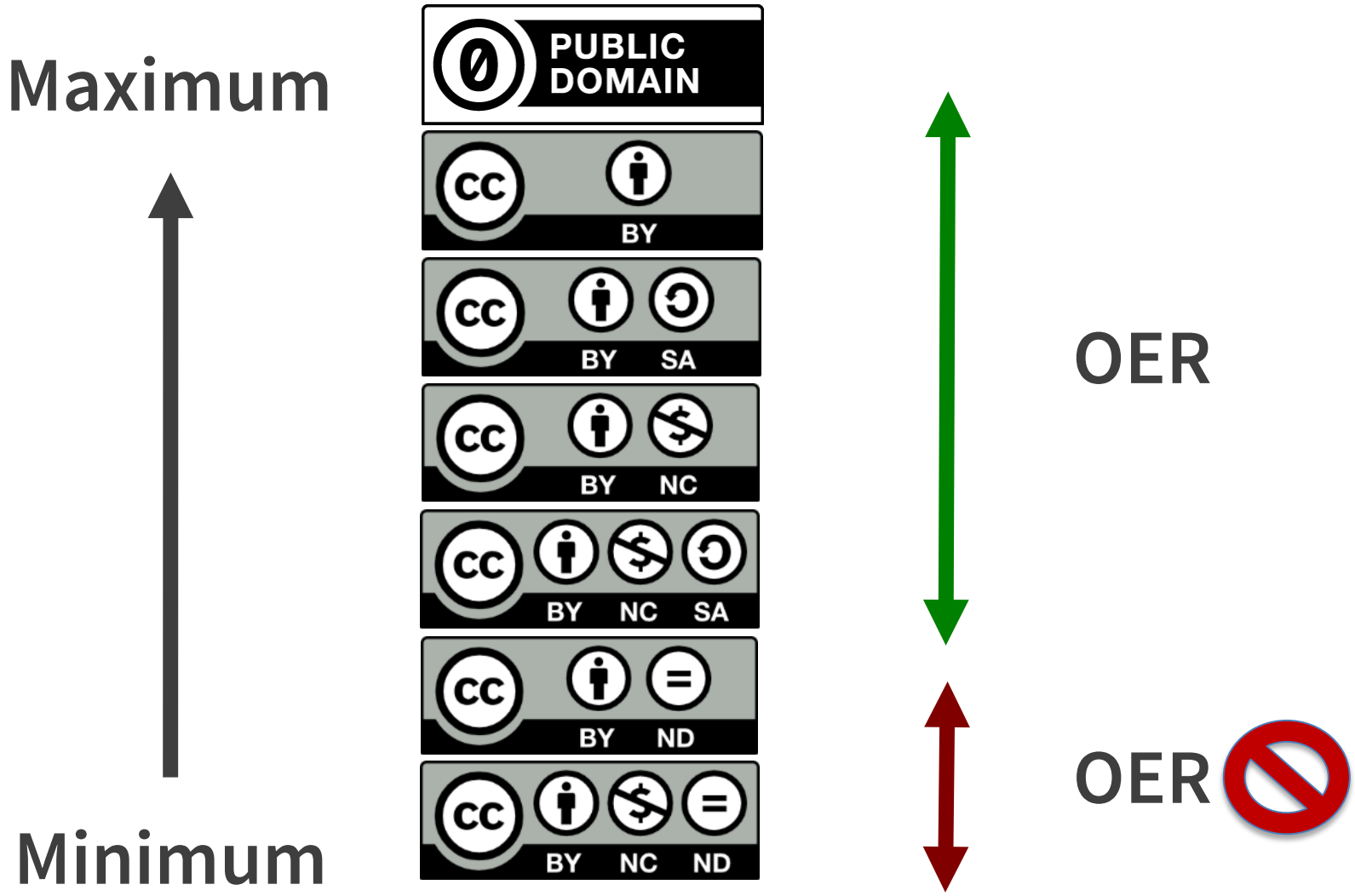
Open Educational Resources are the result of a different approach to education: the focus is on sharing, improving and reusing educational materials created by people (not only super-experts) who are willing to let knowledge spread and be used by anyone.

Course Number	OER101
Classes Start	Mar 22, 2019
Classes End	Sep 01, 2019
Estimated Effort	1-2 hour/week
Language	English

MOOCs For Teachers

OER and Creative Commons Licenses

UNESCO
"OER are teaching, learning and research materials in any medium, digital or otherwise, that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation and redistribution by others with no or limited restrictions."



Where to find Open Educational Resources?

OCW @MIT	OCW @TUDelft	Merlot	Creative Commons Search tool
The most known OER repository promoted by MIT (from 2001) * Section for *educators* and teaching and learning approaches	The richest European repository, by TU Delft (from 2008)	Inter-institutional Repository by California State University Center (from 1997) *with a tool to create and share resources and web pages	Creative Commons search engine (always in evolution)

Where to find OER? Textbooks, simulations, STEM content…

BC Campus OpenEd	OpenStax	PhET	UCI Open
Promoted by the Canadian Ministry of Education (British Columbia-Canada) to share Open textbook on several topics, with peer review service.	Promoted by Rice University, with the mission to support global open access	University of Colorado repository of interactive simulation (scientific and math topics),	University of California, Irvine, Open CourseWare, started with OpenChem (chemistry) and now expanding towards new topics

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STUDENTS | FACULTY

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Adopt

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FACULTY

Adapt

a Textbook

Adapt

Take advantage of the open textbook Creative Commons license and customize an open textbook to fit your specific needs. See Support for Adapting an Open Textbook for a list of resources to help you modify an existing open textbook.

OPEN EDUCATION FOR AN OPEN FUTURE

Open Education Global Conference

26-28 November 2019

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