EXTEND

# Training materials for EXTEND centres

D2.1 (B) Set of materials presented by EU partners during the project meetings that can be further used by EXTEND centres in their training activities

March 2019

Co-funded by the Erasmus+ Programme of the European Union

# Training materials for EXTEND Centres

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# Training materials for EXTEND Centres

## Background

In the context of the activities of WP2 [Establishment of Engineering Teaching and Learning Excellence Centers (EXTEND centres) in PCs] it was expected to develop the task 2.2 Develop and set-up of EXTEND centres including development of documentation, intake and training of staff for the centres. People, knowledge and facilities are connected within the centres, allowing for the creation of new connections and solutions.

This document presents the training material developed by the European partners while helping the Higher Education institutions of partner countries developing their staff. This part of the project will prepare colleagues from Higher Education institutions of partner countries to involve themselves in the process and later on to create and develop the centres.

The list of training materials from each training session, shared in the annexes, is presented in the following page.

**D2.1 (B) Set of materials for EXTEND centres**

# Training materials for EXTEND Centres

## List of training materials

| Year | Month | Meeting | Deliverable from | Training description | File Name |
|---|---|---|---|---|---|
| 2018 | 3 | Saransk | UMinho - Assunção Flores | Session 1 - Learning Outcomes | 2018_3_Saransk_UMinho_Session1_LOs.pdf |
| 2018 | 3 | Saransk | UMinho - Assunção Flores | Session 2 - Assessment | 2018_3_Saransk_UMinho_Session2_Assessment.pdf |
| 2018 | 3 | Saransk | UPB – Elisabeth Lazarou and Laura Trifan | Session 1 - Quality Assurance (QA) for Teaching and Learning Developing of QA framework | 2018_3_SARANSK_UPB_Session1_Quality_Assurance_Teaching_Learning |
| 2018 | 3 | Saransk | UPB - Elisabeth Lazarou | Session 2 - Technology-enhanced learning (TEL) | 2018_3_SARANSK_UPB_Session2_TechnologyEnhancedLearning |
| 2018 | 3 | Saransk | UPB - Maria Dascalu | Session 3 - Introduction to QA – Competences descriptors for engineering disciplines | 2018_3_SARANSK_UPB_SESSION3_QA_CompDescriptors |
| 2018 | 3 | Saransk | UPB - Maria Dascalu | Session 4 - Technology-enhanced Teaching | 2018_3_SARANSK_UPB_SESSION4_TechEnhancedTeaching |
| 2018 | 6 | Bucharest | UMinho - Rui Lima, Diana Mesquita | Session 1 - Engineering Education Research | 2018_6_BUCHAREST_UMinho_Session1_EER.pdf |
| 2018 | 6 | Bucharest | UMinho - Rui Lima, Diana Mesquita | Session 2 - Project Based Learning | 2018_6_BUCHAREST_UMinho_Session2_PBL.pdf |
| 2018 | 6 | Bucharest | UMinho - Rui Lima, Diana Mesquita | Session 3 - Curriculum | 2018_6_BUCHAREST_UMinho_Session3_Curriculum.pdf |
| 2018 | 6 | Bucharest | UMinho - Rui Lima, Diana Mesquita | Session 4 - Teacher Professional Development - sharing models | 2018_6_BUCHAREST_UMinho_Session4_TeacherProfessionalDevelopment.pdf |
| 2018 | 6 | Bucharest | UPB - Maria Dascalu, Elizabeth Lazarou, Laura Trifan | Session 1 - Best practices | 2018_6_BUCHAREST_UPB_SESSION1_BestPractices |
| 2018 | 6 | Bucharest | UW - Robin Clark | Session 1 - Teacher Professional Development | 2018_6_BUCHAREST_UWarwick_Session1_TeacherProfessionalDevelopment.pdf |
| 2018 | 10 | Khujand | UMinho - Rui Lima, Diana Mesquita | Session 1 - Teachers' Competences for Excellence in Engineering Education | 2018_10_KHUJAND_UMinho_Session1_TeachersCompetences.pdf |
| 2018 | 10 | Khujand | UMinho - Rui Lima, Diana Mesquita | Session 2 - PBL & curriculum | 2018_10_KHUJAND_UMinho_Session2_PBL_&_Curriculum.pdf |
| 2018 | 10 | Khujand | UMinho - Rui Lima, Diana Mesquita | Session 3 - Teachers' Professional Development: EXTEND Centres | 2018_10_KHUJAND_UMinho_Session3_CentresTeachrProfDevelopment.pdf |
| 2018 | 10 | Khujand | UPB - Maria Dascalu | Session 1 - Ontologies for Curriculum Design | 2018_10_KHUJAND_UPB_SESSION1_OntoForCurriculumDesign |

EXTEND Co-funded by the Erasmus+ Programme of the European Union

# Competences and Learning Outcomes

UNIVERSITY OF MINHO
MARIA A. FLORES
RUI M. LIMA
DIANA MESQUITA

## Session Plan

| | |
|---|---|
| **90min** | **Topics:**<br>Higher Education and Bologna Process: inputs for competences and learning outcomes<br>Competences: conceptual overview and categories (e.g. Technical and Transversal competences)<br>Learning Outcomes (LO) : why and what for; curriculum alignment<br>Bloom taxonomy<br><br>**Discussion & Questions** |
| **60min** | **Working Session**<br>Review and/or define the Learning Outcomes for a specific course |
| **30min** | **Wrap up/Discussion & Questions** |



## Introduction: Higher Education in Europe

- **Bologna Process principles:** Quality, Mobility and Employability
- **Curricula and pedagogy innovation:** Developing Competences (Tuning Project - 2007)
- **Active Learning:** Student Centred Approach (Prince & Felder, 2006)

## Introduction: Higher Education in Europe

The Bologna Process has brought about changes with implications for teaching, learning and assessment methodologies. This "new" educational paradigm recognises the key role of students in their learning process based on autonomy, shared work and project-based work (Flores & Veiga Simão, 2007). Within this context, engineering curriculum was restructured and new teaching methodologies were introduced such as student-centred methodologies and project- based work, amongst others.



## For reflection…

**- What are the current challenges in teaching in Higher Education in the contexts in which you work?**

**- What kinds of curriculum design/curriculum documents do you use?**



## Glossary: Brainstorming…

Clarify the following concepts:

(1) Competence

(2) Curriculum

(3) Learning Outcomes

## (1) Competence

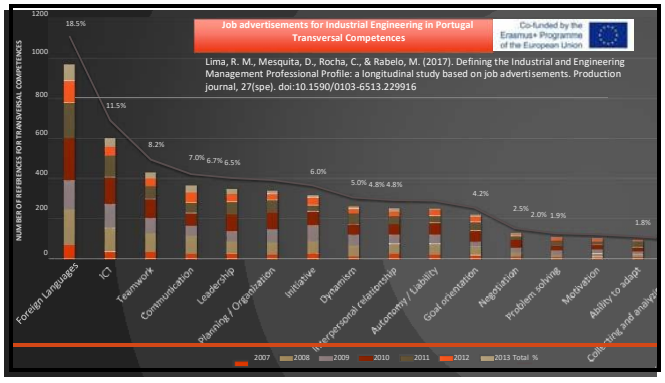
Teaching and Learning system based on the idea of **knowledge transfer**

transition

Teaching and Learning system based on the idea of **development of competences**

**Competence is the capacity to mobilize resources (knowledge, experiences, values,…) in specific contexts, to formulate and to solve problems.**
Le Boterf (1997, 2004, 2005); Zarifian (2001)






## (1) Competence

- Specific technical knowledge is not enough for engineering practice
(Nair & Mertova, 2009; Stiwne & Jungert, 2010; Tymon, 2013; Mesquita et al., 2015)

| | |
|---|---|
| Technical Competences | **Specific of each area of knowledge (expertise)** Examples: design a production cell; developing simulation models |
| Transversal Competences also known as "generic", "professional" or "soft skills" | **Relevant in all areas of knowledge** Examples: communication skills; teamwork; leadership. |

## (1) Competence

The contexts of the professional practice requires the combination of both types of competences:
**Technical and Transversal**

**Example:** John is an engineer and today he has to present the results of the month in the general meeting where the CEO is attending. So, he needs to communicate effectively (transversal competences) and also to demonstrate knowledge related to his engineering practice (technical competences).



## Brainstorming …

**In the context of your course/program:**

- What are the main competences (technical and transversal) that you expected your students to develop?
- How do students develop or can develop these competences?
- Which are the strategies used for developing these competences? (examples)



## (2) Curriculum

Curriculum development enables the **conditions, situations, experiences and opportunities** for students to develop competences related to their professional practice.

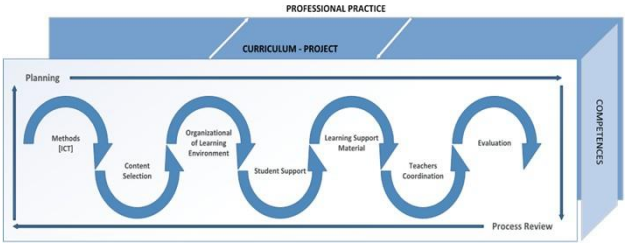
"engineering curricula play an important, if not crucial, role in the education process of professional engineers" (Boud et al., 2009, p. 491).

## (2) Curriculum

**Curriculum is more than the program plan with the different courses.**
**It entails an integrated project, which must include student profile: experiences, contents, competences, values, strategies, resources, assessment…**
Zabalza (2009)

**Curriculum + Competences + Professional Practice**






Mesquita (2015) - Model of Curriculum Development inspired in the ten criteria to assess quality of teaching in Higher Education – Zabalza, 2009



## The Importance of Planning!

**Key-competence in teaching** (Biggs & Tang, 2011)

- Activities and Strategies; Contents; Learning Environment; Student Support (e.g. tutorials); Learning Materials; Evaluation; …

**Road Map : Where are we? Where are going to?**

- must be flexible
- must be intentional (what for?)
- must be clear for students

## (3) Learning Outcomes

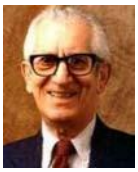
**Learning Outcomes are "statements of what a learner is expected to know, understand and/or be able to demonstrate after a completion of a process of learning".** CEDEFOP (2009)

- Requirements that are needed to develop during learning process in the context of a course **("At the end of this course the students must…")**
- Description should include the competences that are students are expected to develop
- Suggest an action (be observable) = **Statement starts with a verb**



## (3) Learning Outcomes

**How to define the Learning Outcomes?**



**BLOOM'S TAXONOMY**
Bloom, B. (1979). Taxonomy of Educational Objectives. Handbook 1: Cognitive Domain. New York: David McKay.

**Benjamin Bloom** – Original (1956) and Revised (2001)

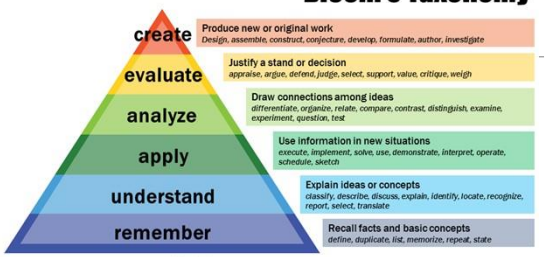
**Framework to promote higher forms of thinking in education**

Helps teachers to design valid assessment tasks and strategies considering the objectives defined **(curriculum alignment)**



Source: cft.vanderbilt.edu/guides-sub-pages/blooms-taxonomy/

## Bloom's Taxonomy




Vanderbilt University Center for Teaching

**Remember – recall facts and basic concepts**

**Examples:** Recognizing; Recalling; Identifying; Defining; …

**Understand – explain ideas and concepts**

**Examples:** Interpreting; Exemplifying; Classifying; Summarizing; Inferring; Comparing; Explaining; …

**Apply – use information in new situations**

**Examples:** Executing; Implementing; Solving; …

**Analyze – Draw connection among ideas**

**Examples:** Differentiating; Organizing; Attributing; …

**Evaluate – Justify a stand or decision**

**Examples:** Checking; Critiquing; Arguing; …

**Create – Produce new or original work**

**Examples:** Generating; Planning; Producing; …



## Assignment

**Review and/or define the Learning Outcomes for a specific course using Blooms' Taxonomy.**

**Deliverable – Word Template**

To be used in both sessions: Tuesday and Thursday

Final feedback: to be sent via email



## Future Work

**How to assess the learning outcomes?**

- Thursday: 1st March

**- Further questions and comments:**

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# References


CEDEFOP. (2009). The shift to learning outcomes. Policies and Practices in Europe (978-92-896-0576-2). Retrieved from Thessaloniki, Greece: http://www.cedefop.europa.eu/EN/Files/5501_en.pdf

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Zarifian, P. (2001). Objetivo competência: por uma nova lógica. São Paulo: Atlas.

Prince, M., & Felder, R. (2006). Inductive Teaching and Learning Methods: Definitions, Comparisons, and Research Bases. Journal of Engineering Education, 95(2), 123-138.

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Boud, F., Bayard, O., Chatti, S., Axinte, D., Nicolescu, M., & Agirre, J. (2009). A new approach in standardising a European curriculum in production engineering. European Journal of Engineering Education, 34(6), 487-496.

Tuning. (2007). Tuning Project Report : General Brochure final version J. González & R. Wagenaar (Eds.), Retrieved from http://www.unideusto.org/tuning/eu/images/stories/documents/General_Brochure_final_version.pdf

Lima, R. M., Mesquita, D., Rocha, C., & Rabelo, M. (2017). Defining the Industrial and Engineering Management Professional Profile: a longitudinal study based on job advertisements. Production Journal, 27(spe). doi:10.1590/0103-6513.221810

Tymon, A. (2013). The student perspective on employability. Studies in Higher Education, 38(6), 841-856.

Nair, C., Patil, A., & Mertova, P. (2009). Re-engineering graduate skills – a case study. European Journal of Engineering Education, 34(2), 131-139.

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Stiwne, E., & Jungert, T. (2010). Engineering students' experiences of transition from study to work. Journal of Education and Work, 23(5), 417-437.

Mesquita, D. (2015). O currículo da formação em Engenharia no âmbito do Processo de Bolonha: desenvolvimento de competências e perfil profissional na perspetiva dos docentes, dos estudantes e dos profissionais. (Doutoramento em Ciências da Educação, especialidade em Desenvolvimento Curricular), Universidade do Minho, Braga. (http://hdl.handle.net/1822/40379)

Bloom, B. (1979). Taxonomy of Educational Objectives. Handbook 1: Cognitive Domain. New York: David McKay.

| Course Overview | |
|---|---|
| **Name** | |
| **Brief Description** | |
| **Program** | |
| **Semester** | |
| **Number of Hours** | |
| **Number of Students** | |
| **Teacher(s)** | |

| Learning Outcomes |
|---|
| **At the end of the course the students must…** |
| |

# GLOSSARY: RETRIEVED FROM THE PROJECT: UNITED NATIONS DEVELOPMENT PROGRAM COLOMBIA (UNDP) PEGEL PROGRAM, ON DELIVERING ELECTRONIC GOVERNANCE- AND GOVERNMENT CHIEF INFORMATION OFFICER-RELATED EDUCATION IN COLOMBIA, INTERNATIONAL COURSES FOR CIO, FEBRUARY 2016.

| CONCEPT | WORKING DEFINITION | REFERENCES |
|---|---|---|
| **Assessment** | Assessment is as an integral component of curriculum and instruction planning. It is used to assess students' learning and to determine to what extent the course goals are met. | Tyler, R. W. (1949). *Basic principles of curriculum and instruction*. Chicago: University of Chicago Press.<br><br>Ribeiro, A. C. (1999). *Desenvolvimento Curricular*. Lisboa: Texto Editora. |
| **Competence** | Mobilization of resources (knowledge, previous experiences, values, and abilities) in given specific contexts (e.g. academic or professional). In other words, competences are associated with how to do things and how to act in a complex situation or problem. | Le Boterf, G. (1997). *De la compétence à la navigation professiionelle*. Paris: Les Éditions d' Organisation.<br><br>Le Boterf, G. (2005). *Construir as competências individuais e coletivas. Resposta a 80 questões*. Porto: Edições Asa.<br><br>Perrenoud, P. (2004). De uma metáfora a outra: transferir ou mobilizar conhecimentos? In J. Dolz & E. Ollagnier (Eds.), *O enigma da competência em educação* (pp. 47-63). Porto Alegre: Artmed. |
| **Course or Curricular Unit** | A course is a unit of teaching that typically lasts an academic term, and it is led by one or more instructors or professors. It usually refers to a given subject. Students may receive a grade or a number of credits after completion of the course or curricular unit. In the UK it is synonymous with module as course refers to program (see below). | Biggs, J. (2003). *Teaching for quality learning at university*. Maidenhead: SRHE & Open University Press.<br><br>Ribeiro, A. C. (1999). *Desenvolvimento Curricular*. Lisboa: Texto Editora. |
| **Curriculum** | Curriculum is understood as a project and includes the teaching and learning experiences, the process of its development (design, development and evaluation) and the following key elements (objectives, content, resources, assessment and teaching and learning strategies), in order for students to develop knowledge and competencies related to a given area/domain. | Zabalza, M. (2009). *Competencias docentes del profesorado universitario: calidad y desarrollo profesional* (2nd ed.). Madrid: Narcea.<br><br>Barnett, R., Parry, G., & Coate, K. (2001). Conceptualising Curriculum Change. *Teaching in Higher Education*, *6*(4), 435-449.<br><br>Gimeno, J. (1988). *El curriculum: una reflexion sobre la practica*. Madrid: Ediciones Morata. |

| | | |
|---|---|---|
| **Curriculum Plan** | The Curriculum Plan is the planning document which establishes the key domains and strategies for curriculum development, ECTS, curriculum structure and organization and ways of conducting the teaching and learning process as well as assessment of students' learning.<br><br>The Curriculum Plan highlights a structured set of courses with different weight distributed throughout given academic years, weekly academic schedule and credit units. | Ribeiro, A. C. (1999). *Desenvolvimento Curricular*. Lisboa: Texto Editora. |
| **Evaluation** | Systematic and dynamic collection of useful information about the activities, characteristics and outcomes of programs to make judgments about them (impact), improve their effectiveness, and/or inform decisions about future programming. | Patton, Q. M. (1997). *Utilization focused evaluation: The new century text* (3rd Ed.). London: Sage Publications.<br><br>Stufflebeam, D., & Shinkfield, A. (1993). *Evaluación sistemática: guía teórica y práctica.* Madrid: Paidós.<br><br>Joint Committee on Standards for Educational Evaluation. (1981). *Standards for evaluations of educational programs, projects, and materials*. New York: McGraw-Hill.<br><br>Joint Committee on Standards for Educational Evaluation. (1988). *The personnel evaluation standards: How to assess systems for evaluating educators*. Newbury Park, CA: Sage.<br><br>Joint Committee on Standards for Educational Evaluation. (1994). *The program evaluation standards: How to assess evaluations of educational programs*. Thousand Oaks, CA: Sage. |
| **Learning Outcomes** | Statements of what a learner is expected to know, understand and/or be able to demonstrate after a completion of a process of learning. | CEDEFOP. (2009). The shift to learning outcomes Policies and practices in Europe, from http://www.cedefop.europa.eu/en/publications-and-~~resources/publications/3054~~ |
| **Professional Profile** | Ii is the first dimension to consider in curriculum design, in order to guide the selection of contents, learning strategies and practices, strategies and evaluation.<br><br>The professional profile implies the definition of areas of knowledge, roles and activities related to professional practice and the competencies that | Zabalza, M. (2009). *Competencias docentes del profesorado universitario: calidad y desarrollo profesional* (2nd ed.). Madrid: Narcea.<br><br>Lima, R. M., Mesquita, D., Amorim, M., Jonker, G., & Flores, M. A. (2012). An Analysis of Knowledge Areas in Industrial Engineering and |

| | | |
|---|---|---|
| | need to be mobilized within the professional contexts. | Management Curriculum. *International Journal of Industrial Engineering and Management, 3*(2), 75-82.<br><br>Lima, R. M., Mesquita, D., & Rocha, C. (2015). Defining the Industrial and Engineering Management Professional Profile: a longitudinal study based on job offers. *Engineering Management Journal* (EMJ) [submitted]. |
| **Program** | It is a project of education or training in a given field of knowledge (usually at higher education). It implies the definition of the professional profile to be developed and it is designed for training (knowledge, skills, and professional behavior) in a given domain (ex. Arts or Sciences). It also includes a number of curricular units or courses, credits and given ways of structuring and organizing them throughout the duration of the program. | Biggs, J. (2003). *Teaching for quality learning at university*. Maidenhead: SRHE & Open University Press.<br><br>Ribeiro, A. C. (1999). *Desenvolvimento Curricular*. Lisboa: Texto Editora |
| **Syllabus** | Usually the syllabus is an outline and summary of topics to be covered in a particular course. However, it also should include learning goals, teaching and learning activities in articulation with assignments and resources, namely bibliography. "It communicates the overall pattern of the course so a course does not feel like disjointed assignments and activities, but instead an organized and meaningful journey. In particular, a good syllabus clarifies the relationship between goals and assignments." (Slattery & Carlson, 2005: 159)<br><br>Syllabus sets the tone for a course, motivates students to set achievable goals, serves as a planning tool for faculty, structures students' work, helps faculty plan and meet course goals in a timely manner, serves as a contract between faculty and students about what students can expect from faculty and vice versa, and is a portfolio artifact for tenure, promotion, or job applications. | Slattery, J. M., & Carlson, J. F. (2005). Preparing An Effective Syllabus: Current Best Practices. *College Teaching*, *53*(4), 159-164.<br><br>Littlefield, V. M. (1999). My syllabus? It's fine. Why do you ask? Or the syllabus: A tool for improving teaching and learning. Paper presented at the Society for Teaching and Learning in Higher Education, Calgary, Canada. |

EXTEND Co-funded by the Erasmus+ Programme of the European Union

# Assessment in Higher Education

UNIVERSITY OF MINHO
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RUI M. LIMA
DIANA MESQUITA

## Session Plan

| | |
|---|---|
| **90min** | **Topics:**<br>Assessment: concept and functions<br>Modes and methods<br><br>**Discussion & Questions** |
| **60min** | **Working Session**<br>Review and/or define assessment methods for a specific course |
| **30min** | **Wrap up/Discussion & Questions** |



## Introduction: Assessment

Assessment has significant effects on student learning, (Gibbs 1999; Scouller 1998) as assessment and learning are closely related (Light and Cox 2003; Scouller 1998).

The teaching methods must be aligned with assessment methods and learning goals for teaching effectiveness to be enhanced (Biggs 2003).

## Introduction: Assessment

Assessment – Most important element for students

LO – Most important element for teachers

(Biggs, 2003)



## Introduction: Assessment

The ways in which students look at assessment impact on their approaches to learning (Boud and Falchikov 2006, Fletcher et al 2012)

The ways in which teachers see assessment influence the assessment practices they use and how they relate assessment to the teaching and learning process (Fletcher et al 2012; Swann and Ecclestone 1999; Samuelowicz and Bain 2002).



## For reflection…

**- What kinds of assessment methods do I use in my context? Why?**

**- What the main difficulties or challenges do I face in assessing my students' learning?**

## Introduction: Assessment

Samuelowicz and Bain (2002, p. 181) found that different teachers' orientations or beliefs result in different assessment practices.

Teachers who see the teaching and learning process as reproduction or transmission of knowledge view assessment as students' ability to reproduce the knowledge acquired. In contrast, teachers who see teaching as facilitating learning and promoting critical thinking view assessment as transformation of knowledge and as an integral part of the teaching and learning process.



## Introduction: Assessment

Assessment has developed according to different understandings and conceptions such as *assessment as a tool for learning* (Dochy and McDowell 1997) *as improvement for teaching and learning* (Brown, Lake and Matters 2011) and *learner-centred assessment* (Webber 2012).



## Functions and Modes of assessment

Hadji (1994) suggests that assessment has three main functions, corresponding to three main different goals:

- the purpose of *certification* associated with *summative assessment*;
- the purpose of *regulation* associated with *formative assessment*;
- the purpose of *guidance* associated with *diagnostic or prognostic assessment*.

## Functions and Modes of assessment

Formative assessment has a pedagogical propose and is inherent to the process of teaching itself (Brown and Knight 1994; Hadji 1994).

The formative role of assessment is important to improve learning, because it provides students with feedback during the process of learning (Brown, Bull and Pendlebury 1997).

It also allows them to have opportunities to improve (Brown, Race and Rust 2004) making it possible for both students and teachers to get to know how learning is proceeding (Biggs 2003), its successes and difficulties.



## Assessment methods

- **What kinds of assessment modes do I use in my teaching?**
- **What would I like to do differently? Why?**
- **Do I use feedback? How? Why?**



## Functions and Modes of assessment

Self-assessment and peer assessment

Earlier empirical work (Sambell, McDowell and Brown 1997) shows that students have a negative opinion about traditional assessment methods (namely written tests and exams), considering that they affect negatively the learning process as they tend to promote memorisation rather than understanding.

Segers and Dochy (2001) have shown that students have positive perceptions about the use of self and peer assessment in a problem-based learning environment in so far as they stimulate deep learning and critical thinking.

## Functions and Modes of assessment

The so-called learner-centred methods foster the development of autonomy, sense of responsibility, and reflection (Sambell and McDoweel 1997) and influence the ways in which students look at their own learning (Sluijsmans, Dochy and Moerkerke 1999).

However, the non-traditional methods do not always change the perceptions of students and do not always lead to deep learning (Segers, Gijbels and Thurlings 2008).

In fact, students' approaches to learning (Marton and Saljo 1997) may be influenced by the assessment methods and assessment tasks (Struyven, Dochy and Janssens 2005).

A wide variety of methods should be used (Brown, Race and Rust 1995; Wen and Tsai 2006) and teachers should be designers of the assessment process avoiding the exclusive use of traditional assessment (Boud 1995).



## Functions and modes of assessment

The culture of traditional tests

A culture that fosters the integration of assessment, teaching and learning, through active involvement of students and assessment tasks (Sambell, MacDowell & Brown, 1997, Black and Wiliam, 1998).

## The importance of feedback

- Timely;
- Relevant;
- Suitable for the context;
- Recognised and understood by both students and teachers.

(Ramsden, 1996; Knight & Yorke, 2003; Orsmond, Merry, & Reiling, 2005; Flores et al, 2014; Pereira, et. 2016)

## Assessment for learning (Santos,Flores, Flores, Pereira & Dourado, 2017)

- Balance between formative and summative assessment;
- Formal and informal feedback mechanisms;
- Adjustment of teaching strategies and learning activities (continuous improvement);
- Students' learning and performance as a priority;
- Opportunities to try out and practice knowledge, skills and understanding;
- Authentic or relevant assessment tasks;
- Students' independence and autonomy.

(McDowell et al., 2011)

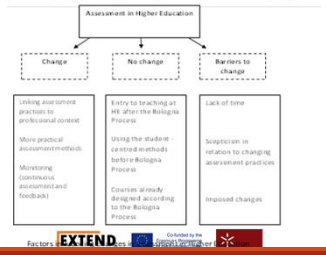
**More positive formative experiences:**

- Active engagement;
- Greater teacher support;
- Flexible curricular design;
- Dialogue opportunities;
- Peer learning;
- Research opportunities;
- Self-regulated learning.

(Black et al., 2002, 2005; McDowell et al., 2011)



## Changes in assessment (Pereira & Flores, 2014)




Factors

## Students' perceptions (Santos, Flores, Flores, Pereira, & Dourado, 2017)

| Item | Agree/ Strongly Agree |
|---|---|
| In making sense of new ideas, I have often related them to practical or real life contexts. | 83,3% |
| The feedback given on my work during the course helped me to improve ways of learning and studying. | 80,3% |
| I've been over the work I've done to check my reasoning and see that it makes sense. | 79,5% |
| This course seemed to be more about learning than jumping through assessment hoops. | 70,2% |
| I had to really understand the subject to get good marks in this course. | 68,8% |
| I was allowed some choice over what aspects of the course to concentrate on. | 66,2% |
| On the whole, I've been quite systematic and organised in my studying. | 53,9% |
| However | |
| I liked to be told precisely what to do in essays or other assignments. | 62,8% |
| I geared my studying closely to just what seems to be required for assignments and exams. | 57,7% |
| I've tended to take what we've been taught at face value without questioning it much. | 50,7% |

## Assessment methods (Pereira, Niklasson & Flores, 2017)

| | |
|---|---|
| Live presentations in group | 87,2% |
| Reports in group | 83,8% |
| Individual reports | 74% |
| Project in group | 67% |
| Practical or experimental work in group | 65,3% |
| Individual written reflections | 59,5% |
| Practical or experimental work individual | 52,6% |
| Group written reflections | 48% |
| Individual oral presentations | 28,9% |
| Individual project | 26,6% |
| Individual portfolio | 23,7% |
| Oral tests and oral examinations | 22% |
| The students are asked to perform self-assessment | 19,6% |
| Portfolios in group | 17,9% |
| The students are asked to perform peer assessment | 17,9% |



## Assessment methods

- **What do I want to assess?**

- **How am I going to do that?**



## Future Work

- **Further questions and comments:**

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| Course Overview | |
|---|---|
| **Name** | |
| **Brief Description** | |
| **Program** | |
| **Semester** | |
| **Number of Hours** | |
| **Number of Students** | |
| **Teacher(s)** | |

| Assessement |
|---|
| **Methods, modes and criteria** |
| |

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# Quality Assurance (QA) for Teaching and Learning
## Developing of QA framework

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**National Research Ogarev Mordovia State University (MRSU) Saransk, Russia**

teaching
outcomes
learning
Quality Assurance in Higher Education
learning environ-ments
context

# What is Quality?

**Q: What is quality for teaching and learning in higher education? (student and teacher perspective)**

**Q: What does it look like in practice?**

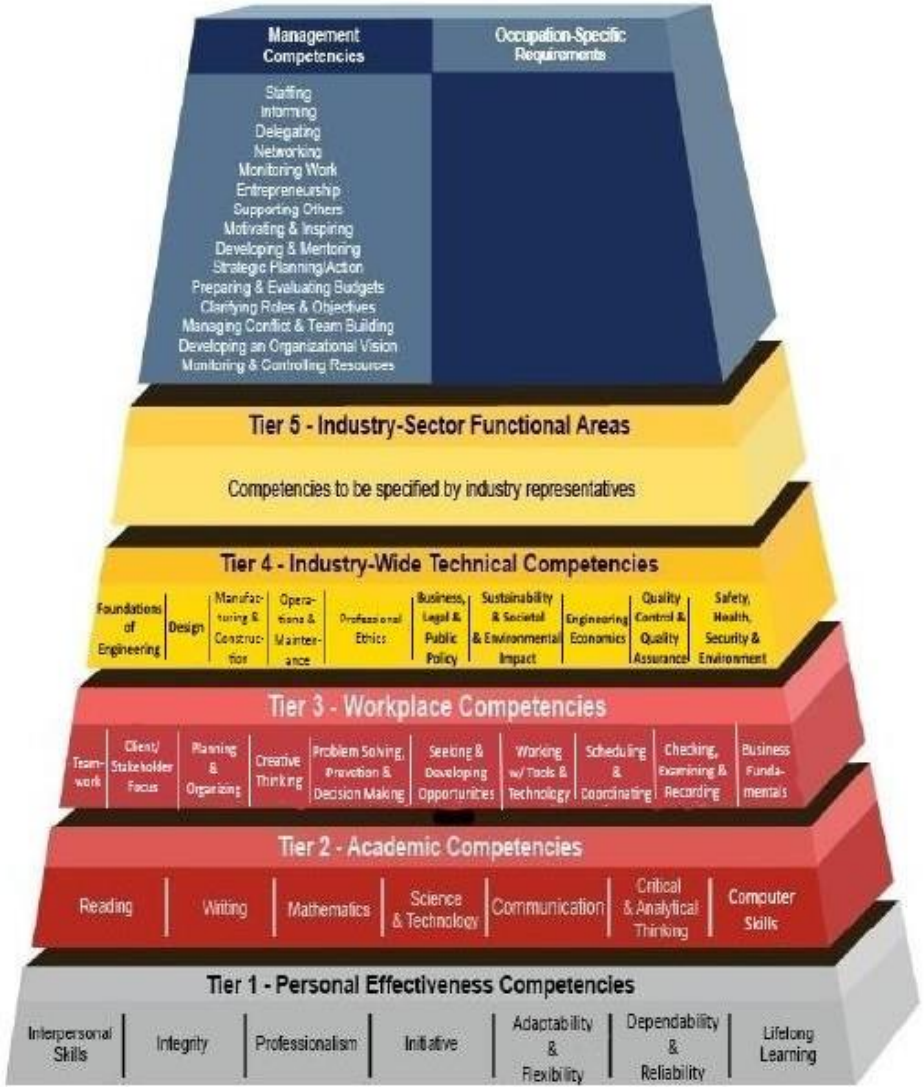
# Developing a Quality Assurance – FRAMEWORK for teaching and learning

This Framework relies on **Quality Commitments**:

- Providing high quality skills-based, **inclusive** learning experiences

(for the project – development of teaching materials and teacher training, platform etc.)

# Engineering Competency Model




www.doleta.gov

# Significance of inclusion

What do we mean by **inclusion**?

How do students inform you about their needs?

What kind of Special Educational Needs and Disabilities (SEND) did you have to deal with?

# Inclusive teaching - Embedding life-skills

| **Undergraduates´needs:** | **Postgraduates´ needs:** |
| --- | --- |
| | |
| | |
| | |

Q: What are the needs of your students? What would they expect for engaging in your lessons?

Q: Do you cover life skills in your curriculum? If so, how?

# Inclusive teaching - Embedding life-skills for inclusion

| **Undergraduates´needs:** | **Postgraduates´ needs:** |
|---|---|
| communication and language | work-life balance |
| social networking | social networking |
| employability | career development |
| academic literacy | academic literacy |
| using the library | mental health |
| mental health | |

Q: What are the needs of your students? What would they expect for engaging in your lessons?

Q: Do you cover life skills in your curriculum? If so, how?

# SWOT Analysis – QA Framework

Strenghts

Weaknesses

Opportunities

Threats

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# Technology-enhanced learning (TEL)

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# Why to use technology-enhanced Learning (TEL)?

- Tapping into young people's worlds
- Digital learners? – are students in touch with the world of ICT?
- Smart devices
- Social media

# Why use TEL?

- Thinking as a teacher, what are the benefits of using technology-enhanced learning?

- **In your groups, compile a list of between five and ten items.**

# Benefits

- Inclusion – students who struggle to engage in the classroom
- Stay in touch with what is going on beyond the classroom
- Instant communication
- Gives you a global perspective
- Worldwide access

www.doleta.gov

# Benefits (2)

- Can be a more engaging process of learning – interactive
- Leave work for students to catch up with – absences etc.
- Lecture capture
  - Reinforce learning
  - Students relive the moment!!

# Benefits (3)

- Multi-sensory tools for learning
- Define your own work hours (as can students)
- Automated systems record submission times
- Plagiarism software – e.g. Turnitin
  (Technology to improve student writing)

# Digital natives, digital immigrants (Prensky, 2001)

**Digital natives**
Born into it!

Take to technology like a fish to water

Naturally gifted – techno wizards!

digital natives- digital immigrants

Can you remember the first time you accessed the internet?

# Digital immigrants

- Are new(ish) to technology
- Have grown and adapted to a technological world, fitting in where they can
- Have to learn everything from scratch
- Take a long time to figure out how a program works and then only know it in a limited way

# Digital immigrants

- Reference materials: using books first then the internet second
- Technology: learning a new language
- Printing a document to revise/edit it rather than doing it on the screen

Digital immigrants ‘speak an outdated language [and] are struggling to teach a population that speaks an entirely new language’ (Prensky, 2001, p. 2).

***Strong claims? Or words that resonate?***

# Digital natives

- Seek instant gratification and embrace multi-sensory input.
- Are familiar with being bombarded with various stimuli
- Have little patience for long talks/lectures
- Respond to each other immediately – instant messenger, snapchat, WhatsApp
- Use email rather than snail mail

# Digital immigrants

Can’t study with music playing in the background

- Send a letter to their local MP (member of Parliament)
- Teach the way they were taught – because they learnt best that way???
- Struggle with change and the way ‘natives’ function

# Digital native oder digital immigrant?

- **Which one are you?**
- **What are your thoughts on this concept?**

**Discuss this with the person(s) next to you.**

# Why Prensky?

- Early identification of concerns and changes
- Similar arguments from Weiler (2005) and Rosen (2010)

# Why Prensky?

‘So what should happen? Should the Digital Native students learn the old ways, or should their Digital Immigrant educators learn the new? Unfortunately, no matter how much the Immigrants may wish it, it is highly unlikely the Digital Natives will go backwards. In the first place, it may be impossible – their brains may already be different’ (Prensky, 2001, p. 3).

- Radical claims?  But what can we take from this?

# Giving a Kahoot!

https://kahoot.it/

- Types of tasks: quiz, jumble, survey, discussion

1. Visit https://kahoot.it/
2. Create an account
3. Join at **kahoot.it** with Game PIN: **5558048** Areas of Technology: https://play.kahoot.it/#/?quizId=adadb9d6-2ad3-4d4b-bf0c-66a9dfccfed2

# The dangers of TEL

- Never switch off
- Students expect instant responses
- Students become impatient – information generation
- What happens when it all goes wrong? The importance of a back-up plan

# Controversial thinking

***We are preparing students for an unknown world and unknown jobs. These jobs don't even exist yet. How can we prepare them for that?***

**Your thouhgts!!**

# Technological shifts and trends

- ✓ Rapid and constant technological developments and innovations requiring new skills, knowledge and competencies
- ✓Technological developments providing new opportunities for education and work
- ✓Converging technologies requiring cross-disciplinary skills and knowledge
- ✓Technology enabling greater access to information, supporting information sharing and exchange
- ✓Greater digital divide between those with digital skills and IT access, and those how have no or limited skills and access.

**Source:** Barnes, Brown and Warhurst (2017, p. 8).

# Assessment

Think about assessment, how could you use Kahoot to assess your students?

**Note down one activity or topic within your teaching that this could be useful for.** (e.g. this could be as a summative assessment.)

# Task

Now return to Kahoot (https://kahoot.com/welcomeback/)

In your groups (4 person), you need to devise a quiz that contains the following:

- 3 questions on financial and project management EXTEND
- 3 questions on Quality Assurance in learning and teaching
- 3 questions on competencies and learning outcomes
- 3 questions on the history of MRSU

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# Tools for learning

- **Tools for teaching and learning** http://c4lpt.co.uk/top100tools/ (200 tools)
- You tube
- Hihaho: www.hihaho.com (interactive video)
- Coursera: www.coursera.org (MOOC)
- Animoto: https://animoto.com/ (video maker / video creator)
- Adobe Premiere: **www.adobe.com**/products/**premiere**.html (video editing software )
- Padlet: https://**padlet.com**

  can be used for collaboration, presentation and reflection: https://www.youtube.com/watch?v=5c9vWCPn8ys

**Social media:** WhatsApp – Facebook - Twitter etc.

**Light Board**

https://www.youtube.com/watch?v=N1I4Afti6XE

https://www.youtube.com/watch?v=FYwXOLU4TKk

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# Introduction to QA Aspects – Competences descriptors for engineering disciplines

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## Roadmap

- What is our goal?
  - To support educational efficiency
  - Exercise: define educational efficiency
- How to support educational efficiency?
- Key concepts
- Competences descriptors grids – Romanian example
- Competences descriptors grids for an engineering bachelor program
- From competences descriptors to subject descriptions
- Subject description – UPB example

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## What is our goal?

- To provide an efficient higher education: the amount of benefits brought to individuals and society by education has to be high.
- In a study made by UNESCO (2015), education efficiency is divided in:
  - internal efficiency: measures the output and outcome of the education system – the set of competences acquired in university;
  - external efficiency: measures the extent to which those competences are translated into economical/ social benefits => statistics related to graduate unemployment are considered indicators for quantifying educational efficiency.
- In order to "be able to justify increased or maintained level of financing" from public resources, the education sector must demonstrate efficient use of governments' funding, by proving its efficiency and contribution to GDP growth => employable students.
- In majority of countries, the education level influences directly the individuals' earnings and also the labor market outcomes (European Commission, 2014) => there is a

  connection between education and the features of being employable.

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## How to support educational efficiency? (1)

- By developing the necessary skills and knowledge which are useful for a certain professional qualification;
- The necessary skills and knowledge which are useful for a certain professional qualification are indicated in frameworks, e.g.:
  - frameworks defining education quality;
  - frameworks reflecting the necessary skills and knowledge to be efficient in a certain domain.
- Several frameworks defining education quality exists and provide instruments to analyze/support education efficiency, e.g.:
  - UNESCO General Education Quality Analysis/Diagnosis Framework;
  - National Qualifications Frameworks – developed under the auspices of the Bologna process;
  - European Quality Assurance Reference Framework.

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## How to support educational efficiency? (2)

- The frameworks reflecting the necessary skills and knowledge to be efficient in a certain domain can be used to research whether the graduates of certain higher education institutions have the necessary competences to be productive on the market, e.g.:
  - e-Competences Framework – for ICT professionals (e-CF);
  - the Skills Framework for the Information Age (SFIA);
  - European Skills/Competences, qualifications and Occupations (ESCO)- "identifies and categorizes skills, competences, qualifications and occupations in a standard way, using standard terminology in all EU languages and an open format": http://ec.europa.eu/social/main.jsp?catId=1042&langId=en

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## Key concepts

- Professional qualification
- Learning outcomes
- Knowledge versus skills versus competences
- Categories of competences
- Competences descriptors

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## Professional qualification

- the official recognition of the value of individual learning outcomes for the labor market, as well as for continuous education and training/ lifelong learning through a study certificate/ diploma that confers the legal right to practice a profession;

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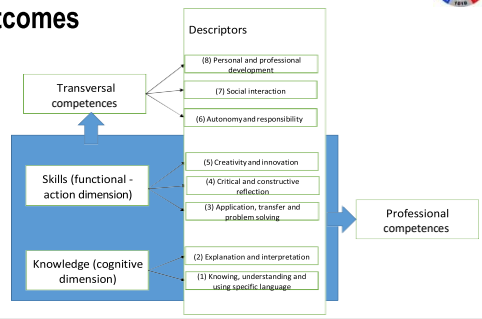
## Learning outcomes

- the set of knowledge, skills and competences a person has acquired and he/she is capable of demonstrating them after completion of the learning process on a particular schooling cycle;

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## Knowledge versus skills versus competences

- Knowledge: the result of assimilation, by learning, of information; a set of facts, principles, theories and practices of a particular field of work or study;
- Skills: the ability to apply and use knowledge to perform tasks and to solve problems;
- Competences: the proven ability to select, combine and use appropriate, knowledge, skills and other acquisitions (values and attitudes) to successfully solve a certain category of work/ learning situations as well as for professional or personal development, under conditions of effectiveness and efficiency.

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## Categories of competences

- Professional competences:
  - proven capabilities to select, combine and use appropriately the knowledge, skills and other acquisitions (values and attitudes) to successfully solve a certain category of work situations/ learning, circumscribed to the profession in question in an efficient and effective manner;
  - can be general or specific;
- Transversal competences:
  - capacities that transcend a specific domain / study program, having a transdisciplinary nature.

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## Competences descriptors

- Generic descriptors:
  - are compatible with the descriptors of the European Qualifications Framework (EQF / CEC) for bachelor, master and PhD – https://ec.europa.eu/ploteus/en/content/descriptors-page ;
  - based on them, both professional (generic descriptors 1, 2, 3, 4 and 5) and transversal competences (generic descriptors 6, 7 and 8) are examined and described.
- Level descriptors:
  - explains generic descriptors for each learning outcome, for each type of competence and for each level of qualification.

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## Competences descriptors grids – Romanian example

- National Qualification Framework from Higher Education:
  - unique tool that establishes the structure of qualifications and ensures national recognition, and also international compatibility and comparability of qualifications acquired within the higher education system;
  - facilitates the recognition, measurement and relationship of all learning outcomes achieved within the higher education system;
  - ensure the consistency of certified titles and diplomas;
- National Qualification Framework from Higher Education Grid:
  - integrates on qualification levels and generic descriptors, professional and transversal competences detailed by level descriptors;
- Grid 1:
  - a tool for analyzing, describing and evaluating a qualification obtained through a bachelor/master/PhD program;
- Grid 2:
  - a tool for identifying correlations between professional competences and transversal competences, content areas, study subjects and assigned credits.

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## Nat onal Qualificat on Framework from Higher Educat on Grid – Romanian Example

| | | | Bachelor | Master | PhD |
|---|---|---|---|---|---|
| Transversal competences | Personal and professional development competences | Personal and professional development | Awareness of the need for continuous training; the efficient use of resources and learning techniques for personal and professional development | Self-control of the learning process; diagnosis of training needs; reflexive analysis of their own professional activity | Development of projects centered on creativity, as a theme of self-realization |
| | Role competences | Social interaction | Familiarizing with the roles and activities specific to team work and the distribution of tasks for the subordinate levels | Assign roles / leadership functions to the work of professional groups or institutions | Assuming responsibility and ability to organize and manage the work of professional groups, scientific research, or institutions |
| | | Autonomy and responsibility | Responsible execution of professional tasks, under conditions of limited autonomy and qualified assistance | Performing complex professional tasks in conditions of autonomy and professional independence | Innovative initiation and development of theoretical and practical complex projects |
| Professional competences | Skills (functional - action dimension) | Creativity and innovation | Developing professional projects with the use of established principles and methods in the field | Developing professional and / or research projects, using innovatory a wide range of quantitative and qualitative methods | Designing and carrying out original research, based on advanced methods leading to the discovery of scientific, technological and / or research methodologies |
| | | Critical and constructive reflection | Appropriate use of criteria and standard evaluation methods to assess the quality, merits and limits of processes, programs, projects, concepts, methods and theories | Use tangible and relevant criteria and evaluation methods to formulate value judgments and substantiate constructive decisions | Critical-constructive evaluation of scientific research projects and results, appreciation of the theoretical and methodological knowledge stage; identifying the knowledge and application priorities of the field |
| | | Application, transfer and problem solving | Applying basic principles and methods for solving well-defined problems / situations, typical of the field under qualified assistance | Integrated use of the conceptual and methodological apparatus, in incompletely defined situations, to solve new theoretical and practical problems | Selection and application of principles, theories and advanced methods of knowledge; transfer of methods from one domain to another, interdisciplinary approaches to solving theoretical and practical problems, new and complex |
| | Knowledge (cognitive dimension) | Explanation and interpretation | Using basic knowledge to explain and interpret various types of concepts, situations, processes, projects associated with the field | Use of specialized knowledge to explain and interpret new situations in wider contexts associated with the field | Use of advanced principles and methods to explain and interpret, from multiple perspectives, new and complex theoretical and practical situations / problems specific to the field |
| | | Knowing, understanding and using specific language | Knowledge, understanding of the concepts, theories and basic methods of the field and of the specialization area; their proper use in professional communication | In-depth knowledge of a specialization area and, within it, of the theoretical, methodological and practical developments specific to the program; the proper use of specific language in communication with different professional backgrounds | Systematic, advanced knowledge of concepts, research methods, controversies and new hypotheses specific to the field; communication with specialists in related fields |
| Learning outcomes | | Generic descriptors | Level descriptors | | |

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## Competences descriptors grids for an engineering bachelor program

- Level: bachelor
- Fundamental domain: Engineering Sciences
- Domain: Computers and Information Technology
- Study program: Engineering Information in English
- Organising institution: University POLITEHNICA of Bucharest (www.upb.ro), Faculty of Engineering in Foreign Languages http://ing.pub.ro/)
- See UPB_Grid1, UPB_Grid2 documents (filled as an example)

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## Exercise

- See UPB_Grid1_template, UPB_Grid2_template
- Exercise:
  - Think at one professional competence for your domain (C1 from the template) and the corresponding explicit competences through level descriptors (C1.1, C1.2,….).
  - Fill it in UPB_Grid1_template.
  - Fill in UPB_Grid2_template some subjects which help the students acquire the one stated competence.
  - Exchange the filled templates with a colleague and check if the competence is clearly stated.

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## From competences descriptors to subject descriptions – steps to describe higher education qualifications

- Step 1: description of the study program through professional competences and transversal competences – Grid1;
- Step 2: identifying, for each study program, a correlation between competences and content areas, study disciplines and credits allocated to disciplines – Grid2;
- Step 3: elaboration of the study curriculum, in accordance with the competences defining the qualification – Study plan;
- Step 4: elaboration of the subject descriptions in accordance with the curriculum and the competences defining the qualification.

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## Subject description – UPB example

- See Study_plan_for_Engineering_Information_in English_at_UPB;
- See Subject _description_template;
- See Subject_description_for_Systems_Engineering_at_UPB, discipline taught during 4th year of study at Engineering Information in English specialisation at UPB.

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## References


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- UNESCO, 2015: Education - System Efficiency, www.unesco.org/


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## Work session

- Fill in the Subject _description_template for a lecture you teach.
- Exchange the filled template with a colleague and check if the information is clearly stated.

- Materials: https://www.dropbox.com/home/UPB_Didactic_2015/Rusia/Final/CompD escriptors

- You can send questions to: maria.dascalu@upb.ro

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# Technology-enhanced Teaching

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## Roadmap

- Fundamental change in education and challenges for teachers in digital age
- Teaching paradigms
- Design models for teaching
- Media or technology
- Key media and technology characteristics
- What technology/media to choose for our teaching?
- Social media
- Analysis of technology and media from an educational perspective
- Commonly available teaching technologies

2

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## Fundamental change in education

- Technology is leading to massive changes in the economy, in the way we communicate and relate to each other and in the way we learn.
- Yet our educational institutions were built largely for another age, based around an industrial rather than a digital era.
- Thus teachers and instructors are faced with a massive challenge of change: we have to deliver courses suitable for today's cultural and social values, for knowledge workers.
- Could you nominate some challenges a teacher has to face today?

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## Challenges for teachers in digital age

- Greater diversity of students
- The lifelong learning market
- Digital natives
- ....

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## Teaching paradigms

- Objectivism/ behaviorism: a course must present a body of knowledge to be learned- facts, formulas, terminology, principles, theories; an "objectivist" teacher has to be very much in control of what and how students learn, choosing what is important to learn, the sequence, the learning activities, and how learners are to be assessed.
- Cognitivism: focuses on comprehension, abstraction, analysis, synthesis, generalization, evaluation, decision-making, problem-solving and creative thinking; a teacher teaches students *how* to learn/ *how* to develop stronger or new mental processes for future learning.
- Constructivism: knowledge is mainly acquired through social processes or institutions that are socially constructed - schools, universities, online communities. Thus what is taken to be "valued" knowledge is also socially constructed. Knowledge is constructed based on personal experiences and hypotheses of the environment.
- Connectivism: knowledge is built outside the individual, within networks.

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## Exercise

1. What teacher paradigm do you use?
2. What areas of knowledge do you think would be best "taught" or learned through a constructivism approach? Why?
3. What areas of knowledge do you think would NOT be appropriately taught through a constructivism approach? Why?
4. What areas of knowledge do you think would be best "taught" or learned through a connectivism approach? Why?
5. What areas of knowledge do you think would NOT be appropriately taught through a connectivism approach? Why?

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## Design models for teaching

1. What design models are more suitable for your course? Why?

2. State some strengths and weaknesses of MOOCS.

| Design model | Epistemology | 20th century learning | 21st century learning | Academic quality | Flexibility |
|---|---|---|---|---|---|
| Transmissive lectures | Objectivist | ** | * | ** | * |
| Interactive lectures/seminars | Constructivist | *** | ** | *** | * |
| Classroom-type online learning | Objectivist | n/a | * | * | *** |
| Online collaborative learning | Constructivist | n/a | *** | *** | *** |
| Experiential learning | Constructivist | ** | *** | ** | *** |
| Competency-based learning | Objectivist | n/a | ** | ** | *** |
| Communities of practice | Connectivist | ** | ** | * | *** |
| x MOOCs | Objectivist | n/a | * | ** | *** |
| cMOOCs | Connectivist | n/a | ** | * | *** |

7

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## Media or technology?

- Technology:
  - tools and machines that may be used to solve real-world problems, to support teaching and learning.
- Media:
  - depend on technology, but technology is only one element of media;
  - particular ways of representing, organizing and communicating knowledge;

- Determine which is a medium and which a technology, or which could be both and under what conditions:
  - A newspaper
  - A learning management system
  - A blog
  - Twitter
  - Second Life
  - A podcast
  - An open textbook

8

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## Discussions

- Do you think that knowledge becomes something different when represented by different media? For instance, does an animation of an algorithm is better than writing the algorithm on the blackboard?

Example: https://www.cs.usfca.edu/~galles/visualization/Algorithms.html

- What in your view makes the Internet unique from a teaching perspective, or is it just old wine in new bottles?

9

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## Key media and technology characteristics....

10

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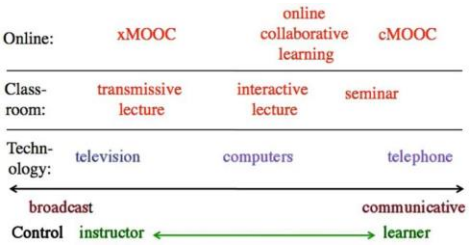
## Continuum of knowledge dissemination




11

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## Separations of teachers/instructors from learners

| | | Place | | |
|---|---|---|---|---|
| | | Same | Different | |
| Time | Same | *Live (face-to-face) media*: lectures, seminars, tutorial, labs, workshops | Webinars<br>Video-conferencing<br>Virtual worlds<br>Remote labs | **Synchronous** |
| | Different | Self-managed labs/workshops/ studios<br>Library/learning centres | *Recorded media*: books, cassettes, LMSs, online discussion forums, lecture capture/ streamed video, blogs, wikis | **Asynchronous** |

12

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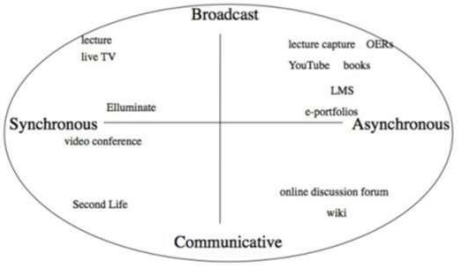
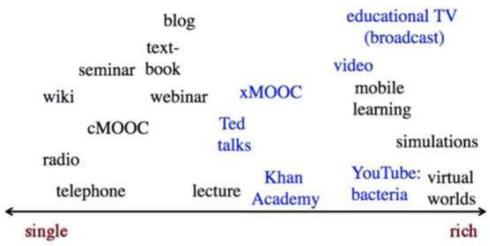
## Significance of the Internet in terms of media characteristics




13

EXTEND Co-funded by the Erasmus+ Programme of the European Union

## Continuum of media richness




14

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## Exercise

1. Do you use technologies for teaching?
2. How do you decide what technologies to use for teaching? Do you have a theory or set of principles for making such a decision?

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## What technology/media to choose for our teaching?

- Technologies are merely tools that can be used in a variety of ways. What matters more is how technologies are applied. The same technology can be applied in different ways, even or especially in education.
- So in judging the value of a technology, we need to look more closely at the ways in which it is being or could be used. In essence this means focusing more on media – which represent the more holistic use of technologies.

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## Exercise

- Take one of the courses you are teaching at the moment. How could you make your teaching more communicative, asynchronous, and rich in media? What media or technologies would help you do this?

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## Social media

- Blogs - allows an individual to make regular postings to the web, e.g. a personal diary or an analysis of current events;
- Wikis - an "open" collective publication, allowing people to contribute or
- create a body of information;
- Social networking - a social utility that connects people with friends and others who work, study and interact with them;
- Multimedia archives - allows end users to access, store, download and share audio recordings, photographs, and videos;
- Virtual worlds - real-time semi-random connection/ communication with virtual sites and people;
- Multiplayer games - enables players to compete or collaborate against each other or a third party/parties represented by the computer, usually in real time;
- Mobile learning - enables users to access multiple information formats (voice, text, video, etc.) at any time, any place.

18

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## Exercise

Take one of your courses and analyze how social media could be used in your course:

- what new learning outcomes could the use of social media help develop?
- would it be better just to add social media to the course or to re-design it around social media?

19

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## Analysis of technology and media from an educational perspective

20

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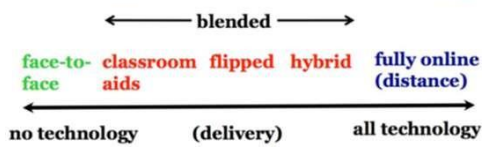
## Continuum of technology-based teaching




21

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## Commonly available teaching technologies

- learning managements systems (e.g. Blackboard, Moodle, Desire2Learn, Canvas);
- synchronous technologies (e.g. Blackboard Collaborate, Adobe Connect, Big Blue Button);
- lecture recording technologies (e.g. podcasts and lecture capture);
- tablets and mobile devices, e.g. iPads, mobile phones, and the apps that run on them;
- MOOCs and their many variants;
- other social media, such as blogging software, wikis, Google Hangout, Google Docs and Twitter;
- learner-generated tools, such as e-portfolios.

22

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## Discussions

1. Do you use a LMS? What?
2. How much formal training have you had on your institutional LMS?
3. Is this enough training/ are you now fully confident that you know all the features and how best to use them?

23

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## Conclusions

Nine steps to quality teaching in a digital age:

- Step 1: Decide how you want to teach
- Step 2: Decide on mode of delivery
- Step 3: Work in a Team
- Step 4: Build on existing resources
- Step 5: Master the technology
- Step 6: Set appropriate learning goals
- Step 7: Design course structure and learning activities
- Step 8: Communicate, communicate, communicate
- Step 9: Evaluate and innovate

24

## References and extra reading


- ***Teaching in a Digital Age*, by A.W. (Tony) Bates, 2016**
- *8 Exciting Technology-enhanced Teaching and Learning Approaches that Teacher are Embracing*, by Kelly Walsh, 2014
- *The Future of Learning*, by Cynthia Luna Scott, 2015
- *Social learning analytics: a mandatory step for e-education success*, by Maria Dascalu & all, 2016
- *Supporting self-regulated learning via technology tools: a case study in an engineering degree program in Romania*, by Maria Dascalu & all, 2017
- *Experiential Learning VR System for Studying Computer Architecture*, , by Maria Dascalu & all, 2017


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EXTEND

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# A Glimpse on Engineering Education Practice and Research

UNIVERSITY OF MINHO

RUI M. LIMA

DIANA MESQUITA

## Engineering Education Research

Engineering Education Research in the World

Engineering Education Research in Europe

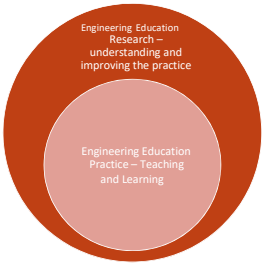
Centres of Teacher Development



## Engineering Education

Teaching knowledge and principles related to the professional practice of engineering. Engineering education integrates research and education (practice) to accelerate technological and educational innovation and to improve the quality and diversity of engineering graduates entering the technical workforce.

Handbook of Research on Recent Developments in Materials Science and Corrosion Engineering Education



## Associations and initiatives

Associations
- ASEE – American Society for Engineering Education (https://www.asee.org/)
- IEEE Education Society (http://ieee-edusociety.org/)
- SEFI – European Society for Engineering Education (http://www.sefi.be/)
- IGIP - International Society for Engineering Pedagogy (http://www.igip.org/)

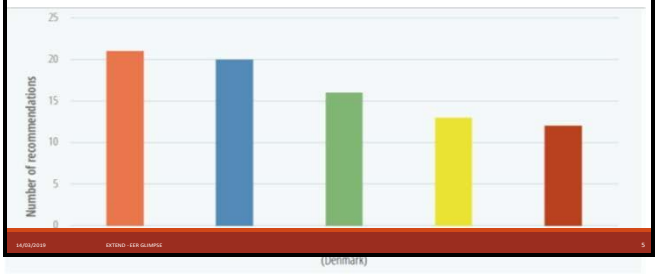
PhD Engineering Education (or similar)
- Virginia Tech - Department of Engineering Education (http://www.enge.vt.edu/)
- Purdue University - School of Engineering Education (https://engineering.purdue.edu/ENE)
  - "How engineering is best taught, learned, and practiced."
- Aalborg University (Denmark) - UNESCO Chair in Problem Based Learning in Engineering
- Chalmers University of Technology (Sweden) - Department of Applied Information Technology
- Engineering Education Research and Teaching Centers…
  - http://engineeringeducationlist.pbworks.com/w/page/27430570/Engineering%20Education%20Research%20and%20Teaching%20Centers
  - http://engineeringeducationlist.pbworks.com/w/page/27430507/Engineering%20Education%20Departments%20and%20Programs%20Graduate

Initiatives
- LASPAU – affiliated to Harvard - http://www.laspau.harvard.edu/
- CDIO: Conceiving - Designing - Implementing – Operating – from MIT to the world - http://www.cdio.org/



## MIT report - The five institutions most frequently identified as 'current leaders' in engineering education

(Graham, 2018 p.10)



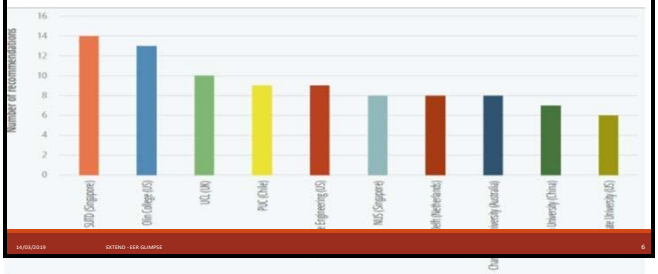



(Denmark)

EXTEND

## MIT report - The 10 most frequently-identified 'emerging leaders' in engineering education

(Graham, 2018 p.10)






EXTEND

# Engineering Education Research in the World

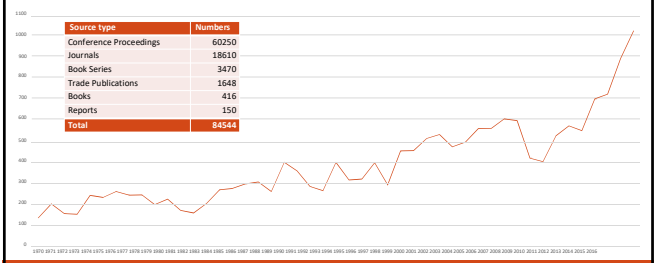
SCOPUS JOURNALS – " ENGINEERING EDUCATION" LIMA ET AL. (2018)



## Evolution of the number of publications from 1970 to 2016

Scopus indexed documents - search results of the term "engineering education"

| Source type | Numbers |
|---|---|
| Conference Proceedings | 60250 |
| Journals | 18610 |
| Book Series | 3470 |
| Trade Publications | 1648 |
| Books | 416 |
| Reports | 150 |
| Total | 84544 |





Top 25 HEI with papers published in journals

"Engineering education"

Since **1970**

| | | | Times HE World rank |
|---|---|---|---|
| 1 | **Purdue University** | 298 | 70 |
| 2 | IEEE | 203 | |
| 3 | **Pennsylvania State University** | 185 | 13 |
| 4 | Virginia Polytechnic Institute and State University | 163 | 251 |
| 5 | Georgia Institute of Technology | 144 | 38 |
| 6 | University of Texas at Austin | 120 | 50 |
| 7 | **University of Washington Seattle** | 117 | 25 |
| 8 | **Massachusetts Institute of Technology** | 117 | 5 |
| 9 | Texas A and M University | 112 | 169 |
| 10 | North Carolina State University | 111 | 201 |
| 11 | Arizona State University | 109 | 131 |
| 12 | **Carnegie Mellon University** | 100 | 23 |
| 13 | **Stanford University** | 97 | 3 |
| 14 | Universidad Politecnica de Madrid | 96 | 601 |
| 15 | Iowa State University | 88 | 351 |
| 16 | **University Michigan Ann Arbor** | 84 | 21 |
| 17 | Technion - Israel Institute of Technology | 83 | 301 |
| 18 | University of Manchester | 82 | 55 |
| 19 | University of Wisconsin Madison | 82 | 45 |
| 20 | Delft University of Technology | 77 | |
| 21 | Missouri University of Science and Technology | 72 | 501 |
| 22 | Nanyang Technological University | 70 | 54 |
| 23 | Rensselaer Polytechnic Institute | 67 | 251 |
| 24 | Loughborough University | 66 | 301 |
| | Universitat Politecnica de Catalunya | 66 | 401 |
| | University of Florida | 66 | 134 |
| | UC Berkeley | 66 | 10 |

Scopus®

Top 25 HEI with papers published in journals
"Engineering education"

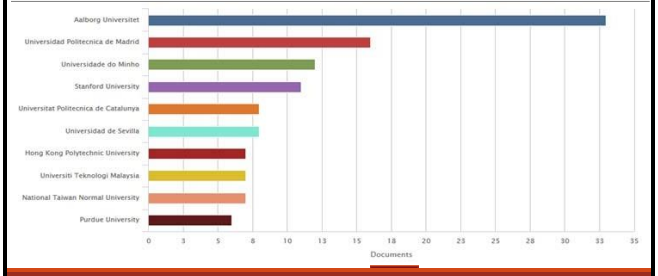
5 years **2012-16**

New HEI entering Top 25 bibliometric:

- Aalborg Universitet
- Utah State University
- University of Ljubljana
- National Taiwan Normal University
- Chalmers University of Technology
- Oregon State University
- Universidad de Salamanca
- Universidad Nacional de Educacion a Distancia
- Queensland University of Technology QUT
- National Taiwan University
- The Royal Institute of Technology KTH
- Universidade do Minho



## Research Journals: "Engineering education" AND PBL (<2018)






## Top 10 authors with papers published in journals

| # | Name | Number of papers | Area (Bachelor or Master degree) |
|---|---|---|---|
| 1 | Borrego, M. | 37 | Mechanical Engineering |
| 2 | Wald, M. | 36 | Engineering - Math and physics |
| 3 | Dym, C.L. | 26 | Engineering design |
| 4 | Atman, C.J. | 25 | Industrial Engineering |
| 5 | Ohland, M.W. | 24 | Mechanical Engineering |
| 6 | Besterfield-Sacre, M. | 23 | Industrial Engineering |
| 6 | Pudlowski, Z.J. | 23 | Electrical Engineering |
| 8 | Kolmos, A. | 22 | Social Science and Psychology |
| 9 | Felder, R.M. | 20 | Chemistry Engineering |
| 10 | Finelli, C.J. | 18 | Electrical Engineering |
| 10 | Adams, R.S. | 18 | Mechanical Engineering |
| 10 | Case, J.M. | 18 | Chemical Engineering |

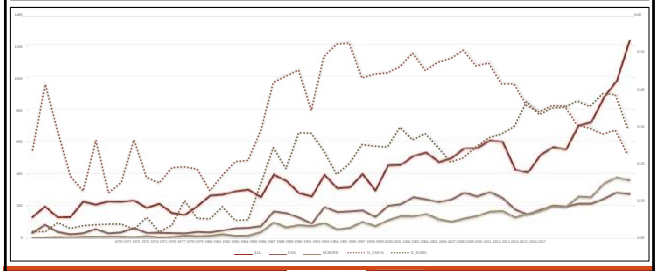
Scopus journals – "engineering education"

# Engineering Education Research in Europe

SCOPUS JOURNALS – " ENGINEERING EDUCATION" LIMA & MESQUITA (2018)



## Perspective on the evolution of the number of publications (1970-2017)





## Top 15 European countries publishing papers in EER – 5-year average of publications

| Country | Tot. | 2017 -2013 | 2012 -2008 | 2007 -2003 | 2002 -1998 | 1997 -1992 | 1992 -2008 |
|---|---|---|---|---|---|---|---|
| UK | 1330 | 51 | 30 | 31.6 | 58.6 | 39.6 | 39 |
| Spain | 737 | 72 | 38.2 | 23.2 | 8.4 | 3.8 | 1.6 |
| Germany | 344 | 24.6 | 13.2 | 10.8 | 7.6 | 6.2 | 4 |
| Netherlands | 236 | 14.8 | 11 | 7.4 | 7.8 | 2.4 | 2.4 |
| Turkey | 220 | 16 | 12.6 | 11.6 | 3 | 0.8 | 0 |
| France | 203 | 13.2 | 5 | 4.4 | 5.4 | 5.6 | 4.4 |
| Sweden | 193 | 17.2 | 7.8 | 6.2 | 4 | 1.2 | 1.2 |
| Italy | 188 | 18.8 | 5.6 | 5.6 | 3.8 | 1.6 | 1.8 |
| Russian F. | 151 | 15 | 2.8 | 2.6 | 2 | 3 | 4.6 |
| Portugal | 138 | 14 | 6.6 | 3.2 | 2.2 | 0.8 | 0.2 |
| Finland | 127 | 12 | 3.4 | 2.8 | 4.2 | 1 | 1.8 |
| Denmark | 119 | 10.2 | 5.8 | 2.4 | 3 | 0.6 | 0.4 |
| Greece | 112 | 9.2 | 4.6 | 5.6 | 1 | 0.8 | 0.8 |
| Poland | 100 | 10.6 | 2.4 | 1.6 | 2.6 | 1.4 | 1.2 |
| Ireland | 92 | 6.6 | 3.8 | 3 | 2.2 | 1 | 0.8 |

Top25 HE institutions

| # | | Number |
|---|---|---|
| 1 | Universidad Politecnica de Madrid | 105 |
| 2 | Delft University of Technology | 75 |
| 3 | University of Manchester | 71 |
| 4 | Universitat Politecnica de Catalunya | 65 |
| 5 | Aalborg Universitet | 61 |
| 6 | Loughborough University | 58 |
| 7 | University of Ljubljana | 52 |
| 8 | Universitat Politècnica de València | 48 |
| 9 | Universidad Nacional de Educacion a Distancia | 44 |
| 10 | University of Strathclyde | 41 |
| | University of Edinburgh | 41 |
| | Budapest University of Tech. and Economics | 41 |
| 13 | Chalmers University of Technology | 39 |
| | Open University | 39 |
| | University of Twente | 39 |
| 16 | Imperial College London | 36 |
| | University of Cambridge | 36 |
| 18 | Universidad Carlos III de Madrid | 35 |
| | The Royal Institute of Technology KTH | 35 |
| 20 | Norges Teknisk-Naturvitenskapelige Universitet | 32 |
| 21 | Linkopings universitet | 31 |
| 22 | University of Leeds | 30 |
| | Aalto University | 30 |
| 24 | University of Birmingham | 29 |
| | KU Leuven | 29 |
| 25 | University of Sheffield | 28 |
| | Universidade do Minho | 28 |

Top25 journals

| # | | Num. | Area |
|---|---|---|---|
| 1 | International Journal of Engineering Education | 354 | Eng. Ed. |
| 2 | IEEE Transactions on Education | 286 | Eletrical+ Eng. Ed. |
| 3 | International Journal of Electrical Engineering Education | 252 | Eletrical Eng. Ed. |
| 4 | European Journal of Engineering Education | 203 | Eng. Ed. |
| 5 | Computer Applications In Engineering Education | 155 | Eng. Ed. |
| 6 | International Journal of Continuing Eng. Education and Life Long Learning | 139 | Eng. Ed. |
| 7 | International Journal of Technology and Design Education | 102 | Ed. Technology |
| 8 | Computers and Education | 78 | Ed. Technology |
| 9 | Revista Iberoamericana De Tecnologias Del Aprendizaje | 61 | Ed. Technology |
| 10 | Journal of Professional Issues In Engineering Education and Practice | 58 | Eng. Ed. |
| 11 | Computers In Human Behavior | 57 | Eng. specific |
| 12 | IEE Colloquium Digest* | 56 | Eng. specific |
| 13 | British Journal of Educational Technology | 50 | Ed. Technology |
| 14 | Engineering Science and Education Journal* | 50 | Eng. Ed. and Science |
| 15 | International Journal of Online Engineering | 50 | Eng. specific |
| 16 | International Journal of Mechanical Engineering Education | 39 | Mec. Eng. Ed. |
| 17 | IEEE Antennas and Propagation Magazine | 36 | Eng. specific |
| 18 | Journal of Technology Transfer | 33 | Eng. specific |
| 19 | IFAC Papersonline | 30 | Eng. specific |
| 20 | IEEE Transactions on Learning Technologies | 26 | Ed. Technology |
| 21 | Journal of Engineering Education | 26 | Eng. Ed. |
| 22 | World Transactions on Engineering and Technology Education | 25 | Eng. Ed. |
| 23 | Journal of Cleaner Production | 24 | Eng. specific |
| 24 | Research Policy | 24 | Eng. specific |
| 25 | European Journal of Physics | 22 | Physics Ed. |

# Times Higher Education Top 25 Centres of Engineering Education or Staff Development

## Centres of Engineering Education or Staff Development in the Times Top 25 (1-10)

| Rank | Higher Education Institution | Education support |
|---|---|---|
| 1 | University of Oxford<br>United Kingdom | Training & development<br>https://www.ox.ac.uk/staff/working_at_oxford/training_development?wssl=1 |
| 2 | California Institute of Technology<br>United States | Caltech Center for Teaching, Learning, & Outreach (CTLO)<br>https://www.ctlo.caltech.edu/ |
| 3 | Stanford University<br>United States | Cardinal at work<br>https://cardinalatwork.stanford.edu/learn-grow |
| 4 | University of Cambridge<br>United Kingdom | CETE Center of Excellence for Technology Education (network)<br>http://www.cete-net.com/home/?no_cache=1 |
| 5 | MIT<br>United States | Teaching and Learning Lab (http://tll.mit.edu/about/who-we-are-and-what-we-do)<br>Communication Lab (http://mitcommlab.mit.edu/about-us/) |
| 6 | Harvard University<br>United States | Office of Faculty Development & Diversity<br>https://faculty.harvard.edu/about |
| 7 | Princeton University<br>United States | Keller Center for Innovation in Engineering Education<br>https://kellercenter.princeton.edu/ |
| 8 | Imperial College London<br>United Kingdom | Education and teaching support<br>https://www.imperial.ac.uk/engineering/staff/education-and-teaching-support/ |
| 9 | ETH Zurich<br>Switzerland | Educational Development and Technology (LET)<br>https://www.ethz.ch/en/the-eth-zurich/organisation/departments/educational-development-and-technology.html |
| 10 | University of California, Berkeley<br>United States | Center for Teaching & Learning<br>http://teaching.berkeley.edu/ |
| 10 | University of Chicago<br>United States | Engineering Makerspace (http://coemakerspace.uic.edu/)<br>UIC Innovation Center (http://innovationcenter.uic.edu/wordpress/?page_id=475) |

## Centres of Engineering Education or Staff Development in the Times Top 25 (12-20)

| Rank | Higher Education Institution | Education support |
|---|---|---|
| 12 | Yale University<br>United States | Center for the Integration of Research, Teaching, and Learning (CIRTL) (network) (https://www.cirtl.net/)<br>Center for Engineering Innovation and Design (CEID) (http://ceid.yale.edu/about-1/#courses) |
| 13 | University of Pennsylvania<br>United States | Leonhard Center for Enhancement of Engineering Education<br>http://www.engr.psu.edu/leonhardcenter/ |
| 14 | University of California, Los Angeles<br>United States | Human resources - Training and Development<br>https://www.chr.ucla.edu/training-and-development |
| 15 | University College London<br>United Kingdom | UCL Centre for Engineering Education<br>http://www.engineering.ucl.ac.uk/centre-for-engineering-education/ |
| 16 | Columbia University<br>United States | Center for the Integration of Research, Teaching, and Learning (CIRTL) (network)<br>https://www.cirtl.net/ |
| 17 | Johns Hopkins University<br>United States | Center for Educational Resources (CER)<br>http://cer.jhu.edu/about |
| 18 | Duke University<br>United States | Human resources<br>https://hr.duke.edu/training/course-offerings |
| 19 | Cornell University<br>United States | James McCormick Family Engineering Teaching Excellence Institute (METEI) (https://www.engineering.cornell.edu/academics/teaching/teaching_excellence/)<br>Center for Teaching Excellence (CTE) (https://www.cte.cornell.edu/about/index.html) |
| 20 | Northwestern University<br>United States | Northwestern Center for Engineering Education Research (NCEER)<br>http://www.mccormick.northwestern.edu/research/engineering-education-research-center/ |
| 21 | University of Michigan<br>United States | Center for Research on Learning and Teaching in Engineering (CRLT-Engin)<br>https://crlte.engin.umich.edu/ |

## Centres of Engineering Education or Staff Development in

| Rank | Higher Education Institution | Education support |
|---|---|---|
| 21 | University of Michigan<br>United States | Center for Research on Learning and Teaching in Engineering (CRLT-Engin)<br>https://crlte.engin.umich.edu/ |
| 22 | University of Toronto<br>Canada | Education Technology Office (ETO) (http://edtech.engineering.utoronto.ca/)<br>Centre for Teaching Support & Innovation (CTSI) (http://teaching.utoronto.ca/) |
| 23 | Carnegie Mellon University<br>United States | Center for Faculty Success (CFS)<br>https://engineering.cmu.edu/faculty-staff/professional-development/center-faculty-success/index.html |
| 24 | National University of Singapore<br>Singapore | Centre for Development of Teaching and Learning (CDTL)<br>http://www.cdtl.nus.edu.sg/welcome-to-cdtl.htm |
| 25 | London School of Economics and Political Science<br>United Kingdom | Academic and Professional Development Division (https://info.lse.ac.uk/Staff/Divisions/Academic-and-Professional-Development-Division)<br>Teaching and Learning Centre (https://info.lse.ac.uk/Staff/Divisions/Teaching-and-Learning-Centre/Teaching-and-Learning-Centre) |

## Two exemples of missions

Virginia Tech

- We advance the engineering profession by integrating research and teaching to impact learning and practice.

Purdue - School of Engineering Education (ENE)

- Our mission to transform engineering education based on scholarship and research rests on three pillars: Re-imagining engineering and engineering education, creating field-shaping knowledge, and empowering agents of change.
- Above all else, we seek to put students first in all we do.

UCL - Centre for Engineering Education

- The Centre for Engineering Education works to improve Transitions into and through engineering for people at different stages in their lives or careers. Both an active participant in the global engineering community and an observatory for that community, we seek to be a catalyst, partnering with others and providing a platform for debate and action to demonstrate engineering's contribution to a sustainable future.



## Concluding remarks

| | |
|---|---|
| Engineering Education Practice | Most effective models?<br>Best practices? |
| Engineering Education Research (EER)? | Why? How? Who? |
| Centers / Departments/ Schools of EE? | What would you do?<br>What would you like to have in a perfect world? |



## References


Graham, R. (2018). The global state of the art in engineering education. Retrieved from Massachusetts, USA: http://neet.mit.edu/wp-content/uploads/2018/03/MIT_NEET_GlobalStateEngineeringEducation2018.pdf

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EXTEND

Co-funded by the Erasmus+ Programme of the European Union

# 13 years of Project-Based Learning (PBL) interacting with companies

UNIVERSITY OF MINHO

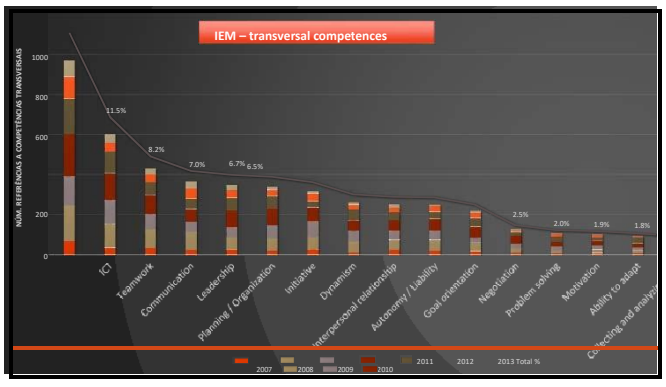
RUI M. LIMA

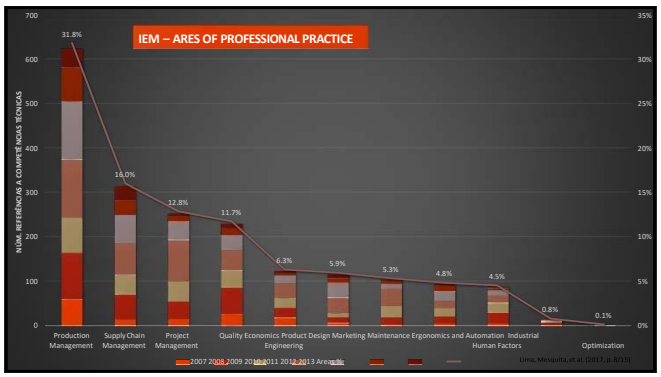
DIANA MESQUITA

## PBL at UMINHO

- Motivation for active learning
- PBL principles
- PBL at IEM - UMinho








## Goldberg, D. E., & Somerville, M. (2014). A Whole New Engineer - FIVE pillars OF CHANGE

Alegria (Joy) | Confiança (Trust) | Coragem (Courage) | Abertura (Openness) | Colaboração (Collaboration)



## Development of Competences

Teaching and Learning system based on the idea of **knowledge transfer** → transition → Teaching and Learning system based on the idea of **development of competences**

**Capacity to mobilize resources (knowledge, abilities, experiences, values,…) in specific contexts, to formulate and solve problems.**

Le Boterf (1997, 2004, 2005); Zarifian (2001)

**Learning outcomes are "statements of what a learner is expected to know, understand and/or be able to demonstrate after a completion of a process of learning".**

CEDEFOP (2009)

## Active Learning - key ideas

Active Learning – Meaningful Experiences

- Context – adequate environments
- Engagement – energy and motivation
- Relevance – why learn this?
- Critical thinking – evaluate their own learning
  - Felder & Brent (2009), Prince (2004), Prince & Felder (2006), Bonwell & Eison (1991)



## EVIDENCES?

**Based on a meta-analysis of the data published in 225 studies, Freeman et al. (2014) refer that active learning increases the performance in exams… and lectures increase the failure rate in 55%.**



## Active Learning environments (examples)

*Brainstorming* | Team buidling

*Gallery Walk*

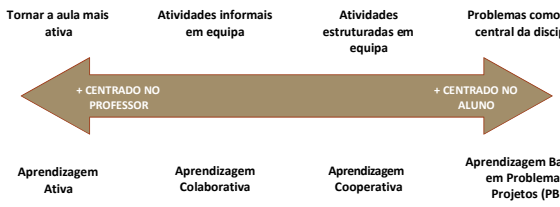
*Think Pair Share*

Flipped Classroom

PBL – Problem and Project-Based Learning

Gamification

## Aprendizagem ativa
## Continuum – M. Prince (2010)




Prince (2011) https://www.asee.org/documents/conferences/annual/2011/plenary-michael-prince.pdf

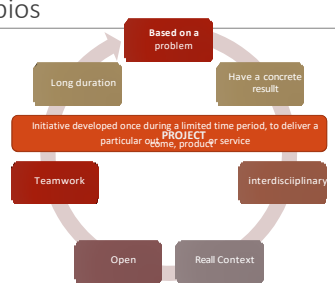


## "The Active Learning Continuum" - Prince

# PBL – Project Based Learning

APRENDIZAGEM BASEADA EM PROJETOS INTERDISCIPLINARES

## PBL - princípios






## Project types

***An exercise of project***

Course Project

Kolmos, 1996; Helle, Tynjälä, & Olkinuora, 2006



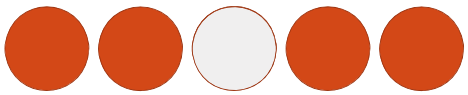
## Project types

A **course** as a project

Course Project

## Project types

**Interdisciplinary project** approach

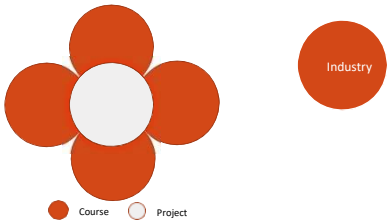


Course Project



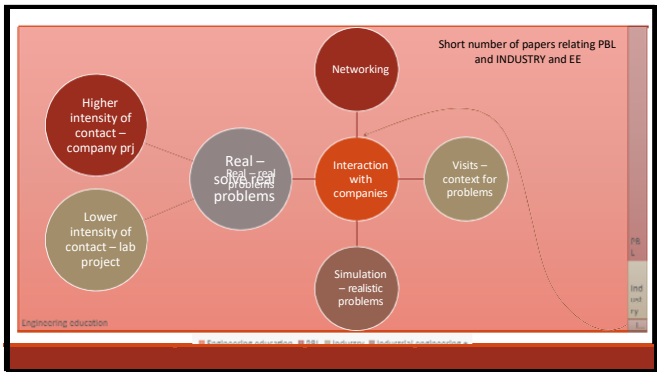
## Tipos de projetos

**Interdisciplinary project** approach

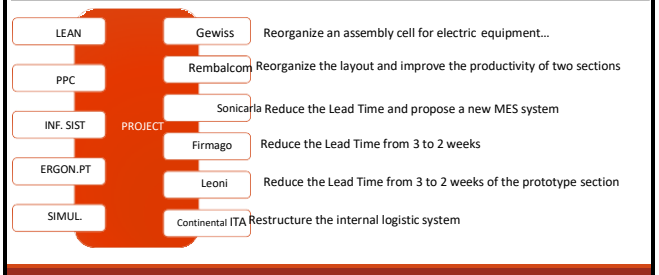



Course Project





## UMinho MIEGI_PBL – 7th Semester




Reorganize an assembly cell for electric equipment…

Reorganize the layout and improve the productivity of two sections

Reduce the Lead Time and propose a new MES system

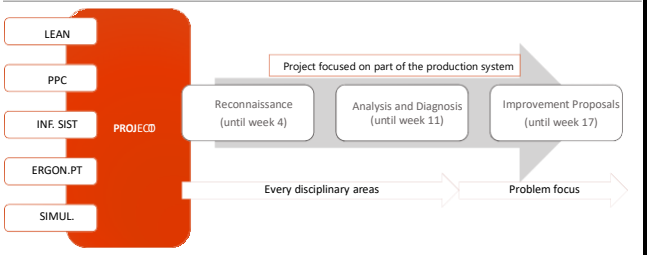
Reduce the Lead Time from 3 to 2 weeks

Reduce the Lead Time from 3 to 2 weeks of the prototype section

Restructure the internal logistic system

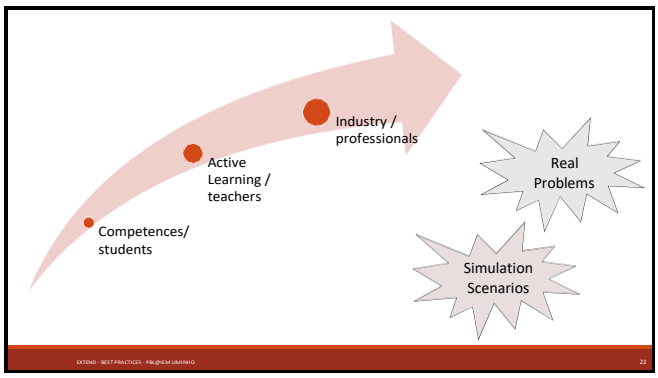


## UMinho MIEGI_PBL – 7th Semester



Vídeo final do G[illegible] EGI: https://youtu.be/BTFnEzt_TGI

[illegible] Sérgio Marques.



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EXTEND

Co-funded by the Erasmus+ Programme of the European Union

# Curriculum

UNIVERSITY OF MINHO

RUI M. LIMA

DIANA MESQUITA

## Outline

- Curriculum in the context of HE
- Curriculum in Practice
- Curriculum in EXTEND Centers



## What is Curriculum in the Context of HE?

**"MISSING TERM"**

Barnett, R., & Coate, K. (2005). Engaging the Curriculum in Higher Education. Maidenhead: Open University Press / Society for Research Into Higher Education.

## What is Curriculum in the Context of HE?

- **Curriculum as a product**
  Linear and static: Bobbitt (1918), Tyler (1949) e Taba (1962)
- **Curriculum as a process**
  Focus on the experiences: Caswell & Campbell, (1935), Tanner & Tanner (1980)
- **Curriculum as a project**
  Flexible and Alignment: Zabalza (2009); Biggs (2003); Barnett, et al. (2001).



## For a common understanding …

Curriculum is understood as a **project** and includes the **teaching and learning experiences**, the process of its **development** (design, development and evaluation) and the following **key elements** (objectives, content, resources, assessment and teaching and learning strategies), in order for students to develop knowledge and competences related to a given area/domain.

Zabalza, M. (2009). Competencias docentes del profesorado universitario: calidad y desarrollo profesional (2nd ed.). Madrid: Narcea.

Barnett, R., Parry, G., & Coate, K. (2001). Conceptualising Curriculum Change. Teaching in Higher Education, 6(4), 435-449.

Biggs, J. (2003). Teaching for quality learning at university. Maidenhead: SRHE & Open University Press.



## 3 KEY-IDEAS ABOUT CURRICULUM IN ENGINEERING EDUCATION

## 1/3

"engineering curricula play an important, if not crucial, role in the education process of professional engineers."

(Boud et al., 2009, p. 491)



## 2/3

Curriculum are made by people.

(different interests, visions, opinions about what should be)

## 3/3

"You must not interpret any of the ideas or procedures within this curriculum as final or binding […] we have learned to expect change"

(Goldberg & Sommerville, 2014, p. 23)



## Curriculum in Practice

… so we are talking about **curriculum continuous development**!

Enables the **conditions, situations, experiences and opportunities** for students to develop competences related to their professional practice.

In short, it to put the curriculum into **action** which implies **decision making.**



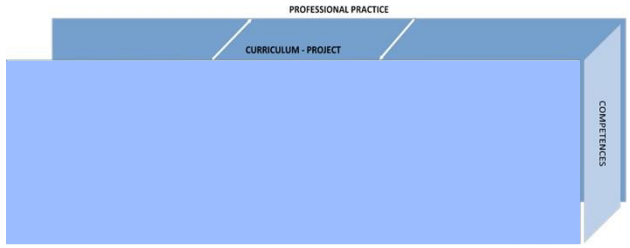
## Think-Pair-Share

**Think**
Individual – 2minutes
**What is the most important dimension of the curriculum in practice?**

**Pair**
Groups – 10 minutes
Share your individual perspective and get to a common idea inside the group

**Share**
All – 5 minutes
Present to all the idea of the group

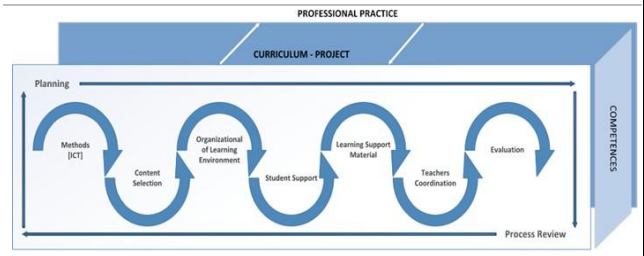
## Curriculum Development Model for HE




Mesquita (2015) - Model of Curriculum Development inspired in the ten criteria to assess quality of teaching in Higher Education – Zabalza, 2009



## Curriculum Development Model for HE

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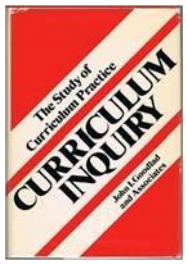
## Curriculum in Practice




Curriculum Levels
J. Goodlad (1979)

## Curriculum Levels

**IDEAL** — **FORMAL** — **OPERATIONAL**

**IDEAL CURRICULUM**
refers to the rational of basic philosophy underlying a curriculum, it represent ideas on believes and intentions. All possibilities are allowed, because it is all about the **ideas.**



## Curriculum Levels

**IDEAL** — **FORMAL** — **OPERATIONAL**

**FORMAL CURRICULUM**
is a transformation of the ideal curriculum in **formal documents**. Can be develop at different contexts: Ministry of Education (macro), University (meso), Teacher (micro).

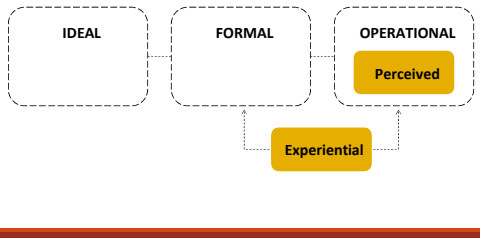


## Curriculum Levels

**IDEAL** — **FORMAL** — **OPERATIONAL**

**OPERATIONAL CURRICULUM**
refers to what actually happens in the classroom. Are related to the **teaching and learning practices** and the interaction between teachers, students and, in some occasions, other stakeholders (e.g. companies representatives).

## Curriculum Levels

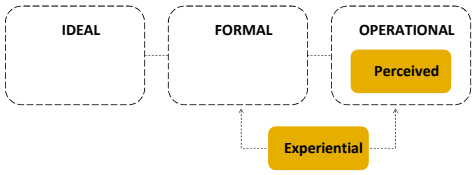



**EXPERIENTIAL CURRICULUM**

Refers to the **teaching and learning experiences** that exists in a program or course (e.g. PBL).



## Curriculum Levels




**PERCEIVED CURRICULUM**

Represents the **interpretations** of the stakeholders regarding to what happens in the classroom.



## Summary

- **Wider sense what is curriculum:**

Curriculum + Professional Practice + Competences

- **Curriculum Development:**

Put curriculum into action (making decisions about educational processes)

- **Curriculum happens at different levels and contexts:**

Ideal, Formal, Operational, Perceived and Experiential

## Curriculum in EXTEND CENTERS: It is important? WHY?



## Think-Pair-Share

**Think**
Individual – 5 minutes

**What we need to define, explore and develop about the curriculum in the context of the EXTEND CENTERS?**

**Pair**
Groups – 15 minutes

Share your individual perspective and get to a common idea inside the group

**Share**
All – 10 minutes

Present to all the idea of the group

EXTEND

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# Teacher Professional Development – sharing models and setting up some questions

UNIVERSITY OF MINHO

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## Teacher profile(s)

Some characteristics identified in literature:

- Transforming teaching and learning spaces
- Being able to innovate the pedagogical practice (e.g. try different strategies)
- Being open to learning (with students, peers, others)
- Working in a collaborative environment
- Communicate effectively (e.g. feedback, listening, asking questions)
- To know the different learning styles of students
- Open the classroom to the outside
- Have a sense of humor
- Be able to inspire and motivate students
- Reflecting on teaching practice

Zabalza, 2009; Goldber & Sommervile, 2014; Barnett, 2012; Biggs & Tang, 2011; Cowan, 2006; Fitzmaurice, 2010



## Continuous Professional Development (CPD) Models (Kennedy, 2005, 2014)

1. **Training** - generally 'delivered' to the teacher by an 'expert'
2. **Award-bearing** - relies on, or emphasises, the completion of award-bearing programmes of study – usually, but not exclusively, validated by universities
3. **Deficit** - designed specifically to address a perceived deficit in teacher performance.
4. **Cascade** - involves individual teachers attending 'training events' and then cascading or disseminating the information to colleagues.
5. **Standards-based** - represents a desire to create a (unified) system of teaching, and teacher education, that can generate and empirically validate connections between teacher effectiveness and student learning
6. **Coaching/mentoring** – defining characteristic of this model is the importance of the one-to-one relationship.
7. **Community of practice** - There is a clear relationship between communities of practice and the mutually supportive and challenging form of the coaching/mentoring model.
8. **Action research** - 'the study of a social situation, involving the participants themselves as researchers, with a view to improving the quality of action within it'.
9. **Transformative** - it could be argued that the transformative model is not a clearly definable model in itself; rather it recognises the range of different conditions required for transformative practice.

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7. Community of practice - [illegible] supportive and challenging form of the coaching/mentoring model.
8. Action research - 'the study of a social situation [illegible] participants themselves as researchers, with a view to improving the quality of action within it.'
9. Transformative - it [illegible] model in itself; rather it recognises the range of different conditions required for transformative practice.

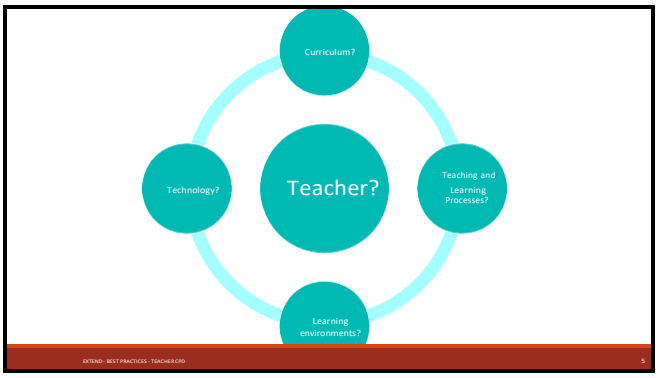
TRAINING

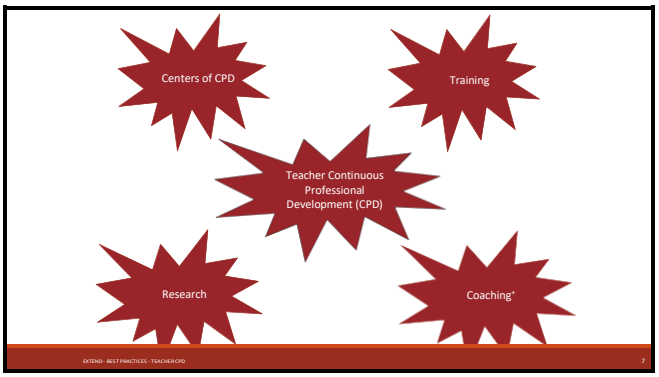
COACHING, MENTORING AND COMMUNITIES

RESEARCH

TRAINING, COACHING and RESEARCH









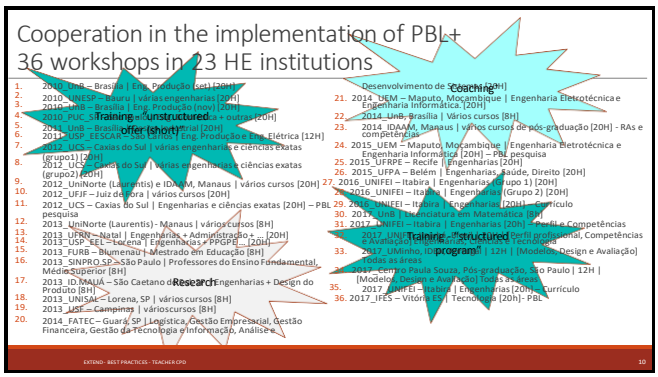

# Sharing



## Cooperation in the implementation of PBL+
## 36 workshops in 23 HE institutions

1. 2010_UnB – Brasília | Eng. Produção (set) [20H]
2. 2010_UNESP – Bauru | várias engenharias [20H]
3. 2010_UnB – Brasília | Eng. Produção (nov) [20H]
4. 2010_PUC_SP – São Paulo | Eng. Biomédica + outras [20H]
5. 2011_UnB – Brasília | Design Industrial [20H]
6. 2011_USP_EESCAR – São Carlos | Eng. Produção e Eng. Elétrica [12H]
7. 2012_UCS – Caxias do Sul | várias engenharias e ciências exatas (grupo1) [20H]
8. 2012_UCS – Caxias do Sul | várias engenharias e ciências exatas (grupo2) [20H]
9. 2012_UniNorte (Laurentis) e IDAAM, Manaus | vários cursos [20H]
10. 2012_UFJF – Juiz de Fora | vários cursos [20H]
11. 2012_UCS – Caxias do Sul | Engenharias e ciências exatas [20H] – PBL pesquisa
12. 2013_UniNorte (Laurentis) - Manaus | vários cursos [8H]
13. 2013_UFRN – Natal | Engenharias + Administração + … [20H]
14. 2013_USP_EEL – Lorena | Engenharias + PPGPE … [20H]
15. 2013_FURB – Blumenau | Mestrado em Educação [8H]
16. 2013_SINPRO.SP – São Paulo | Professores do Ensino Fundamental, Médio Superior [8H]
17. 2013_ID.MAUÁ – São Caetano do Sul, SP | Engenharias + Design do Produto [8H]
18. 2013_UNISAL – Lorena, SP | vários cursos [8H]
19. 2013_USF – Campinas | váriosc ursos [8H]
20. 2014_FATEC – Guará, SP | Logística, Gestão Empresarial, Gestão Financeira, Gestão da Tecnologia e Informação, Análise e Desenvolvimento de Sistemas [20H]
21. 2014_UEM – Maputo, Moçambique | Engenharia Eletrotécnica e Engenharia Informática [20H]
22. 2014_UnB, Brasília | Vários cursos [8H]
23. 2014_IDAAM, Manaus | vários cursos de pós-graduação [20H] - RAs e competências
24. 2015_UEM – Maputo, Moçambique | Engenharia Eletrotécnica e Engenharia Informática [20H] – PBL pesquisa
25. 2015_UFRPE – Recife | Engenharias [20H]
26. 2015_UFPA – Belém | Engenharias, Saúde, Direito [20H]
27. 2016_UNIFEI – Itabira | Engenharias (Grupo 1) [20H]
28. 2016_UNIFEI – Itabira | Engenharias (Grupo 2) [20H]
29. 2016_UNIFEI – Itabira | Engenharias [20H] – Currículo
30. 2017_UnB | Licenciatura em Matemática [8h]
31. 2017_UNIFEI – Itabira | Engenharias [20h] – Perfil e Competências
32. 2017_UNIFEI, Itajubá, Brasil | 20H | [Perfil profissional, Competências e Avaliação] Engenharias, Ciências e Tecnologia
33. 2017_UMinho, IDEA, Portugal | 12H | [Modelos, Design e Avaliação] Todas as áreas
34. 2017_Centro Paula Souza, Pós-graduação, São Paulo | 12H | [Modelos, Design e Avaliação] Todas as áreas
35. 2017_UNIFEI – Itabira | Engenharias [20h] – Currículo
36. 2017_IFES – Vitória ES | Tecnologia [20h]- PBL

## Cooperation in the implementation of PBL+ 36 workshops in 23 HE institutions




1. 2010_UnB – Brasília | Eng. Produção (set) [20H]
2. 2010_UnB – Brasília | Eng. Produção (nov) [20H]
3. 2010_UNESP – Bauru | várias engenharias [20H]
4. 2010_PUC_SP – São Paulo | Eng. Biomédica + outras [20H]
5. 2011_UnB – Brasília | Design Industrial [20H]
6. 2011_USP_EESCAR – São Carlos | Eng. Produção e Eng. Elétrica [12H]
7. 2012_UCS – Caxias do Sul | várias engenharias e ciências exatas (grupo1) [20H]
8. 2012_UCS – Caxias do Sul | várias engenharias e ciências exatas (grupo2) [20H]
9. 2012_UniNorte (Laurentis) e IDAAM, Manaus | vários cursos [20H]
10. 2012_UFJF – Juiz de Fora | vários cursos [20H]
11. 2012_UCS – Caxias do Sul | Engenharias e ciências exatas [20H] – PBL pesquisa
12. 2013_UniNorte (Laurentis) - Manaus | vários cursos [8H]
13. 2013_UFRN – Natal | Engenharias + Administração + ... [20H]
14. 2013_USP_EEL – Lorena | Engenharias + PPGPE ... [20H]
15. 2013_FURB – Blumenau | Mestrado em Educação [8H]
16. 2013_SINPRO.SP – São Paulo | Professores do Ensino Fundamental, Médio Superior [8H]
17. 2013_ID.MAUA – São Caetano do Sul, SP | Engenharias + Design do Produto [8H]
18. 2013_UNISAL – Lorena, SP | vários cursos [8H]
19. 2013_USF – Campinas | vários cursos [8H]
20. 2014_FATEC – Guará, SP | Logística, Gestão Empresarial, Gestão Financeira, Gestão da Tecnologia e Informação, Análise e Desenvolvimento de Sistemas [20H]
21. 2014_UEM – Maputo, Moçambique | Engenharia Eletrotécnica e Engenharia Informática [20H]
22. 2014_UnB, Brasília | Vários cursos [8H]
23. 2014_IDAAM, Manaus | vários cursos de pós-graduação [20H] - RAs e competências
24. 2015_UEM – Maputo, Moçambique | Engenharia Eletrotécnica e Engenharia Informática [20H] – PBL pesquisa
25. 2015_UFRPE – Recife | Engenharias [20H]
26. 2015_UFPA – Belém | Engenharias, Saúde, Direito [20H]
27. 2016_UNIFEI – Itabira | Engenharias (Grupo 1) [20H]
28. 2016_UNIFEI – Itabira | Engenharias (Grupo 2) [20H]
29. 2016_UNIFEI – Itabira | Engenharias [20H] – Currículo
30. 2017_UnB | Licenciatura em Matemática [8h]
31. 2017_UNIFEI – Itabira | Engenharias [20h] – Perfil e Competências
32. 2017_UNIFEI, Itajubá, Brasil | 20H | [Perfil profissional, Competências e Avaliação] Engenharias, Ciências e Tecnologia
33. 2017_UMinho, IDEA, Portugal | 12H | [Modelos, Design e Avaliação] Todas as áreas
34. 2017_Centro Paula Souza, Pós-graduação, São Paulo | 12H | [Modelos, Design e Avaliação] Todas as áreas
35. 2017_UNIFEI – Itabira | Engenharias [20h] – Currículo
36. 2017_IFES – Vitória ES | Tecnologia [20h]- PBL



## Cooperation in the implementation of PBL+ 36 workshops in 23 HE institutions

Training - "Programme"

1. 2010_UnB – Brasília | Eng. Produção (set) [20H]
2. 2010_UnB – Brasília | Eng. Produção (nov) [20H]
3. 2010_UNESP – Bauru | várias engenharias [20H]
4. 2010_PUC_SP – São Paulo | Eng. Biomédica + outras [20H]
5. 2011_UnB – Brasília | Design Industrial [20H]
6. 2011_USP_EESCAR – São Carlos | Eng. Produção e Eng. Elétrica [12H]
7. 2012_UCS – Caxias do Sul | várias engenharias e ciências exatas (grupo1) [20H]
8. 2012_UCS – Caxias do Sul | várias engenharias e ciências exatas (grupo2) [20H]
9. 2012_UniNorte (Laurentis) e IDAAM, Manaus | vários cursos [20H]
10. 2012_UFJF – Juiz de Fora | vários cursos [20H]
11. 2012_UCS – Caxias do Sul | Engenharias e ciências exatas [20H] – PBL pesquisa
12. 2013_UniNorte (Laurentis) - Manaus | vários cursos [8H]
13. 2013_UFRN – Natal | Engenharias + Administração + ... [20H]
14. 2013_USP_EEL – Lorena | Engenharias + PPGPE ... [20H]
15. 2013_FURB – Blumenau | Mestrado em Educação [8H]
16. 2013_SINPRO.SP – São Paulo | Professores do Ensino Fundamental, Médio Superior [8H]
17. 2013_ID.MAUA – São Caetano do Sul, SP | Engenharias + Design do Produto [8H]
18. 2013_UNISAL – Lorena, SP | vários cursos [8H]
19. 2013_USF – Campinas | vários cursos [8H]
20. 2014_FATEC – Guará, SP | Logística, Gestão Empresarial, Gestão Financeira, Gestão da Tecnologia e Informação, Análise e Desenvolvimento de Sistemas [20H]
21. 2014_UEM – Maputo, Moçambique | Engenharia Eletrotécnica e Engenharia Informática [20H]
22. 2014_UnB, Brasília | Vários cursos [8H]
23. 2014_IDAAM, Manaus | vários cursos de pós-graduação [20H] - RAs e competências
24. 2015_UEM – Maputo, Moçambique | Engenharia Eletrotécnica e Engenharia Informática [20H] – PBL pesquisa
25. 2015_UFRPE – Recife | Engenharias [20H]
26. 2015_UFPA – Belém | Engenharias, Saúde, Direito [20H]
27. 2016_UNIFEI – Itabira | Engenharias (Grupo 1) [20H]
28. 2016_UNIFEI – Itabira | Engenharias (Grupo 2) [20H]
29. 2016_UNIFEI – Itabira | Engenharias [20H] – Currículo
30. 2017_UnB | Licenciatura em Matemática [8h]
31. 2017_UNIFEI – Itabira | Engenharias [20h] – Perfil e Competências
32. 2017_UNIFEI, Itajubá, Brasil | 20H | [Perfil profissional, Competências e Avaliação] Engenharias, Ciências e Tecnologia
33. 2017_UMinho, IDEA, Portugal | 12H | [Modelos, Design e Avaliação] Todas as áreas
34. 2017_Centro Paula Souza, Pós-graduação, São Paulo | 12H | [Modelos, Design e Avaliação] Todas as áreas
35. 2017_UNIFEI – Itabira | Engenharias [20h] – Currículo
36. 2017_IFES – Vitória ES | Tecnologia [20h]- PBL



## Cooperation in the implementation of PBL+ 36 workshops in 23 HE institutions

Coaching

1. 2010_UnB – Brasília | Eng. Produção (set) [20H]
2. 2010_UnB – Brasília | Eng. Produção (nov) [20H]
3. 2010_UNESP – Bauru | várias engenharias [20H]
4. 2010_PUC_SP – São Paulo | Eng. Biomédica + outras [20H]
5. 2011_UnB – Brasília | Design Industrial [20H]
6. 2011_USP_EESCAR – São Carlos | Eng. Produção e Eng. Elétrica [12H]
7. 2012_UCS – Caxias do Sul | várias engenharias e ciências exatas (grupo1) [20H]
8. 2012_UCS – Caxias do Sul | várias engenharias e ciências exatas (grupo2) [20H]
9. 2012_UniNorte (Laurentis) e IDAAM, Manaus | vários cursos [20H]
10. 2012_UFJF – Juiz de Fora | vários cursos [20H]
11. 2012_UCS – Caxias do Sul | Engenharias e ciências exatas [20H] – PBL pesquisa
12. 2013_UniNorte (Laurentis) - Manaus | vários cursos [8H]
13. 2013_UFRN – Natal | Engenharias + Administração + ... [20H]
14. 2013_USP_EEL – Lorena | Engenharias + PPGPE ... [20H]
15. 2013_FURB – Blumenau | Mestrado em Educação [8H]
16. 2013_SINPRO.SP – São Paulo | Professores do Ensino Fundamental, Médio Superior [8H]
17. 2013_ID.MAUA – São Caetano do Sul, SP | Engenharias + Design do Produto [8H]
18. 2013_UNISAL – Lorena, SP | vários cursos [8H]
19. 2013_USF – Campinas | vários cursos [8H]
20. 2014_FATEC – Guará, SP | Logística, Gestão Empresarial, Gestão Financeira, Gestão da Tecnologia e Informação, Análise e Desenvolvimento de Sistemas [20H]
21. 2014_UEM – Maputo, Moçambique | Engenharia Eletrotécnica e Engenharia Informática [20H]
22. 2014_UnB, Brasília | Vários cursos [8H]
23. 2014_IDAAM, Manaus | vários cursos de pós-graduação [20H] - RAs e competências
24. 2015_UEM – Maputo, Moçambique | Engenharia Eletrotécnica e Engenharia Informática [20H] – PBL pesquisa
25. 2015_UFRPE – Recife | Engenharias [20H]
26. 2015_UFPA – Belém | Engenharias, Saúde, Direito [20H]
27. 2016_UNIFEI – Itabira | Engenharias (Grupo 1) [20H]
28. 2016_UNIFEI – Itabira | Engenharias (Grupo 2) [20H]
29. 2016_UNIFEI – Itabira | Engenharias [20H] – Currículo
30. 2017_UnB | Licenciatura em Matemática [8h]
31. 2017_UNIFEI – Itabira | Engenharias [20h] – Perfil e Competências
32. 2017_UNIFEI, Itajubá, Brasil | 20H | [Perfil profissional, Competências e Avaliação] Engenharias, Ciências e Tecnologia
33. 2017_UMinho, IDEA, Portugal | 12H | [Modelos, Design e Avaliação] Todas as áreas
34. 2017_Centro Paula Souza, Pós-graduação, São Paulo | 12H | [Modelos, Design e Avaliação] Todas as áreas
35. 2017_UNIFEI – Itabira | Engenharias [20h] – Currículo
36. 2017_IFES – Vitória ES | Tecnologia [20h]- PBL

## Cooperation in the implementation of PBL+ 36 workshops in 23 HE institutions

Research

1. 2010_UnB – Brasília | Eng. Produção (set) [20H]
2. 2010_UnB – Brasília | Eng. Produção (nov) [20H]
3. 2010_UNESP – Bauru | várias engenharias [20H]
4. 2010_PUC_SP – São Paulo | Eng. Biomédica + outras [20H]
5. 2011_UnB – Brasília | Design Industrial [20H]
6. 2011_USP_EESCAR – São Carlos | Eng. Produção e Eng. Elétrica [12H]
7. 2012_UCS – Caxias do Sul | várias engenharias e ciências exatas (grupo1) [20H]
8. 2012_UCS – Caxias do Sul | várias engenharias e ciências exatas (grupo2) [20H]
9. 2012_UCS – Caxias do Sul | Engenharias e Ciências Exatas [20H] – PBL pesquisa
10. 2012_UFJF – Juiz de Fora | Vários cursos [20H]
12. 2013_UniNorte (Laurentis) - Manaus | vários cursos [8H]
13. 2013_UFRN – Natal | Engenharias + Administração + … [20H]
14. 2013_USP_EEL – Lorena | Engenharias + PPGPE … [20H]
15. 2013_FURB – Blumenau | Mestrado em Educação [8H]
16. 2013_SINPRO/SP – São Paulo | Professores do ensino Fundamental, Médio Superior [8H]
17. 2013_ID.MAUA – São Caetano do Sul, SP | Engenharias + Design do Produto [8H]
18. 2013_UNISAL – Lorena, SP | vários cursos [8H]
19. 2013_USF – Campinas | vários cursos [8H]
20. 2014_FATEC – Guará, SP | Logística, Gestão Empresarial, Gestão Financeira, Gestão da Tecnologia e Informação, Análise e Desenvolvimento de Sistemas [20H]
21. 2014_UEM – Maputo, Moçambique | Engenharia Eletrotécnica e Engenharia Informática. [20H]
22. 2014_UnB, Brasília | Vários cursos [8H]
23. 2014_IDAAM, Manaus | vários cursos de pós-graduação [20H] - RAs e competências
24. 2015_UEM – Maputo, Moçambique | Engenharia Eletrotécnica e Engenharia Informática [20H] – PBL pesquisa
25. 2015_UEPRE – Recife | Engenharias [20H]
26. 2015_UFPA – Belém | Engenharias, Saúde, Direito [20H]
27. 2016_UNIFEI – Itabira | Engenharias (Grupo 1) [20H]
28. 2016_UNIFEI – Itabira | Engenharias (Grupo 2) [20H]
29. 2017_UNIFEI – Itabira | Engenharias [20H] – Outras competências
30. 2017_UnB | Licenciatura em Matemática [20H]
31. 2017_UNIFEI, Itabira, Brasil | 20H | Perfil profissional, Competências e Avaliação| Engenharias, Ciências e Tecnologia
33. 2017_UMinho, IDEA, Portugal | 12H | (Modelos, Design e Avaliação) Todas as áreas
34. 2017_Centro Paula Souza, Pós-graduação, São Paulo | 12H | (Modelos, Design e Avaliação) Todas as áreas
35. 2017_UNIFEI – Itabira | Engenharias [20h] – Currículo
36. 2017_IFES – Vitória ES | Tecnologia [20h] -PBL



## pipBIRA – program
(Pedagogical Innovation Programme in Itabira)

| Diagnostic | 2016/01 | 2016/02 | 2017/01 | 2017/02 | 2018/01 | 2018/02 | Closing |
|---|---|---|---|---|---|---|---|
| - Teachers' profile<br>- Programme guide | Project Based Learning – PBL | Curriculum development version 1.0 | Professional profile and competences | Curriculum development version 2.0 | Engineering Education Research | Coaching for teachers | - Global Evaluation/ Impact<br>- eBook production<br>- Final event |

## pipBIRA – program
(Pedagogical Innovation Programme in Itabira)

**Coaching & Mentoring** – Individual or collective sessions to meet the needs of program participants (EE practice, research, classroom implementation, etc.)

**Lectures** – delivered by specialists at the beginning of the academic year, as an opportunity to involve the entire teacher and staff community in the themes that will be worked on in the workshops.

**Student Workshops** - held at the beginning of the 2nd semester, in order to involve students in the process of institutional change, being a privileged moment to gather their motivations and expectations about their educational process. Theme: definition and development of competences for the practice of Engineering.

**Workshops** - 20 hours of training for 50 teachers divided into two groups (T1 and T2), which are joined together in the last day for sharing presentations of the results and preparation of the next phase.

**Workshop evaluation** - always to be done at the end of the week

**WIP - *work in process*** - post-workshop activities developed by the participants in order to deepen the knowledge acquired in the workshop and reflect on their teaching practices. Each participant will build a portfolio over the three years.

## CET@UPT – program
## Center for Excellence in Teaching

| 2017 | 03/2018 | 05/2018 | 04/2018 a 07/2018 (*) | 05/2018 | 06/2018 | 07/2018 |
|---|---|---|---|---|---|---|
| Active Learning Strategies: an introduction (6h)<br><br>Followed by a follow up session at the end of next semester | Project Based Learning (PBL) | Curriculum development (levels of curriculum using gamification)<br><br>Course Coordinator Oriented | Scholarship of Teaching and Learning (SoTL)<br><br>(*) one session per month | Team Based Learning (TBL) | Flipped Classroom | Final Event Presentation of training results and experiences of pedagogical innovation to the community. |

Each theme is composed of 4 sessions of 3 hours (total 12 hours)
Each teacher has to do at least two training actions (compulsory).
Supplemental Coaching & Mentoring sessions with lesson observation (volunteer)



## Teacher CPD – What is the idea?

Training Programs?
- Why? Difficulties? Teacher assessment?

Coaching*?
- Why? Difficulties? Resources?

Research?
- Why? Difficulties? Value?

Resources?
- Pedagogical exemplary room?
- Fab Lab? Fab lab (fabrication laboratory) is a small-scale workshop offering (personal) digital fabrication
- People 10%-100%?
- …



## References

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# Best European Practices in Teaching Engineering Disciplines and Teacher Competence Enhancement-Examples

**Maria-Iuliana Dascalu, PhD**
**Elizabeth Lazarou, UPB coordinator**
**Laura Trifan, PhD**

University POLITEHNICA of Bucharest, Faculty of Engineering in Foreign Languages

*EXTEND Seminar, 3rd of June – 9th of June, UPB, Bucharest, Romania*

1

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## Oracle Academy

- Research and development
- Curriculum development and delivery
- Governance
- Lifelong learning
- Internationalization and mobility
- Higher education
- Industry

**I. Quick Facts**
EU country: global
WEB page: https //academy.oracle.com/
Competence enhancement: University teachers are provided with a complete portfolio of computer science education resources.
Relation to engineering: Computer science

2

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## Oracle Academy

**II Summary**
Mission:
- To provide resources to help prepare teachers and students for life and work in our modern technology-driven global economy.

Description:
- Each year, Oracle Academy reaches more than 3.5 million students in 120 countries.
- Oracle Academy offers a complete portfolio of computer science education resources to secondary schools; technical, vocational, and two-year colleges; and 4-year colleges and universities, with the goal of helping students become college and career ready.
- Oracle Academy supports continuous computer science learning at all levels, making available a variety of resources that can be used in the classroom and in not-for-profit academic course- and degree-related research, including technology, curriculum and courseware, student workshops, educator training, and Oracle industry certification and exam preparation materials.
- Students develop IT and business skills while using production software used widely across hundreds of industries, and educators keep pace with current technology through ongoing professional development.

**III Checklist of Prerequisites to success**
- Willingness of institution to make an account on Oracle Academy
- Willingness of teachers to enroll in the Oracle Academy program
- Infrastructure (classrooms and labs), staff (academic)

3

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## Summer Schools organised by Faculty of Automatic Control and Computers, UPB

- Research and development
- Curriculum development and delivery
- Governance
- Lifelong learning
- Internationalization and mobility
- Higher education
- Industry

**I. Quick Facts**
EU country: Romania
WEB page: http://acs.pub.ro/
Competence enhancement: University teachers need to have/increase the ability of conducting projects and workshops with a high practical applicability, correlated with industry needs.
Relation to engineering: Computer science

4

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## Summer Schools organised by Faculty of Automatic Control and Computers, UPB

**II Summary**
Mission:
- To provide advanced educational resources related to specialised fields of computer science, with a high practical focus.

Description:
- Each year, ACS organises several specialized summer schools, which last 2 months e.g. 3DUPB Summer School (http://3d.upb.ro/), LeMAS "Multi-Agent Systems and Learning Agents" Summer School etc
- Industry guest lectures are invited at these summer schools.
- The curriculum is aligned with the mandatory university curriculum and offers extra knowledge.
- The students can equivalate their mandatory practical period with their participation at the summer schools.
- Summer schools are a starting point for the final bachelor projects.
- Summer schools are a good way of attractive students from other universities to master and PhD studies at UPB.

**III Checklist of Prerequisites to success**
- Directives of faculties' leaders
- Willingness of faculty teachers to organize the summer schools
- Infrastructure (classrooms and labs), staff (academic)

5

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## Faculty of Engineering in Foreign Languages, UPB

- Research and development
- Curriculum development and delivery
- Governance
- Lifelong learning
- Internationalization and mobility
- Higher education
- Industry

**I. Quick Facts**
EU country: Romania
WEB page: http://ing.pub.ro/
Competence enhancement: University teachers need to have/increase the ability of teaching engineering disciplines in foreign languages, correlated with international curricula.
Relation to engineering: Computer Science, Applied Electronics, Mechanical Engineering, Chemical Engineering, Engineering and Management

6

EXTEND Co-funded by the Erasmus+ Programme of the European Union

## Faculty of Engineering in Foreign Languages, UPB

**II Summary**

Mission:

- To provide higher engineering education in 3 foreign languages of international circulation: English, French and German.

Description:

- The formation of bilingual and multilingual specialists with a wide area of expertise, capable of filling the needs of Romanian companies with developed external partnerships, of mixed enterprises and of foreign enterprises established in Romania.
- The promotion of mobility for students by facilitating their travel abroad for internships in foreign companies, perfecting their language skills and offering the possibility of study in foreign partner universities and also creating opportunities for student exchanges.
- The development of bilateral and multilateral ties with the engineering schools of foreign universities, in the purpose of assuring a rapid exchange of pedagogical and specialized knowledge and of creating the conditions for the recognition of diplomas.
- The possibility for foreign students to directly commence their studies without the need of learning the Romanian language beforehand.

**III Checklist of Prerequisites to success**

- Directives of university leaders'
- Engineering teachers who have foreign languages competences
- Infrastructure (classrooms and labs), staff (academic+administrative)

7

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## Entrepreneurship Center, UPB

- Research and development
- Curriculum development and delivery
- Governance
- Lifelong learning
- Internationalization and mobility
- Higher education
- Industry

**I. Quick Facts**

EU country: Romania

WEB page: http://antreprenoriat.upb.ro/

Competence enhancement: University teachers need to have/increase entrepreneurship skills and how to fasten the transfer of knowledge to industry.

Relation to engineering: all areas of engineering

8

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## Faculty of Engineering in Foreign Languages, UPB

**II Summary**

Mission:

- the support, development and encouragement of the entrepreneurial spirit among the students and graduates, in order to transform UPB into a supporter of the business environment;
- the diversify the university education package by including a series of activities complementary to the university curriculum.

Description:

- Several courses related to starting a business are provided.
- Mentorship and success stories are offered to students.
- Industry specialists and experts are involved in the centre activities.
- Hackathons and startup accelerators are organised.

**III Checklist of Prerequisites to success**

- Directives of university leaders'
- Engineering teachers with entrepreneurship skills
- Infrastructure (classrooms and labs), staff (academic+administrative)

9

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## IT University, Sweden

- Research and development
- Curriculum development and delivery
- Governance
- Lifelong learning
- Internationalization and mobility
- Higher education
- Industry

**I. Quick Facts**
EU country: Sweden
WEB page: **http://www ituniv.se/**
Competence enhancement: University teachers need to have/increase the ability of conducting research and educational collaborative activities with industries.
Relation to engineering: ITC

10

EXTEND Co-funded by the Erasmus+ Programme of the European Union

## IT University, Sweden

**II Summary**
Mission:
- to manage and develop the areas within ICT in Gothenburg that are not already a part of any of the Areas of Advance, departments or of the ordinary education areas, with questions about how the use of IT can lift each business.

Description:
- IT University is a network common between Chalmers and University of Gothenburg. In order to regulate the activities there is an agreement signed by the President of Chalmers and the Vice Chancellor of University of Gothenburg.
- The IT University is also responsible for linking IT to research, education and other activities where IT is not the area's main component, but an important tool to reach full potential and acheive excellence in research and education.
- IT University will also actively contribute to the development of a virtual campus at Lindholmen in Gothenburg. **Lindholmen Science Park** is an international collaborative environment for research, innovation and education within the areas Transport, ICT and Media. The universities collaborate with high tech industries and the local community in different development projects. Currently 250 companies, notably Volvo Cars, Volvo Technology, Ericsson, IBM. Over 21 000 employees or students are working or studying at the area.

**III Checklist of Prerequisites to success**
- Directives of university leaders'
- Infrastructure (classrooms and labs), staff (academic+administrative)
- Proximity of companies and universities
- Willingness of collaboration from the private sector

11

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## Other Initiatives

- Professionally oriented HEI, such as the **universities of Applied Science**, which provide educational programmes oriented towards immediate needs of labour market and usually involving some form of work-based component.

- The **German and Hungarian models** with "dual" HE studies:
  - The dual system consists in a new, but emerging programme format at tertiary level, which combines an advanced practical apprenticeship with a "school-based" theoretical programme.
  - Example: the combination between mechanical engineering courses and an apprenticeship in the automotive sector.
  - Both the German and Hungarian systems are distinctive in requiring students to follow two programmes (HE and VET) in parallel.
  - The Hungarian model is a joint initiative between government, the HE sector and private business, whereas the Germany model is based on the business leadership. In both cases, key challenges have been to facilitate the participation of SMEs in the system and to ensure proper coordination between the (pre-existing) school and work-based courses.

•Source: EC-DGEC (2015) Promoting employability through higher education, ET 2020 country workshop, Brussels, 2-3 February 2015, European Commission, Directorate-General for Education and Culture available at: http://ec.europa.eu/education/policy/strategic-framework/expert-groups/documents/higher-education-employability_en.pdf

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## Other Initiatives

• The **Austrian model** of the dual VET system: Austria offers an ideal combination of theoretical background knowledge, practical skills and important key qualifications. The wide success of this training proves that young people are aware of the benefits of apprenticeship.

•Source: FMSRE (2014) Apprenticeship: dual vocational education and training in Austria ; modern training with a future / Federal Ministry of Science, Research and Economy [Ed.]. - 13th, rev. ed., August 2014. - Vienna, 2014

13

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## Things to Reflect Upon

• What elements can be inserted in EXTEND excellence centres?

•What resources are necessary to do that?

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## Thank you!

**Contact:**
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http://mariaiulianadascalu.com/

University POLITEHNICA of Bucharest
Vice Dean, Faculty of Engineering in Foreign Languages
Associate professor, Department of Engineering in Foreign Languages

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# Technology-enhanced learning (TEL)

**Elisabeth Lazarou – Elisabeth.lazarou@upb.ro**

**EXTEND seminar, February 3rd – 9th June 2018,**

**University Politehnica of Bucharest (UPB), Romania**

# Benefits

- Inclusion – students who struggle to engage in the classroom
- Stay in touch with what is going on beyond the classroom
- Instant communication
- Gives you a global perspective
- Worldwide access

www.doleta.gov

# Benefits (2)

- Can be a more engaging process of learning – interactive
- Leave work for students to catch up with – absences etc.
- Lecture capture
  - Reinforce learning
  - Students relive the moment!!

# Benefits (3)

- Multi-sensory tools for learning
- Define your own work hours (as can students)
- Automated systems record submission times
- Plagiarism software – e.g. Turnitin
  (Technology to improve student writing)

# Tools for learning

- **Tools for teaching and learning** http://c4lpt.co.uk/top100tools/ (200 tools)
- You tube
- Hihaho: www.hihaho.com (interactive video)
- Coursera: www.coursera.org (MOOC)
- Animoto: https://animoto.com/ (video maker / video creator)
- Adobe Premiere: **www.adobe.com**/products/**premiere**.html (video editing software )
- Padlet: https://**padlet.com**

  can be used for collaboration, presentation and reflection: https://www.youtube.com/watch?v=5c9vWCPn8ys

**Social media:** WhatsApp – Facebook - Twitter etc.

**Light Board**

https://www.youtube.com/watch?v=N1I4Afti6XE

https://www.youtube.com/watch?v=FYwXOLU4TKk

# Tools for teaching and learning

http://c4lpt.co.uk/top100tools/ (200 tools)

**First step**: 15 minutes: to familiarize yourself with the content of the website

**Second step: (Partner-work)**

a) Your target audience?

b) The learnings objectives (outcomes) that you want to achieve with this tool

c) Create the task with this tool

**Thrid Step:** Presentation

# Teacher Professional Development

June 2018

## What we will explore

- What and Why?
- The UK Perspective
- Other considerations

# What and Why?

- What do you want to achieve?
- What should it look like?
- Why is it important to you?

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# What and Why?

- Competent and Confident
- Creative and Flexible
- Up to date
- Engaging
- Deliver a great student experience
- Facilitate learning
- Anything else?

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# The UK Perspective

- Ad hoc
- Teaching Qualification
- UK Professional Standards Framework

- An obvious progression

# The Environment

NSS
National Student Survey

Postgraduate
Taught
Experience
Survey

# 6th November 2015

- 105 pages to digest
- Teaching Excellence Framework
- "Universities should produce well equipped students ready to contribute to society and business"
- An opportunity?

# What is the TEF?

- Student Experience (NSS)
- Employment Destinations (DLHE)
- Look at for different groups of students
- Rating – Gold, Silver, Bronze

# The Aspiration

**Gold**: The Panel will award a provider a rating of Gold if it appears likely, based on the evidence available to the Panel, that provision is consistently outstanding and of the highest quality found in the UK Higher Education sector; that is:

The provider achieves consistently outstanding outcomes for its students from all backgrounds, in particular with regards to retention and progression to highly skilled employment and further study. Course design and assessment practices provide scope for outstanding levels of stretch that ensures all students are significantly challenged to achieve their full potential, and acquire knowledge, skills and understanding that are most highly valued by employers. Optimum levels of contact time, including outstanding personalised provision secures the highest levels of engagement and active commitment to learning and study from students.

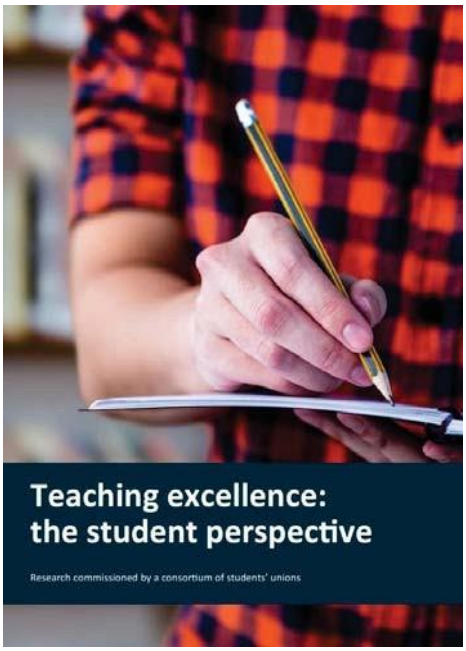
Outstanding physical and digital resources are actively and consistently used by students to enhance learning. Students are consistently and frequently engaged with developments from the forefront of research, scholarship or practice, and are consistently and frequently involved in these activities. An institutional culture that facilitates, recognises and rewards excellent teaching is embedded across the provider.

TEF Teaching Excellence Framework

TEF: Year 2 and beyond – Government response September 2016

# A sobering thought

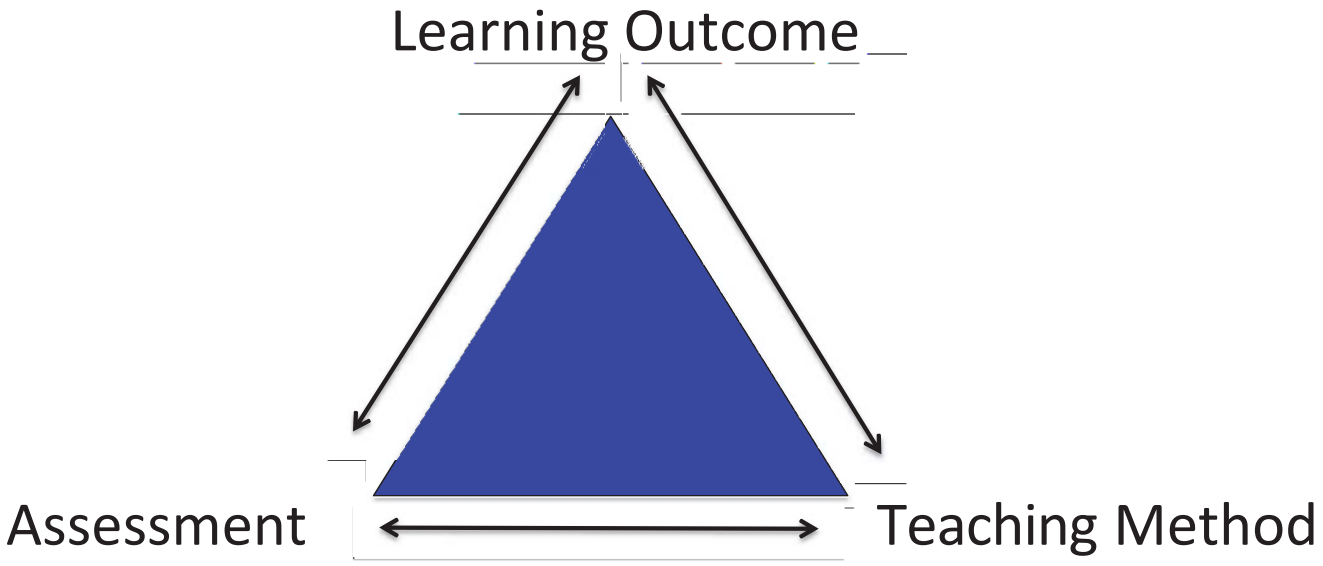
- Study of 9000 students across 123 institutions
- 50% would not have applied or would have reconsidered applying to a bronze rated university



# Teaching Qualification

- Postgraduate Certificate
  - Intro to L+T in HE
  - Engaging Practice
  - Assessment and Feedback
  - Individual Project
- Portfolio based
- Observations and sharing
- Mapped against UKPSF

# Starting Point



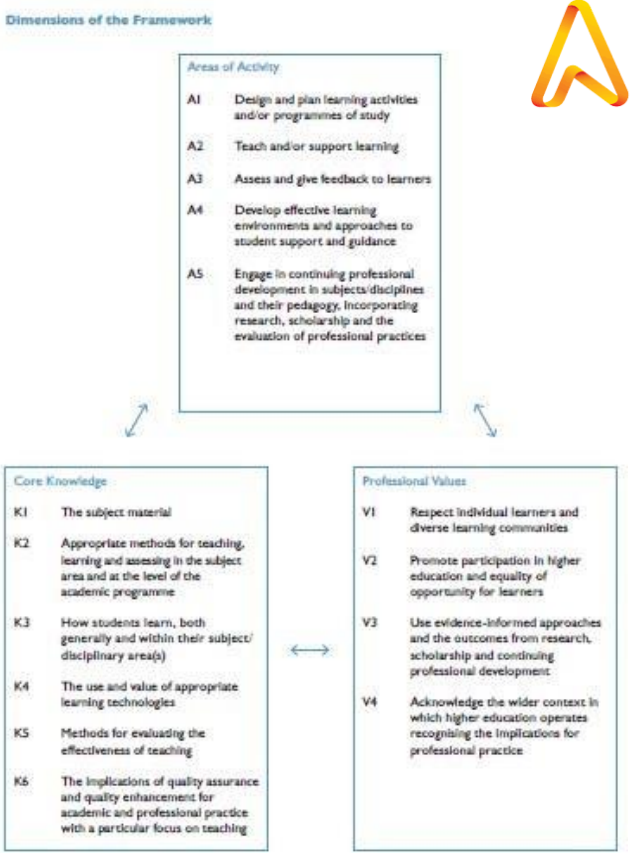

**Constructive alignment** (Biggs, 1999, 2003)

# R+V+S = Student Success

- **Relationships** – between us all as, despite technology, contact is valued
- **Variety** – how we engage students in different ways
- **Synergy** – beyond alignment – pre-university to LLL
- A way to communicate priorities – basis for a plan of action

Clark, R. & Andrews, J. (2014). "Relationships, Variety & Synergy: The vital ingredients for scholarship in engineering education?" *European Journal of Engineering Education,* Volume 39, No. 6, pp 585-600

# UK PSF




Higher Education Academy

# HEA

- The national body which **champions teaching excellence**.
- Works with governments, ministries, universities and **individual academics** in the UK, and around the globe.
- Provides value to the HE sector by focusing on the **contribution of teaching** as part of the wider student learning experience.
- **Champions teaching excellence** in higher education across the globe to improve student outcomes.
- Focuses entirely on **improving approaches to teaching**, and **individual teaching practice**, to help improve the student journey into, through and beyond higher education.
- Helps to **raise the profile of teaching** so that **staff are recognised for their work** and are **motivated to keep developing their knowledge and careers**.
- Independent, not-for-profit, charitable and non-regulatory organisation working for, and on behalf of, the whole sector.

https://www.heacademy.ac.uk/about-us

# Why are HEA Fellowships important?

- International recognition as a HE teaching professional
- To consolidate personal development
- Use of post-nominal letters
- A portable asset to your career

- For the institution: your achievement can be recoded as part of the institutional Key Information Set (KIS) data

- Training / Coaching / Research

# Four Fellowship Categories

- Associate Fellow
- Fellow
- Senior Fellow
- Principal Fellow

# Associate Fellow (AFHEA)

If you are able to provide evidence of effectiveness in relation to your professional role which will typically include **at least some teaching and/or learning support** responsibilities, by applying for Associate Fellowship you will present an understanding of specific aspects of effective teaching, learning support methods and student learning.

https://www.heacademy.ac.uk/individuals/fellowship

# Fellow (FHEA)

If you are able to provide evidence of broadly based effectiveness in **more substantive teaching and supporting learning roles** and can demonstrate a broad understanding of effective approaches to learning and teaching support as a key contribution to high quality student learning.

https://www.heacademy.ac.uk/individuals/fellowship

# Senior Fellow (SFHEA)

If you can demonstrate a thorough understanding of effective approaches to teaching and learning support as a key contribution to high quality student learning. You may be an **experienced member of staff able to demonstrate impact and influence on other colleagues** through, for example, **responsibility for leading, managing or organising programmes, subjects and/or disciplinary areas**.

https://www.heacademy.ac.uk/individuals/fellowship

# Principal Fellow (PFHEA)

If you can demonstrate a **sustained record of effective strategic leadership** in academic practice and development and you are **highly experienced with wide-ranging strategic leadership responsibilities** in connection with key aspects of teaching and supporting learning

https://www.heacademy.ac.uk/individuals/fellowship

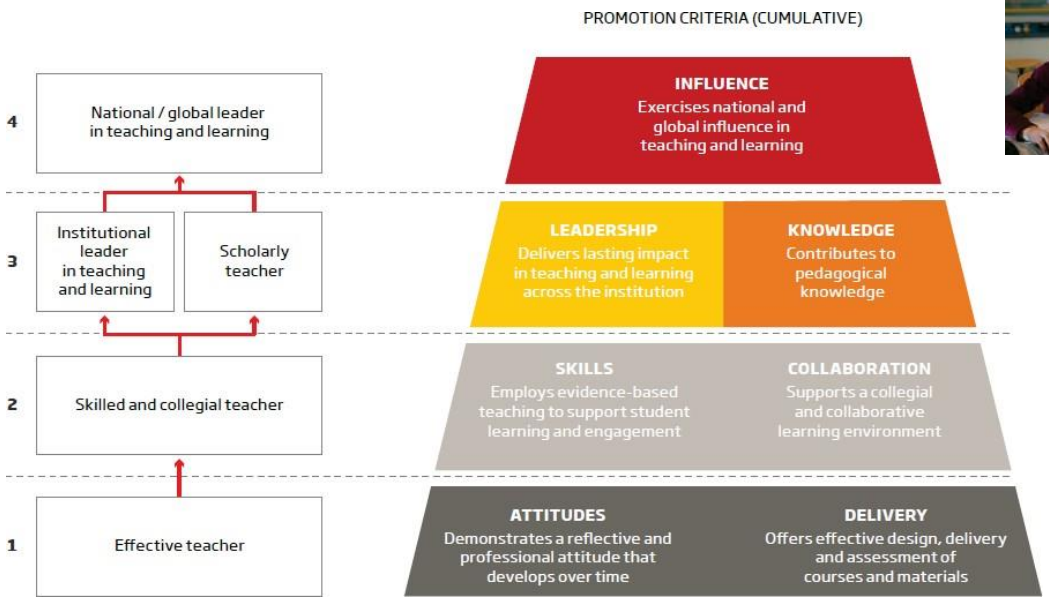
# What does this mean?

- Framework for Professional Development
- Institution provided CPD
- Department provided CPD
- Opportunities for scholarship
- Opportunities for networking
- Linked to promotion and recognition
- Promotes reflection
- Key word is EVIDENCE

# Recognition

ROYAL ACADEMY OF ENGINEERING

The Career Framework for University Teaching: background and overview




# Warwick Approach

| | RESEARCH AND SCHOLARSHIP | TEACHING AND LEARNING | IMPACT, OUTREACH, ENGAGEMENT | COLLEGIALITY, LEADERSHIP AND MANAGEMENT |
|---|---|---|---|---|
| **FA9 - Professor** | | | | |
| To be achieved through meeting minimum thresholds in each of the four key areas of activity as detailed below<br>Total minimum score = 22 | | | | |
| Research and Teaching (Minimum required) | 7 | 5 | 4 | 4 |
| Teaching Focused (Minimum required) | 3 | 8 | 4 | 4 |
| Research Focused (Minimum required) | 8 | 3 | 4 | 4 |
| **FA8 - Reader** | | | | |
| To be achieved through meeting minimum thresholds in each of the four key areas of activity as detailed below<br>Total minimum score = 20 | | | | |
| Research and Teaching (Minimum required) | 6 | 4 | 3 | 3 |
| Teaching Focused (Minimum required) | 3 | 7 | 3 | 3 |
| Research Focused (Minimum required) | 7 | 3 | 3 | 3 |
| **FA8 -Associate Professor** | | | | |
| To be achieved through meeting minimum thresholds in each of the four key areas of activity as detailed below<br>Total minimum score = 18 | | | | |
| Research and Teaching (Minimum required) | 5 | 4 | 3 | 3 |
| Teaching Focused (Minimum required) | 3 | 6 | 3 | 3 |
| Research Focused (Minimum required) | 6 | 3 | 3 | 3 |
| **FA7** | | | | |
| To be achieved through meeting minimum thresholds in each of the four key areas of activity as detailed below<br>Total minimum score = 14 | | | | |
| Research and Teaching (Minimum required) | 4 | 3 | 2 | 2 |
| Teaching Focused (Minimum required) | 2 | 5 | 2 | 2 |
| Research Focused (Minimum required) | 5 | 2 | 2 | 2 |
| **FA6** | | | | |
| To be achieved through meeting minimum thresholds in each of the four key areas of activity as detailed below<br>Total minimum score = 10 | | | | |
| Research and Teaching (Minimum required) | 3 | 2 | 1 | 1 |
| Teaching Focused (Minimum required) | 2 | 4 | 1 | 1 |
| Research Focused (Minimum required) | 4 | 2 | 1 | 1 |

- Provide evidence for excellence in teaching against the criteria
  - Student feedback / teaching observations
  - Sustained exceptional student achievement
  - Doctoral student completions
  - Research and scholarship
  - CPD (courses, mentoring, student reviews)
  - Contributions to teaching committees, outreach etc.
  - Invitations to teach / present (external to department)
  - External recognition – committees, awards etc.

# Evidence

- WATE
- WIHEA
- National Teaching Fellowship

# Your context

- What 'frameworks' are in place in your institutions?
- How effective are they?
- How could they be improved?

# EER and Scholarship

- Why is it of value?
- How can we nurture it?
- Where is there support?

# The Value

- Proactive approach to L+T
- Evidence
- Informed decision making
- Sharing
- Network
- Professional recognition
- Promotion
- **NOT** for research only

# UK Network

- 2009 – Special Interest Group
- 2013 – First Annual Symposium
- 2014 – Network and welcome Ireland
- Independent
- 5th Annual Symposium – November 2017 in London

UK&IE EER network

# Our community

IfM

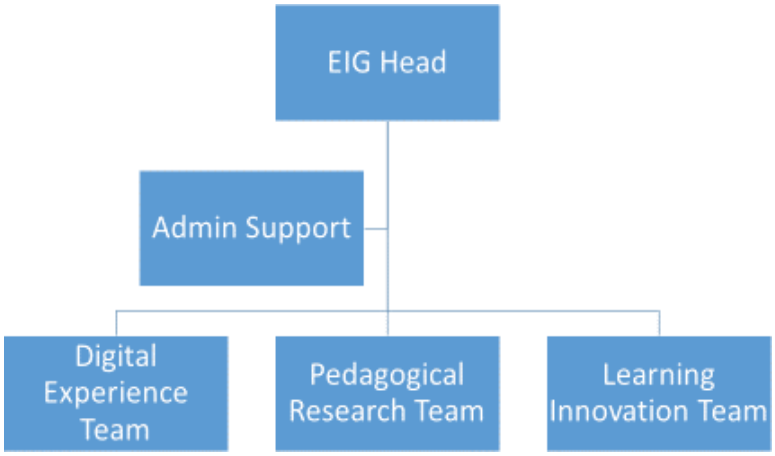
ASEC
Aston STEM
Education Centre

UCL Centre for Engineering Education

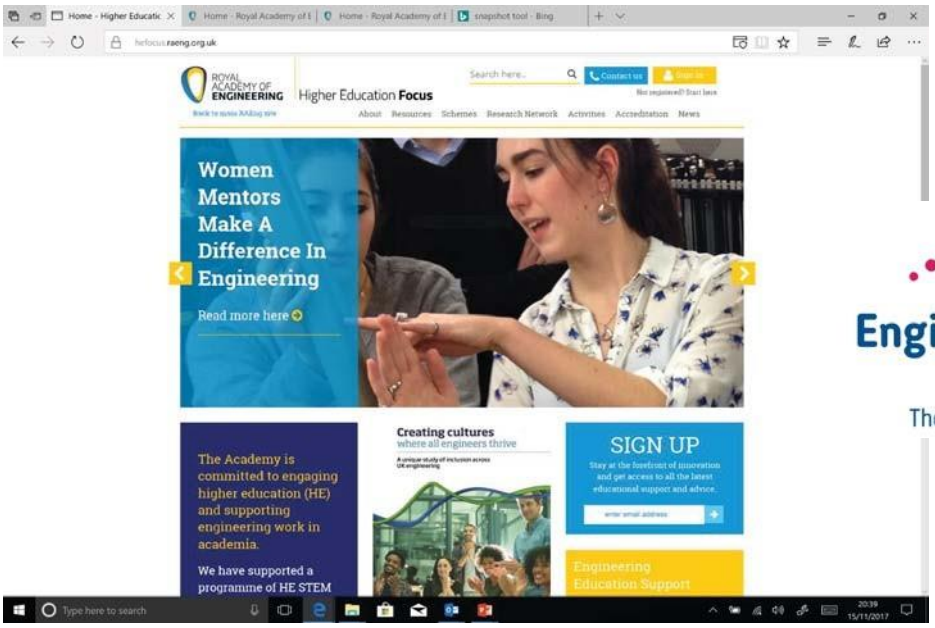
WMG
THE UNIVERSITY OF WARWICK

cdio
CONCEIVE DESIGN IMPLEMENT OPERATE

# WMG Education Innovation Group




# Network Visibility




Engineering Professors COUNCIL

The voice of engineering academics

# Beyond the UK

- SEFI
- REEN
- ASEE, AAEE, SASEE, CDIO
- Centres and National Societies
- EU Projects – QAEMP

QUALITY ASSURANCE AND ENHANCEMENT
MARKETPLACE FOR HIGHER EDUCATION INSTITUTIONS

Research in Engineering Education Network
REEN

CENTRE FOR ENGINEERING EDUCATION

European Society for Engineering Education
Europäische Gesellschaft für Ingenieur-Ausbildung
Société Européenne pour la Formation des Ingénieurs

QUALITY ASSURANCE AND ENHANCEMENT
MARKETPLACE FOR HIGHER EDUCATION INSTITUTIONS

TURKU AMK

Aston University

# Self Evaluation and Assessment

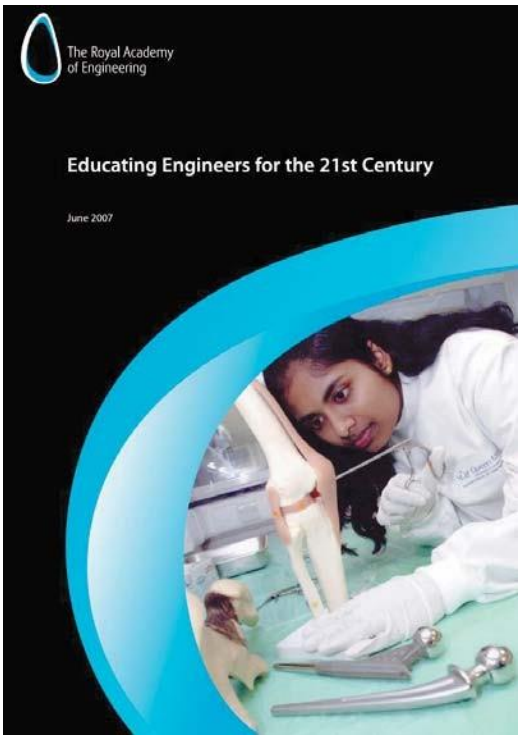
- A set of criteria drawn from a comprehensive range of Quality Frameworks*
- Pairing process based on outcomes of the self assessment questionnaire
- Cross-sparring visits and peer learning in a supportive community of practice
- Sharing of best practice
- Structured implementation

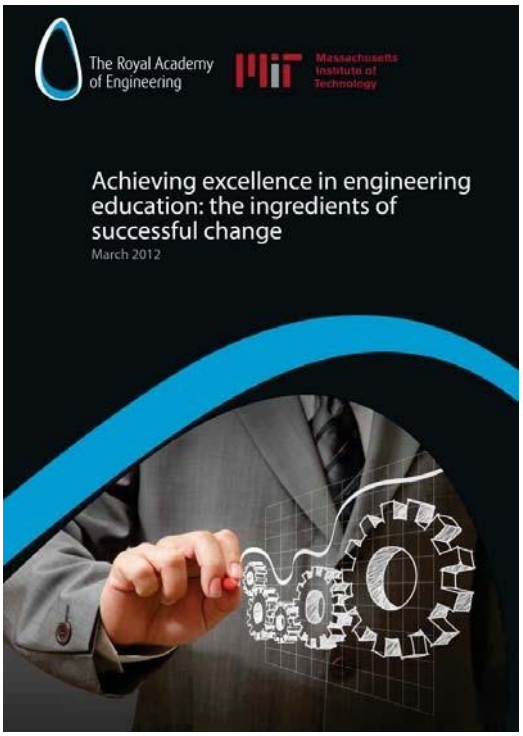
* Clark et al (2015): Developing a Robust Self Evaluation Framework for Active Learning : The First Stage of an Erasmus + Project (QAEMarketPlace4HEI ) Proceedings of the 43rd SEFI conference

# Criteria

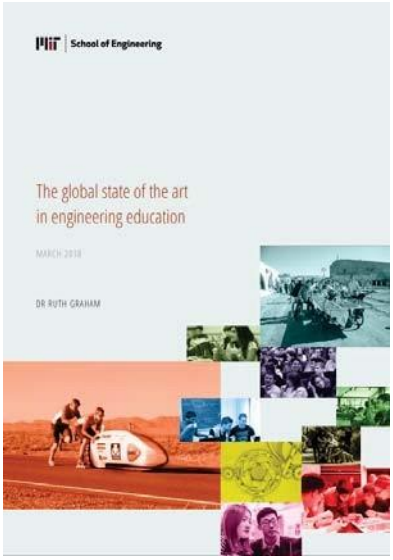
| | | Turku | Aston |
|---|---|---|---|
| Crit. no | Name | Value | Value |
| 1 | A holistic view of learning | 4 | 3 |
| 2 | Appropriate learning outcomes (developed from | 4 | 3 |
| 3 | An integrated curriculum | 3 | 3 |
| 4 | A sound subject foundation | 4 | 5 |
| 5 | Active learning approaches | 3 | 3 |
| 6 | Appropriate workspaces and equipment | 3 | 3 |
| 7 | Personal and interpersonal skills development | 3 | 3 |
| 8 | Faculty development (knowledge and teaching) | 2 | 1 |
| 9 | Learner assessment (type, level and amount) | 3 | 3 |
| 10 | Programme evaluation to promote continuous | 3 | 3 |
| 11 | Links to employability are made throughout | 4 | 2 |
| 12 | Collaborative learning | 3 | 3 |
| 13 | Additional support for learning | 3 | 3 |
| 14 | Technology to engage students in learning | 3 | 3 |
| 15 | Feedback is timely, appropriate and formative | 3 | 1 |
| 16 | Research is used in teaching | 4 | 3 |
| 17 | Student participation in programme review and | 5 | 1 |
| 18 | Wider stakeholder input to programme development | 4 | 3 |
| 19 | Student retention and progression is monitored | 4 | 2 |
| 20 | Work placements are promoted | 5 | 4 |
| 21 | Problem solving opportunities (links to the research | 4 | 3 or 5 |
| 22 | Design projects are integrated throughout the | 5 | 3 or 5 |
| 23 | Equality, diversity and equal opportunity considerations | 2 | 3 |
| 24 | Professional attributes and topical considerations are | 3 | 4 - |
| 25 | Evidence of educational scholarship by faculty | 4 | 3 |
| 26 | Effective communication with students | 3 | 3 |
| 27 | Different learning styles are taken account of | 2 | 3 |
| 28 | Teaching resources | 3 | 3 |

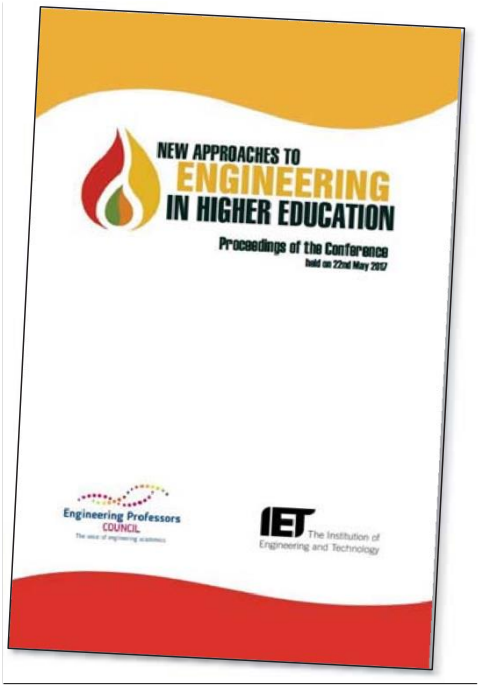
# In 2007 and 2012




# Recent reports





# New Approaches

- Incorporating creativity into science
- Broaden the diversity of students
- A strong emphasis on project work
- Industry engagement in design and delivery
- Experience of the workplace for students
- Greater interdisciplinarity

- What is missing?

# Current topics of interest

- Student Experience
- Integrated Curriculum
- Employability
- Innovative Practice
- Technology in Learning
- Developing Staff
- Supportive Quality Processes
- EVIDENCE

# Again in your context

- What role does EER / Scholarship play in your institution?
- How embedded is it?
- How would you like to see the situation develop?

# Conclusions

- Developing Engineering Educators requires a clear rationale and a clear framework
- The UK experience is driving a coherent and linked response to a range of demands
- This is promoting a sustainable approach
- Considering some of these ideas when developing the EXTEND Centres may be helpful

# Comments or Questions

- Please address any comments or questions to:

Prof Robin Clark
r.clark.6@warwick.ac.uk

Graeme Knowles
g.Knowles@warwick.ac.uk

EXTEND

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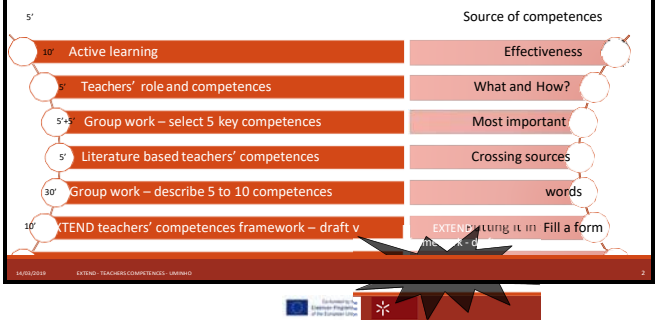
# TEACHERS' COMPETENCES FOR EXCELLENCE IN ENGINEERING EDUCATION

UNIVERSITY OF MINHO

RUI M. LIMA

DIANA MESQUITA

## Outline

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# Teachers' Competences: evidences from the survey

TEACHERS' VIEW

## BMSTU

"the need for constant excessive stress to achieve the expected results" - 2,33

"are not quite sure that the expected results correspond to their capabilities" – 3,56

"the use of innovative ICTs " – 2,78

"necessary to use new ICTs in my teaching practice" – 4,135

"necessary to have knowledge of psychology and pedagogy for teaching students" – 4,308



## Tajikistan

The vast majority of teachers understand that modern education requires the use of modern **information and communication** in the educational process.

Modern educational technologies are **not only ICT**, but also the implementation of such **pedagogical approaches** as interdisciplinary, practice-oriented, individual, project, as well as the use of various active forms of education.



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# Teachers' Competences: evidences from the survey

STUDENTS' VIEW

## BMSTU

"it is easier for me to study when a teacher uses ICT" - 4,09

"real projects and case studies help students to be closer to professional life" – 4,43

"role of international experience in my education" – 4,01

"young teachers are more likely to use ICT " – 4,20

"teachers of engineering disciplines use ICT" – 2,95



## Tajikistan – students perspectives

… priority of **practice** should be considered adequate.

… graduate students are absolute supporters of the introduction of modern **information and communication technologies (ICT)**.

… increase the role of **international experience** in their own education.

Among the methods for assessing "the knowledge" used by teachers in the educational process, students noted: tests, practical cases, oral questioning, essay, written work, score-rating system, laboratory work, test papers.

The most important competences for the teacher are: ability to prepare high-quality presentation of educational materials, communication skills, practical experience, ability to support students' interest in the subject of the course, creativity, sense of humor.



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# Active Learning

## Development of Competences

Teaching and Learning system based on the idea of **knowledge transfer**

transition

Teaching and Learning system based on the idea of **development of competences**

**Capacity to mobilize resources (knowledge, abilities, experiences, values,…) in specific contexts, to formulate and solve problems.**

Le Boterf (1997, 2004, 2005); Zarifian (2001)

**Learning outcomes are "statements of what a learner is expected to know, understand and/or be able to demonstrate after a completion of a process of learning".**

CEDEFOP (2009)



## Active Learning - key ideas

Active Learning – Meaningful Experiences

- Relevance – why learn this?
- Context – adequate environments
- Engagement – energy and motivation
- Critical thinking – evaluate their own learning
  - Felder & Brent (2009), Prince (2004), Prince & Felder (2006), Bonwell & Eison (1991)



## EVIDENCES?

**Based on a meta-analysis of the data published in 225 studies, Freeman et al. (2014) refer that active learning increases the performance in exams… and lectures increase the failure rate in 55%.**

## "The Active Learning Continuum" – M. Prince (2011)

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## Group work – select 5 key competences



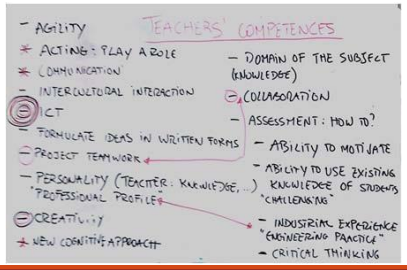
## Activity: select 5 competences

Based on survey evidences and your own experience:

Select the 5 most important competences for your group

Share those competences

## Activity: select 5 competences



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## Crossing sources: literature based list of competences



## 1. Transforming teaching and learning spaces

http://cecl.mit.edu/projects/3d_visualization/teal_classroom.html

## TEAL Classroom @MIT
## Technology-Enhance Active Learning

http://web.mit.edu/edtech/casestudies/teal.html

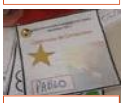


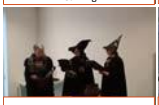
## 2. Be able to innovate teaching practice
## (e.g. try different active learning strategies)

*Brainstorming*

Problem and Project Based Learning

Research-based Learning


Gamificação


Role Playing

*Gallery Walk*

Original Photos:
Workshops for Teachers
Professional Development

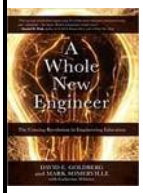


## 3. Open to learn with others
## (students, peers, companies, …)

Original Photo:
Tutorial Project Based Learning (PBL)

## 4. Communication (e.g. content, feedback, empathy, …)

Chapter 7
The Whole New Professor: From Expert to Coach




Teacher as a Coach: "True knowledge exists in knowing that you know nothing." – Socrates

1. **Observing:** posture, words, etc.
2. **Listening:** active listening (*feedback*)
3. **Questioning:** making questions that lead the student to think further
4. **Understanding:** empathy (connection between teacher and student)
5. **Performing "Speech Act":** interpretation of the teacher role with creativity, energy and enthusiasm (inspire your students)
6. **Sense of Humour**



## 5. Deal with unpredictable situations

"It looks like you have everything under control."

https://www.google.com/search?tbm=isch&sa=1&ei=MnIFW57vCI-MmgXeh6bgBw&btnG=Pesquisar&q=chaotic+classroom+cartoon#imgdii=MmRgXTHpvROr_M:&imgrc=YePmMMlyUIBerM



## 6. Collaboration / Teamwork

Original Photos: Workshops for Teachers Professional Development

## 7. Be able to use technology

**Lightboard:** http://lightboard.info/

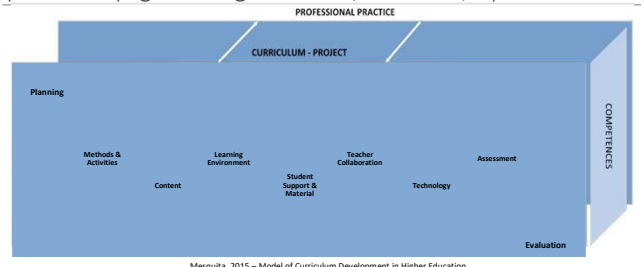


## 8. Be able to reflect about teaching practice

Original Photo:
Workshop for Teachers Professional Development



## 9. Be able to design, develop and evaluate curriculum processes (e.g. learning outcomes, resources, …)




Mesquita, 2015 – Model of Curriculum Development in Higher Education

## 10. Time Management

## Teaching in Engineering Education
## Summary

1. Transforming teaching and learning spaces
2. Be able to innovate teaching practice (e.g. try different active learning strategies)
3. Open to learn with others (students, peers, companies, …)
4. Communication (e.g. content, feedback, empathy, …)
5. Deal with unpredictable situations
6. Collaboration / Teamwork
7. Be able to use technology
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10. Time Management

Zabalza, 2009; Goldberg & Sommervile, 2014; Barnett, 2012; Biggs & Tang, 2011; Cowan, 2006; Fitzmaurice, 2010; …



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# Group work – describe 5 to 10 key competences

PUTTING IT IN WORDS

## Activity: describe 5 to 10 key competences

Based on literature, survey evidences and your own experience:

Create a detailed description of 5 to 10 competences for your group

Fill in the form: https://goo.gl/forms/5FKccxW75shlBC6Q2

Share those competences



## Teaching in Engineering Education

### Description results

1. Transforming teaching and learning spaces
   - Use of examples from life , compere with practical skills of students
2. **Be able to innovate teaching practice (e.g. try different active learning strategies)**
3. Open to learn with others (students, peers, companies, ...)
4. **Communication (e.g. content, feedback, empathy, ...)**
   - **The teacher is able to communicate professionally in oral and written forms using state and foreign languages**
5. Deal with unpredictable situations
6. **Collaboration / Teamwork**
   - **The teacher is able to interact socially and fulfill his/her role in a team**
   - **Ability to work in the team, ability to create the common goals, planning and involev other participants, leastening the participants opinions nad position, be creativity and tolerancing, make opportunity to open for new ideas.**
   - **Teacher have to be able to collaborate with the biger and smoler groups to achive the objectives and solving task set during the class.**
7. Be able to use technology
   - Using equipment ( hardware and software ) during the learning process. Both - inside and outside the classroom.
8. **Be able to reflect about teaching practice**
9. **Be able to design, develop and evaluate curriculum processes (e.g. learning outcomes, resources, ...)**
10. Time Management
    - Ability organize work according on situations and targets, planing the time including the aims, analyse the spending of time, time fixing, indicate the priorities, control on goals.
    - Ability to organize the class within the given amount of time and resources. Timely organization of all tasks planed for the class.
11. **Intercultural interaction** - the teacher is able to perceive intercultural diversity of society in socio-historical, ethical and philosophical context
12. Use of experience skills, experience of products. Use of examples from life , compere with practical skills of students



## Conclusion

EXTEND teachers' competences framework – draft version

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# PBL - workshop

UNIVERSITY OF MINHO

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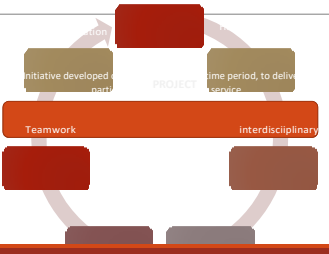
DIANA MESQUITA

## PBL - characteristics






## Project types

*An exercise of project*

Course Project

Kolmos, 1996; Helle, Tynjälä, & Olkinuora, 2006

## Project types

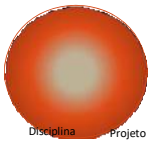
A **course** as a project

Course Project



## Project types

**Curriculum** is project-based



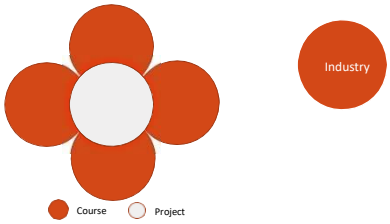
Disciplina Projeto

Adaptado: Helle, L., Tynjälä, P., & Olkinuora, E. (2006)

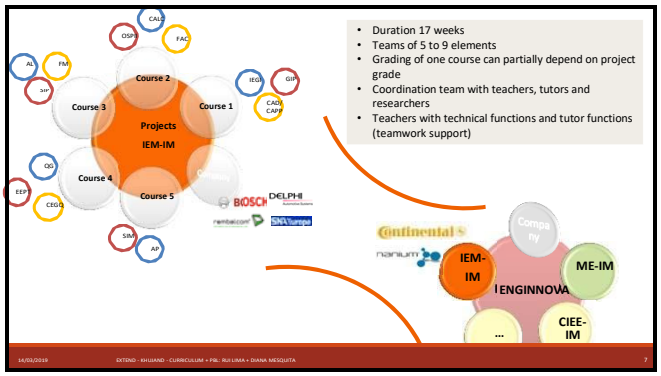


## Project types

**Interdisciplinary project** approach

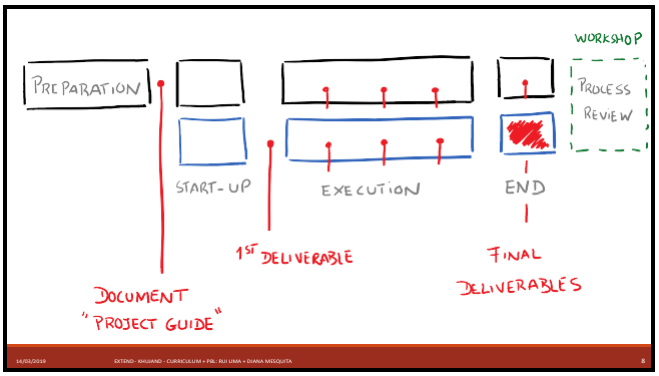



Course Project




- Duration 17 weeks
- Teams of 5 to 9 elements
- Grading of one course can partially depend on project grade
- Coordination team with teachers, tutors and researchers
- Teachers with technical functions and tutor functions (teamwork support)








## Session goals

Imagine that your rector called you and said:

*- It is very important that the university starts creating PBL approaches in several programs. This is important in order to attract new students (international) and to have more funding from the companies.*

He asks to you if it would be possible to create one PBL approach for a first year of a program. He also tells you that he chose you because you and your colleagues had the opportunity to have a workshop about PBL during the meeting in Khujand. Finally he asks you if that is possible and if he could count on your team. What would be your answer?

- **Yes it is possible and you can count on us!**

## Session goals

**Create a PBL proposal through a simulation process:**

- Planning a PBL Process
- Working in a collaborative and interdisciplinary environment
- Explore multiple dimensions of a PBL process

**Simulating:**

- Project goals
- Milestones
- Time constraints
- Specific result
- Teachers collaboration



## Milestone 1 - Requirements for PBL organization - 10 min.

Each team will have to identify the fundamental requirements for the organization of a project (PBL) - what is needed? Do not try to answer to the requirements, just define them…

- Teacher team
- Project phases (deliveries)
- Evaluation
- Curricular Framework
- ...



## Milestone 2 - Theme / problem definition - 15 minutes

Each team will have to define the theme / problem on which students will work during the semester, which should integrate 2 or more courses.

Students of 1st year should be able to develop a concrete result.

## Milestone 3 - PBL Implementation Proposal - 20 minutes

- Yes, it is always possible. You just have to look for the solutions.
- Define a specific implementation, trying to overcome contextual difficulties, in order to implement the first pilot next semester.

The draft proposal of your team must be developed in a Power Point

- Theme / Problem
- Curricular Framework (courses)
- Final result
- Project Phases (deliverables)
- … and some other elements if you have time



## Final Deliverable

Final Presentation – 3 min.



## Debriefing

- Defining Learning Outcomes / Competences
- Assessment in PBL (e.g. peer assessment)
- Project Management (teachers and students)
- Students' Support (teamwork)

esprit
Se former autrement

**PAEE/ALE' 2019**
**Hammamet, Tunisia**
**10-12 June 2019**
**(SCOPUS indexed)**

https://paeeale.esprit.tn/

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# Teachers' Professional Development: EXTEND Centres

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RUI M. LIMA
DIANA MESQUITA

## Continuous Professional Development (CPD) Models (Kennedy, 2005, 2014)

1. **Training** - generally 'delivered' to the teacher by an 'expert'
2. **Award-bearing** - relies on, or emphasises, the completion of award-bearing programmes of study – usually, but not exclusively, validated by universities
3. **Deficit** - designed specifically to address a perceived deficit in teacher performance.
4. **Cascade** - involves individual teachers attending 'training events' and then cascading or disseminating the information to colleagues.
5. **Standards-based** - represents a desire to create a (unified) system of teaching, and teacher education, that can generate and empirically validate connections between teacher effectiveness and student learning
6. **Coaching/mentoring** – defining characteristic of this model is the importance of the one-to-one relationship.
7. **Community of practice** - There is a clear relationship between communities of practice and the mutually supportive and challenging form of the coaching/mentoring model.
8. **Action research** - 'the study of a social situation, involving the participants themselves as researchers, with a view to improving the quality of action within it'.
9. **Transformative** - it could be argued that the transformative model is not a clearly definable model in itself; rather it recognises the range of different conditions required for transformative practice.

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TRAINING

COACHING, MENTORING AND COMMUNITIES

RESEARCH

TRAINING, COACHING and RESEARCH



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# Curriculum Development: EXTEND Centres

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## For a common understanding …

Curriculum is understood as a **project** and includes the **teaching and learning experiences**, the process of its **development** (design, development and evaluation) and the following **key elements** (objectives, content, resources, assessment and teaching and learning strategies), in order for students to develop knowledge and competences related to a given area/domain.

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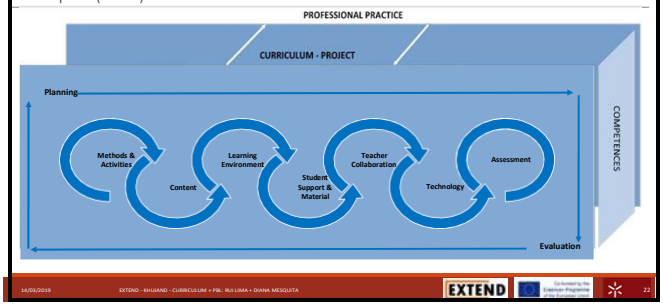
Mesquita (2015)






## Aprendizagem Ativa
## Continuum – M. Prince (2011)

Turns the class more active

Informal activities in teams

Structured activities in teams

Problem as the main purpose of the course

+ CENTRADO NO PROFESSOR

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Think-Pair-Share

Brainstorming

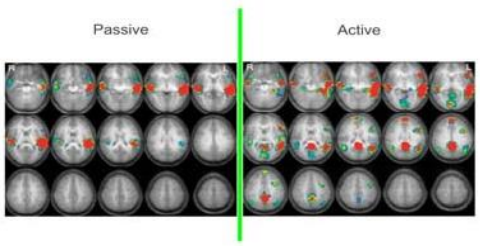
Team Based Learning (TBL)

Problem and Project Based Learning (PBL)

Flipped Learning

Prince (2011) https://www.asee.org/documents/conferences/annual/2011/plenary-michael-prince.pdf



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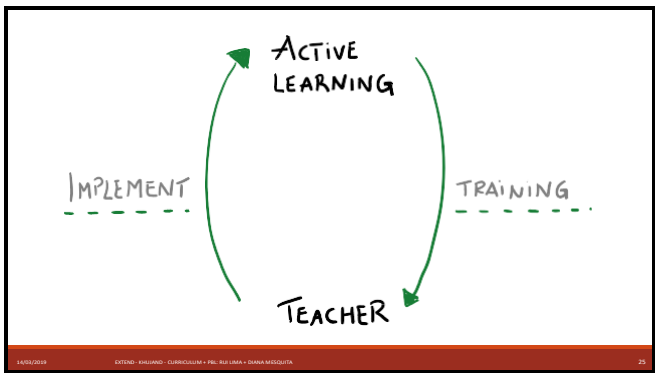


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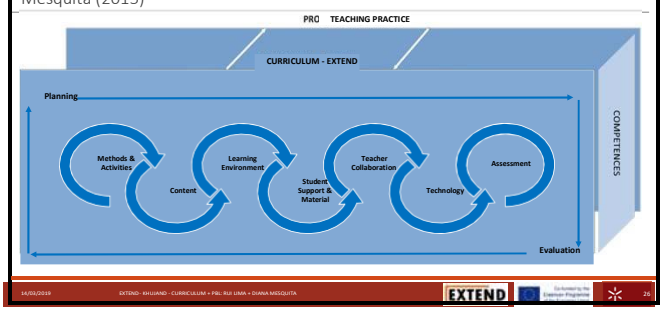
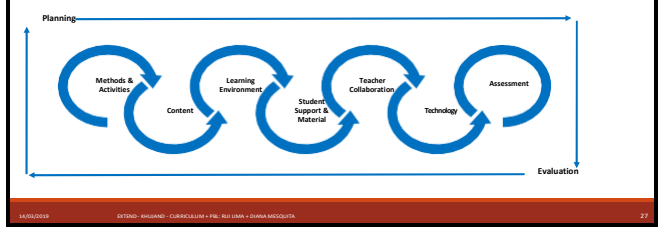



## Curriculum Development Model

Can you create a relation between the model and the previous PBL training?



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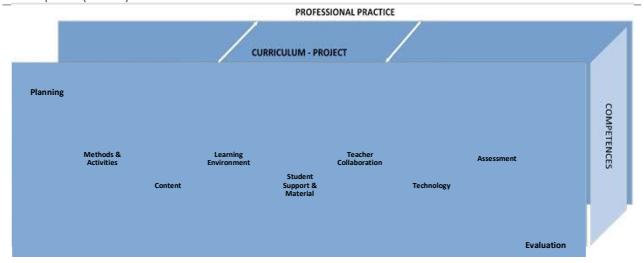

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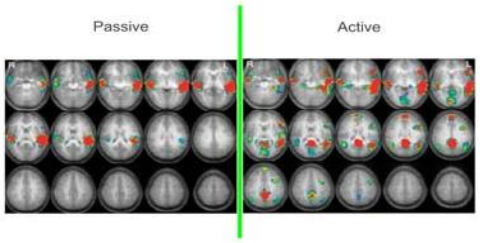


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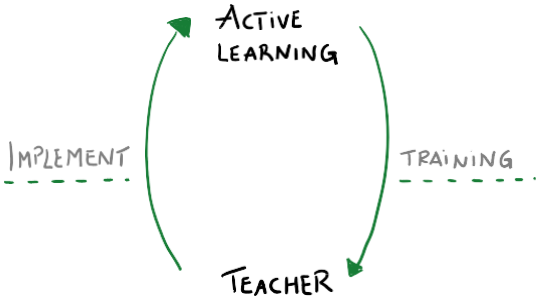

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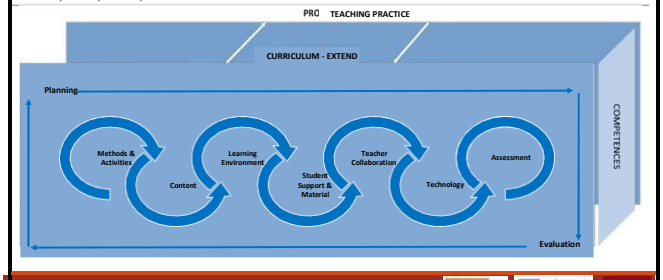




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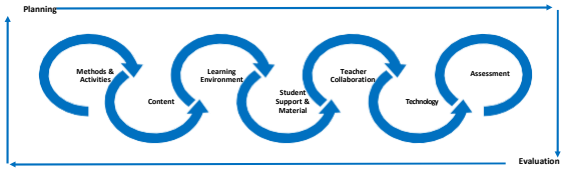

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# Ontologies – Facilitators for Curriculum Design

**Assoc. prof. Maria-Iuliana Dascalu, PhD**
University POLITEHNICA of Bucharest, Faculty of Engineering in Foreign Languages
www.mariaiulianadascalu.com
maria.dascalu@upb.ro

*EXTEND Seminar, 14th of October – 20th of October 2018, KSU, Khujand, Tajikistan*

1

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## Ontology: Origins and History

- a philosophical discipline—a branch of philosophy that deals with the nature and the organisation of reality
- science of being (Aristotle, Metaphysics, IV, 1)

2

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## Ontology in Computer Science

- an engineering artefact:
  - specific vocabulary used to describe a certain reality
  - a set of explicit assumptions regarding the intended meaning of the vocabulary
- describes a formal specification of a certain domain:
  - shared understanding of a domain of interest
  - formal and machine manageable model of a domain of interest
- an explicit specification of a conceptualization => shared conceptualization of a domain of interest

3

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## Structure of an Ontology

- Ontologies typically have two distinct components:
  - Names for important concepts in the domain (common vocabulary)
  - Background knowledge/constraints on the domain
- Example:
  - Names for important concepts in the domain:
    - *Elephant* is a concept whose members are a kind of animal
    - *Herbivore* is a concept whose members are exactly those animals who eat only plants or parts of plants
    - *AdultElephant* is a concept whose members are exactly those elephants whose age is greater than 20 years
  - Background knowledge/constraints on the domain:
    - *AdultElephants* weigh at least 2,000 kg
    - All *Elephants* are either *AfricanElephants* or *IndianElephants*
    - No individual can be both a *Herbivore* and a *Carnivore*

4

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## What's inside an OWL ontology?

- Classes/concepts + class-hierarchy: subclasses of *Animal* – *Male*, *Female*; *Female* and *Male* are disjoint classes.
- Individuals/objects/instances: *Peter* and *Ian* are objects in the class *Man*
- Relations between classes(inheritance, disjoint_with, equivalence )
- Properties (slots) / values:
  - Object properties, relations between instances of two classes: Maria *isMarried* Tom
  - Datatype properties, relations between instances of classes and literals/datatypes: Maria *hasAge* 35
- Characteristics of properties:
  - symmetric - *isMarried*
  - transitive- hasAncestor
  - functional – *hasMother* (Mary hasMother MrsRobinson, Mary hasMother Anne=>Mrs Robinson is Anne)
  - inversefunctional – *hasStudentNumber* (Mary hasStudentNumber 87324, MsSmith hasStudentNumber 87324 => Mary is MsSmith)
- Restrictions on properties (type, cardinality):
  - The parent of a *Person* is also a *Person* => type of parent is Person
  - Any person must have exactly 1 father = > cardinality of *hasFather* property is 1.
- Annotations (comments…)
- Reasoning tasks: classification, consistency checking

5

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## Example: ontology of an university

http://www.cs.man.ac.uk/~rector/Modules/CS646-2004/Labs/Thursday/Simple_University-01.owl

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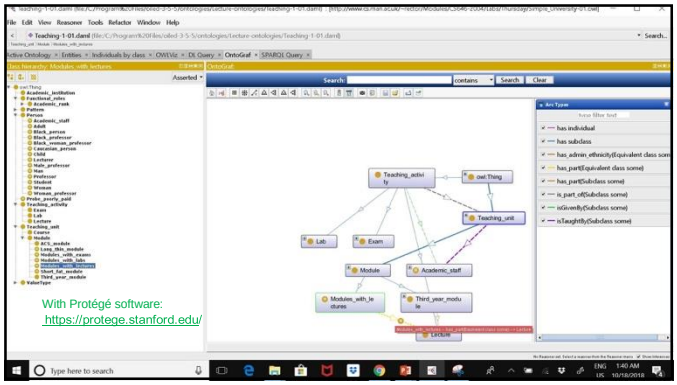
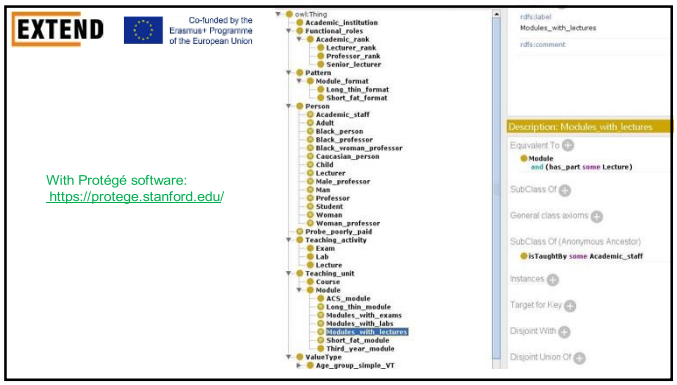

With Protégé software:
https://protege.stanford.edu/

7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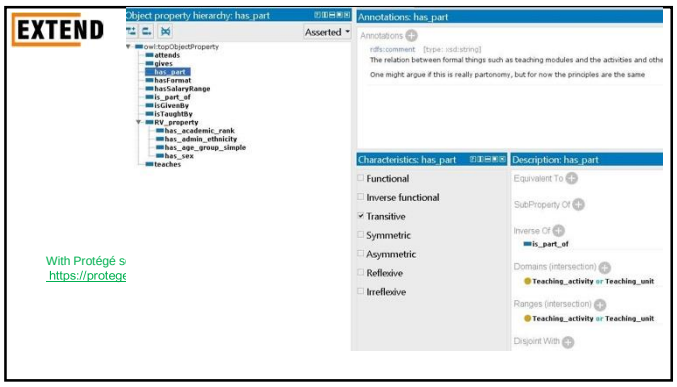
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With Protégé s
https://protege

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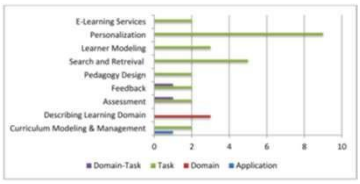
## Usage of ontologies

- Ontologies reduce conceptual and terminological confusion by providing a unified framework for describing the concepts of the world and their relations -> improve communication and cooperation between people and organizations
- Ontologies are cross-platforms, cross-applications -> improve interoperability
- Provide reusability, reliability, specification




*M. Al-Yahya, R. George, and A. Alfaries, "Ontologies in e-Learning: Review of the Literature," Int. J. Softw. Eng. Its Appl., vol. 9, no. 2, pp. 67–84, 2015.*

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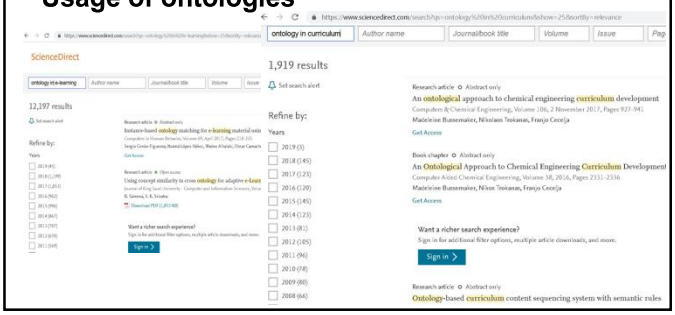
## Usage of ontologies

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## Ontologies in curriculum development

- Foster the transparency, collaboration, exchangeability and interoperability (*M.C. Van der Wende, "The Bologna Declaration: Enhancing the Transparency and Competitiveness of European Higher Education," J. Stud. Int. Educ., vol. 4, no. 2, pp. 3–10, 2000*)
- Support the aligning, classification, comparing, and matching between universities, educational systems or relevant disciplines (*H. Chung and J. Kim, "An Ontological Approach for Semantic Modeling of Curriculum and Syllabus in Higher Education," Int. J. Inf. Educ. Technol., vol. 6, no. 5, pp. 365–369, 2016*)
- Help in managing the educational offerings of an institution, revealing useful information like course overlapping, uncovered or less covered areas, possible synergies between courses (*M. Ronchetti and J. Sant, "Curriculum Management and Review: an ontology-based solution," Trento, Italy, 2007*)
- Supports personalization, recommendation etc in e-learning (*M.I. Dascalu & all, "How social and semantic technologies can sustain employability through knowledge development and positive behavioral changes," Computers in Human Be havior, vol. 70, pp. 507-517, 2017*)

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## Examples of ontologies in curriculum development

- The Bologna Ontology: http://diuf.unifr.ch/main/xi/bowlogna
- BBC Curricula Ontology: https://www.bbc.co.uk/ontologies/curriculum
- CCSO: http://xworks.gr/ontologies/ccso.owl

(EVANGELOS KATIS, "Semantic Modeling of Educational Curriculum & Syllabus," TECHNOLOGICAL EDUCATIONAL INSTITUTE OF CRETE,2018)

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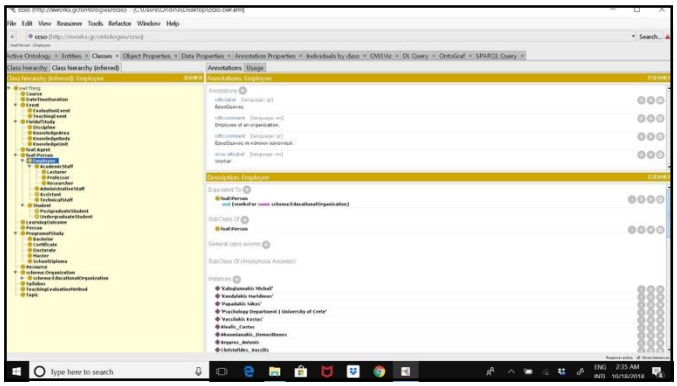

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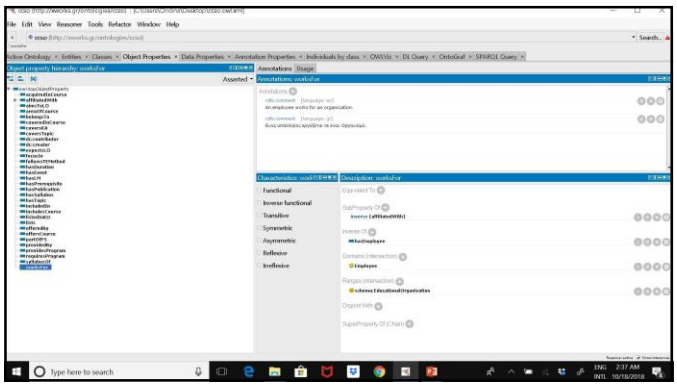

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## Interrogating the ontology with SPARQL

- Which Courses cover a certain Knowledge Area?

```
SELECT ?CS ?CSname
  WHERE { ?CS rdf:type ccso:Course .
  OPTIONAL { ?CS ccso:csName ?CSname } .
      ?CS ccso:coversKA ?KA .
       ?KA ccso:fsName ?KAname .
  FILTER regex(str(?KAname), "Networking and Communication")
  ORDER BY ?CS
```

| ?CS | ?CSname |
|---|---|
| <http://…/ccso#CS330/CS_BSc/CSD/SSE/UoC> | Introduction to Telecommunication Theory^^xsd:string |
| <http://…/ccso#CS370/CS_BSc/CSD/SSE/UoC> | Digital Signal Processing^^xsd:string |
| <http://…/ccso#CS435/CS_BSc/CSD/SSE/UoC> | Network Technology & Programming Lab^^xsd:string |
| <http://…/ccso#CS438/CS_BSc/CSD/SSE/UoC> | Software Defined Networks (SDN)^^xsd:string |
| <http://…/ccso#CS439/CS_BSc/CSD/SSE/UoC> | Wireless Networks and Mobile Computing^^xsd:string |
| <http://…/ccso#CS474/CS_BSc/CSD/SSE/UoC> | Multimedia Technology^^xsd:string |
| <http://…/ccso#RM302/IM_MSc/IED/STEF/TEIC> | Computer Networks^^xsd:string |
| <http://…/ccso#RM303/IM_MSc/IED/STEF/TEIC> | Advanced Multimedia Technologies^^xsd:string |
| <http://…/ccso#RM202/IM_MSc/IED/STEF/TEIC> | Wireless Networks^^xsd:string |

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## Exercise

- Identify some use cases for creating the EXTEND ontology.

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## Starting points for EXTEND ontology

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## Exercises– create EXTEND ontology

- Design your center curriculum using ontologies on paper (20 minutes):
  - Define at least 5 classes/concepts – 5 minutes
  - Define the relations between those classes - object properties – 5 minutes
  - Define the characteristics of those properties (symmetric, transitive,functional, inverse functional) – 5 minutes
  - Define 3 instances/individuals for one of the classes of your ontology 5 minutes
- Put everything in Protégé (https://protege.stanford.edu/), save it and send it to maria.dascalu@upb.ro (20 minutes)

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