TECHNICAL UNIVERSITY OF CRETE

Teaching & Learning Support Center
Technical University of Crete

Skills development in HE

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11th International Week
3rd ATHENA International Week

Hellenic Mediterranean University, 27-31 May, 2024, Chania, Crete

Some basics

Learning

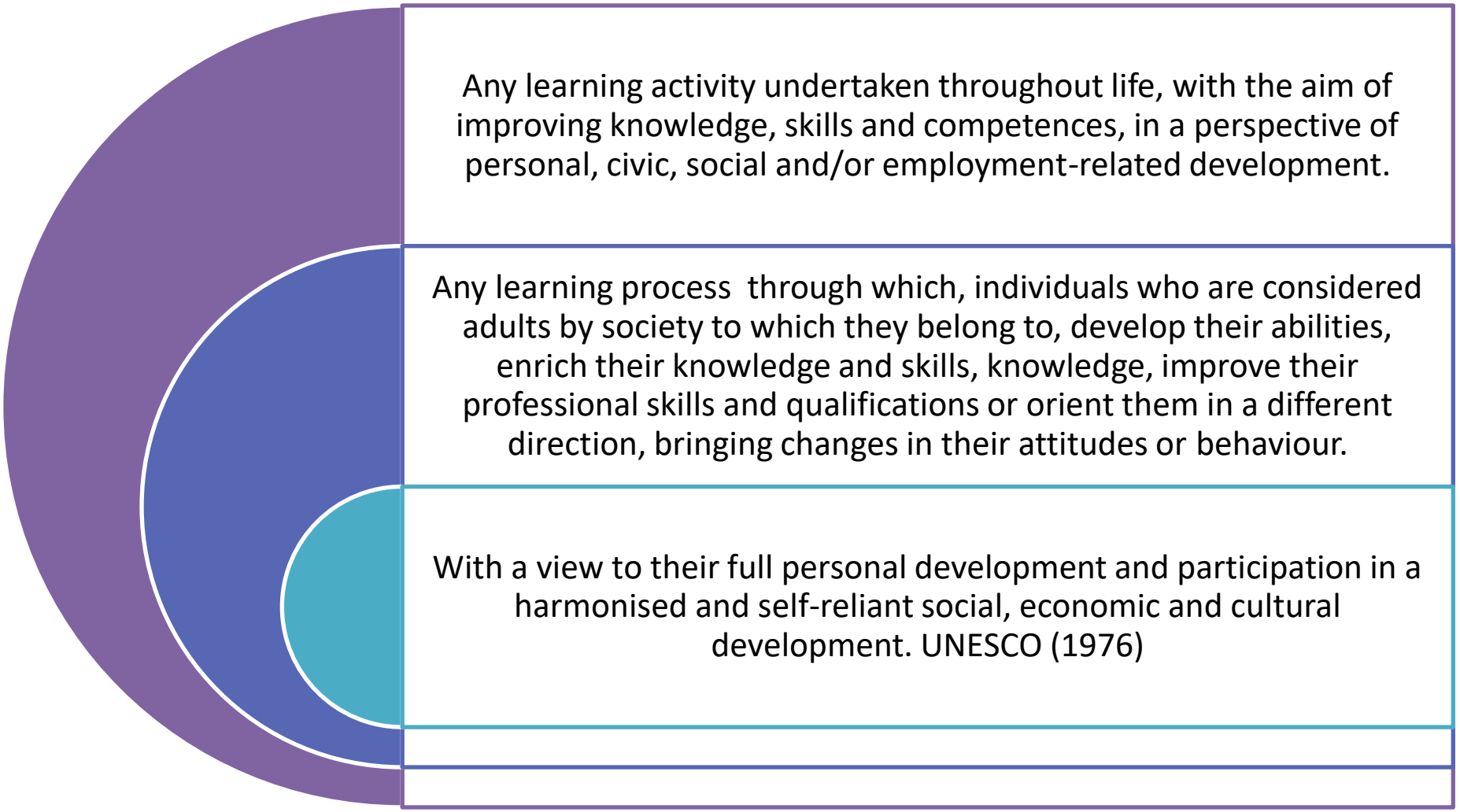
Learning is any, more or less, permanent change in behaviour that comes as a result of experience (Bigge, 1999)

Learning is any process which in living organisms leads to a permanent change in perception,which is not due exclusively to biological maturation or ageing (Illeris, 2016)

Education

The designed learning activities offered by various institutions in which learners participate consciously and with specific objectives (Jarvis, 2004)

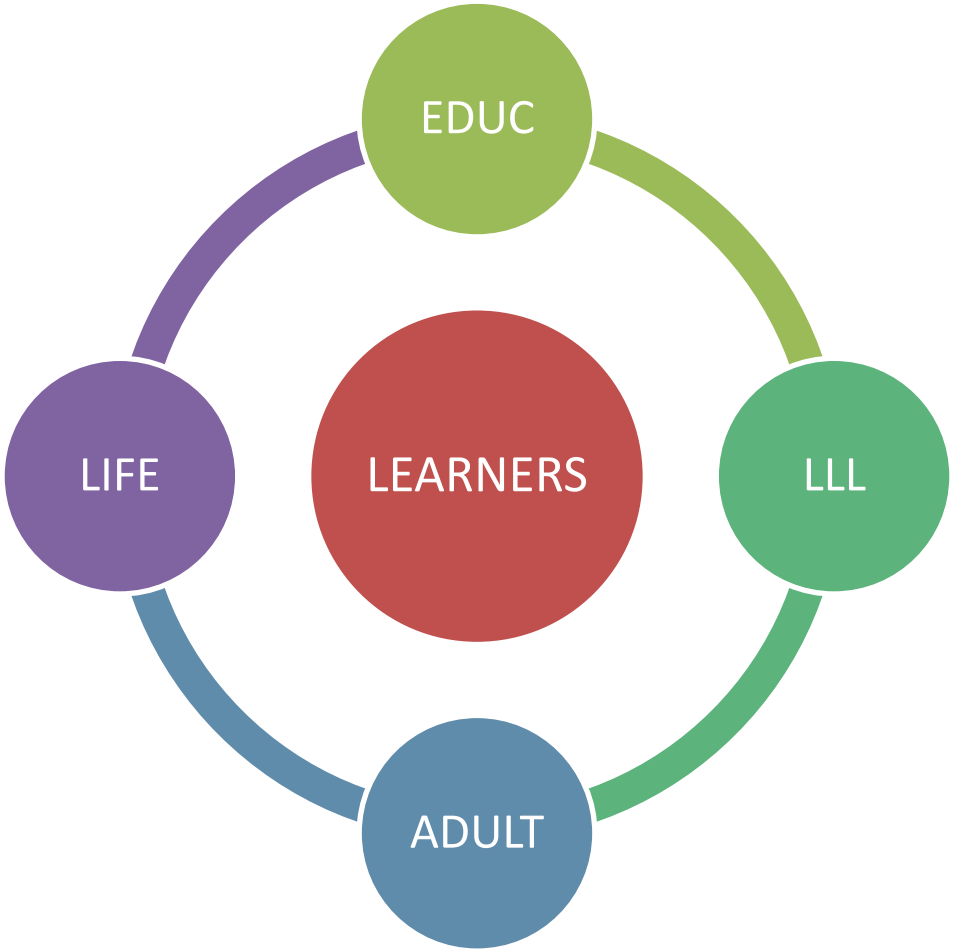
Adult Education



Life-Long Learning

Any learning activity undertaken throughout life with the aim of improving knowledge, skills and competences, in a perspective of personal, civic, social and/or employment-related development (EU, 2001)

We are Learners in various contexts

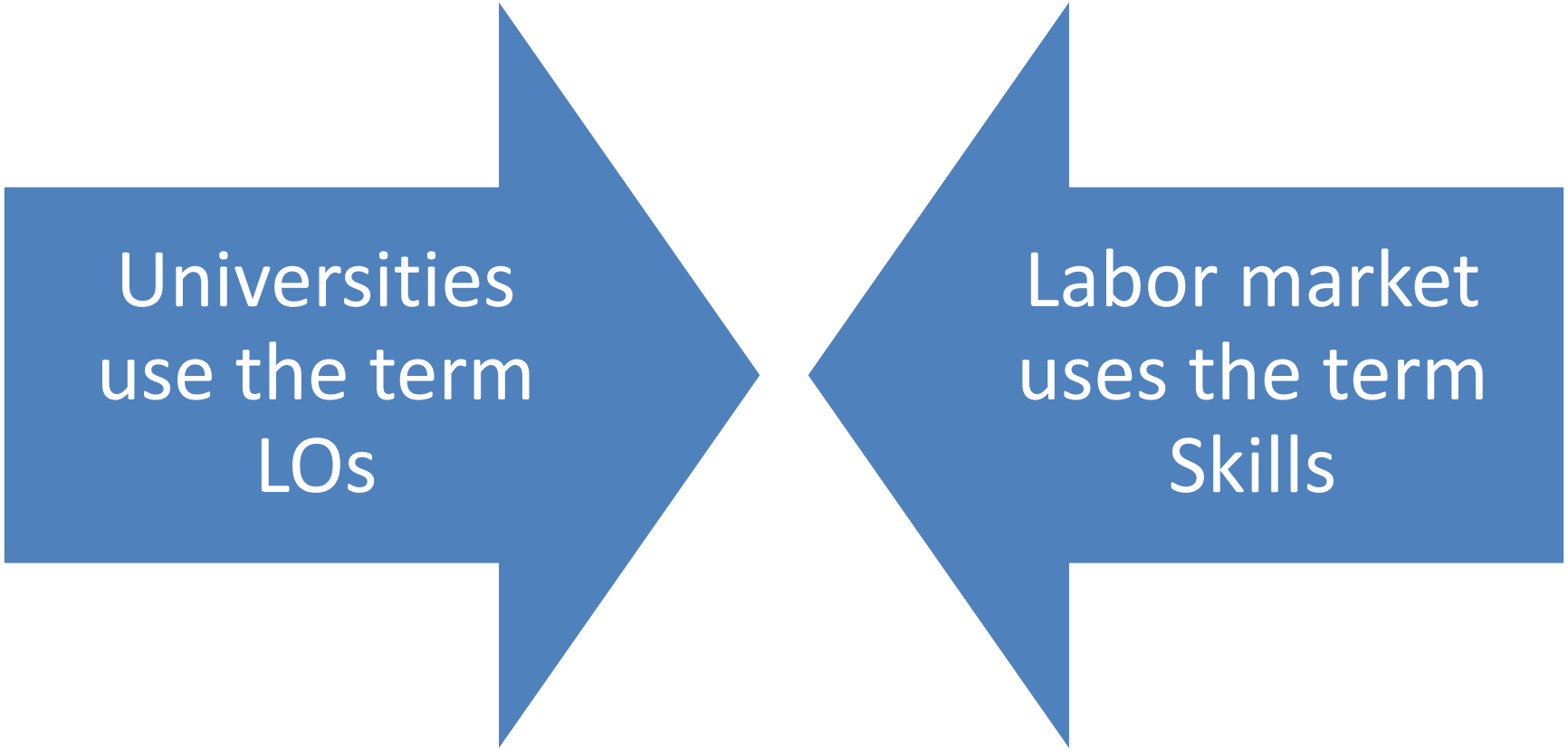


The emerging importance of the qualities that graduates should possess

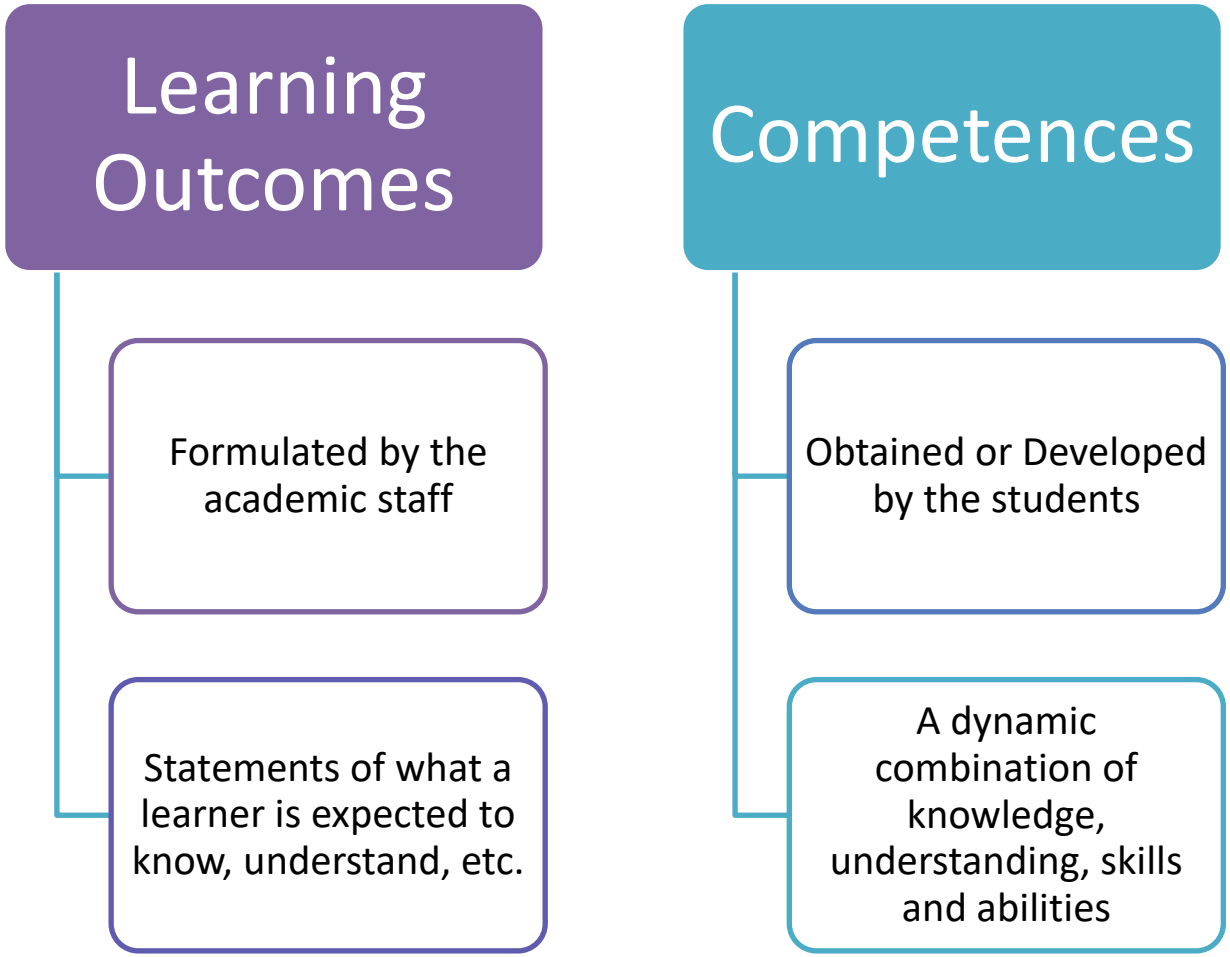
- The emphasis on the student & future graduate is rooted in socio-economic factors such as advances in science and technology, the society of the globalised world, knowledge-based work to a significant extent, exclusion and unemployment, multiculturalism, the mismatch of educational programmes with contemporary needs, the emergence of new professions and new demands, sustainability and viability, etc.
- There have been several theoretical approaches over the last 20 years to the characteristics of graduates. According to Cummings (1998) most approaches are based on: the **Education is a lifelong process,** the **focus on the relationship between education and employment**, due to phenomena of underemployment, unemployment, vulnerability of population groups, etc., and **the development of measurable results** as part of the quality assurance process.

Vocabularies

Different vocabularies …

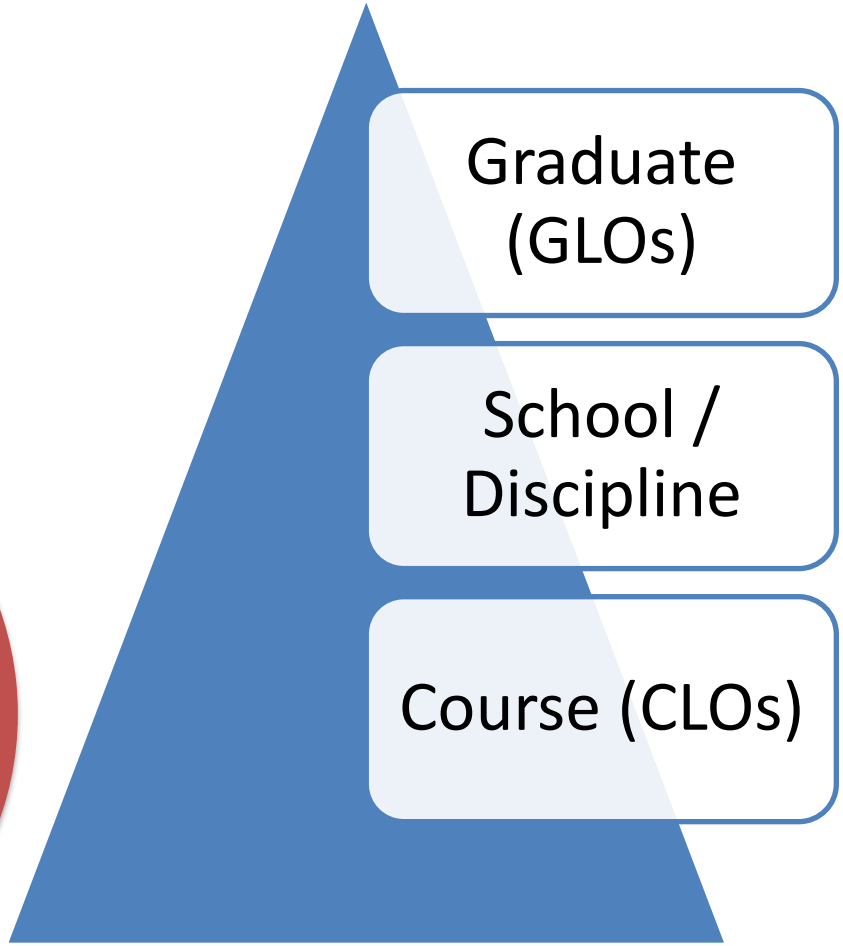


Distinction between LOs - Competences



LOs are mainly related to Teaching & Learning

Levels of LOs



The relationship between LOs & competences (a complex area)

- A competent person is someone with sufficient skills, knowledge and capabilities.
- “Competence” refer to aptitude, proficiency, capability, skills and understanding, etc.
- “Competence” and “Competences” are used in association with learning outcomes in different countries in a number of ways.
- Some take *a narrow view* and equate competence just with skills acquired by training...

Competence and Skill

In the **Tuning project**, they are understood as:

Knowing & Understanding

- **Theoretical knowledge of an academic field**
- **The capacity to know and understand**

Knowing how to act

- **Practical and operational application of knowledge to certain situations**

Knowing how to be

- **Values as an integral element of the way of perceiving and living with others and in a social context**

Competence represents a combination of attributes, with respect to knowledge and its application, skills, responsibilities and attitudes. They are used to describe the level or extent to which a person is capable of performing them

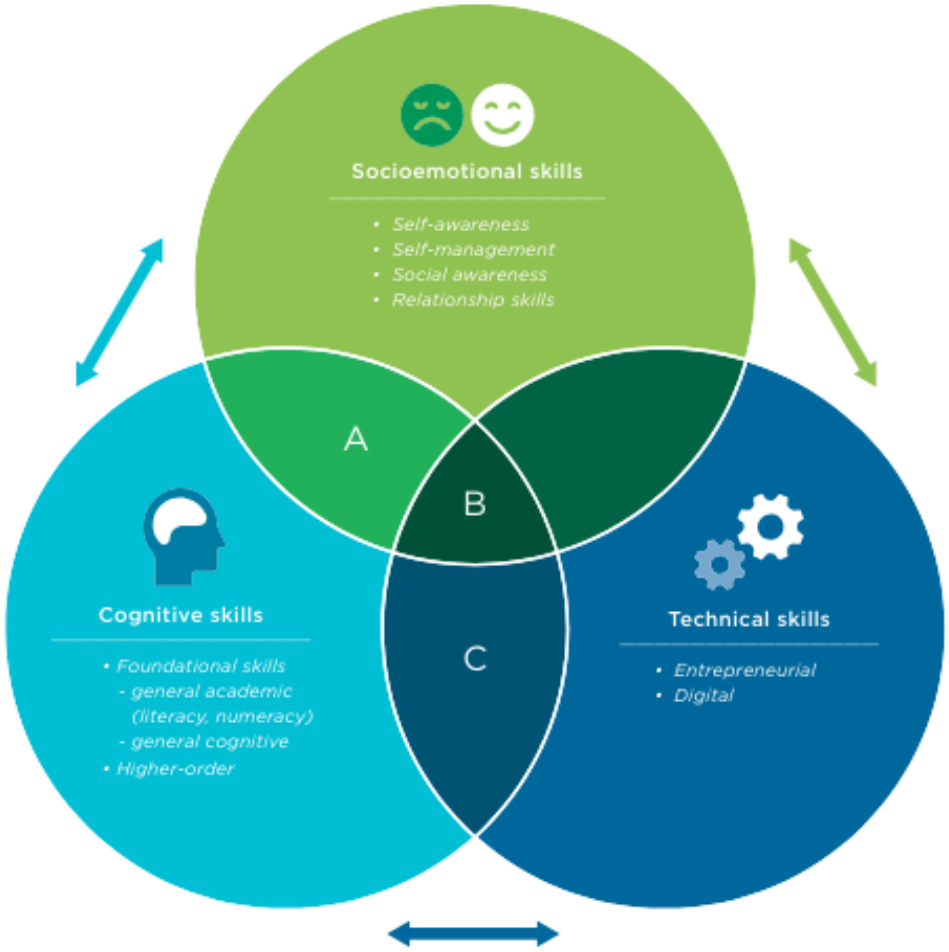
Tuning project distinguishes 3 types of generic competences

Instrumental competences	Systemic competences	Interpersonal competences
• **Cognitive abilities** • **Methodological abilities** • **Linguistic abilities**	• **Abilities & Skills concerning systems (combination of understanding, sensibility and knowledge).** Prior acquisition of instrumental and interpersonal competences required	• **Individual abilities like social skills (social interaction and co-operation)**

Generic Competences / Skills (Tuning pr.)

1. Capacity for Analysis & Synthesis	15. Problem Solving & Decision-making
2. Capacity for applying knowledge in practice	16. Teamwork
3. Planning and time mgmt	17. Interpersonal skills
4. Basic general knowledge in the field of study	18. Leadership
5. Grounding in basic knowledge of the profession in practice	19. Ability to work in a interdisciplinary skills
6. Oral and written communication	20. Ability to communicate with non-experts
7. Knowledge of a 2nd language	21. Appreciation of diversity and multi-culturality
8. Elementary computing skills	22. Ability to work in an international context
9. Research skills	23. Understanding of cultures and customers of other countries
10. Capacity to learn	24. Ability to work autonomous
11. Information mgmt skills	25. Project design and mgmt
12. Critical & self-critical abilities	26. Initiative and entrepreneurial spirit
13. Capacity to adapt to new situations	27. Ethical commitment
14. Creativity	28. Concern for quality and willingness to succeed

The multidimensionality of skills (World Bank, 2018)



A: Decision making, communication, grit, self-control
B: Problem-solving, organizational skills
C: Mid-level technical, high-level technical

How skills are acquired in the university context

The development of competences and skills

- Inside or outside the University (*place*)
- Learning activities or non-learning activities (*how*)
- Formal / non-formal education, informal learning (*education typologies*)

Inside or outside the University (place)
Learning activities or non-learning activities (how)

Engagement in various learning activities

Engagement in extra-curricular activities

Plus, activities in personal life

The issues we need to rethink

The Categories of Learning Outcomes (LOs) in HE

a) **Subject specific outcomes** that relate to the subject discipline and the knowledge and/or skills particular to it.

b) **Generic outcomes** (sometimes called transferable or transversal) that relate to any and all disciplines e.g. written, oral, problem-solving, IT use, team working skills, etc.

Generic skills are seen as important in enhancing the employability of graduates whatever their discipline.

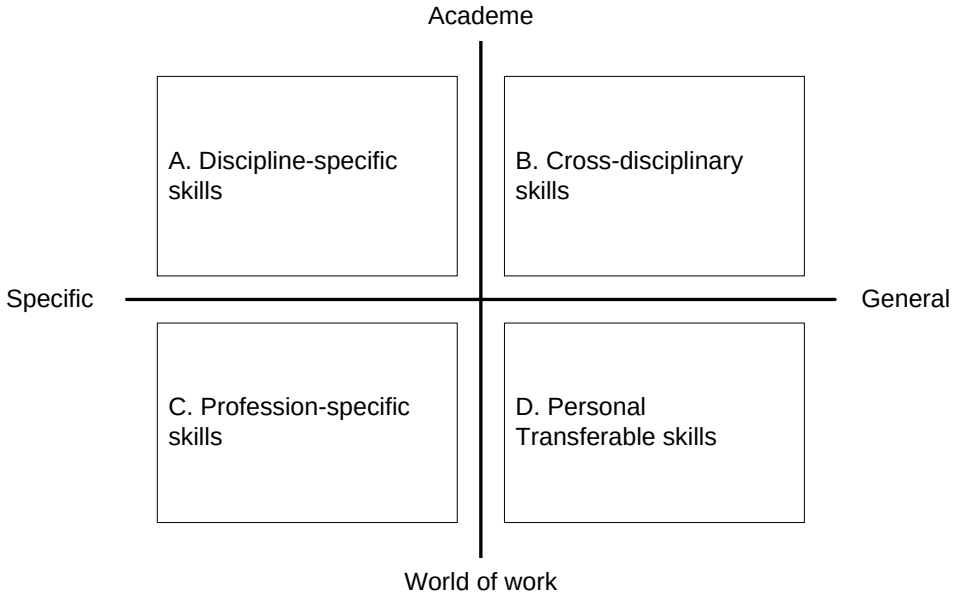
Source: Stephen Adam (2006), "An introduction to learning outcomes", Univ. of Westminster, an expert closely involved in both the Bologna Process and the development of the EQF

The learning outcomes & their multiple applications

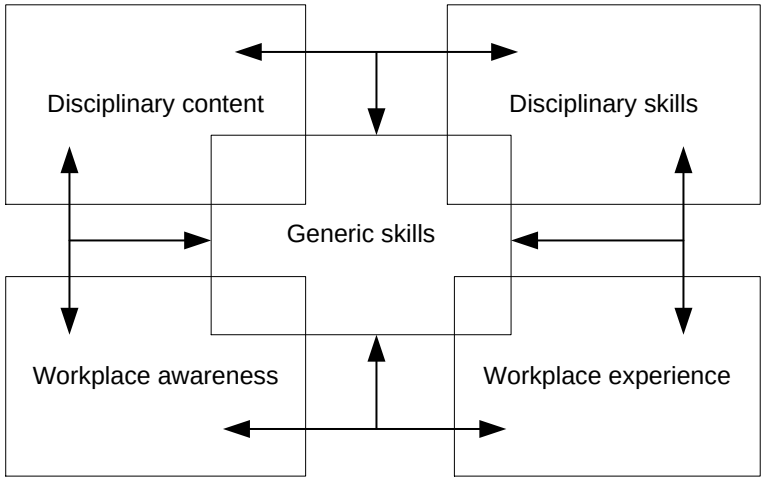
- In course level
- In assessment/grading level
- In qualification level validated by a HEI
- As generic descriptions of types of qualifications, e.g. linked to NQF
  - Knowledge
  - Skills: in Cognitive or Practical level
  - Competences: in respect the responsibility & autonomy
- etc.

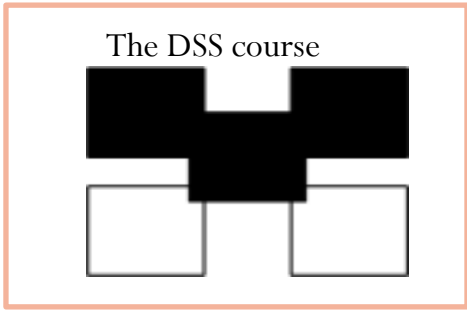
The courses' provision models

Skills in HE (Barnett, 1994)



A course provision model (Bennett et al. 2000)

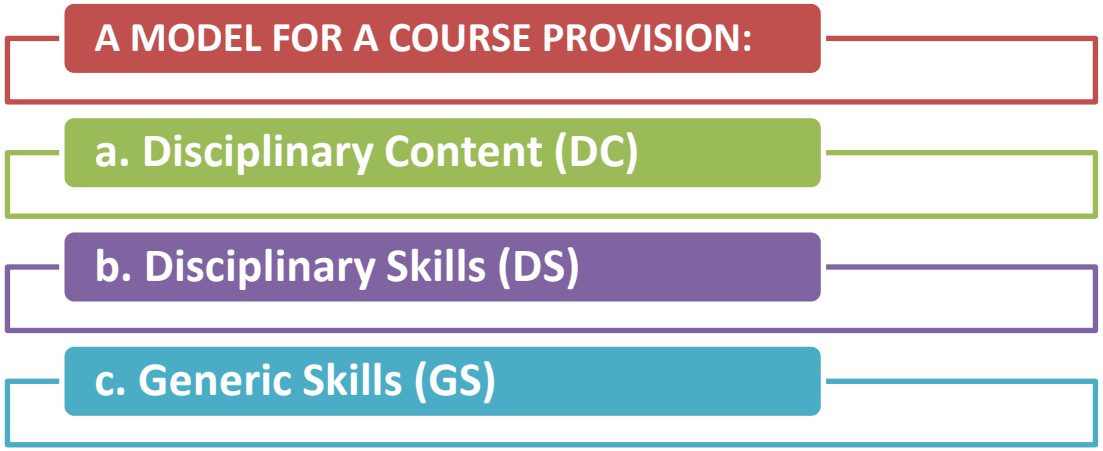




A simplified model for a course provision and a change in teachers' attitude

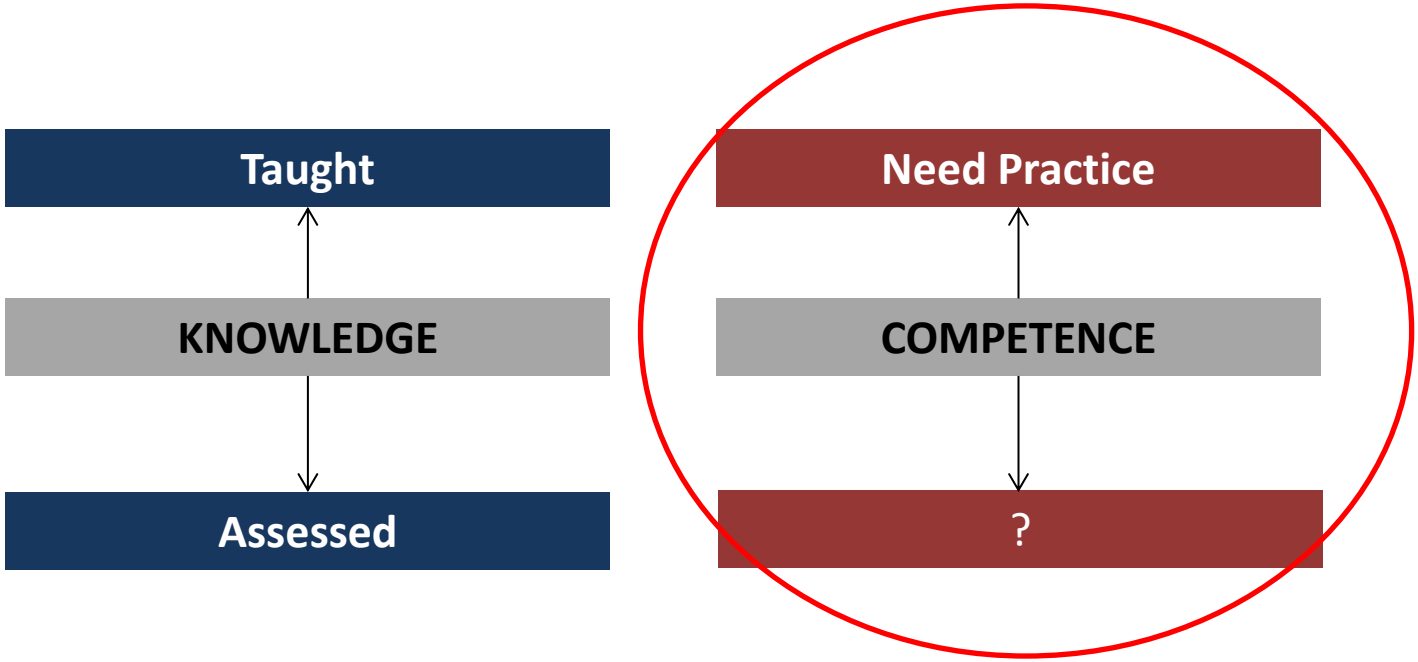
Courses enhance both subject-related skills & generic skills of students.

Courses are the main "vehicles" for broader learning outcomes

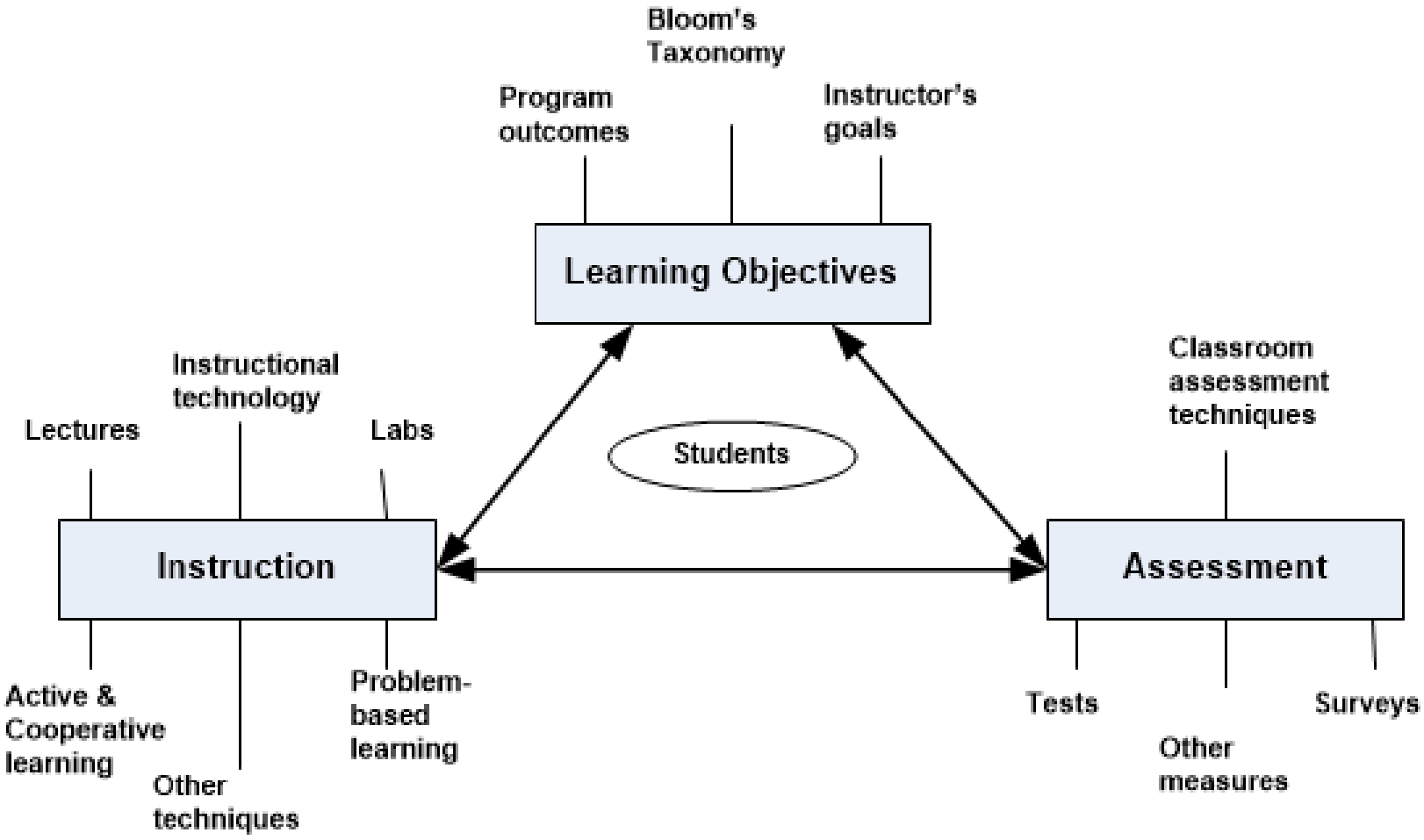


- ✓ We can distinguish the "skills" in the course level, as those either related with the study programme outcomes (subject-related skills) or those which are more general outcomes (generic skills).
- ✓ ***Outcomes*** focus on ***what*** the students ***will be able to do.***
- ✓ ***DC and DS are t***aught and assessed, while the opposite occurs with GS.

The types of practice in HE (lack of practice)



The ways of teaching in a student-centred approach



Our perspective on learning

- In the course level, our perspective on learning, could focus on:
  - the big idea that we hope students will keep after graduation
  - the most important skills that students need to develop and be able to apply in the course-level and beyond
  - the skills and knowledge students will need if they pursue a career in this field
  - the values, attitudes, and habits students will need if they pursue a career in this field

Snapshots of some research results

(a) The most in-demand engineering generic competences and skills

What do you think are the most valuable business skills to demonstrate for an engineer to succeed within your organization? Rank your top five selections with 1= most valued

Options (Top 5)	#1	#2	#3	#4	#5	Count
Problem Solving	**284**	106	57	35	31	513
Listening and Communication	**166**	82	53	57	54	412
Creativity	**115**	58	59	45	35	312
Teamwork	**111**	54	46	76	75	362
High Ethical Standards	**111**	32	34	22	25	224
….						

Source: "*What makes a successful engineer*?" *WILEY. Thereza Macnamara survey results, 604 participants.*

*Employers are looking for "**T-shaped Engineers**" or well-rounded individuals with a breadth of soft career skills in addition to a **depth of technical knowledge**.*

The top career soft skill employers value is *Problem Solving*.

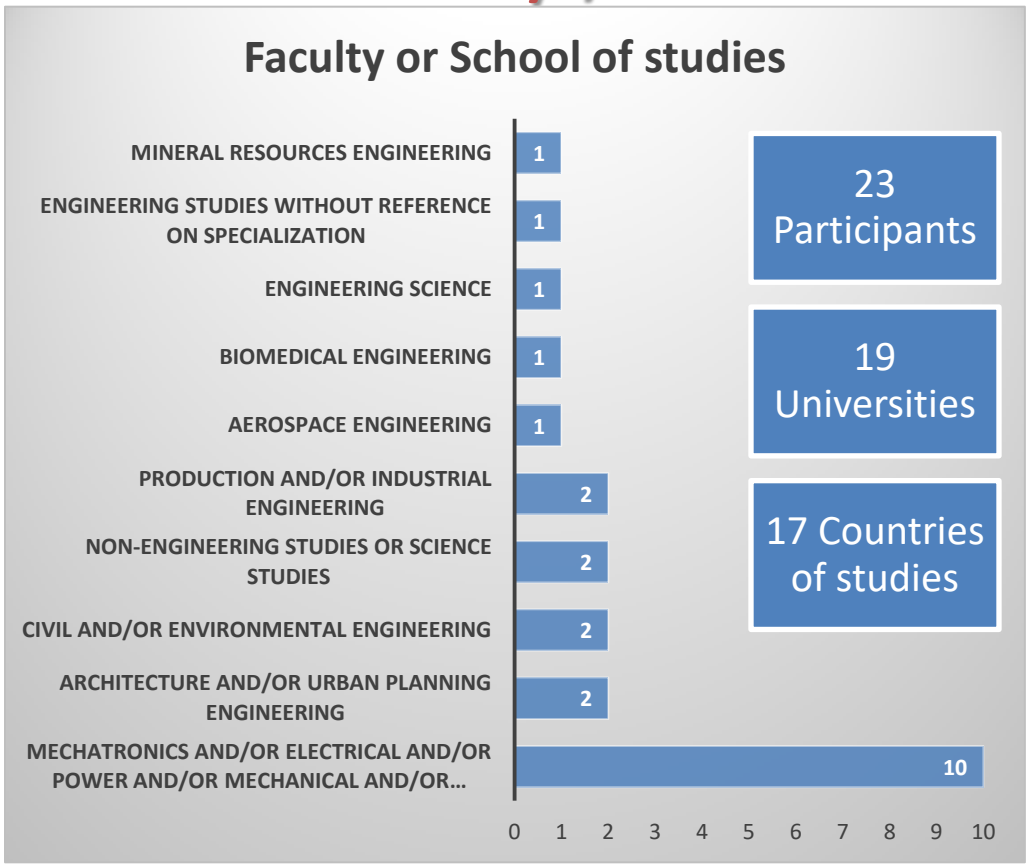
(b) Summer School 2017
TUC Chania – Events on Education

Survey results for the Competences / Skills according to the ABET criteria:

1. **Use tools for engineering practice**
2. **Knowledge of contemporary issues**
3. **Engagement in life-long learning activities**
4. **Broad education**
5. **Communicate effectively**
6. **Ethical responsibility**
7. **Solve engineering problems**
8. **Function in teems**
9. **Design a system, component, process**
10. **Design and conduct experiments**
11. **Knowledge of mathematics, science, etc.**

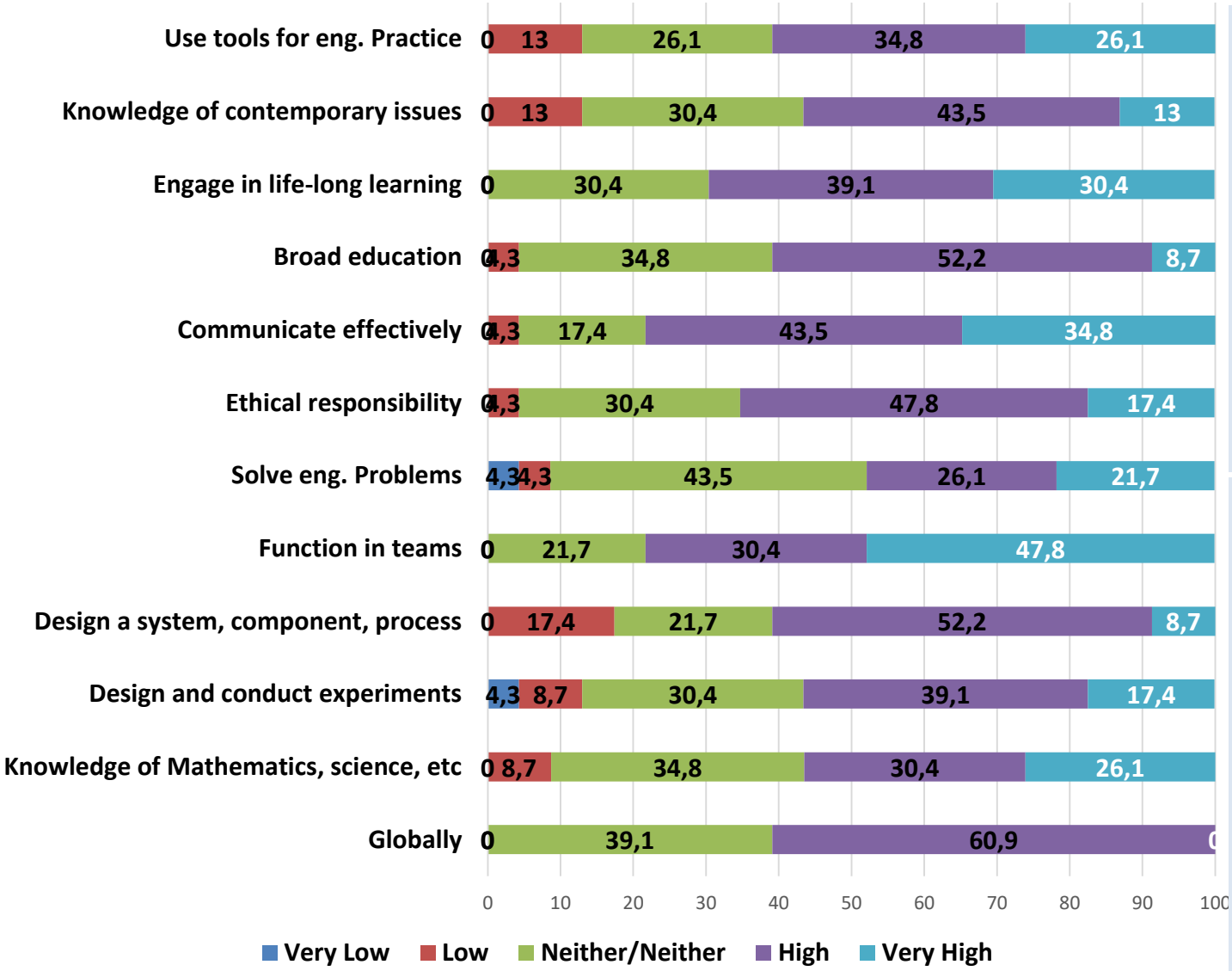
Presentation: 21 July, 2017, Technical University of Crete, Events on Education, 13 – 21 July, organized by the European engineering students' association BEST

Summer School 2017
Faculty / School of studies (N=23)



No	University Name	Country of studies	Count
1	Ghent University	Belgium	1
2	University of Zagreb	Croatia	1
3	Czech Technical University - CTU	Czech Rep.	1
4	Technical University of Denmark - DTU	Denmark	1
5	Tallinn University of Technology	Estonia	1
6	Technical University of Crete - TUC	Greece	2
7	Budapest Univ. of Technology & Economics	Hungary	1
8	University of Rome 'Tor Vergata'	Italy	1
9	Technical University of Moldova	Moldova Rep.	2
10	Delft Engineering University	Netherlands	1
11	AGM University of Science and Technology	Poland	1
12	Wroclaw Univ. of Science and Technology	Poland	1
13	Warsaw University of Technology	Poland	2
14	University of Lisbon	Portugal	1
15	University Polytehnica of Bucharest	Romania	1
16	Ural Federal University	Russia	2
17	Polytechnic University of Catalonia - UPC	Spain	1
18	Instanbul Technical University	Turkey	1
19	National Technical Univ. of Ukraine - KPI	Ukraine	1
			23

Self-assessed Competences & Skills



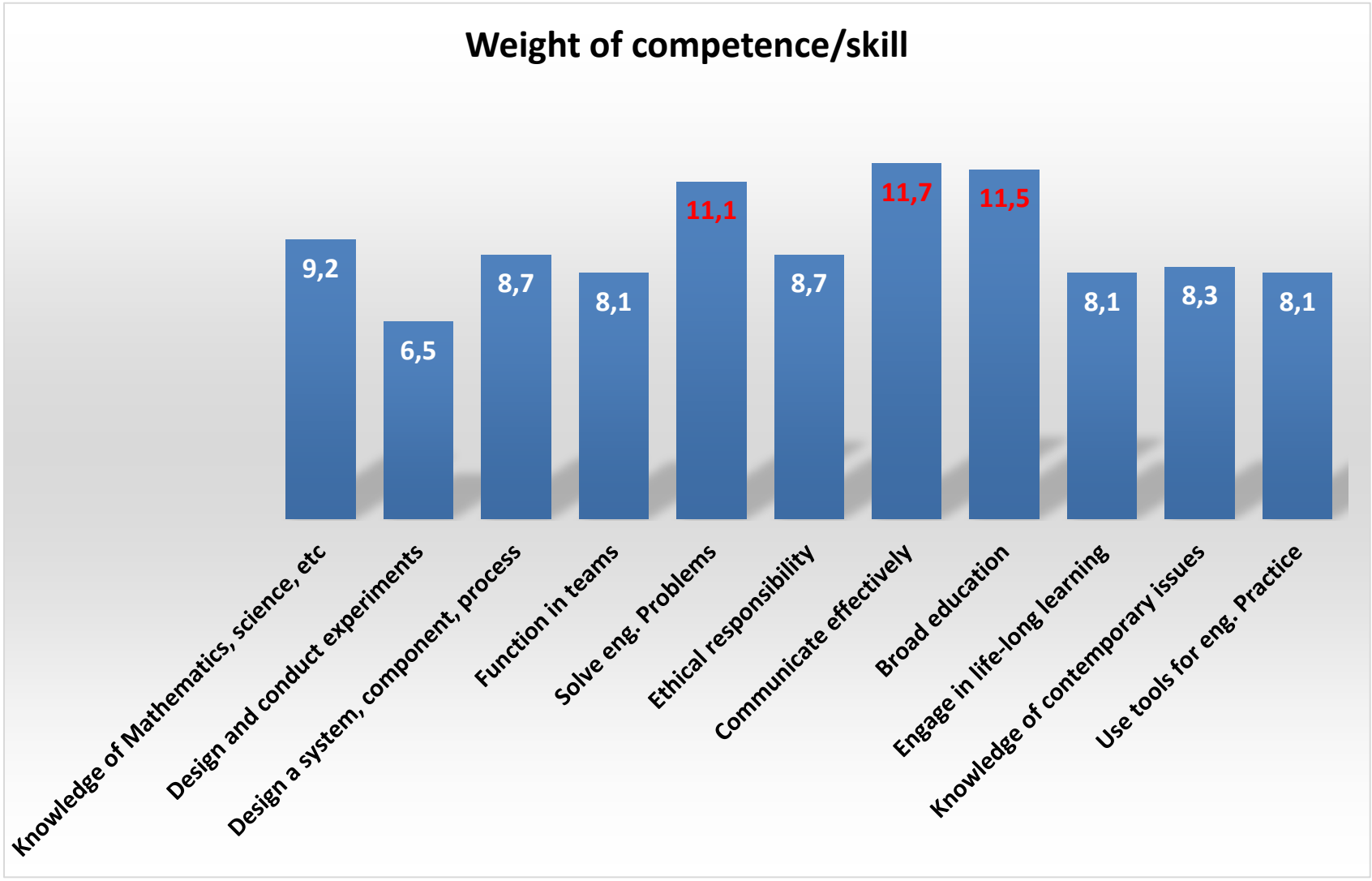
More than 50% express High & Very High level in soft skills:

- Communication,
- Team-working
- Life-long learning
- Ethical responsibility

More than 50% express High & Very High level in hard skills:

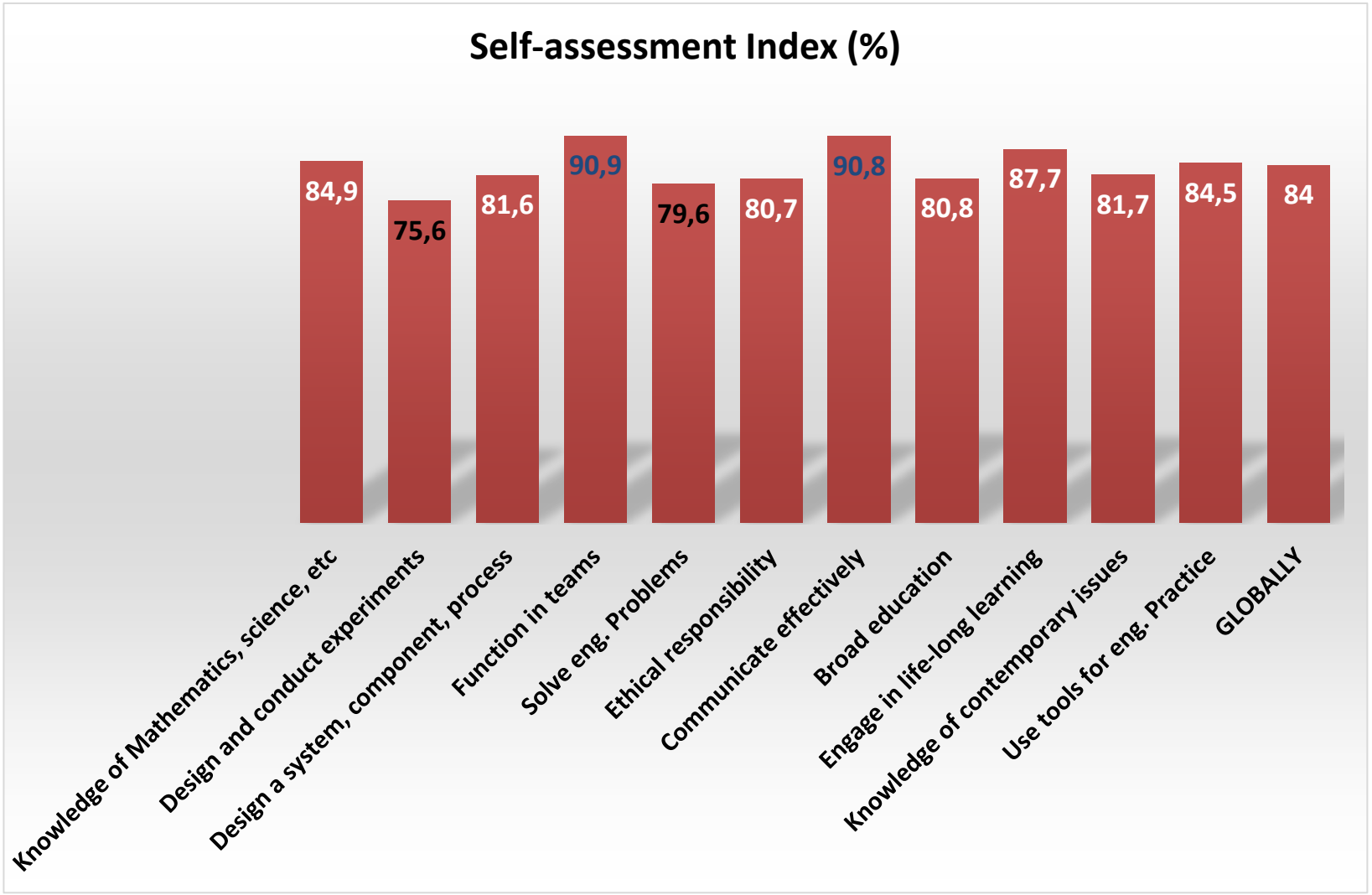
- Use modern tools for engineering practice.
- Design a system, component, or process

The most important are communication, broad education & solving engineering problems

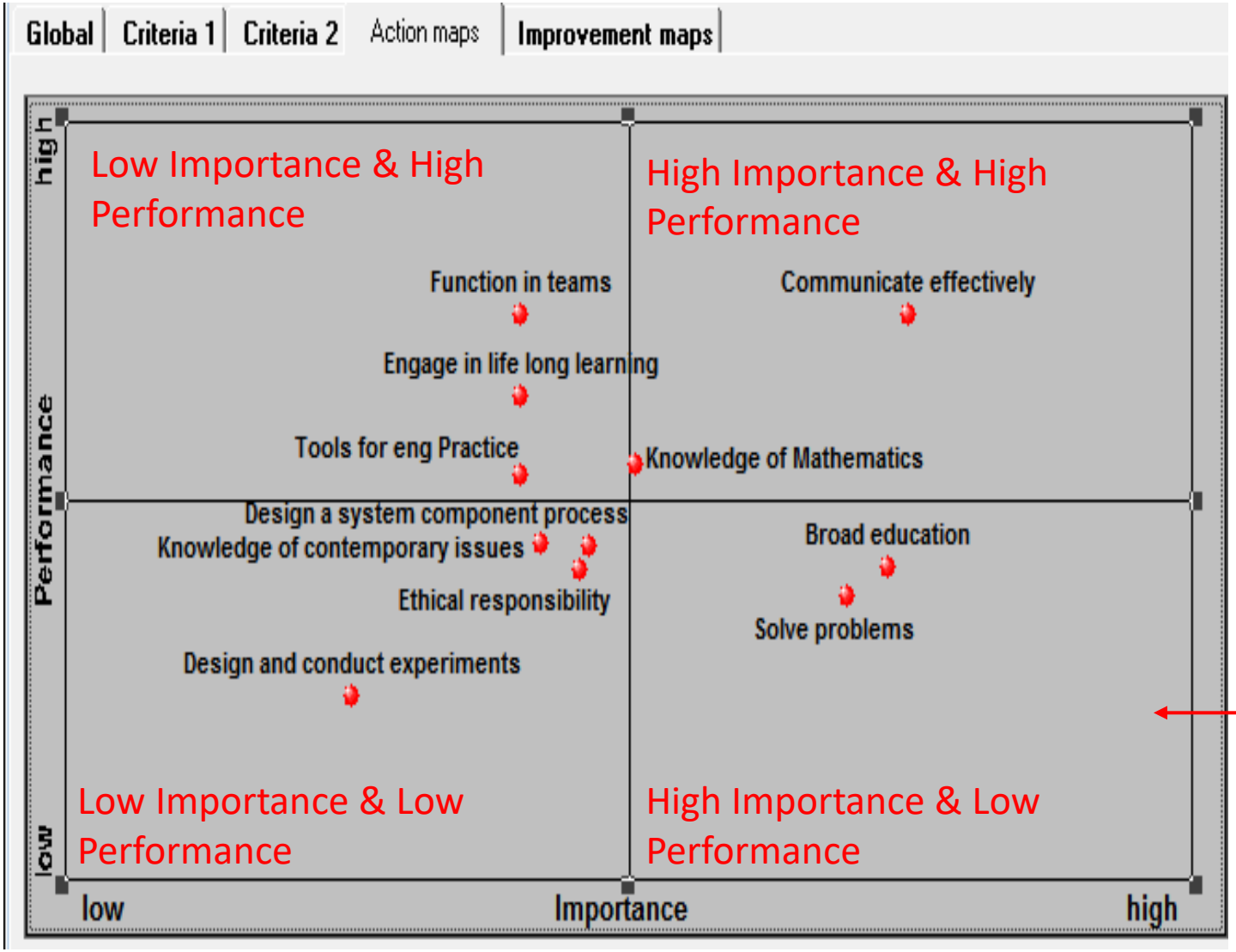


Strengths & weaknesses of the engineering students

High strength in Communication and Team-work.
Weakness in Design & conduct experiments, and Solve engineering problems.



Action Diagram
A performance – importance map (or strategic map)



Dimensions that need attention

(c) Students' preferences for teaching practices which improve generic skills

Presentation: 1st International Conference of the Network of the Learning and Teaching Centers in Greece, "*Transforming Higher Education Teaching Practice*", 6-7 July 2023, Alexandroupolis, Greece

Pilot implementation in an engineering course

- To improve domain-specific knowledge, along with the generic skills of **academic writing & speaking as well as team working**

Aim

- Couse: Decision Support Systems (compulsory), 6th semester/out of 10, 2 hours per week, 3 years of application, small groups – 5 groups in total (one the 1st year & two the next 2 years), **117** students in total

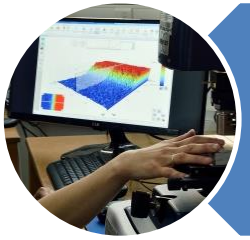
Details

The pre-designed activities in the pilot course

Discussion in a circular manner, equal opportunity for all, 1 – 3 times per session

10 min. exercise, collaboration of 2 students in class, 1 – 3 times per session

Short (written) assignments per week for a topic. Personal written feedback



Oral presentations, in groups of two. Three topics. All groups present a topic and take constructive criticism by their peers

(RQ1) Frequency of Activities

n.	ACTIVITIES	LEVELS	PART-WORTHS
1	**Short (written) assignment**	**Every week** Every 2 weeks	0.119 -0.119
2	**Oral Presentation**	**Every week** Every 2 weeks	0.071 -0.071
3	**Group Project (during the semester)**	**Yes, it is applied** No, it is not applied	0.149 -0.149
4	**Discussion in class, Q/A**	**Yes, it is applied** No, it is not applied	0.554 -0.554
5	**Exercise in class (in pairs)**	**Yes, it is applied** No, it is not applied	0.375 -0.375

Students consider that their skills are improved when they:
prepare every week a short written report along with an oral presentation, do a group project, take part in discussion (Q/A) in class and solve short exercises with their peers.

(RQ2) The most important activities

ACTIVITIES	WEIGHT
Discussion in class (Q/A)	29.55%
Exercise in class (in pairs)	23.25%
Group project (during the semester)	21.48%
Written short assignments	13.91%
Oral Presentations	11.81%

(RQ3) Design (redesign) the 'typical' offered course for the development of the specific skills

- Include techniques:
  - **Discussion in class based on Q/A** (in a rotation manner, equitable involvement of all students).
  - **Cooperation in class, in pairs, for solving short exercises** (micro-groups).
  - **Group projects during the semester.**

(d) Teaching in a Greek Technical University. Survey results

Survey: May – Oct., .2022

Participants : 94 members of the Academic Staff from all the Schools , or 34% of the total population

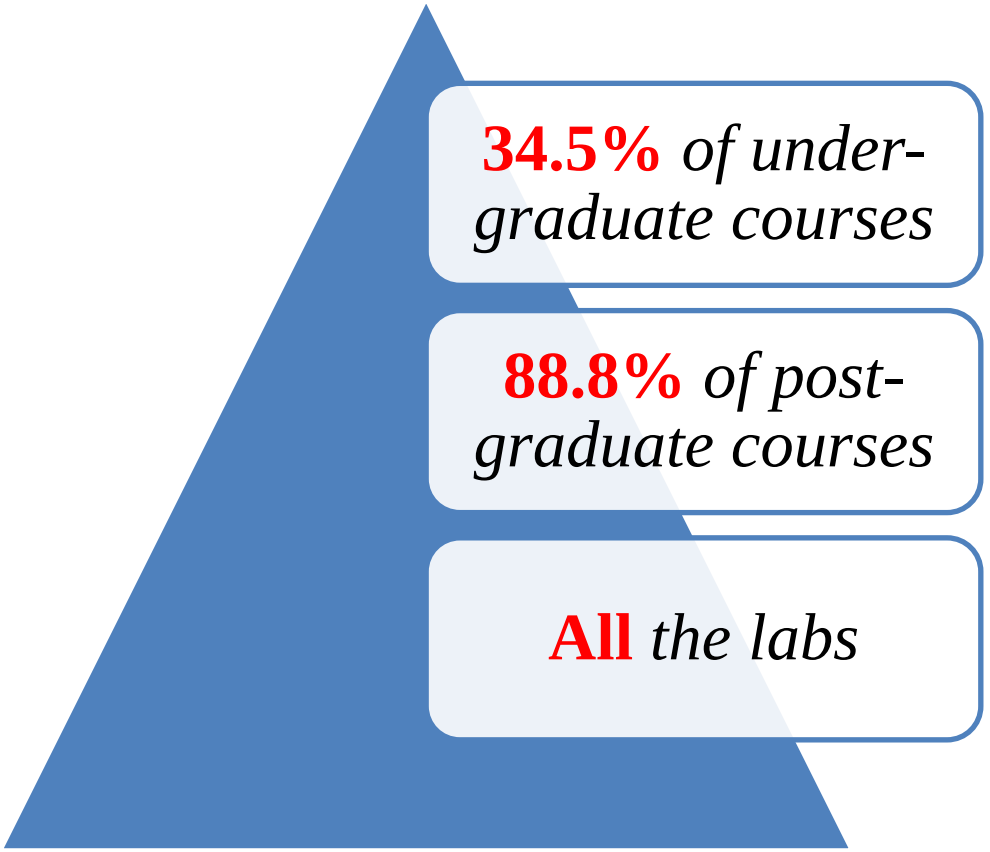
Presentation: 1st International Conference of the Network of the Learning and Teaching Centers in Greece, "*Transforming Higher Education Teaching Practice*", 6-7 July 2023, Alexandroupolis, Greece

Number of students in classrooms

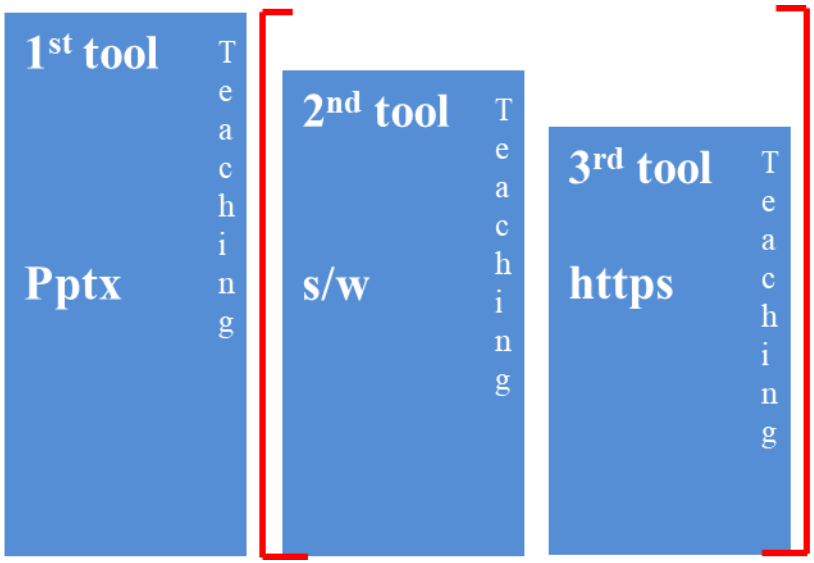
Up to 20 *students*
21 – 40 *students*
41 – 100 *students*
More than 100 *students*

The limited number of students argues for collaborative group activities that contribute to learning (under restrictions for the suitable space, possible non-constant student participation, low faculty-to-student ratio, engineering school course load)

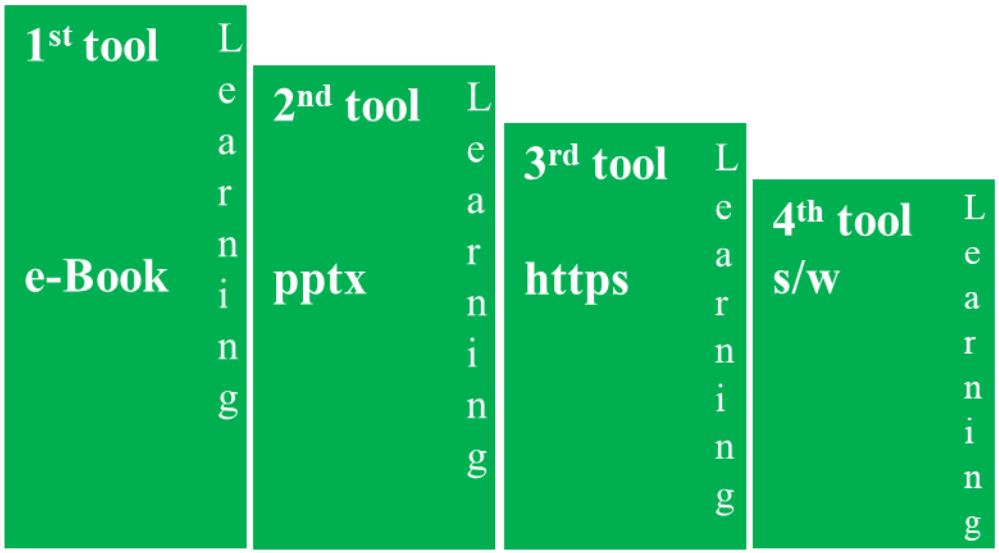
Less than 40 students



ICT tools in Teaching & Learning



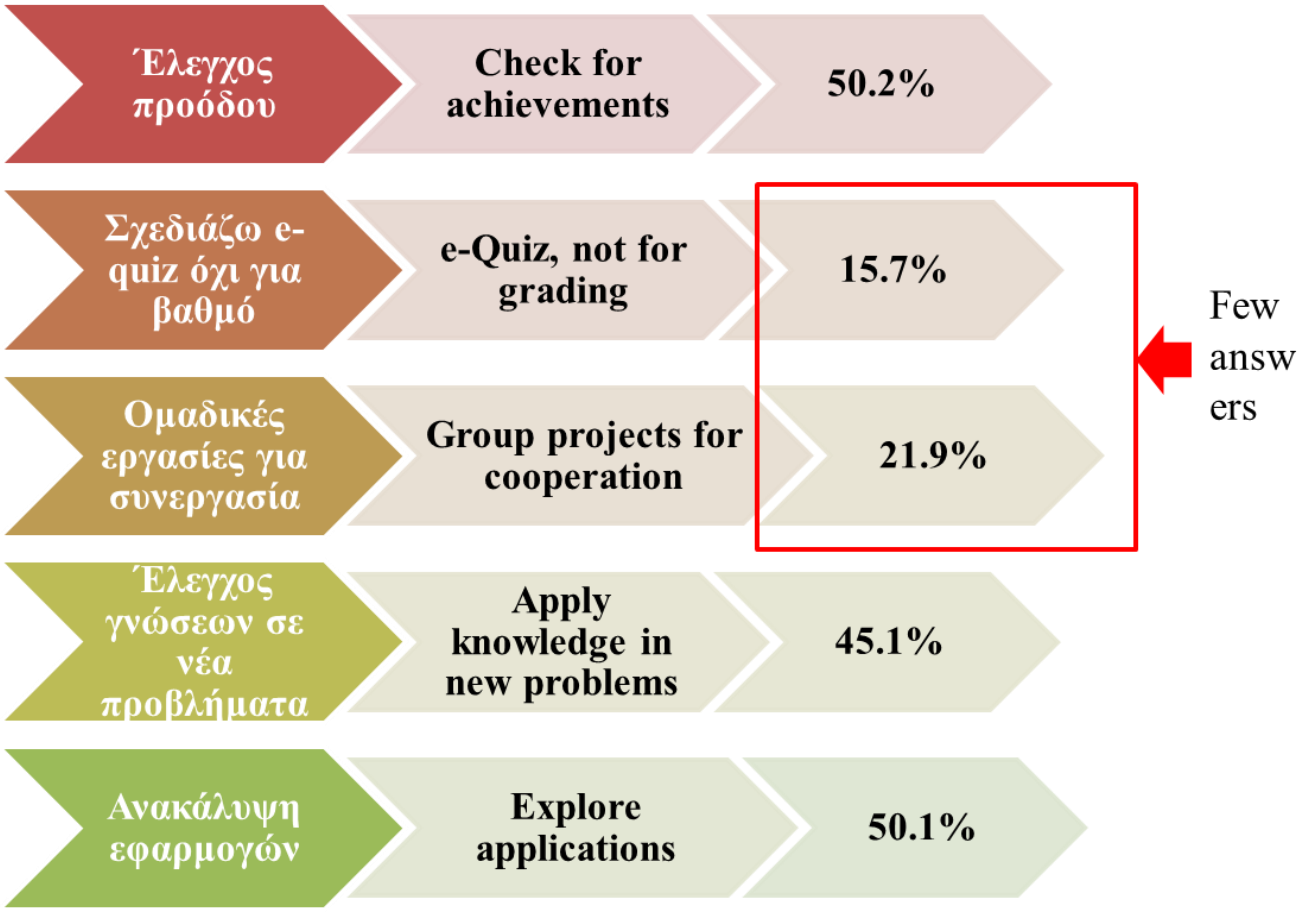
Slides serve as the foundation for lectures/labs and are mostly used among other e-tools



Students, mostly, use for their learning e-Books & Slides, Web pages & scientific s/w.

Design of Assessment

Replies often & very often



Generic Competences / Skills are …

a matter

- of Teaching
- of Learning
- of Practice

The loose use of all terms in an almost interchangeable way does lead to confusion and the development of a common terminological understanding should be encouraged.

Thank you for your attention

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