European Degrees in Engineering

EUt+ Reference Guide

V.1

*In 2017, at the **Gothenburg Social Summit**, the European Commission laid out **its vision** for 2025 of a **European Education Area** in which the free movement of learners is guaranteed: "A continent where spending time in another Member State – to study, to learn or to work – has become the standard and where, in addition to one's mother tongue, speaking two other languages has become the norm. A continent in which people have a strong sense of their identity as Europeans, of Europe's cultural heritage and its diversity."*

This document draws on the basis of the European frameworks on education, the information we have on current developments, the expectations for the European Higher Education Area, the contents of the call for proposals for European Universities and our application to this call, as well as the feedback from the participatory workshops in EUt+.

The examples considered here are mainly from the engineering sector, as they are the majority in EUt+, and the examples are easily transferable to other sectors, such as management or arts.
This document deals with Bachelor and Master programs in engineering (tasks 3.1 and 3.2). It does not deal with doctorates or Master's programs in graduate schools (task 4.1).

Narrative

We come from a generation that has built the world by posing, often unwillingly, problems of a new magnitude, we must educate the generation that will be able to address them with wisdom to solve them.

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1 References, definitions and glossary

1.1 References and bibliography

1.1.1 External resources

European Standards and Guidelines 2015:

- english
- français

Documents on the European diplomas from the DGEAC:
See annexes

Documents on the framework of learning outcomes and competences:
Cadre de l'ENAEE
UNESCO documents on level descriptors use
"Dublin" descriptors: here, and there

Literature on curricula design and competency frameworks:

ORGANISER LA FORMATION A PARTIR DES COMPETENCES, MARIANNE POUMAY, JACQUES TARDIF, FRANÇOIS GEORGES, DE BOECK, JUIN 2017

BERTHIAUME, D. ; REGE COLET, N. (2013). LA PÉDAGOGIE DE L'ENSEIGNEMENT SUPÉRIEUR : TOME 1 : ENSEIGNER AU SUPÉRIEUR. BERNE, SUISSE : PETER LANG.

BERTHIAUME, D. ; REGE COLET, N. (2014). LA PÉDAGOGIE DE L'ENSEIGNEMENT SUPÉRIEUR : TOME 2 : SE DÉVELOPPER AU TITRE D'ENSEIGNANT. BERNE, SUISSE : PETER LANG.

1.1.2 Internal ressources

See annex **"Competency framework of the European University of technology Masters of engineering" / "Compétences générales des Masters Ingénieurs de l'Université de technologie européenne"**

1.2 Definitions

(Pedagogical) competences: "know how to act and manage complex situations"
Jacques Tardif's definition based on the work of Noam Chomsky: it provides a corpus of competencies that is very stable over time, that describes particularly well the "character traits" of a student trained in a given institution or program, and that is robust to changes in professions and disciplines. It best formalizes the "digital footprint of a school" beyond the

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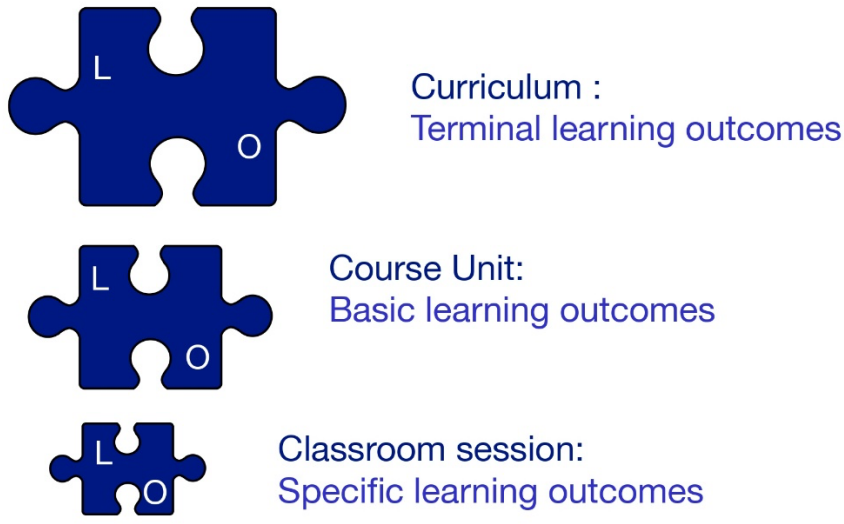
affective “alma mater”, while providing a clear pedagogical framework for effective and persistent learning. In this sense, the corpus of pedagogical competences constitutes the fixed point of the “learning contract” between the school/university and the student.
Example of a pedagogical competence (extracted from the EUt+ Master Pedagogical Competences): “Piloting a process or system reliably and efficiently; deciding, planning and organizing with a holistic vision; anticipating and preventing direct or indirect local impacts of a system on its territory, while being aware of the global challenges.”

Learning outcomes: “At the end of [an educational activity to be specified], the student will be able to [production to be specified]”.
[a pedagogical activity to be determined] = any pedagogical activity which can be a 2-hours lecture, a full semester, a project or a period in a company...
[Output to be determined] = any ability that the student will have acquired as long as it is precisely defined, which may be “expressing the gradient in the three usual coordinate systems”, “describing with suitable mathematical tools the hydrodynamic speed field”, or “having the C1 level in German”.

For practical reasons, a distinction is often made between (From kitmap, Université de Nantes) :

- specific learning outcomes (acquis d’apprentissage spécifiques)
- basic learning outcomes (acquis d’apprentissage élémentaires)
- final learning outcomes (acquis d’apprentissage terminaux)



This is structured pedagogically as follows:

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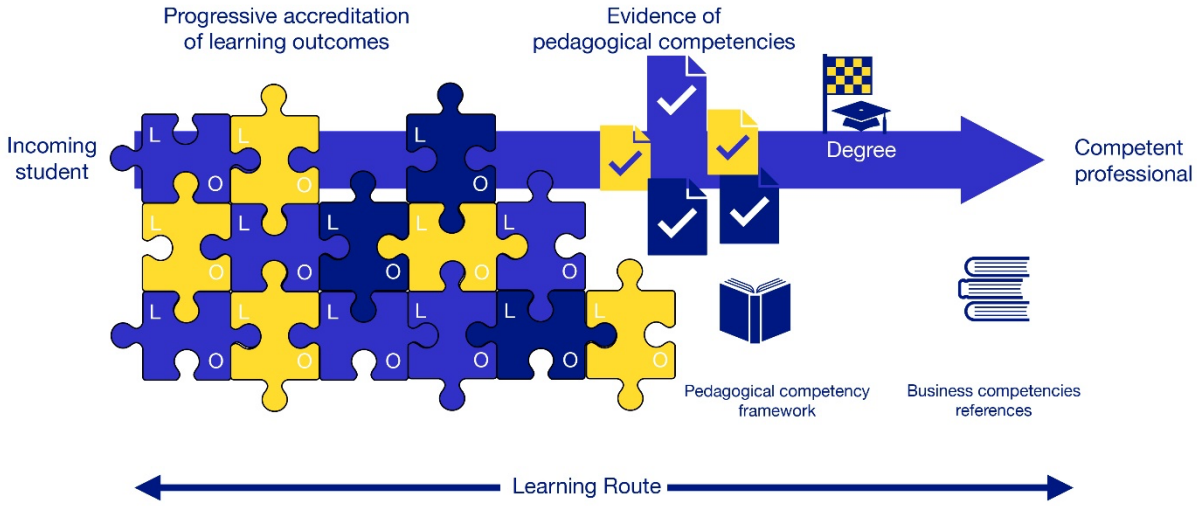

Articulation of competencies and learning outcomes
Based on D. Lemenu and E. Heinen (2015) in "How to move from competences to learning assessment".

In the context of the European diplomas of the EUt+, the target programmes are defined in terms of final learning outcomes. They are the precise description of the learning outcomes for each of the degrees.

The descriptions of the modules (or the smallest exchangeable unit) will be made by basic learning outcomes. Generally one elementary learning outcome per ECTS (or a little less) will be listed. This is the basis for discussion between teachers.
The degree framework is described by final learning outcomes. These will usually be in the order of 15 to 20 for a Bachelor of Engineering and about 25 (or slightly more) for a Master of Engineering (in which case the Master learning outcomes will include, explicitly or not, the Bachelor learning outcomes.

1.3 Generic principle of a student's curriculum

According to the above definitions, the principle of a student's curriculum is as follows:

- A learner is enrolled in the programme because
    - he/she has learning outcomes from previous training and experience
    - He/she demonstrates a capacity to achieve the learning outcomes required for the qualification
- In various ways, he/she collects the basic learning outcomes to progressively validate the final learning outcomes.

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- When he/she has validated all or almost all the final learning outcomes, by means of one or more concrete and complex cases, he/she proves his/her ability to apply them, thus validating the pedagogical competences.

Each step of this progression is monitored by the teachers, who are responsible for guiding the learner, in particular according to his or her prerequisites, then the validated outcomes and the choices he or she wishes to make. Self-assessment and the e-portfolio are essential tools for the acquisition of learner autonomy and for dialogue with teachers.
The teachers validate in particular the final competences, which must be assessed in more or less complex situations.

1.4 Curricula convergence trajectory

The current curricula are converging towards the European curricula through:

- the progression of each of the existing curricula towards the general principles and schemes described below
- the final learning outcomes which allow the design of a “common curriculum”, identical for all students, making local offers compatible.

From the bid:
Each curricula group will progress according to the three-phases schema of (1) harmonized management; (2) decentralized management; (3) deconcentrated management.

	Phase 1	Phase 2	Phase 3
Curricula management	Harmonized	Decentralized	Deconcentrated
Academic regulation	Compatibles for mobility	Identical	Single
Steering	Collaborative	Linked in network	Single, with subsidiarity for operation
Degree	One per campus, same field	One per campus, identical, or joint degree according to national regulation	Only one for the EUt+
Estimated duration of the phase	1 year	2 years	2 years, depending on regulations

Each new curriculum will be integrated from a group of pre-existing curricula from 3 to 5 campuses.

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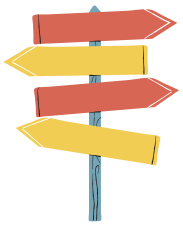
2 The 12 characteristics of the European degree for the EUt+ Bachelor/Master engineering curricula

2.1 Embedded mobility / multi-campus model



Embedded mobility happens when one or more substantial periods of mobility is structural to obtain a degree and that the curriculum is inherently delocalised. The exception is the absence of long or even majority mobility in a curriculum.

In order to build themselves and their vision of Europe, our students need to *experience an in-depth exposure and immersion*. This can only be achieved through *long and transforming mobility*.

Mobility is not an end in itself, but a necessity to be exposed to others and their cultures, and to discover oneself.
Mobility is therefore a way of being more than an operation of geographical movement. For the EUt+ European degrees, students are guided towards this state of mind which leads them to meet other cultures in the long term. They travel for at least several months, ideally for a full semester. They attend classes on the host campus alongside local students and other students on mobility.
In this regard, a short mobility does not make sense, nor does mobility only in a lingua franca. Meetings take place during lessons, during personal work, but also and above all during informal encounters outside teaching periods.

Short mobility lasting a few days or weeks are not supported or taken into account for European degrees, as they do not provide the necessary depth of immersion. Moreover, they would generate too much carbon impact for a limited time, for the sole benefit of being able to say that one has briefly set foot elsewhere in Europe. They do not allow time for immersion in the culture of the other, no time for a deep encounter...
Virtual mobility, an oxymoron by nature, must not be used as a cover for an absence of mobility. Immersion is an encounter, the virtual does not allow a real encounter. However, after meetings and links between students, videoconferences and tools for working together at a distance allow relationships to be pursued. The virtual is used as a tool to continue a meeting. It is also useful to prepare for mobility (language learning, etc).

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From the bid:
Mobility needs to be financially sustainable, simple, attractive and pedagogically embedded. As such, mobility will be almost exclusively for one-semester chunks of time or more, in order to allow a real immersion within the partner institution and the local culture and language, as well as to amortize its carbon footprint.

From the bid:
Firstly, it should be noted that the European framework harmonises levels B, M and D in the EHEA, and characterises them by the Dublin descriptors. It does not align with the exit level of high school. Thus, the existing difference between the 6 and 8 semester-duration Bachelors serves mainly to align the levels of competences in the form of an "entrance buffer" of variable duration in order to eventually reach the same official level of competences.

Narrative

"At the end of her journey, she would have learned to know herself better, to be self-confident, and she is now able to build her own career path. This other-Eut+-campus experience was so enriching, both in terms of learning outcomes and life experience, and allowed her to grow. The experience was all positive, because, even, the 'mobility' was quite easy, in fact. She felt at home on this foreign Eut+ campus. The university environment was well prepared to welcome her, and everything went smoothly: she got an Erasmus grant, no difficulties with accommodation, her European student card allowed her to take public transport easily, go to the university restaurant and even borrow books.
Everything Robyn learned and experienced during this semester gave her the desire and the strength to apply for another semester, this time in Dublin."

EUt+ Bachelor

Long-term mobility for a young student at the beginning of his or her studies, or if he or she encounters a tough time, can be a disincentive to enroll in a curriculum. In programmes that include these more fragile students, a trip lasting a full semester, supervised, prepared and in a group, makes it possible to offer a more progressive immersion by reducing apprehension. Mobility is therefore proposed as a trip for a full semester, with a pre-validated list of courses, proposed in the continuity of the courses already completed in their curriculum. It is therefore, in fact, a linear curriculum with a semester offered in another campus, where the immersion is carried out in a comforting group.

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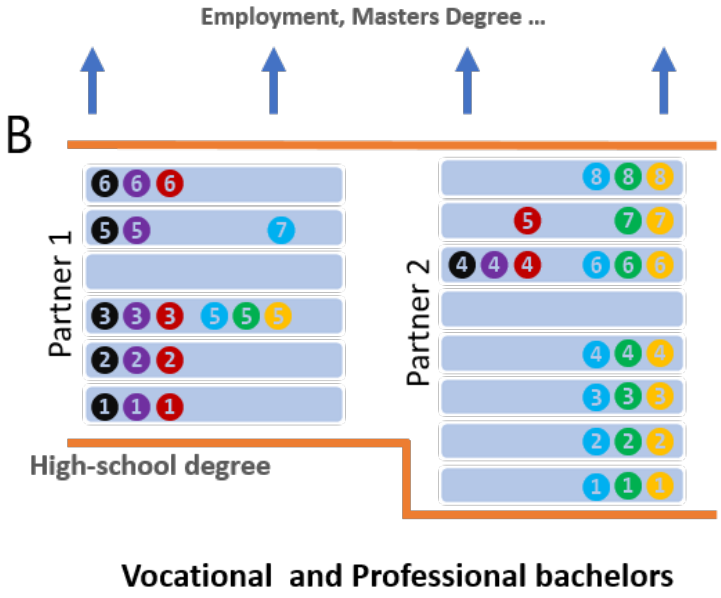
From the bid:



For vocational or professional Bachelor's degree courses, with more vulnerable groups for whom mobility is not an easy matter and employability is above all perceived as local, we adopt structures that are more reassuring for students. They move in groups for a specific semester to another partner, according to a predefined programme when they are globally linguistically and pedagogically ready. Additional individual mobility is then allowed for the most motivated students (e.g. cyan and red). The degrees correspond to a global competence scheme which is harmonized at EUt+ level, but is declined in function of the environment of each partner.

EUt+ Master

In the "Master" programme, which may include the "Master full track" (i.e. the Bachelor part) mobility is fully integrated. As soon as the student is ready for mobility (validated by the teachers, generally at the end of 1 to 3 first semesters), the student freely follows his or her curriculum on the different campuses. Only the pedagogical coherence of the courses is taken into account.

From the bid:
For the Master's courses (2 years or direct), the curricula will be fully joint. As soon as the "buffer entrance" phase is passed, students are free to choose their course according to the skills they wish to acquire, the partners they wish to visit and the details of the offering. The minimum mobility path is shown in blue or yellow (one semester). The green and black itineraries correspond to what we hope will be the majority in the long term. At the end of the complete convergence process, the course in red should be an exception only for students with difficulties that do not allow them mobility (it will only give the national degree and not the European one that we are aiming for in the long term).

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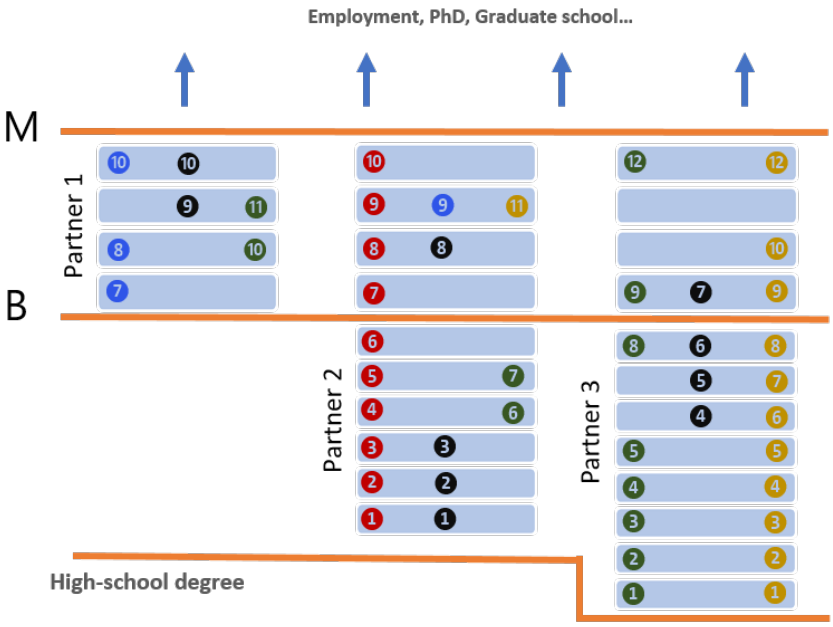

Master of engineering
(2 years or direct curricula)

Through a competences-process and program-approach developed by all the teams in the convergent curricula group, a single competences framework is established and shared for each Master of Engineering target curriculum. The same (single) academic regulations will be applied on all campuses.

From the bid:

Objectives of the proposal	***Indicators:*** *List relevant quantitative and qualitative indicators showing whether and to what extent the objectives of the alliance are being achieved. Please indicate your target where possible.*	***Source of information:*** *How could these indicators be measured? - What could be the sources of information?*	***Assumption and risks:*** *What might be the factors and conditions not under the direct control of the alliance which are necessary to achieve these objectives? What risks have to be considered?*
• Multiculturalism	• Share of EUt+ students who will have spent at least one semester at one of the EUt+ campuses • Efficient communication and daily running of EUt+ Efficient communication at meetings involving representatives from different campuses	Multiculturalism and multilingualism overseeing committee reports (quality management, Task 1.3)	• Financial resources Specific local constraints limiting mobility

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2.2 Multilingualism / Multilinguisme

Multilingualism is the ability to meet others in their own language and when international exchanges are not reduced to a single lingua franca, opening up the richness of the deep diversity of languages and cultures.

The Erasmus preamble states that every European student with a higher education degree should be able to work in at least two foreign European languages in addition to their own. Multilingualism does not mean having one's mother tongue at home and a single lingua franca for study and work. It means being open to a diversity of languages, both in learning and in working.

The fundamental principle on EUt+ languages is that linguistic diversity is a richness, that there is no nobler language and that a native language should not provide an a priori disadvantage. As a corollary, one strives to meet the other in his or her language and not in a lingua franca.

As a reminder of the objectives set out in the EUt+ application and the European Union objectives, in order to maintain linguistic diversity, in particular for the implementation of study programmes:

- Each of the partners with the most widely spoken languages (English, French, German and Spanish) teaches in its national language;
- As a result, each partner prepares its students for learning in other languages on the other campuses and prepares itself to welcome on its campus students with a lower level of proficiency in its national language. In particular, language support courses are organised at the beginning or during the semester;
- Each of the partners with less widely spoken languages (Bulgarian, Greek, Latvian and Romanian) offers courses in other languages for incoming mobility students;
- Students in mobility with low-dissemination language partners are required to follow a course in the host partner's national language at a level of A1 in one semester and A2 in two semesters;
- Low-spread languages are promoted as much as possible among all partners;
- Each partner progressively imposes the mastery of one European foreign language at Bachelor level and two European foreign languages at Master and Doctorate level;
- Particular emphasis is placed on opening up the staff (academic and non-academic) to linguistic diversity and their practice;
- In general, there is a benevolent attitude towards the development of language skills, especially in situations;
- These language provisions do not hinder the development of knowledge of other European or non-European languages.

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A language observatory is indicated in the application and particular care is taken to ensure that it functions effectively and that its conclusions are taken into account.

From the bid:
We strongly encourage multilingualism. On our campuses, 9 out of the 24 official languages of the EU are spoken, and all three alphabets of the EU are used. We will harness this linguistic and cultural richness to work towards the achievement of ambitious objectives. By 2025:

- students having completed a Bachelor's degree will master at least one foreign language at B2 level. At least 30% of them will have benefited from physical mobility and at least 50% from virtual mobility;
- students being awarded a Master's degree (engineering or other) will master at least two foreign language at B2 level. In steady state, at least 80% of students will have undertaken part of their curriculum abroad.

It should be noted that EUt+ is far from being the most ambitious Alliance in this field. In the European Reform University Alliance (ERUA), the Université Paris 8 has opened Danish and Bulgarian courses (German and Greek had already been taught there for a long time). We therefore believe the objective is attainable.

It is essential that students understand that monolingualism does not open up sufficiently to the culture of others, to their way of thinking. Nor does English alone allow students to find a job in a non-English-speaking country, where mastery of the national language is almost always necessary to find a job, and even more so to integrate.

Narrative

"Looking at the courses that would allow him to validate the skills he is aiming at, he sees that they are available in Cluj and Dublin. He chooses to go to Cluj first, based on the fact that he already knows English. Learning Romanian appears to be a more interesting challenge, in terms of intercultural opportunity.
He decides to leave his home country alone, with no classmates, so as to fully be immersed in this new culture and way of living."

EUt+ Bachelor

In the EUt+ Bachelor programme, at least one foreign language at B2 level is required. It will be necessary for the mobility semester. This language will generally be English. In view of the continuation in Master, the acquisition of a second language at an intermediate level in Bachelor is more than recommended. This will also open up the field of mobility.

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In doing so, we remain below the European expectation of two European working languages in addition to the native language for higher education graduates. However, we believe it is a useful first step, being already an improvement as regards the current situation, and will generate insights for iterative improvement.

EUt+ Master

At Master's level, students are expected to master two European foreign languages at B2 level. The deepening of one of these two languages to C1 or even C2 level will almost always be obtained, following the mobility already experienced during the Bachelor's degree and continued at this level.

From the bid:

Objectives of the proposal	***Indicators:*** *List relevant quantitative and qualitative indicators showing whether and to what extent the objectives of the alliance are being achieved. Please indicate your target where possible.*	***Source of information:*** *How could these indicators be measured? - What could be the sources of information?*	***Assumption and risks:*** *What might be the factors and conditions not under the direct control of the alliance which are necessary to achieve these objectives? What risks have to be considered?*
Multilingualism	All Bachelor students will have a certified B2 level in one foreign language All Master students will have a certified B2 level in two foreign languages Meetings between students of EUt+ will take place in several languages Meetings between EUt+ faculty and/or administrative staff will take place in several languages Efficient communication and daily functionning of EUt+	External official language tests Multiculturalism and multilingualism committee observation reports (quality management, Task 1.3)	Local and/or national and/or European higher education support Financial resources Specific local constraints limiting mobility

2.3 Self-customization of study track

Self-customization of study track is the possibility for all students to choose their own course track to fulfill the learning outcomes required for their desired degree.

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The choice of courses does not come from simply more permissive vision of training “menu” or “à la carte”. It has a deeper cause which must be understood before it is implemented, in order to avoid making substantive mistakes.

A degree is the proof attested by a higher education institution of (pedagogical) competences that will allow a given degree of professional and possibly civic autonomy. We understand competences here in the sense of Jacques Tardif, i.e. “knowing how to act in a complex environment”, because they are profoundly structuring pedagogically by ensuring, in particular, the persistence and adaptability of learning. Competences are the deep mark, the digital imprint of the graduating institution. They are based on an underlying set of values, and they characterise the approach and professional development of graduates. Even in a rapidly changing world, with rapidly obsolete techniques, or graduates changing career paths, competences remain stable over time. We will generally count 3 to 5 competences for a Bachelor’s degree, and 5 to 7 competences for a Master’s degree.

It is important to remember that a competence constitutes an autonomous know-how, in the sense that it includes all the elements necessary for its achievement. It is therefore rare that there are purely scientific competences and others that are purely technical or purely “attitudinal”; an engineer, or even any professional, will need to mobilise all these elements simultaneously for the effective performance of a task. The higher the level of qualification, the more strongly this is the case: executive professions require a general approach to problems, unlike highly technical and specialised professions that have been trained in secondary education.

The pedagogical implementation of a degree requires a list of learning outcomes that the graduate must master independently, and that he/she must learn to usefully engage in a complex situation. A learning outcome can be defined as “the ability of the student to do [this] at the end of [a piece of training]”. For a given degree, the list of final learning outcomes is appropriate. It may usefully be supplemented by basic learning outcomes, which are not binding but which help to build up the learning pathway. These learning outcomes are fairly flexible and can be periodically adapted according to the evolution of techniques, the economy and society. In a way, it is the concrete instantiation of competences at a given time. Depending on the granularity level chosen and the mode of description, one final learning outcome can be considered for 5 to 15 ECTS. It can be very precise (e.g. Validate a C1 level in English), more open (e.g. Validate a C1 level in a European foreign language) or very flexible (e.g. Describe with relevance the relevant structure-property relationships of a material).

A list of courses to be validated does not guarantee the learning outcomes for many reasons (partial compensation of courses, general structure not adapted to the particular case of each student, contents of the courses decided independently without global coherence...). Modularity and flexibility are here given to the student to progress on the learning outcomes to be validated, according to the means available to him/her (formal teaching, other teaching

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provided elsewhere or abroad, prerequisites, projects, internships, community involvement…). What is important is that the student validates all the learning outcomes in one way or another and that, before the degree, he/she has been able to prove his/her capacity to implement them in several complex situations related to the young graduate's job.

Far from giving the student total freedom of choice, the customised construction of the pathway is a "co-responsibility" of the student with a teacher-referent for the validation of all the final learning outcomes. Thus, no course is formally compulsory, but no learning outcome can be avoided and the final demonstration of the mobilisation of final learning outcomes in a complex situation must be carried out by the student.

Flexibility in building the learning pathway is intrinsic to this approach. It starts from the very first day (each student, even if he or she has a sufficiently high average level, comes with various preliminary learning outcomes on which to build). It allows each student to follow a more or less different path, and allows periods abroad without them being a *de facto* derogation, as they will simply have to contribute to the progression towards full validation of the final learning outcomes.

The follow-up of these learning outcomes requires that each course be described in terms of basic learning outcomes (approximately one basic learning outcome per ECTS) allowing for the follow-up of the student. The student's progress is usefully monitored via an e-portfolio, a record and pedagogical anticipation of the student's progress, which can be consulted in particular by the teacher-referents, and is a real Ariadne's thread for the educational process.

This responsibility (supported and supervised) given to the student enables in particular:

- A stronger sense of responsibility of the student for the courses he/she has chosen;
- A choice at a time that is often more favourable pedagogically for the student, who chooses courses more spontaneously when he or she is ready;
- Freedom of movement geographically (and temporally).

The concept of repeating a year or semester disappears (but not the possibility of attending a course twice if necessary to validate it). Some students can go very fast, and validate more than 60 ECTS per year, while others will be slower (depending on the student's time or intellectual availability), and this can also vary over time.
Experience shows that students behave very maturely towards this system, which does not generate any major drift, and that the duration of graduation is not substantially increased. On the other hand, there are many spontaneous double degrees and interesting or original pathways.

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Narrative

"She needs to know what her options in the EUt+ framework are: the choices available, the credits, the progression of courses… With the help of her teachers, she identifies what competencies and learning outcomes are missing for her training to be complete.
Because sustainability is one of the major issues of today's society and EUt+ campuses are in advance on the issue, Robyn can choose her courses on this subject from different EUt+ universities and pick the best for her from every campus, and thus design her own path of studies."
"Robyn progressively wants to achieve more autonomy and she is happy to be provided with excellent learning facilities and resources, which enable her to follow her own schedule at her own pace, in compliance with her personal objectives. In this way, Robyn is able to manage her time more effectively and make the most of her stay, absorbing various aspects of the local customs, traditions, and lifestyle."

EUt+ Bachelor

The EUt+ Bachelor model leaves a small margin for students to define what they need. It is based on the full implementation of the Bologna process.
Around a common core for all students:

- The initial level of students is ensured by checking their initial learning outcomes. Gaps are filled, already demonstrated learning outcomes exempt them from relative courses. The level is thus readjusted on enrollment.
- Learning outcomes may be obtained through work experience, community work or other activities. In this case, they will be proven by the student and validated by the teachers.
- During a semester of mobility, or when choosing courses that are not offered in the "standard curriculum", learning outcomes are credited without restriction or constraint if they match a relevant pathway towards the final learning outcomes of the degree.
- Systems of electives allow for different ways of acquiring competences.

EUt+ Master

The curriculum is fully based on the generic principle that requires:

- A free pathway where the student progressively validates basic learning outcomes that ultimately cover the final learning outcomes of the degree;
- Proof of validation of competences during an in-depth experience, in a company, on a real project, or in a research laboratory;
- Support from a referent teacher who guides the student in his or her choices;

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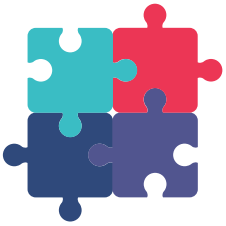
- A European pathway where at least one semester of mobility was carried out during the Master's degree and one during the Bachelor's degree (or two during the Master's degree, if this was not the case during the Bachelor's degree);
- The pathway is recorded and monitored in an e-portfolio.

Some courses have prerequisites or requirements to be followed. These prerequisites are, however, reduced to the minimum pedagogical requirement.
To help the student, standard pathways are suggested, but they are not prescriptive.
The initial level of the student is assessed and possibly compensated for, if initial learning outcomes were lacking or if they had already been demonstrated elsewhere.

2.4 Modularisation and flexibility



Modularisation and flexibility are the possibility for courses to be chosen (or not) at different moments, by students of different programmes, without overall constraints, only because they fit pedagogically in the individual paths.

Modularisation and flexibility are the necessary technical corollaries of the freedom to build a pathway left to the student and the freedom of movement between campuses.
They also allow for adaptation to a variety of audiences (students working in parallel with their studies, disabled people, etc.) as well as original courses (double degrees, additional training outside the initial stream, etc.).

Modularisation and flexibility definitively anchor the notion of competences and learning outcomes as the framework for training, since pedagogical articulations can no longer be made directly between teaching units (which are largely versatile building blocks and are no longer subdivisions of a single degree pathway).
It should be noted that the gathering of students with diverse backgrounds in a course should be usefully used as an advantage.

Modularisation and flexibility imply a clear need for student monitoring, which should be done by means of a pedagogical e-portfolio, in which the student records his or her track and associated basic learning outcomes. The e-portfolio is accessible to the teacher (as soon as the student enables it), and then the learning outcomes are checked and validated in accordance with the curriculum.

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Narrative

"Robyn is aware of the shared learning outcomes in the diploma and of those that are required for him to succeed in his semester. However, he has some doubts about his choice of courses. So, he contacts a mentor who has a pan-campus vision of the programme offerings. The mentor offers advice on the choices available: it is possible to acquire similar learning outcomes through different pedagogical methods (learning by doing, industry placement, laboratory engagements, research group placement, and so on). "
"His fellow students from different engineering backgrounds are able to join his courses because of flexible, additional short-time qualification courses: these are not necessarily STEM subjects, but are drawn from a diverse range of humanities and other courses, including social aspects, including music and arts, as well as sports. "

2.5 Student-centered learning

Student-centered learning implies no longer being interested in the teacher's delivery, but in what the student will ultimately be able to achieve as a learning outcome. The programmes are delivered in a way that encourages students to take an active role in creating the learning process, and that the assessment of students reflects this approach.

Student-centered learning is precisely defined in the quality assurance process: it is point 1.3 of the European standards and guidelines. It is also the "core" of the concept of learning outcomes.

The main idea is to focus on what the student will be able to restitute from his/her learning and not on what the teacher will have "taught" during his/her teaching. Thus the description will be based on learning outcomes, both at the level of the course unit (basic learning outcomes) and at the level of the degree (final learning outcomes).
All the guidelines of point 1.3 of the ESG are to be considered at the level of each course and the overall curriculum.

The pedagogical methods used, as long as they are in line with student involvement as defined in ESG 1.3, are the teachers' freedom and responsibility. Teachers are free to choose the methods they use as long as:

- They put the student at the center of the learning process;
- They guarantee a solid and lasting acquisition of learning outcomes;
- They are addressed to all the students concerned, included in their diversity, with success for all;
- They respect the means allocated by the institution;

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- They are in line with the ethos of the institutions and of EUt+ (this is explicitly reflected in the competences of the degree).

In this context the student is evaluated on the learning outcomes. What is expected of him/her must be shown in a previously stated context.

No numerical marking can provide a comprehensive assessment of these learning outcomes, which must be explicitly assessed. Indeed, the normative nature of numerical marking does not clearly reflect a learning outcome. By giving an illusion of objectivity and impartiality, it prevents a real assessment of the student's abilities, and by standardising according to criteria that are very often implicit, it prevents the richness of student diversity, which is often welcome for the continuation of the curriculum and professional integration. Finally, as mentioned below, they generally express an ability to fit into a learning scheme that is more akin to behaviourism, through the ability to conform to an exercise with a strong implicit codification, than to the progressive construction of skills. Finally, it is important to make a real assessment of the learning outcomes, in the context in which they have been defined:

- not beyond, although it is welcome to always challenge students reasonably and to encourage them to go further than the strict framework of the syllabus;
- not below, whether to maintain a minimum success rate, compensate for an overly ambitious programme or for limited resources.

Care should also be taken with assessments that require students to provide answers to overly prepared questions, which would not then question the real appropriation of what they have learned.

Work on this subject has shown that the persistence of learning is largely dependent on metacognition and in particular on the student's ability around:

- Self-evaluation
- Identification of know-how

Self-assessment and cross-assessment should therefore be developed as much as possible. The construction of the *e-portfolio* also firmly consolidates these two fundamental capacities for a solid training.

Since learning is student-centered, the quality of teaching is therefore measured by the overall added value in student learning outcomes. The inclusive values of EUt+ invite us to measure the quality of teaching in terms of the success of all students. In this sense, the support of the student on a differentiated pathway must be carried out with particular attention to ensuring the mastery of the prerequisites which must be precisely given for each teaching unit.

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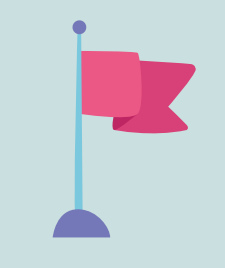
2.6 Challenge-based experiential learning



Challenge-based experiential learning involves learning by nearly constantly immersing students in a conducive, stimulating, visionary environment to solve real-world challenges.

The transition from transmissive teaching methods to a socio-constructivist approach is disrupting the core of learning. The focus is shifting from lecture-based teaching to immersing students in an environment that expects them to be active and collaborate in solving the problems they have been given. It is therefore no longer a question of a few projects here and there, but of a "training core" which is articulated around at least one major project allowing a supervised learning trajectory towards the achievements of the diploma.
Such an evolution requires in-depth work that takes time: it is a general transformation of the university environment, towards methods such as those developed at the MIT MediaLab, for example.

This is closely linked to new pedagogical methods: "Challenge-based experiential learning" should not compensate for too much traditional teaching, but as a new basis for structuring pedagogy. It is therefore necessary to support teachers in this process.

Narrative

"Projects are a central part of Robyn's courses, and her final project would be an important assessment of her EUt+ diploma. Robyn chooses to work on an interdisciplinary project entitled 'Ethics in technology: how to overcome the future?' During this project, Robyn interacts with students from other EUt+ campuses and develops a variety of skills: a problem-solving mindset, leadership, teamwork, but also creativity. Robyn also learns to question her own role in society in a conscious way."
"In seminars she approaches challenges from real-life situations in power plants of different European countries. In a collaborative way she and the other students find solutions for these challenges. Their teachers supply them with insights from their current research projects. "

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2.7 Innovative pedagogies

Innovative pedagogies are the decisive shift towards socio-constructivist, student-centered pedagogies, with all professors having a deep knowledge of the didactics of their fields, team-working to apply the most effective methods.

The teacher, the professor, is no longer there to recite disciplinary knowledge and expect students to answer correctly to a series of questions. He or she is no longer a lecture provider. He/she has to design a supportive, stimulating and visionary environment in which the student is immersed, and has a role as a leader-catalyst for the students in their process of acquiring learning outcomes.

The objective is not, in fact, innovation as such, nor is it innovation for innovation's sake. It is above all to use the most effective practices for the students we are teaching and the objectives we are pursuing, supported above all by a very good knowledge of didactics by the teachers.

Innovative pedagogies have nothing to do with the excessive digitalisation of teaching or the introduction of digital technology or original teaching formats that are "fashionable" or inspired, without sufficient prior reflection, by institutions with high media activity.
It is a question of leaving the transmissive doctrine of training, which institutes a transmission of knowledge based on a highly asymmetric exchange. Student-centered learning, valuing the learning outcomes, their persistence, and their effective mobilisation is the objective to be achieved. It substitutes for the evaluation of the student's ability to reproduce the barely contextualised content of lectures or tutorials.

These pedagogies place the student at the centre of the learning process and his or her ability to mobilise what has been learned as proof of quality. This is a deep evolution of the hierarchical representation associated with "traditional" teaching methods. It should be noted that digital tools remain fairly neutral in these developments, as the medium does not in itself lead to any modification of the pedagogical relationship, except that it largely supports the communication between students around a given problem.

The management of "challenge-based experiential learning" requires such a pedagogical evolution.

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Narrative

"There are other students in his class with a similar age/work profile, so he does not feel isolated or lonely. The class is organised around group working so he has an opportunity to get to know the others. These older students also help the younger ones by giving them confidence to speak out and ask questions in class."
"Students keep an e-portfolio of their work which allows them to reflect on their learning and to demonstrate how they believe that they are meeting the described learning outcomes for the programme. This forms part of the final assessment."

2.8 Academic rigour

Academic rigour refers to professors having a comprehensive and extensive knowledge and a deep and critical reflection to teach and expect from their students to a high demand.

In fact, it is more the teacher who is involved in this, to ensure that the content transmitted is already up to standard, with knowledge that is not isolated or superficial.

One can only demand from the student what he or she has been taught, not only as a subject, but also as a model of behaviour. Academic rigour is required of the teacher, both in terms of mastery of what he/she teaches and the associated didactic tools, but also in terms of the state of mind that he/she communicates to the student.

The teaching of learning outcomes in an active form leaves the student a great deal of autonomy in the progression. The teacher is not the source of transmitted knowledge, but guides the student on a learning journey which is not linear, and which must constantly be adapted to what arouses the students' interest, to technical developments, to new jobs, to current topics, to interactions with other courses or to varying prerequisites or cultures. It is therefore necessary for the teacher to have a broad and deep knowledge of his or her field. They cannot simply teach a pre-prepared course or moderate tutorials according to the only method they know. Academic rigour requires a broad and solid knowledge that gives the necessary ease to have no difficulty in guiding students in unexpected directions with relevance and hindsight.

Teaching cannot be satisfied with mastery of one's discipline alone, no matter how profound. The brain of the student arriving in a new education is not virgin, even if he has never tackled the slightest question of what he is going to learn there. He has or will spontaneously have (modes of) representation which will perturb his capacity to construct knowledge or more

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accurate methods. Teaching thus consists of accompanying the student in successive cycles of deconstruction of erroneous representations to enable the construction of correct representations. This is a long, iterative process in which different representations generally coexist. The identification of erroneous representations, epistemological obstacles and the ability to direct students towards relevant examples in order to deconstruct and reconstruct representations or to put them to the test requires the teacher to have a solid grasp of the didactics of his or her discipline. The didactics of a discipline cannot be improvised, even when one has a deep and solid mastery of one's own discipline. It also needs to be learned and tested. Academic rigour is at stake: the most tried and tested knowledge or methods can only be deeply and durably acquired by a student if they are taught with great didactic dexterity.

Also, the teacher remains a human model who will deeply influence the student by his rigour, his seriousness, his courage, his culture, by the depth he shows in his reflections and in general in the values he transmits voluntarily or not. The values and behaviour of the teaching staff will have a profound influence on the students. They cannot be completely distinguished from the more "academic rigour", especially in professions such as engineering where thinking about the application of knowledge is as important as the knowledge itself.

Finally, it is important to move away from traditional transmissive modes of teaching where the "on-table" assessment of the student involves many implicit assumptions (what to take away from the lecture or tutorials, what to write and how to write it, etc.) that are essential for success. In such cases, a selection of students who understand the implicits of the teaching and assessment framework in particular is carried out, which is a form of behaviourism. Well-selected students know how to behave in order to continue to succeed, which guarantees rather comfortable success trajectories for the teacher and the institution. However, they do not fully guarantee an in-depth acquisition of the lessons, but a capacity of restitution according to given codes. The quality of the training is also diminished in terms of the "job to be passed on". These transmissive methods with standardised assessments that are not based on contextualised learning outcomes thus lead to heterogeneous and non-guaranteed quality learning, which runs counter to the expected academic rigour.

From the bid:

Objectives of the proposal	***Indicators:*** *List relevant quantitative and qualitative indicators showing whether and to what extent the objectives of the alliance are being achieved. Please indicate your target where possible.*	***Source of information:*** *How could these indicators be measured? - What could be the sources of information?*	***Assumption and risks:*** *What might be the factors and conditions not under the direct control of the alliance which are necessary to achieve these objectives? What risks have to be considered?*
Academic freedom and integrity	Satisfaction of academic and student teams	Return of external solicitations and audits	External factors explicitly or implicitly limiting freedom of expression and ethical conduct

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2.9 Interdisciplinarity

Interdisciplinarity gives students the awareness that complex problems require a synergy of very different disciplines to be tackled, and the competence to do so.

There is always a big pitfall: for some people, interdisciplinarity means mixing mechanics and thermodynamics!

The competences of the degree are structurally interdisciplinary, they are even transdisciplinary: the spontaneous running of the world has little to do with disciplinary breakdowns. The student must be able to:

- combine different disciplinary elements in order to solve a problem that links issues from different disciplines
- deal with a problem in which no part is reducible to disciplinary elements, where each element is thus inherently complex.

It is not advisable to ask the student to do this exercise at the very end of the curriculum, as it takes a long time to learn to decompartmentalise. Moreover, the student cannot do it alone, bearing the burden of decompartmentalisation which is not carried out by the teachers. Interdisciplinarity cannot be addressed only during projects, internships or interdisciplinary activities. It is all teaching, without exception, that is concerned.

It should be understood that the level of interdisciplinarity is induced by the real problems that our graduates will have to solve during their professional career and their civic life. Graduates of higher education will have to tackle problems in which “hard” science issues will be inseparable from technical issues, humanities and social science issues as well as ethical, environmental or financial issues. This level of interdisciplinarity will necessarily have to be progressively achieved during the course of the curriculum. Thus, the courses themselves must address interdisciplinary complexity at a gradual level adapted to the student’s progress. From the very beginning of the course, the traditional compartmentalisation of teaching between traditionally related subjects should vanish and offer as many bridges as possible. Gradually, the disciplines will no longer be simply connected and decompartmentalised, but will usefully deal with pedagogically adapted problems so as to bring students into a depth of thought that combines the solidity of the disciplinary knowledge and the complexity of real problems.

Narrative

“After long conversations about the possibility of flexibly modulating courses, Robyn is convinced that interdisciplinarity is a ‘must’: today’s societal challenges require the complementarity of different disciplines as any competences blend most of them. She chooses

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her classical technological courses, mixing technological engineering with courses on applied ethics and sustainable sciences. The objective, she thinks, is to bring different modules together that are thematically connected, in line with her professional project. By the interdisciplinarity of her courses, Robyn will learn to think human first and be conscious of her environment, to become a technologically responsible and aware citizen. '

2.10 Exposure / engagement with research

Exposure / engagement with research means raising students' awareness of research methods and results in various ways according to their level and ambitions.

The student must be aware of the existence of research, its role, what it allows but also what it does not allow, its diversity, and, depending on his/her level, be introduced to methodologies. They must also clearly distinguish research from innovation.

This can be done in different ways, depending on the field, level or aspirations of the student. However, we are aware that a simple visit to a research laboratory or a project lasting a few hours does not do much in this respect. A discussion on the role of research and its methods is necessary.

EUt+ Bachelor

During the Bachelor's degree, all students are given an introduction to research and an overview of its role. This discovery takes various forms during the course, as not all students are equally receptive at the same level.
The most motivated students can, in one way or another, participate in a research activity to deepen their insight.

EUt+ Master

A substantial period of time will be spent on an R&D issue, in the public or private sector, in an appropriate manner. This is expected to provide an introduction to research methods and an awareness of its importance.
In the case of graduate schools, exposure to research is permanent, as the lab it is the central place for the student.

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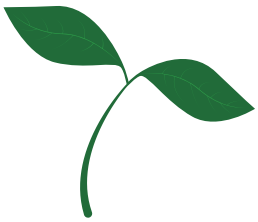
Quality processes

In Master of Engineering, exposure to research is usefully the subject of a learning outcome or elements of a learning outcomes.

2.11 Civic engagement



Civic engagement
discards the concept of elitism confined to an 'Ivory Tower' and holds that there is no relevant science without conscience.

It concerns both the public and the major societal and fundamental issues, calling for a very strong secularisation of teaching.

The graduate student must be aware of his role in the world. They are trained to be aware of their role and duty on the external world, not just to take selfish advantage of opportunities. Graduates must be responsible, with a strong civic awareness and critical thinking.
Civic engagement is not a philanthropic micro-activity where a (future) elite meets the rest of the population in a limited setting. It is about the awareness of the role of graduates in society as a whole and, in particular, the interdependence of all its actors. The impact of human activities and especially those of technology on the environment is a major component of this civic engagement.

The learning of social and environmental responsibility, of which graduates will be important actors, is done through this civic engagement. Ethical issues are also addressed. The consequences of technology on society and the environment are often indirect: during their civic commitment, graduates will realize this complexity, which should lead them to consider carefully the issues at stake in the tools they will be developing.

Civic engagement provides learning opportunities that would otherwise be difficult to obtain. It also allows for an interdisciplinary approach to real issues.

Civic engagement should not compensate for an overly strong academic approach to teaching: awareness of it should be integrated into all teaching units, alongside activities that are linked to the outside world. 'Traditional' courses should be open to these issues so that students can derive the greatest benefit from these periods of engagement.

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Narrative

'During his stay, because of his civic engagement, Robyn gets involved in his local community. He learns how to interact with others outside the campus and to adapt to the different circumstances and different scenarios. Building relationships with his classmates from other EUt campuses make him become more aware of his European identity, of the importance that we are living in a society with so diverse people, and these interactions prepare him for the world of tomorrow.'

EUt+ Bachelor

In Bachelor, the commitment must allow, through various activities, an awareness of the interdependence of the various components of society and its environment.

EUt+ Master

In the Master's programme, preparing for an executive role, the student must be prepared for in-depth reflection and a proactive attitude to his/her role in society and the environment. In particular, he/she integrates the notions of sustainable development and social responsibility into all his/her activities with the required proportion.

Quality processes

Civic engagement contributes to learning outcomes, validated on the demonstration of these outcomes and not only on the time spent on such an activity. Competences include this dimension.

2.12 Alignment with future labour market needs

Alignment with future labour market needs enable students to be very flexible and anticipatory in a job market and competence expectation that will change dramatically in the coming decades

The issue here is to enable students to keep up with drastic and unpredictable changes in skill requirements, because it will not be possible to train tens of millions of adults en masse when professions are going to change dramatically, without being able to foresee anything about this now.

In technological curricula, the alignment with the past and present labour market is generally very good. It is more difficult when it comes to anticipating general developments. Alignment with the future labour market requires:

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- in-depth prospective work on trends and developments, which is not exclusively fed by research trends;
- The training of students with a very good degree of polyvalence, notably based on solid scientific and technical foundations;
- The important introduction of human and social sciences in technological training, in particular to have the tools and the capacity of reflection to anticipate and follow a changing world;
- The development of strong self-learning skills;
- A taste (or at least the absence of reluctance) for disciplinary and geographical mobilities.

This alignment is not just a matter of curriculum management or syllabus choices. It is integrated at all levels of granularity, especially within the teaching. Alignment with the future labour market therefore relies in particular on the exposure, in one way or another, of the entire teaching staff to the economic activities and sectors likely to employ students.
It also requires a continuum in teaching, avoiding too much distinction between the academic and the applied.

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3 Annex: Competency framework of the European University of technology Masters of engineering

Memorandum of Understanding

Competency framework of the European University of technology Masters of engineering

The eight partners constituting the European University of Technology agree on the following general competency framework for their Masters of Engineering graduates:

Identifying, analysing comprehensively and formalising complex or multidisciplinary technical or socio-technical problems by relying on solid scientific and technical skills and knowledge.
Proposing and designing original, resilient, sustainable and reliable solutions or systems, integrating all technical, societal, human, environmental and economic constraints over the entire life cycle.
Managing a team or structure in an international, transdisciplinary and multilingual context, integrating social and legal aspects, interacting, integrating a wide variety of profiles, ensuring the integrity of the work and the expression of diversity.
Piloting a process or system reliably and efficiently; deciding, planning and organizing with a holistic vision; anticipating and preventing direct or indirect local impacts of a system on its territory, while being aware of the global challenges.
Guaranteeing a quality or validation process at all levels; carrying out a continuous improvement process; evaluating performance and margins for improvement and progress.
Exchanging, receiving and transmitting information and ideas to any trade at any level of qualification and to the civil society; assessing information; accompanying professional developments; assessing and completing training and self-training needs; self-directed learning.
Leading or supporting an innovation process and implementing original proposals, based on the state of the art and mobilising a variety of skills, proposing solutions based on an avant-garde vision; contributing to a research and development process, evolving in an uncertain and restricted technical and technological environment.

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Protocole d'accord

Compétences générales des Masters Ingénieurs de l'Université de technologie européenne

Les huit partenaires constituant l'Université de technologie européenne s'accordent sur les compétences générales suivantes pour leurs diplômés de *Master Ingénieur* :

Identifier, analyser avec une vision globale et formaliser des problèmes techniques ou sociotechniques complexes ou pluridisciplinaires en s'appuyant sur des aptitudes et une culture scientifique et technique solides.
Proposer et concevoir des solutions ou des systèmes originaux, résilients, pérennes et fiables, en intégrant l'ensemble des contraintes techniques, sociétales, humaines, environnementales et économiques sur l'ensemble du cycle de vie.
Gérer une équipe ou une structure dans un contexte international, transdisciplinaire, et polyglotte, en intégrant les aspects sociaux et juridiques, interagir, intégrer une grande variété de profils, garantir l'intégrité du travail et l'expression de la diversité.
Piloter un procédé ou un système avec fiabilité et efficience ; décider, planifier et organiser avec une vision systémique ; anticiper et prévenir l'ensemble des incidences locales directes ou indirectes d'un système sur son territoire, tout en ayant conscience des enjeux globaux.
Garantir un processus de qualité ou de validation à tout niveau, mener une démarche d'amélioration continue, évaluer les performances et marges d'amélioration et de progression.
Échanger, recevoir et transmettre des informations et des idées à tout corps de métier et tout niveau de qualification ainsi qu'à la société civile ; vérifier des informations ; accompagner les développements professionnels ; évaluer et compléter les besoins de formation et d'autoformation ; s'autoformer.
Mener ou accompagner une démarche d'innovation et concrétiser des propositions originales, s'appuyant sur l'état de l'art et mobilisant des compétences variées, proposer des solutions s'appuyant sur une vision d'avant-garde ; contribuer à un processus de recherche et développement, évoluer dans un environnement technique et technologique incertain et contraint.

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