



# Didactical Concept and methodology for validation and assessment

By ASEV

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## INTRODUCTION

This output was finalized within the project "INDEX - industrial expert", funded under the Erasmus +, key action 2 Cooperation for innovation and exchange of good practices. Broadly, the INDEX project, aims to develop an e- learning educational resource for professionals in application-oriented areas to learn innovative solutions of Industry 4.0 concept.

In particular this paper, is part of a set of innovative, fluid, and scientific sound-based documents, created by the experts of the INDEX consortium, that will form a methodological package consisting of the following tools:

- the **"INDEX profile"** - an open and flexible tool, the result of field and desk research, which outlines the professional figure of the Industry 4.0 expert, its training objectives, job opportunities, relevant applications in companies and areas of work.
- the **"Didactical Concept"** – (which we are currently addressing) a description of the general teaching approach, the methodology on which the INDEX curricula are grounded, the basic professional pedagogical knowledge related to e-learning resources, and the fundamentals for creating your own modules.
- the **"INDEX course"** <https://elearn.ifac.cnr.it/> – based on Open EdX-platform with a modular structure which refers to the European Qualifications Framework (EQF).

The purpose of the present output is to provide a solid and grounded scientific basis for the teaching and training of technically complex content, which is valid both for MOOC (Massive Open Online Courses) and blended learning scenarios, developing a concept based on vocational training approaches.

Of particular importance is the adaptability to different levels of skills and knowledge related to the topics developed in the teachings and the ability to address learners with different pre-qualifications. The didactical concept is of particular relevance for specialists in teaching and vocational training content.

In practice it will help teachers to:

1. Designing a training course to meet the needs of an adult target group.
2. Address a heterogeneous group with different prequalification.
3. Integrating Mooc/ e-learning platform etc. into teaching concepts
4. Determine the relevant tools applied to combine online and classical teaching.
5. Transmit the academic content in such a way that it can be understood even in the absence of previous academic titles.

And it will support vocational training specialists in:

1. developing educational content in order to achieve ideal results for the target groups of pre-trained professionals.
2. adaptation of educational content to the concept of digital learning such as Mooc.

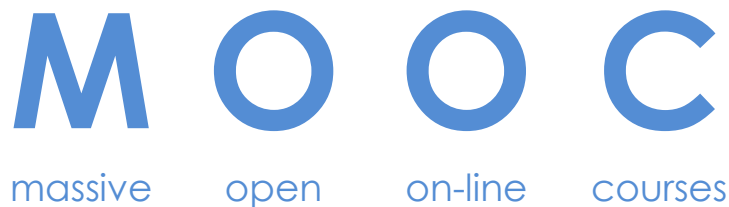
*"Learning is the only thing the mind never exhausts, never fears, and never regrets."  
Leonardo da Vinci*

## Part 1

### Explanation of the didactical concept of the INDEX platform

With the goal of creating an educational tool that interfaces with a constantly changing professional world such as Industry 4.0, the MOOC platform has been selected to meet these needs and to increase the tools relevance as well.

MOOC stands for "Massive Open Online Courses", is a free platform, offering online courses, accessible by a very large number of users, without specific prerequisite.



A MOOC platform enables both pure online advanced training and blended learning courses. Based on suitable open source software (in our case Open edX), a completely new MOOC platform that goes way beyond MOOC but is rather a central IT learning interface that operates a MOOC has been built and hosted within the INDEX project. It is highly versatile and adaptable for further extensions as well. This platform is explicitly designed for advanced training courses in Industry 4.0 area, it is also freely accessible and provide interfaces for future course content. The platform can be used on all end devices: computers (workstations, laptops, file servers, and web servers), mobile handheld devices (smartphones, tablets), and other devices that will be connected to the IoE (devices and consumer products connected to the internet and outfitted with expanded digital features).

The MOOC platform is structured in a modular format and offers tailored content for individual target groups in the modern high-tech employment sectors. This feature fits perfectly with the concept of modularity that is addressed in Part 3 of this "Didactic Concept" where it is explained in detail that the entire structure of the INDEX course has been designed in a modular format both to allow maximum flexibility in terms of user access to the content, and to offer the possibility of choosing the level (basic, intermediate, advanced) and to promote the formal recognition of the skills acquired.

The platform has also been designed to:

- enable the trainers to upload their own material.
- enable online interaction of the users with the educational content.

- enable discussion.
- enable assessment.
- enable getting certification.

With this in view the INDEX courses are offered as OER “*Open Educational Resources (OER) are teaching, learning and research materials in any medium – digital or otherwise – that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation and redistribution by others with no or limited restrictions.*” (Source: UNESCO, *what are Open Educational Resources?*).

From a didactical point of view, we can affirm that the "open" concept, in its different meaning (of public domain, free, accessible to all, independently manageable, flexible, innovative, reusable, etc.), is radically modifying the way of teaching all over the world, in its formal and non-formal aspects.

UNESCO, in 2002, recognized the specificity of open content used in the field of education and coined the expression "Open Educational Resources". In this area, open contents (modules, courses, Learning Objects, books, articles, encyclopedias, images, videos, etc.) make possible a process of sharing and building knowledge at many levels, since they can be used by anyone, adapted, or modified and shared again, in an endless cycle of enrichment and improvement.

The growing availability of OER on the web offers great opportunities to renew also in-presence teaching and experiment with new forms of teaching, which optimize time, increase the level of interaction with the teacher and collaboration between learners in the classroom, replaying what happens in virtual educational environments.

Another important consideration is that MOOC courses entitle to recognized degrees.

The phenomenon has grown exponentially between 2011 and 2012, catalyzing the attention not only of professionals but also of the media as a phenomenon of custom, of investors as a sector of new business, of companies as a new source for better market analysis. (Source <http://www.appendimentocapovolto.it/>)

## Part 2

### General guidelines for using digital learning environments in VET concepts and for adult learners.

Today more than ever, it is essential to think of an educational environment in a digitally sense, especially when it comes to adult education. The impact of the Covid-19 pandemic, combined with the needs of a constantly evolving labor market, which requires continuous updating to allow workers to be always competitive, have confirmed that the provision of vocational training to adults can not only pass-through traditional channels, but must make use of multimedia tools, to able to bypass limits such as time and place of training.

The digital transformation is one of the identified priorities of the European Commission's flagship strategy. High quality and inclusive education and training are key elements in achieving this ambition and ensuring that all European citizens are prepared to live and work in the digital age.

E-Learning has been defined as "technology-enhanced learning" and more recently "digital learning". E-Learning describes a set of technology-enhanced methods that can be applied to support student learning and can include elements of assessment, mentoring and education. Learning by using technology is not the same as learning through technology. Learning by using technology implies that technology is used as one method among many others, while learning through technology suggests that technology is the only channel through which the student receives instruction and communicates with his or her instructor (definition by [https://link.springer.com/referenceworkentry/10.1007%2F978-1-4419-1428-6\\_431](https://link.springer.com/referenceworkentry/10.1007%2F978-1-4419-1428-6_431)).

Social media technologies and platforms are the basis of an unprecedented and constantly evolving reorganization of learning environments. Technology should be exploited to provide access to more learning resources than are available in traditional education (schools, universities, VET providers) and provide links to a broader set of "educators", including trainers, experts, and mentors outside the physical teaching space. It should also be used to enable 24-hour, 7-day-a-week, and for lifelong learning.

In the "Action Plan for Digital Education" (drafted in 2018 by the European Commission and under review at the time of writing this output) which aims to support the use of technology in education and the development of digital skills, it is stated that "Digital technology enriches learning in many ways, offers learning opportunities that must be accessible to all and opens up access to a huge amount of information and resources".



A digital training environment implies that both the trainer and the learner have the basic digital knowledge and skills, as identified by the European Union thanks to a long path, started in 2006 and revised in 2018. A complex process that has seen the Parliament and the Commission working in synergy to identify the 8 key competences that every European citizen must possess, including digital competence: it is the competence of those who know how to use the new technologies with familiarity, for education, training, and work. For example, the following are part of this competence: computer literacy, online security, digital content creation.

Source : [http://ec.europa.eu/education/news/european-commission-adopts-key-education-initiatives-for-inclusivecohesive-societies\\_en](http://ec.europa.eu/education/news/european-commission-adopts-key-education-initiatives-for-inclusivecohesive-societies_en)

Speaking of digital learning environments, below is an overview of the benefits of eLearning compared to pure face-to-face classroom teaching. The list is split into three parts respecting the different target groups involved in eLearning. The summary is based on modern eLearning courses using an optimized platform and well-done courses using a lot of multimedia elements and interactivity.

#### Advantages of eLearning (learner's view)

- Learner actively involved in his/her e-learning
- Interactivity and attractiveness of eLearning content
- Flexibility and adaptability according to availability (time, location)
- Training at own pace, independently of other learners
- Self-assessment during and at end of course
- Personal progress monitoring during eLearning course and appraisal of results obtained thanks to tracking
- Tutorial support on demand (if necessary)
- Contact to other learners (if planned and necessary)
- No travel costs

#### Advantages of eLearning (company's view)

- "Mass" training (big number of learners)
- Savings relative to classroom-based training indirect costs (travel, accommodation, etc.)
- Flexibility and adaptability according to learner availability (time, location)
- Customization and adjustment of training courses to predefined skills and teaching goals
- Low logistical constraints (no room booking, employee travel, accommodation, etc.)
- Precise course reporting and automated results analysis thanks to tracking (based on the eLearning platform)
- Durable and updatable teaching materials (often reusable)

#### Advantages of eLearning (trainer's view)

- Prerequisites for assessing learner levels.
- Training performed on interactive and attractive tools for both trainer and learners.
- Flexibility and adaptability according to availability (time, location) especial for the tutorial support.
- Learner monitoring from the platform (tracking).

#### References

[https://www.etf.europa.eu/sites/default/files/2018-10/DSC%20and%20DOL\\_0.pdf](https://www.etf.europa.eu/sites/default/files/2018-10/DSC%20and%20DOL_0.pdf)

<https://www.advanced-training.net/ebi-eie/tag/self-paced-learning/>

<https://eur-lex.europa.eu/legal-content/IT/TXT/PDF/?uri=CELEX:52018DC0022&from=EN>

<https://www.lifteducation.com/3-reasons-elearning-is-great-for-adults/>

### Part 3

## Guidelines for creation of e-learning content/curricula in continuous professional training and adult education with a strong focus on high-tech fields.

The challenge of the INDEX curriculum is to take advantage of learning sciences and modern technologies to create an engaging, relevant, and personalized learning experience. In contrast to traditional education, this requires learners to be placed centrally and be able to take control of their own learning, providing flexibility in a variety of dimensions.

Adults are characterized by maturity, self-confidence, autonomy, solid decision-making, and are generally more practical, multi-tasking, purposeful, self-directed, experienced, and less open-minded and receptive to change than younger students. All these traits affect their motivation, as well as their ability to learn. Course designers need to know and consider the cognitive and social characteristics of adult learners in order to create the right content and structure of the course and adapt their attitude.

<b>Adult Learners' Traits</b>	<b>Description</b>	<b>Impact on the creation of e-learning content/curricula</b>
<b>Self-direction</b>	Adults feel the need to take responsibility for their own lives and decisions, hence it is important for them to have the control of their own learning.	Self-assessment, a peer relationship with trainers, multiple options and initial, yet discrete support are all imperative.
<b>Practical and results-oriented</b>	Adult learners are usually practical, resent theory, need information that can be immediately applicable to their professional needs, and generally prefer practical knowledge that will improve their skills, facilitate their work and boost their confidence	It is essential to create a course that will cover their individual needs and have more practical content.
<b>Less open-minded</b>	Adults are more resistant to change. Maturity and deep life experiences usually lead to rigidity, which is hostile to learning.	Course designers need to provide the reason behind the change, new concepts that can be linked to already established ones and promote the need to explore.
<b>Slower learning, yet more integrative knowledge</b>	Aging does affect learning. Adults tend to learn less rapidly with age.	However, the depth of learning tends to increase over time, navigating knowledge and skills to unprecedented personal levels.
<b>Use personal experience as</b>	Adults have the tendency to link their past experiences to anything new and validate new concepts based on prior	It is crucial to create a learning community consisting of people who

<b>a resource</b>	learning.	can profoundly interact.
<b>Motivation</b>	Learning in adulthood is usually voluntary. Thus, it's a personal choice to attend a course, in order to improve job skills and achieve professional growth.	This motivation is the driving force of learning and that is why it is essential to draw on the learners' intrinsic impulse with the right reflective material that questions conventional thinking and stimulates their minds.
<b>Multi-level responsibilities</b>	Adult learners have a lot to deal with: family, friends, work and the need for personal quality time. For this reason, it is more difficult for an adult to make room for learning, while it is absolutely essential to set priorities. If life is already challenging, the learning outcome will be compromised.	A course designer needs to create a flexible curriculum, adapt to a busy schedule, and accept that personal obligations may inhibit the learning process.
<b>High expectations</b>	Adult learners have high expectations. They want to be taught about things that will be useful to their work, expect to have immediate results, seek for a course that will worth their while and not be a waste of their time or money.	It's important to create a course that will maximize their advantages, meet their individual needs and address all the learning challenges.

Adapted from: <https://elearningindustry.com/8-important-characteristics-of-adult-learners>

The process that leads to the creation of a high-tech oriented curriculum for adult education, must consider flexibility as an underpinning term for both concepts: flexibility is a necessary component for an adult approaching an educational path, flexibility is fundamental for an approach to high tech being a sector in continuous and constant evolution.

To meet these critical needs, the INDEX program allows students to create their own personalized path, providing different certificates, depending on the level they want/need/require to achieve.

Flexibility is also intended to address a heterogeneous group with different prequalification and to impart academic content in such a way that it can be understood without prior academic qualifications.

The curriculum design allows learners to choose what level of competence, knowledge and skills want to achieve according to their own prequalification, to the time available to them and the extent of knowledge they want to acquire in the field of Industry 4.0.

Flexibility is in the INDEX case expressed in a course consisting of three different levels: basic, intermediate, and advanced.

Each level is preparatory to the subsequent one, but attendance is not compulsory for the upgrade to the Intermediate level. In fact, students can decide to access the Intermediate Level only by successfully passes the assessment provided at the end of the Base Level.



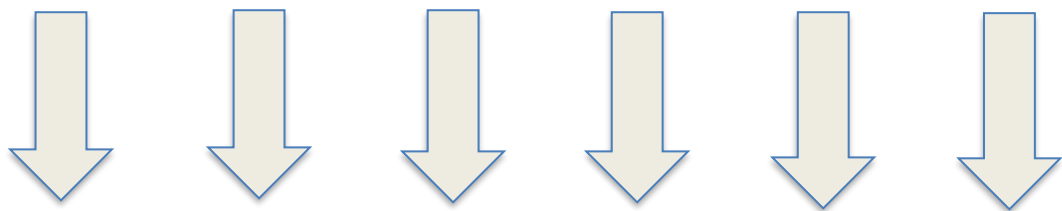
The basic level of Index is common to all courses, and, from a content point of view, it offers basic information on the topics covered by the individual courses at the intermediate level. In total the courses offered are 5.

The Intermediate level offers 5 courses on the main topics of Industry 4.0. They are mainly composed of written parts, videos, multimedia elements and case studies. There are also moments of self-assessment in the form of multiple-choice tests and a final test that allows both the achievement of the qualification and the passage to the subsequent level.

Although prior knowledge of INDEX course topics is not mandatory or even necessary, the Advanced Course asks learners to show the ability to choose and apply different technologies learned in the INDEX course. For this reason, to access the Advance Level, learners are required to successfully complete the whole Base Module and to successfully complete at least 2 Intermediate Courses of their choice.

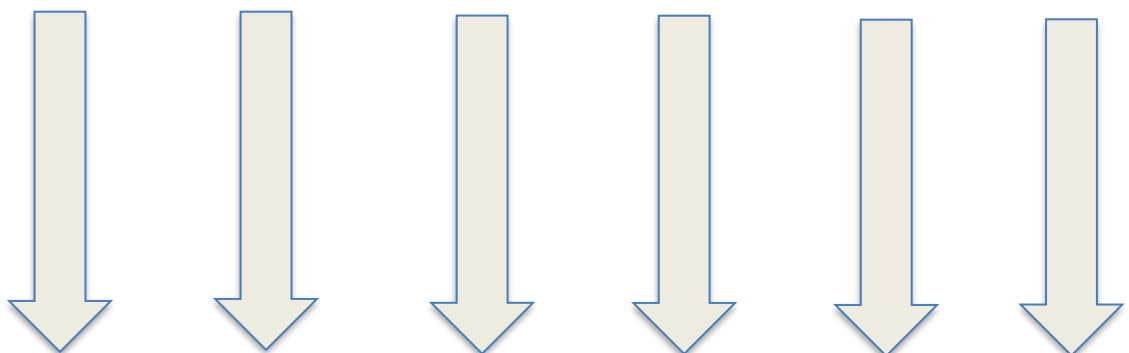
<b>Qualification INDEX Level Base</b>	Students are required to pass the assessment to receive the "Base level" qualification. <b>Duration: 40 hours</b> <b>Assessment:</b> formative and summative questions in the form of multiple choices quiz
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Students can choose one or more intermediate courses.



Level II – Intermediate level Courses Title	Entrepreneurship, Technology and Restructuring Management (E-TRIM)	Sensors and Automation	Additive Manufacturing	Internet of things	Augmented Reality	Virtual Reality
<b>Qualification INDEX level Intermediate</b>	Students are required to attend the entire course + pass the assessment quiz to receive the "Intermediate level" qualification. <b>Duration: 40 hours per courses (80 per AM) tot. 240 hours</b> <b>Assessment:</b> formative and summative questions in the form of multiple choices quiz					

Students must successfully accomplish at least 2 intermediate courses to access the advanced level course



<b>Level III – Advanced level</b> Course's title	<b>Entrepreneurship, Technology and Restructuring Management (E-TRIM), Sensors and Automatization, Additive Manufacturing, Internet of things, Augmented reality, Virtual Reality</b>
<b>Qualification</b>	Students are required to elaborate the case study to receive the “advanced level” qualification. <b>Duration: 20 hours</b> <b>Assessment:</b> Practical assignment

Structure of the INDEX programme

The INDEX course is organized in modules to enable the users of the “educational resource” to acquire specific knowledge in implementation 4.0 Industry approach in specific application-oriented areas.

Each application-oriented course of the Base and Intermediate levels includes:

- theory module: general information on a specific component of the Industry 4.0 (basic concepts, terms, basic principles etc.), potential implementation areas etc.
- Learning modules-case studies with a detailed information on practical application of a specific I 4.0 component.

We designed a specific lesson plan for creating the course/curriculum content. The lesson plan is considered a basic educational tool in an online training environment as well. The structure of the INDEX lesson plan for the Basic and Intermediate level was conceived specifically for the needs of the INDEX pathway and then proposed, discussed, revised, and finally validated by the entire partnership. All the courses' creators fulfilled the lessons plan template to provide homogeneity in the development of the content of the different units and to facilitate the understanding of the students which, without the direct presence of the trainer, need a clear view of the unit in terms of time, contents, objectives, learning outcomes.

Furthermore, lesson plans are fundamental for the definition of knowledge, skills, and competences in connection with the system for recognising, accumulating, and transferring learning credits, as later described in the Part 6 of this output.

For the **level Base and level Intermediate** of the INDEX course the following lesson plan has been established:

<b>Course X</b> <b>LEVEL XXX</b>	[Title]
<b>Table of Contents</b> [Insert the title of each section/subsection]	<ul style="list-style-type: none"> <li>• &lt;x&gt;.1 &lt; Section 1 &gt;</li> <li>- &lt;x&gt;.1.1 &lt; Subsection 1 &gt;</li> <li>- &lt;x&gt;.1.2 &lt; Subsection 2 &gt;</li> </ul>

	<p>- ...</p> <ul style="list-style-type: none"> <li>• <b>&lt;x&gt;.2 &lt; Section 2&gt;</b></li> </ul> <p>- &lt;x&gt;.2.1 &lt;Subsection 1&gt;</p> <p>- &lt;x&gt;.2.2 &lt;Subsection 2&gt;</p> <p>- ...</p> <ul style="list-style-type: none"> <li>• <b>&lt;x&gt;.3 &lt; Section 3&gt;</b></li> </ul> <p>- &lt;x&gt;.3.1 &lt; Subsection 1&gt;</p> <p>- &lt;x&gt;.3.2 &lt; Subsection 2&gt;</p> <p>- ...</p> <p>...</p>						
<b>Duration* XX hours</b>	<b>ECVET points** X</b>						
<b>Estimated duration of the Course:</b> <i>[Estimate minimum hours based on the detailed breakdown of the training contents, assignments, and activities]</i>	<p>Lesson hours:</p> <p>Self-study hours:</p> <p>Practical activities: <i>if any</i></p> <p>Other (specify): <i>if any</i></p> <p>Assessment:</p>						
<b>Section 1/learning outcome</b>	[Title]						
['learning outcomes' means statements of what a learner knows, understands and is able to do on completion of a learning process, which are defined in terms of knowledge, skills and competence]	<b>Objectives/ expected outcomes.</b>						
	By the end of this Section, the trainee will:						
	<b>Knowledge</b>	<b>Skills</b>	<b>Competence</b>				
	['knowledge' means the outcome of the assimilation of information through learning. Knowledge is the body of facts, principles, theories and practices that is related to a field of work or study. In the context of the European Qualifications Framework, knowledge is described as theoretical and/or factual]	['skills' means the ability to apply knowledge and use know-how to complete tasks and solve problems. In the context of the European Qualifications Framework, skills are described as cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments)]	['competence' means the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development. In the context of the European Qualifications Framework, competence is described in terms of responsibility and autonomy]				
	<b>- he/she has knowledge of ...</b>	<b>- he/she is able to ...</b>	<b>- he/she has developed ...</b>				
<b>Assessment tools</b>	Multiple choice quiz (motivating questions) - 4 questions 1 right						
<b>Learning material</b> <i>[the learning material should be designed for a self-study approach. For more instructions see next chapter]</i>	<p>[List the learning materials corresponding to each session described above]</p> <p><u>Learning material</u></p> <p>for any learning material, please fill in the following table:</p> <table border="1" style="width: 100%;"> <tr> <td style="width: 20%;"><b>Title</b></td> <td>[insert title of material that will appear in the platform. Distinguish between original material that will be developed for INDEX project and available material that exist from other sources]</td> </tr> <tr> <td colspan="2"> <input type="checkbox"/> original material  <input type="checkbox"/> existing material         </td> </tr> </table>			<b>Title</b>	[insert title of material that will appear in the platform. Distinguish between original material that will be developed for INDEX project and available material that exist from other sources]	<input type="checkbox"/> original material <input type="checkbox"/> existing material	
<b>Title</b>	[insert title of material that will appear in the platform. Distinguish between original material that will be developed for INDEX project and available material that exist from other sources]						
<input type="checkbox"/> original material <input type="checkbox"/> existing material							

	<b>Size</b>	[in pages or duration, depending on the type]	
	<b>Duration</b>	[Estimated time for study]	
	<b>Short description</b>	[Include your long course description here. The long course description should contain 150-400 words]	
	<b>Prerequisites</b>	[Add information about course prerequisites]  E.g., No mandatory prerequisites but basic knowledge of XXXX and XXX is beneficial.	
	<b>Copyright</b>	[describe the copyright if it is free, restricted, or free under conditions]	
<u>Glossary</u>			
Provide a list of terms used in the unit with their definition.			
		<b>Term:</b>	<b>Definition</b>
		[technical terms, acronyms, expressions]	[one – two sentences definition of term. In case of acronym/abbreviation, the full name]
<b>Section 2/learning outcome</b>	[Title]		
	<b>Objectives/ expected outcomes</b>		
	<b>Knowledge</b>	<b>Skills</b>	<b>Competence</b>
<b>Assessment tools</b>	Multiple choice quiz (motivating questions) - 4 questions 1 right		
<b>Add as many sections as needed following the same scheme</b>			
<b>Final assessment tool</b>	Multiple choice quiz (summative questions) 10 questions (60% must be correct to pass the level or obtain the certification).		

By using the same vocabulary as the MOOC platform, where the course has been uploaded, the lesson plan indicates time, objectives, evaluation methods, number of ECVET points, description of the learning materials, and a glossary of the technical terminology used.

For the **advanced level**, a different didactical route has been designed, aimed to emphasizing the student's ability to put into practice the notions provided during the modules previously attended. There is a way more prominence here on the practical activity than the theoretical aspect. There will be 20 hours of learning within this level, consisting primarily of the student's development of a case study.

The advanced course, in terms of structure, consists indeed of multidisciplinary case studies that feature end-to-end technology. The case studies proposed in this level are related to the



technology taught in the intermediate course, in the sense that they combine some technologies that have been addressed in the INDEX paths of the intermediate level.

Hence, for the advanced level, a different lesson plan has been designed:

<b>INDEX Course Advanced:</b>	[Topic/Title]				
<b>INDEX courses involved</b>	1. Lead Course: 2. Associated course: 3. Associated course: 4. -----				
<b>Prerequisites</b>	Have successfully passed the following courses: <ul style="list-style-type: none"> <li>• INDEX Basic course</li> <li>• INDEX Intermediate level courses:             <ul style="list-style-type: none"> <li>• -----</li> <li>• -----</li> <li>• -----</li> </ul> </li> </ul>				
<b>Case Study description</b>	Please write here the description/background of the case:				
<b>What the student should do</b>	Please write here the indication for the student:				
<b>Case study features</b>	<input type="checkbox"/> <b>An essay</b> from 20k to 40k characters OR <input type="checkbox"/> <b>A text</b> from 10k to 20k characters + files  Time required for the realization: <b>20 hours</b> .				
<b>Presentation requirements</b>	<b>Free format</b>  The student can choose the format that best describes the type of case study he/she is developing as long as he/she respects the above-mentioned features.				
<b>Tools &amp; resources</b>	To complete the case study the student will need:				
<b>Submitting the assignment</b>	Describe here the necessary steps to submit the assignment:				
<b>Assessment criteria:</b>	1. innovativeness of the proposed solution	very uninnovative 0	1	2	very innovative 3
	2. ability to use the content from the courses involved	less than 1 content 0	1	2	a various mixture of content 3
	3. ability to apply the technologies presented in the courses involved	less than 1 technology 0	1	2	a various mixture of technologies 3

	4. clarity of the content	very unclear 0	1	2	very clear 3
	5. quality of the content	very superficial 0	1	2	very deep 3
	6. use of appropriate technical language	very poor 0	1	2	very precise 3
	7. general organization/structure	very unorganized and not structured 0	1	2	very organized and well structured 3
<b>learning outcome</b> WRITE HERE THE LEARNING OUTCOMES BASED BOTH ON THE COURSES INVOLVED AND THE ability to put the knowledge learned into practice.	<b>Objectives/ expected outcomes.</b>				
	By the end of this course, the trainee will:				
	<b>Knowledge</b>	<b>Skills</b>	<b>Competence</b>		
	<i>['knowledge' means the outcome of the assimilation of information through learning. Knowledge is the body of facts, principles, theories, and practices that is related to a field of work or study. In the context of the European Qualifications Framework, knowledge is described as theoretical and/or factual]</i>  <b>- he/she has knowledge of ...</b>	<i>['skills' means the ability to apply knowledge and use know-how to complete tasks and solve problems. In the context of the European Qualifications Framework, skills are described as cognitive (involving the use of logical, intuitive, and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments)]</i>  <b>- he/she is able to ...</b>	<i>['competence' means the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development. In the context of the European Qualifications Framework, competence is described in terms of responsibility and autonomy]</i>  <b>- he/she has developed ...</b>		
<b>ECVET points:</b>	<b>2 ECVET points</b> (taking as parameters the time needed to perform the task, the relevance of the assignment and the effort required)				

The lesson plan for the Advanced INDEX Course is again designed for the sake of clarity and uniformity and as a guide for students who must successfully develop the case study. Therefore, it initially provides the list of prerequisites that the student must have to be eligible to carry out the case study development from a general perspective, and then includes both specific guidelines for the proper development from a content standpoint and procedures for its delivery.

A difference from the preceding lesson plan template, is that the latter indicates the parameters that the evaluator will consider to assess the case study, this is another useful information for the students to calibrate their work. As with the previous lesson plan, the information necessary for the

assignment of ECVET points from the perspective of knowledge, skills and competencies are clearly indicated as well as the number of ECVET points assigned.

Speaking of methodology, it is interesting to dwell on how this part of the INDEX educational path was constructed: for each case study, a leader was designated for developing it from the perspective of his or her course topic, the case study had to involve integration with one or two other INDEX courses/topics, so each case study confronts the learner with the challenge of solving a problem related to Industry 4.0 through the use of multiple specific technologies.

For the assessment aspect of the Advanced level please also refer to the Part 7 of this output.

Since at this stage of the course the student is tasked with producing work in complete autonomy, along with the lesson plan a checklist is provided, to be completed prior to the commencement of the case study to ensure that he or she has all the knowledge and tools necessary for the case study proper implementation. We present it below.

<b>BEFORE STARTING THE CASE STUDY</b>	<b>Yes</b>	<b>No</b>
I read the case study instructions/ carefully		
I know which INDEX courses/modules are involved in the case study		
I have the needed prerequisites		
I understand the case study description		
I understand what I must do to properly accomplish the task		
I know what I need to perform the task (tools/resources)		
I understand the deadline for delivery the case study		
I have estimated the deadline for delivery of the case study		
I understand how to deliver the project		
I understand the assessment criteria		
I am aware of the ECVET points I can achieve		

Check list for the learners.

The student is then suggested to take note of how many "no" he/she has marked and, if the number is significant, he/she is recommended to read the lesson plan again or to contact the trainer always available for any doubt, clarification, or support.

In the INDEX Advanced Course, students are challenged with their ability to re-elaborate and to incorporate into the real world what they have learned during the previous phases of INDEX, by applying an active educational approach.

As anticipated in the previous chapter, one of the cornerstones of learning theory states that adults appreciate "active learning" rather than "passive listening or reading" and seek some degree of control over the content and learning process. The use of videos, animations and interactive

activities allows to capture and keep the attention of the learners, thus increasing the degree of interest and learning.

A training course delivered in e-Learning environment mode is characterized by three fundamental principles:

1. Flexibility: the course can be used without any temporal and spatial constraints.
2. Interactivity: the user of the course is not a passive spectator but is called to learn by participating and interacting with the contents through simulations and teaching activities.
3. Modularity: the presence of individual modules (microlearning) allows the learner to "guide" their training according to their professional commitments and needs.

The principle of modularity is inextricably linked to the concept of "learning outcomes", which brings back to the question of transparency and validation of qualifications. This issue has been tackled with commitment and determination by the European Commission in recent years, a commitment that has led to excellent results and has dictated very precise rules in the creation of uniform training paths in the member states.

Learning outcomes are statements of what a learner knows, understands and is able to do on completion of a learning process, defined in terms of "knowledge", "skills" and "competences" ([European Centre for the Development of Vocational Training - Cedefop](#)). Education and training institutions are increasingly describing their qualifications in terms of learning outcomes following the approach adopted by the European Qualifications Framework (EQF). Learning outcomes can be listed in a catalogue of units. It can be the smallest part of a qualification (or several qualifications) that can be assessed, validated and, possibly, certified.

The INDEX training program conforms to this approach, as reflected in the lesson plans detailed in this chapter.

**Source:**

<http://www.fao.org/3/i2516e/i2516e.pdf>

[https://ec.europa.eu/assets/eac/education/library/reports/policy-provision-adult-learning\\_en.pdf](https://ec.europa.eu/assets/eac/education/library/reports/policy-provision-adult-learning_en.pdf)

## Part 4

### General structure of curricula for piloting.

Within the development phase of the INDEX project, partners organize a pilot period with the aim of ensuring the quality of the MOOC platform, the adequacy and effectiveness of the course content and of the educational methodology implemented. The pilot also aims to give the partners the opportunity to change the methodology, if considered ineffective, or to make improvements.

The Application Form stated that the pilot would have to consist of three phases as follow:

#### Pilot phase 1

All partners should have selected at least 15 suitable participants as pilot trainees in their participating country, for a total of 75 participants, based on those criteria:

- Interest in technical issues.
- Perspective goal to work in interface positions.

In this phase a face-to-face course, with the aim of evaluating the developed curricula and methodology, to be organised at each participating educational institution was planned. *Guidelines* for the implementation of the pilot and the collection of feedback should have been agreed upon and shared among the partners to make the process smooth and to gather consistent and concrete information.

*Feedback* should have been collected based on written questionnaires or, if necessary, by individual interviews, addressing the following major issues:

- general impression and remarks.
- Which units did the trainees like? which not?
- What was the learning outcome?
- Suitability and efficacy of lesson plans and working material.
- Suggested changes to the course / Intellectual Output.

The results obtained during the pilots should have been evaluated and incorporated into the development of the beta version of the teaching materials.

#### Pilot phase 2

The beta versions should have been embedded in the MOOC platform. During this time, an open pilot of the online training was supposed to take place, supervised by the certified trainers. Both the content and the platform should have been tested. Feedback was supposed to be collected through the platform itself.

### **Pilot phase 3**

Based on the findings of the previous phases, final adjustment of the teaching material and platform will be done, if the consortium will consider that the feedback received is in line with the quality criteria established by the steering committee at the beginning of the project.

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As a consequence of the Covid-19 pandemic, there was a need to vary the scheduling and the features of pilot activities, primarily due to the inability to hold any in-person events. Hence all the activities planned in face-to-face mode have had to be cancelled. To compensate for this inability, in the new pilot programming, the original objectives have of course been maintained but more emphasis was placed on the quality and efficiency of the test than on the number of people involved or on how it is implemented.

Here is how the new pilot strategy thereby was designed:

### **Pilot phase 1**

#### **“Field Expert content review” and “INDEX courses Internal review”.**

For the first phase, an internal pilot will be organized whereby the partners engaged experts in the field and peers, who were responsible for giving an initial evaluation of the courses focusing on:

1. contents
2. structure
3. navigation and functions of the platform
4. overall features

To gather feedback from experts and peers, INTAMT has created and shared an Excel file. For each point listed above a page was created, containing a series of evaluation lists/criteria to which reviewers were to assign a score from 1 to 5 (1 low vote 5 high vote). On each page an "open" space to write any "findings" and "recommendations" was also provided.

The scores will then automatically be collected in a summary page together with all the "findings" or "recommendation".

Partners will be asked to implement the collected suggestions.

## Pilot phase 2

### “Online Pilot Training”.

In the second phase, an external online pilot is proposed. It will involve 150 participants from the partner countries and beyond, belonging to the following target groups:

1. **Learners** (will complete the basic and intermediate course and take the final exam)

Main objective: to indicate to what degree the course is learnable for the students, identify whether the Open edX is functionally friendly, without obstacles and whether further improvements are needed.

Completing of the pilot: there might be two options.

- Taking the whole course, final exam and get the signed certificate of attendance (workload is defined by the curriculum)

AND/OR

- Taking a part of the course and getting the signed certificate of attendance for taking particulars sections of the course (workload of each section is defined in the curriculum).

Feedback is provided by learners in a form of multiple-choice questions and qualitative open questions that give an adequate assessment (evaluation and validation) that remain subjective and based on the learners' personal experiences. It will be expressed using the scale from 1 to 5, where:

1 – bad, major improvements are needed; 2 – poor, some improvements are needed; 3 – satisfactory, improvements are not needed; 4 good - improvements are not needed and 5 – excellent. If the learner assesses with 1, 2 or 3 scores, the choice shall be supported with short explanations (1-3 sentences) on what exactly must be improved.

The feedback form shall also include the information about position, university, field of studies.

Certificate of Completion with the assigned ECVET-points: upon the participation in the online pilot training, the completion of the course by taking the final exam and the fulfilment of the feedback form.

2. **Stakeholders** (will complete the course and take the final exam)

Main objective: to indicate to what degree the course is being in demand among Industry 4.0 as well as among specialists and managers in the various application areas of smart technologies;

and if the courses are relevant and useful for the certain area of stakeholder's expertise and professional interest.

Completing of the pilot: the workload is defined by the curriculum of the course in question.

Feedback is provided by stakeholders in a form of yes/no questions and qualitative open-ended questions after finalizing the course.

The feedback form shall also include the information about position, university, field of studies.

Certificate of Completion: the finalizing the course and the fulfillment of the feedback form, will be rewarded by the free of charge signed "Certificate of Completion" with assigned ECVET points.

Learners and stakeholders are provided with a full guideline comprehensive of instructions for accessing the course, procedures for registration, preview of feedback form questions to help them focus on points that are then needed by the authors for any changes/improvements, procedures on how to obtain the certificate.



## Part 5

### Guidelines and concept for the use of INDEX products in diverse learning environments

Several pedagogical studies prove that a quality educational environment for adult learners, must be characterized by a different (than traditional educational settings) and more active educational approach.

An active learning approach must encompass that:

- Adult learners build up their own meanings, based on what they already know and how they see the environment around them, thanks to their experience which they cannot disregard.
- Different adult learners give different interpretations to the same thing, may retain different aspects, and may act differently based on the same information.
- There are many ways through which adult can learn without someone else passing on pieces of expert knowledge.
- Learning is a social activity and a lot of it is tacit.
- Learning is dynamic and context-bound and, therefore, good learning depends on meaningful learning environments.

Other European studies provide some indications of elements or criteria that are associated with the quality learning environment. Based on these studies, the researcher Simon Broek, concludes that, to establish a quality learning environment:

- it should be motivational for the learners,
- it should be rich and reflective,
- the provision should be tailor made, learner centered and attuned to the specific learning needs of the adult learning.
- the provision should respect the background of the adult learner and the knowledge and experience of the adult learner should be used as resource in the learning process.
- the provision should be offered in a flexible manner in terms of duration, time, and place.
- the learning should be both relevant for the adult learner and – potentially – other stakeholders (e.g., employers, societal organizations).

(Source: <https://epale.ec.europa.eu/en/blog/quality-learning-environments-what-makes-adult-learning-different-0>)

One of the INDEX project's specificities is the possibility to use its products in different educational fields. This peculiarity is given by the modularity of the courses, by the fact that the access to the

course does not require special prerequisites, by its nature as e-course that makes it adaptable and customizable.

In addition, Industry 4.0. concept and its basic components are efficient tools with versatile applicability, meaning that a wide range of potential consumers can benefit from the project.

At this point it is important to mention the beneficiaries of the project, the target group, and the educational environment they belong to.

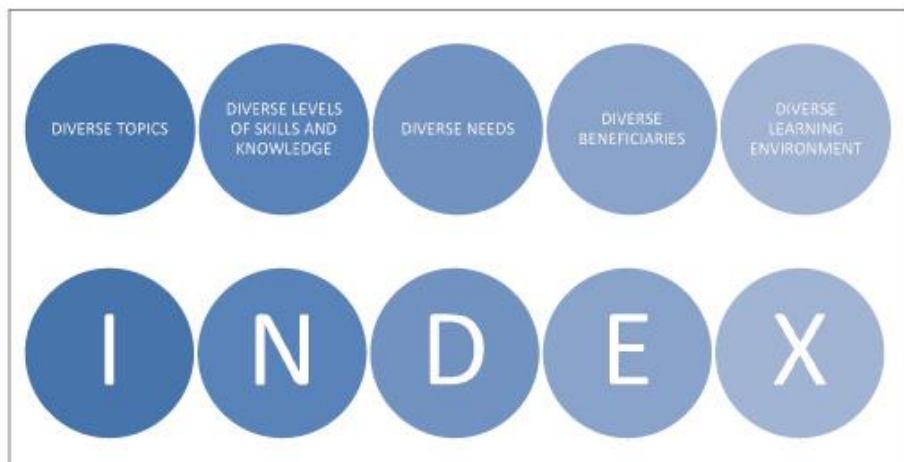
The project's beneficiaries include:

- **senior executives and professionals** (including managers of prospective development departments) of enterprises and companies interested in learning about current developments on Industry 4.0. technologies and opportunities of their implementation in the area of their expertise. The project will enable the professionals of this group to widen their horizon in terms of technical expertise in order to develop reasoned proposals in promising areas of company development.
- **Professionals interested in opportunities to apply Industry 4.0 components in their area of expertise:** e.g. professionals in endoprosthesis (manufacturing prosthetic implants); professionals in construction (manufacturing construction parts and units); professionals in prototyping: artistic models, architectural models, prototype models for museum exhibits, exhibitions etc.; professionals in complex item manufacturing, injection mold manufacturing; professionals in manufacturing general merchandise (token gifts, jewelry, toys, clothing, shoes etc.)
- **Founders of high-technology startups** for designing and implementing monitoring and control systems in accordance with IoT principles (for agricultural producers, health professionals, general consuming public); manufacturing complex items and units at the commission of other companies and enterprises; providing services of manufacturing individual tokens and gifts (e.g., wedding figurines or anniversary celebrants for decoration of the festive table).
- **Professionals of companies and enterprises that are already working in development of specific components of 4.0.Industry** concept and equipment for certain fields of application but are interested in expanding the base of customers developing new technologies and equipment for new fields of application.
- **Educators teaching graduate and postgraduate courses focusing on Industry 4.0.** technologies.
- **Students and postgraduates of the course “Industry 4.0 technologies”.**

Beneficiaries can profit from the INDEX specific educational programs and case studies focusing on the fields of application they may have not yet/never worked in, exploring case studies in specific fields of application of Industry 4.0 technologies. The project also enables students to increase opportunities for a more intensive self-study in online mode.

INDEX's comprehensive design approach makes it possible to meet the different needs of various groups of beneficiaries.

Of particular importance is the adaptability to different levels of skills and knowledge related to the topics developed in the teachings and the ability to address learners with different pre-qualifications



## Part 6

### Validation of learning outcome on completion of the training (ECVET/ECTS accreditation framework)

#### ECVET

As well described in the previous chapters, INDEX educational path is articulated in 3 levels: level base, level intermediate and level advanced. Each level, in turn, is made up of several courses, each course is structured in modules and, to each module, has been associated a list of learning outcomes, covering knowledge, skills and competences. This path is designed to allow the validation of the INDEX training, in compliance with CEDEFOP principles, and the accumulation of ECVET points.

The European Credit System for Vocational Education and Training (ECVET), is a system for recognizing, accumulating, and transferring learning credits in vocational education and training that aims to:

- make it easier for people to get validation and recognition of work-related skills and knowledge acquired in different systems and countries – so that they can count towards vocational qualifications.
- make it more attractive to move between different countries and learning environments.
- increase the compatibility between the different vocational education and training (VET) systems in place across Europe, and the qualifications they offer.
- increase the employability of VET graduates and the confidence of employers that each VET qualification requires specific skills and knowledge.

(Source: The European Credit system for Vocational Education and Training (ECVET) | europa.eu)

With regard to “how” to access the different levels of INDEX, various steps and various possibilities are envisaged. There are no prerequisites for access to INDEX, other than a fluent English (recommended level B2) since the learning material is completely in English and the assessment projects, required to students who are interested in passing the advanced level, must be produced in English.

Access to any course at the Intermediate level is possible when the student has either taken the entire Base course and successfully passed the final assessment (60% of the answers must be correct) or, if he/she believes that he/she is already familiar with the knowledge of the basic level, he/she can directly access the final assessment of the basic level and successfully pass it (60% of the answers must be correct).

A different approach concerns the access to the advanced level: students must pass at least two assessments of two Intermediate level course.

The topic of certification is quite complex and articulated. It is in fact given the possibility to the learners to gain a certification upon the successful conclusion of each course at each level. In conclusion, a student can receive up to 9 INDEX certificates, as proof of qualification, released by the INDEX consortium.

Back to the topic of ECVET points allocation, it was decided to assign the ECVETs according to the following scheme:

	INDEX COURSES					TOTAL ECVET POINTS
<b>Level Base</b>	Introduction Industry 4.0					
<b>ECVET</b>	<b>3</b>					<b>3</b>
<b>Level Intermediate</b>	E-TRIM	S&A	AM	IOT	AR	
<b>ECVET</b>	<b>3</b>	<b>3</b>	<b>6</b>	<b>3</b>	<b>3</b>	<b>18</b>
<b>Level Advanced</b>	E-TRIM + S&A + AM + IOT + AR					
<b>ECVET</b>	<b>2</b>					<b>23</b>

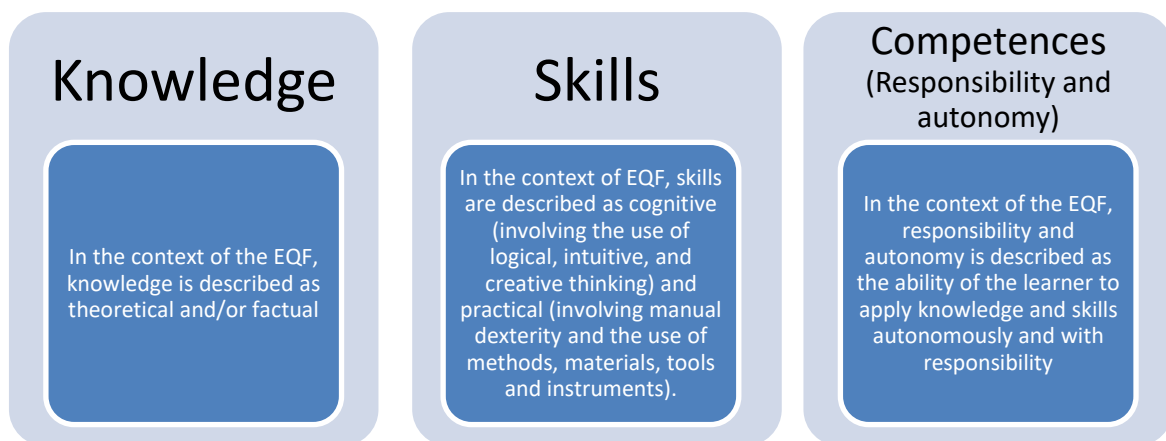
The criteria for attributing credit to units are different and can be combined. In the case of INDEX, they are weighted by an appreciation of the importance of the content in terms of knowledge, skills and competences for each unit, the duration, the workload for the learner, the effort expended by the learner in an informal learning context. The total credit points for a qualification are attributed by the competent authority (the INDEX consortium) to the different units. It is essential to determine a horizontal dimension of learning outcomes in terms of knowledge, skills, and competences.

## EQF

Dealing with accreditation, learning outcomes, qualification, validation, etc.... it is essential to mention the European Qualification Network for lifelong learning (EQF) as well. EQF aims to "classify qualifications according to a set of criteria for specified levels of learning achieved. It

aims to integrate and coordinate qualifications, as well as improve the transparency, accessibility, and quality of qualifications in relation to the labor market, the education and training system, and civil society. Qualification's frameworks support lifelong, with the aim of improving knowledge, skills, and competences within a personal, civic, social and/or employment-related perspective. This definition covers the full range of formal, non-formal and informal learning" (source "The European Qualifications Framework: supporting learning, work and cross-border mobility", Feb 2018). The EQF follows a learning outcomes approach as well. The focus on learning outcomes increases the transparency of the qualification and promotes comparability across and within countries. By focusing on learning outcomes, the EQF can help citizens navigate the choice between increasingly diverse and complex qualifications. The EQF consists of eight levels based on learning outcomes. The related descriptors show how the levels of knowledge, skills, autonomy and responsibility increase progressively from level 1 to level 8. These levels, together with the descriptors, serve as a translation grid and allow for the comparison of qualifications awarded by different countries and institutions.

INDEX is outlined according to the descriptors of the European Qualifications Framework and corresponds **to EQF levels 4-5**. Below an excerpt from the full table of EQF Levels with Levels 4 and 5 highlighted and the EQF definition of "knowledge, skills and competences".



## EQF LEVELS

4

Factual and theoretical knowledge in broad contexts within a field of work or study. A range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study. Exercise self-management within the guidelines of work or study contexts that are usually predictable but are subject to change. Supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities.

5

Comprehensive, specialized, factual, and theoretical knowledge within a field of work or study, and an awareness of the boundaries of that knowledge. A comprehensive range of cognitive and practical skills required to develop creative solutions to abstract problems. Exercise management and supervision in contexts of work or study activities where there is unpredictable change. Review and develop performance of self and others.

6

Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles. A comprehensive range of cognitive and practical skills required to develop creative solutions to abstract problems. Manage complex technical or professional activities or projects, taking responsibility for decision-making in unpredictable work or study contexts; take responsibility for managing professional development of individuals and groups

Adapted from "The European Qualifications Framework: supporting learning, work and cross-border mobility."

### ECVET and ECTS

The European Credit Transfer and Accumulation System (ECTS) is a tool of the European Higher Education Area for making studies and courses more transparent. Like ECVET, ECTS helps students to move between countries and to have their academic qualifications and study periods abroad recognized (definition from the European Commission website).

ECTS, as ECVET, is based on the notion of 60 credits but in the former case, the allocation of credits is different: 60 ECTS credits are the equivalent of a full year of study or work. In a standard academic year, these credits are usually broken down into several smaller modules. A typical 'short cycle qualification' typically includes 90-120 ECTS credits. A 'first cycle' (or bachelor's) degree consists of either 180 or 240 ECTS credits. Usually a 'second cycle' (or master's) degree equates to 90 or 120 ECTS credits. The use of the ECTS at the 'third cycle', or Ph.D. level, varies.

ECVET allocation method, as mentioned above, is less standardized as the criteria for attributing credit to certificates and units are different and can be combined. 60 ECVET points correspond to one full-time formal year in VET. ECVET points are allocated to units of learning outcomes according to their importance within the qualification.

Source:

[Microsoft Word - IT.doc \(ecvet-projects.eu\)](#)

[ECTS User's Guide 2015 \(uniroma4.it\)](#)

[Clarify Validation and Recognition | ECVET Toolkit \(ecvet-toolkit.eu\)](#)



## Part 7 Guidelines for assessing and monitoring the performance of INDEX trainees.

Within the INDEX courses, a robust method for assessing and monitoring student performance was developed with the following purposes: examines learners' attainment, motivate learners to proceed with the proposed training path, allow learners to enter the upper level of a course and, in the end, to get a qualification and to accumulate ECVET points.

### INDEX basic and intermediate levels

As regards the **INDEX basic and intermediate levels**, the evaluation of participants, will be based mainly on self-evaluation in the form of "multiple choice quizzes".

In particular:

- **At the end of each section**, or anywhere the author considers it appropriate, "**motivating questions**" should be located. It is suggested to include approximately one question every 2 hours of study, or 1 hour of reading. For "motivating questions" it is intended questions that help learners not only to reflect on the topics provided, but also to find the right motivation to continue the training path. Each question is made up of 4 answers (3 wrong answers and 1 right answer).

Course authors are asked to come up with motivating questions to be inserted throughout both the basic and intermediate courses.

For each question, the author should provide feedback (1-2 sentences explaining the answers) with the aim to support the learners to process the information, navigate the learning materials, or suggest about which part to review or focus on.

- **At the end of each course** 10 "**summative questions**" should be inserted. "Summative questions" means questions designed to assess students' knowledge, skills, and competencies at the conclusion of a period of instruction, in the case of INDEX at the end of a course. To succeed the course, it is mandatory to pass the 60% of the final questions. Each question is made up of 4 answers (3 wrong answers and 1 right answer).

Course authors are asked to come up with a pool of 4 summative questions for the base course (the platform will select 2 questions per course randomly and form a final test consisting of 10 questions) and 20 summative questions for the advanced course (the platform will select 10 randomly to create ever-changing final tests).

In the case of the course Additive Manufacturing the numbers of the summative questions double, as the course is twice the number of hours compared to other courses.

Below a descriptive table.

<b>Per each course</b>	<b>Assessment tools</b>	<b>Base level</b>	<b>Intermediate level</b>
		each partner should create:	each partner should create
<b>Section 1</b>	4 motivating questions (each formed by 4 answers, 1 correct + feedback)	4 motivating questions	4 motivating questions
<b>Section 2</b>	4 motivating questions (each formed by 4 answers, 1 correct + feedback)	4 motivating questions	4 motivating questions
<b>Section 3</b>	4 motivating questions (each formed by 4 answers, 1 correct + feedback)	4 motivating questions	4 motivating questions
<b>Section XXX</b>	4 motivating questions (each formed by 4 answers, 1 correct + feedback)	4 motivating questions	4 motivating questions
<b>Final assessment at the end of each course</b>	10 formative questions (each consisting of 4 answers 1 right).	4 formative questions (the platform will select 2 random and form a final questionnaire consisting of 10 questions)	20 formative questions (the platform will select 10 randomly)

\* For the intermediate level of Additive Manufacturing, the number of questions of the Final Assessment are 30.

### **INDEX advanced level**

The assessment methodology of the advanced level of the INDEX E-COURSE, has been extensively discussed by the partnership as it has been striving for a tool that puts the student at the center of it and would bring out her/his ability to combine different technologies learned in previous courses in a high-level hands-on assessment.

The INDEX team agreed that, at this stage, the assignment should be in the form of a "case study resolution" with the purpose of applying the concepts and principles learned in the basic and intermediate level courses.

“The benefits of utilizing case studies in instruction include the way that cases model how to think professionally about real problems and situations, helping candidates to think productively about concrete experiences” (Kleinfeld, 1990 in Ulanoff, Fingon and Beltran, 2009).

The case study method entails putting students in the role of decision makers by asking them to address a problem that does not involve a single answer. Students are expected to consider possible theoretical explanations and data, weigh possible solutions, and based on this, make a decision and choose a solution to the problem. Case study assessment focuses on finding solutions as it involves a real-life situation.

Among the various advantages of this methods, it is important to mention that case study is well suited to multi- or interdisciplinary learning, it asks students to demonstrate a variety of skills such as information selection, analysis, decision making, problem solving, and presentation. It also supports the development of several valuable employability skills that are likely to be attractive to both employers and students.

The most significant disadvantages of the case study as a form of assessment are that it takes a long time for the teacher to prepare it beforehand and to correct it afterwards. In addition, during its development, it is very likely that the student will need continuous support given the difficulty of its execution (Source LSE Home). For these and other reasons it was decided that the advanced level of INDEX should be fee-based.

All the case studies of the advanced level have been created by the authors of the INDEX courses specifically and exclusively for this project.

The case study must allow the students both to put into practice the lessons learned in the previous INDEX courses, as we have said, and address a real-world problem situation that allows them to cross-reference the different technologies they have learned, to bring out their personal thinking and their ability to interconnect the multiple INDEX topics according to the issue to be tackled and thus support a deeper learning. Therefore, the evaluation criteria considered are:

- innovativeness of the proposed solution.
- ability to use the content from the courses involved.
- ability to apply the technologies presented in the courses involved.
- clarity of the content.
- quality of the content.
- use of appropriate technical language.
- general organization/structure.

Each of the above items will be evaluated by the trainer with a score from 0 (if the assignment does not present the standard in any way) to 3 (if the assignment presents the standard extensively).

To facilitate the fulfillment of the case study, the INDEX platform will provide the student with an outline where the evaluation criteria are clearly expressed.

A final significant consideration concerns another feature of the case study as a verification tool, namely avoiding plagiarism, which is one of the limitations of online assessment. With the resolution of the case study in fact, the student must not simply put in place the knowledge he/she has learned during the INDEX courses he previously attended but must rework and interconnect them in such a way that they lead him to the resolution of the problem presented to him/her. Each case study can have multiple resolutions and, since they were created specifically for the INDEX course, they cannot be found on the Internet.

Among other features of the assessment at the advanced level, it is important to mention that a workload of 20 hours is calculated to complete the case study and that certain limits are imposed to successfully accomplish the task including the maximum length expressed in characters: 20k to 40k characters for an essay 10k to 20k characters + file for a text. English language must be used.

### **INDEX Final certification**

Obtaining INDEX certification is a flexible and customizable process, consistently with the foundation of the INDEX project's methodological concept: as explained in Part 3 of this output, the whole INDEX educational path is made up of modules, each module is associated to learning objectives and related ECVET points, which can be accumulated only by passing the assessments placed at the end of each module like mentioned above.

The INDEX learner will therefore also decide the path he/she wants to undertake starting from the certification he/she needs.

Therefore, the student must come up with a good balance between describing the case study and analyzing it. The assignments should not be too descriptive but: explain and give reasons, compare and contrast, make suggestions and recommendations, and support their ideas with information from documented sources.

## Appendix

Updating according to the “Council Recommendation of 24 November 2020 on vocational education and training (VET) for sustainable competitiveness, social fairness and resilience 2020/C 417/01”

The ECVET recommendation has been repealed and ECVET principle have been included in the [Council Recommendation of 24 November 2020 on vocational education and training \(VET\) for sustainable competitiveness, social fairness and resilience 2020/C 417/01](#).

The Recommendation states that "During the ten years of its implementation, ECVET has largely contributed to the development of a better quality mobility experience through the use and documentation of units of learning outcomes. However, the concept of ECVET points has not been generally implemented and ECVET has not led to the development of a European credit system in vocational education and training. vocational education and training." Therefore, for vocational qualifications at post-secondary and tertiary levels, the European Credit Accumulation and Transfer System already in use can be applied. This Recommendation replaces the Recommendation of the European Parliament and of the Council of 18 June 2009 on the establishment of a European Quality Assurance Reference Framework for Vocational Education and Training (EQAVET), and the Recommendation of the European Parliament and of the Council of 18 June 2009 on the establishment of a European Credit System for Vocational Education and Training (ECVET).

In light of this change, that occurred while the INDEX project was taking place, the coordinating committee, advised by experts from CEDEFOP and the German National Agency, decided to not to give ECVET points because they are obsolete and worthless, but to indicate in the final certificates issued to the students, the description of the KCS obtained and the EQFs achieved at the end of their training.

Partners were asked to fill in the following outline for the courses they created, keeping in mind that EQF level 4 relates to Index Basic, EQF 5 to Index Intermediate, and EQF level 6 to Index Advanced.

The definitions have been taken directly form the Europass website.

### Level 4

Knowledge	Skills	Responsibility and autonomy
Factual and theoretical knowledge in broad contexts within a field of work or study	A range of cognitive and practical skills required to generate solutions to specific problems in a	Exercise self-management within the guidelines of work or study contexts that are usually predictable, but are subject to change; supervise the routine work of others, taking some responsibility for the evaluation and

field of work or study	improvement of work or study activities
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Level 5

Knowledge	Skills	Responsibility and autonomy
Comprehensive, specialized, factual and theoretical knowledge within a field of work or study and an awareness of the boundaries of that knowledge	A comprehensive range of cognitive and practical skills required to develop creative solutions to abstract problems	Exercise management and supervision in contexts of work or study activities where there is unpredictable change; review and develop performance of self and others

Level 6

Knowledge	Skills	Responsibility and autonomy
Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles	A comprehensive range of cognitive and practical skills required to develop creative solutions to abstract problems	Manage complex technical or professional activities or projects, taking responsibility for decision-making in unpredictable work or study contexts; take responsibility for managing professional development of individuals and groups

Within the final certificates, the number of learning hours, related to each course, was also clearly indicated.