HUCO LABS

Collaborative **H**vet-**U**niversity-**Co**mpany **Labs** for Research

Train the Trainer Programme (HUCO Labs- D.2.4)

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Glossary

AI – Artificial Intelligence
CAPA – Corrective and Preventive Actions
CBL – Challenge-Based Learning
CMQ MSI – *Campus des Métiers et des Qualifications Microtechniques et Systèmes Intelligents*
CoP – Community of Practice
CPD – Continuous Professional Development
D2.1 – Deliverable 2.1 (*TRIComp Framework*)
D2.2 – Deliverable 2.2 (*Set of Training Modules*)
D2.3 – Deliverable 2.3 (*Cooperation Model between Training Providers and Companies*)
D2.4 – Deliverable 2.4 (*Train the Trainer Programme*)
D5.3 – Deliverable 5.3 (*Handbook for Training Implementation Quality Assurance*)
DHBW – *Duale Hochschule Baden-Württemberg*
EEA – European Education Area
ECVET – European Credit System for Vocational Education and Training
ECTS – European Credit Transfer and Accumulation System
EQAVET – European Quality Assurance in Vocational Education and Training
EQF – European Qualifications Framework
ERA – European Research Area
ESCO – European Skills, Competences, Qualifications and Occupations
ESJO – Groupe Scolaire Saint Joseph LaSalle higher education department
EU – European Union
FabLab – Fabrication Laboratory
HE / HEI – Higher Education / Higher Education Institution
HUCO – HVET–University–Company
HVET – Higher Vocational Education and Training
IBL – Inquiry-Based Learning
ITS – *Instituti Tecnologici Superiori*
MC / MCs – Micro-Credential(s)
MoU – Memorandum of Understanding
PBL – Project-Based Learning
R&D – Research and Development
SME – Small and Medium-Sized Enterprise
SSMTP – partner abbreviation used in HUCO documentation
ToT – Train-the-Trainer / Training of Trainers
TRIComp – Transformation, Research and Innovation Competences Framework
UDL – Universal Design for Learning
UPV – *Universitat Politècnica de València*

VET – Vocational Education and Training
WP – Work Package

Executive Summary

Deliverable D2.4 defines the Train-the-Trainer Programme of the HUCO Labs project as the pedagogical implementation layer of the wider HUCO training architecture. Building on Deliverable D2.1, which established the TRIComp Framework, Deliverable D2.2, which documented the integrated module architecture of the Italian EQF Level 5 and French EQF Level 6 pilot pathways, and Deliverable D2.3, which clarified the organisational model for joint implementation, D2.4 focuses on the actors who must make this architecture work in educational practice: teachers, lecturers, researchers involved in teaching, company mentors, trainers, and project supervisors. In this sense, the deliverable provides the professional development concept through which the HUCO model can be translated from curriculum design and institutional cooperation into real pedagogical action.

The rationale for this work lies in a structural challenge already identified in the HUCO project application. The project does not merely seek to add new technical content to existing pathways; it aims to create learning environments that integrate research-based learning, challenge- and project-based formats, dual and company-based learning, digital collaboration, and innovation- and sustainability-oriented competence development. Such environments place new demands on those responsible for facilitation, supervision, and assessment. The application therefore already foresaw a specific “training the trainers” component within Work Package 4: two online courses aimed at academic researchers, higher VET teachers, industrial researchers, and in-company trainers, coordinated by CMQ MSI and delivered with contributions from all partners, with an expected total of around thirty participants.

The present deliverable builds on that project commitment, but develops it in significantly greater depth. It does not merely announce the existence of two online courses. Rather, it documents the pedagogical rationale, competence profile, design principles, module structure, assessment logic, implementation format, and ecosystem function of the Train-the-Trainer Programme. In the course of drafting, the consortium concluded that a short operational description of two courses would not be sufficient to support the implementation of such a complex and transnational training model. To prepare trainers and mentors adequately for the HUCO pathways, the project first needed a more explicit conceptual framework: one that defines what trainers in the HUCO ecosystem need to know and be able to do, how their development should be structured, and how their learning can be documented, recognised, and improved over time. D2.4 therefore goes beyond a simple training schedule and provides a comprehensive professional development concept for the project.

This clarification is important in relation to the application. The application formulates the ToT component primarily as a testing activity in WP4, namely the implementation of two online courses. The current deliverable retains this implementation logic and remains fully aligned with

it: the programme is indeed structured as two online courses, designed for transnational participation and manageable workloads, with CMQ MSI holding delivery responsibility and all partners contributing to content and recruitment. At the same time, D2.4 now makes explicit the broader pedagogical and strategic foundation that underpins those courses. This is not a departure from the project logic, but a necessary elaboration of it. Because the HUCO training pathways are themselves research-based, dual, transnational, and innovation-oriented, the training of trainers also requires a more developed architecture than a short upskilling offer in isolation would suggest.

Substantively, the deliverable presents the Train-the-Trainer Programme as a structured progression from conceptual understanding to pedagogical application. The programme is organised as two complementary online courses: a first course on pedagogical foundations for HUCO trainers and a second course on design, supervision, assessment, and transfer. Together, they cover innovation pedagogy, supervision of applied research and innovation projects, coordination of dual learning environments, assessment of TRIComp-related competences, and the use of digital tools for collaborative and transnational learning. The programme is further supported by competence-oriented assessment, reflective portfolio work, micro-credentials, and the Trainer Passport as a structured instrument for documenting and communicating trainer competences within the HUCO ecosystem.

The deliverable also makes clear that the Train-the-Trainer Programme is not a stand-alone support activity. It is embedded directly within the logic of the HUCO ecosystem. It prepares the actors who will later deliver and supervise the modules defined in D2.2, helps build a shared pedagogical culture across HVET institutions, higher education institutions, and companies, and supports the implementation of the cooperation logic described in D2.3. In this sense, D2.4 functions as the human-capacity counterpart to the curricular and organisational architecture developed elsewhere in WP2.

D2.4 is therefore best understood as the pedagogical backbone of trainer development within HUCO. It translates the project's innovation-oriented educational model into a structured professional development programme that is aligned with the application, but more conceptually explicit and operationally useful than the initial formulation alone. By combining trainer competence profiling, pedagogical design, course architecture, assessment, and long-term ecosystem integration, the deliverable creates the conditions under which the HUCO training pathways can be implemented with pedagogical consistency, institutional coherence, and sustainable impact across the consortium.

1. Introduction

This deliverable presents the Train-the-Trainer Programme of the HUCO Labs project as the structured professional development framework for those actors who will implement the HUCO training pathways in practice. Its purpose is to document how the innovation-oriented, research-based, and dual learning architecture developed within the project is translated into a pedagogically grounded programme for educators, trainers, company mentors, and supervisors. The deliverable therefore occupies a central place within Work Package 2. It should not be read as an isolated staff-development offer, but as the pedagogical implementation layer of the wider HUCO training model, closely linked to the competence framework in D2.1, the training architecture in D2.2, and the collaboration model in D2.3.

1.1 Background and project context

European technical education is under increasing pressure to respond to industrial transformation. Digitalisation, sustainability requirements, advanced manufacturing, applied innovation, and cross-sector collaboration are changing not only the competence profile of technical professionals, but also the ways in which learning for these professions must be designed and facilitated. The HUCO Labs project addresses this challenge by developing integrated pathways that connect Higher Vocational Education and Training (HVET), higher education institutions, and company-based learning and research environments. In this context, the project seeks to prepare mid-level technicians not only for existing occupational routines, but for active participation in research, innovation, digital problem-solving, and sustainable industrial development.

This ambition has direct implications for those responsible for teaching, mentoring, and supervision. If learners are expected to work in inquiry-based, challenge-based, project-based, and company-linked environments, then the educators and mentors guiding them must themselves be prepared for new pedagogical roles. They need to facilitate open-ended learning processes, coordinate across institutional boundaries, supervise research and innovation tasks, assess complex competences, and mediate between theory, practice, and workplace realities. The project application already recognised this by including a dedicated “training the trainers” strand in WP4, envisaged as two online courses for academic researchers, higher VET teachers, industrial researchers, and in-company trainers. D2.4 is the deliverable that develops this trainer-development strand into a coherent pedagogical programme.

1.2 Purpose of the deliverable

In the original proposal logic, the Train-the-Trainer component is presented primarily as a testing activity: the alliance will implement two online courses aimed at approximately thirty participants from educational and industrial contexts, under CMQ MSI coordination and with

contributions from all partners. This implementation logic remains valid and is retained in the current deliverable. The Train-the-Trainer Programme is indeed organised as two complementary online courses, designed for transnational participation and aligned with the practical constraints of working educators and company-based mentors.

However, as work on the deliverable progressed, it became clear that the development of the ToT strand could not be reduced to a short course description alone. Because the HUCO pathways are themselves based on a demanding pedagogical model, involving research-based learning, innovation projects, dual learning environments, company collaboration, and transnational teaching formats, the preparation of trainers required a more explicit conceptual and professional framework. For this reason, the consortium decided to elaborate D2.4 not merely as a brief implementation note for two online courses, but as a fuller pedagogical concept. The deliverable now defines the competence profile of HUCO trainers, the pedagogical rationale of the programme, the structure and logic of the two-course model, its assessment and recognition mechanisms, and its long-term integration into the wider HUCO ecosystem.

This decision should not be understood as a shift away from the application. Rather, it represents a necessary deepening of what the application already required. The two online courses remain the operational format through which the programme will be delivered in WP4, but D2.4 now provides the pedagogical and organisational foundations that make this format meaningful and implementable. In other words, the deliverable clarifies not only that trainers will be trained, but also what they must be trained for, how their development is structured, and how this development supports the success of the wider HUCO model.

1.3 Scope and contribution of this document

Against this background, the present deliverable has four main functions. First, it defines the competence profile required of trainers in the HUCO ecosystem, including innovation pedagogy, supervision of applied research and innovation projects, dual learning coordination, digital and collaborative teaching, inclusive pedagogy, and co-teaching across institutional and cultural boundaries. Second, it develops the pedagogical rationale and methodological principles of the Train-the-Trainer Programme, including its emphasis on challenge-based, project-based, inquiry-based, and experiential learning. Third, it documents the concrete architecture of the programme itself: two online courses, a structured module sequence, assessment and certification approaches, and implementation arrangements for transnational delivery. Fourth, it situates the programme within the broader HUCO ecosystem by explaining how it supports module implementation, institutional cooperation, quality development, and the long-term sustainability of a shared pedagogical culture.

The contribution of the document therefore lies not only in listing course elements, but in making visible the pedagogical logic that connects them. D2.4 shows how trainer development is

embedded within the wider objectives of HUCO: strengthening research- and innovation-oriented technical education, improving cooperation between education and industry, and supporting a more permeable and future-oriented European skills ecosystem. It should therefore be read as the human-capacity and pedagogical counterpart to the curricular and organisational work undertaken elsewhere in WP2. If D2.2 defines what is to be taught and D2.3 defines how the institutional cooperation is organised, D2.4 defines how the relevant educational actors are prepared to enact that model in real learning situations.

1.4 Structure of the Deliverable

Following this introduction, the document first situates the programme within the **European policy context** of teacher and trainer professional development. It then defines the **competence profile for HUCO trainers** and presents the **pedagogical foundations** of the programme. On this basis, the deliverable outlines the **structure of the Train-the-Trainer Programme**, its **training modules**, and its **implementation model**. Subsequent sections.

2 European Context: Professional Development for Teachers

This chapter examines the European context for professional development in technical education. It outlines how digitalisation, industrial transformation, and the green transition are reshaping the competence requirements not only of technical professionals, but also of those responsible for designing, facilitating, and supervising their learning.

2.1 Transformation of Technical Education in Europe

The transformation of industrial production systems, the acceleration of digitalisation, and the growing urgency of the green transition are fundamentally reshaping the competence requirements for technical professionals across Europe. Industrial work is no longer defined only by the execution of standardised procedures or the application of fixed technical routines. Instead, technical occupations are increasingly embedded in dynamic environments characterised by automation, data-driven decision-making, smart manufacturing, sustainability requirements, and continuous innovation.

As a result, European industries are increasingly seeking professionals who are able to combine different forms of expertise and act effectively in complex, evolving contexts. In addition to solid technical knowledge, workers are expected to demonstrate innovation competences, interdisciplinary collaboration skills, digital literacy, and sustainability awareness. They must be able to understand technological systems, analyse problems in context, communicate across disciplinary and organisational boundaries, and contribute actively to the improvement of products, processes, and services.

This shift is particularly relevant in sectors shaped by Industry 4.0, advanced manufacturing, digital engineering, and sustainable industrial transformation. In these contexts, technical professionals are expected not only to operate machines, systems, or processes efficiently, but also to participate in troubleshooting, optimisation, prototyping, applied research, and innovation-related activities. The distinction between execution, development, and innovation is therefore becoming increasingly blurred. Technical roles are expanding from operational implementation towards more analytical, collaborative, and innovation-oriented forms of practice.

Mid-level technicians occupy a particularly important position within this transformation. They often work at the interface between engineering design, production processes, quality assurance, and organisational innovation. Because of this intermediary role, they are frequently required to translate between conceptual planning and practical implementation, between technical specifications and real-world constraints, and between organisational goals and operational realities. This makes them key actors in industrial transformation processes, especially in small and medium-sized enterprises, where flexible and innovation-capable technical staff are essential.

These developments have far-reaching implications for vocational education and training systems. If technical occupations are changing, then technical education must change accordingly. Traditional models of technical education, which often emphasised content transmission, procedural routine, and the reproduction of established knowledge, are no longer sufficient on their own. While foundational technical knowledge remains indispensable, it must increasingly be complemented by learning environments that foster inquiry, experimentation, collaboration, problem-solving, and the ability to apply knowledge in unfamiliar or rapidly changing situations.

This also means that vocational and higher technical education need to move closer to the realities of innovation, research, and workplace transformation. Learners must be prepared not only for existing job profiles, but also for more open-ended professional roles in which they contribute to organisational learning, technology adaptation, and sustainable innovation. Consequently, educational pathways at EQF Levels 5 and 6 must increasingly integrate competence-oriented approaches that connect disciplinary knowledge with applied research, project work, digital tools, and authentic industry challenges.

The HUCO Labs project responds directly to this European challenge. By connecting Higher Vocational Education and Training (HVET), higher education institutions, and companies, the project seeks to create integrated learning pathways that better reflect the realities of contemporary technical work. Its approach is based on the assumption that innovation-related competences cannot be developed through theory alone, but require participation in research-based, challenge-driven, and collaborative learning environments. Through the integration of

research-based learning, innovation pedagogy, and company-based learning settings into technical education pathways at EQF Levels 5 and 6, HUCO contributes to the modernisation of vocational education in ways that are aligned with current industrial, societal, and European policy developments.

In this sense, the transformation of technical education in Europe is not merely a matter of updating curricula. It involves a broader shift in educational purpose: from preparing learners for stable occupational routines towards equipping them for participation in innovation, transformation, and lifelong competence development. This shift provides the wider context in which the Train-the-Trainer Programme of HUCO must be understood.

2.2 European Policy Frameworks

The development of the HUCO training architecture is closely aligned with several European policy initiatives.

European Skills Agenda

The European Skills Agenda emphasises the importance of strengthening vocational education systems in order to support economic competitiveness and social resilience. The agenda highlights the need to develop advanced technical competences and promote lifelong learning opportunities for workers across Europe.

Digital Education Action Plan

The Digital Education Action Plan promotes the integration of digital technologies into education and emphasises the importance of developing digital competences among both learners and educators. Teacher professional development is identified as a key factor in enabling effective digital education.

European Education Area

The European Education Area promotes closer cooperation between education systems, research institutions, and industry partners in order to support innovation and knowledge exchange. By connecting vocational education with applied research environments, the HUCO project contributes to strengthening the links between the European Education Area (EEA) and the European Research Area (ERA).

Herning Declaration (2025)

The Herning Declaration on attractive and inclusive vocational education and training (VET) (2026–2030) reinforces the importance of high-quality, inclusive, and future-oriented VET systems in Europe. It highlights the need to strengthen the attractiveness of VET, expand work-

based learning, and foster closer collaboration between education providers, companies, and social partners.

The declaration also emphasises the development of advanced and transversal skills, the professionalisation of teachers and trainers, and the alignment of VET with labour market needs, including the green and digital transitions.

By focusing on competence-oriented, practice-based learning and strong partnerships between higher education institutions and companies, the HUCO project directly contributes to these objectives and supports the implementation of the Herning Declaration at both national and European levels.

EQAVET (European Quality Assurance in Vocational Education and Training)

EQAVET provides a European reference framework to support the quality assurance and continuous improvement of vocational education and training systems. It is based on a cyclical model of planning, implementation, evaluation, and review, supported by common indicators and descriptors that can be adapted to national contexts.

Importantly, EQAVET does not prescribe a single system but offers a flexible toolbox that enables institutions and countries to design quality assurance processes suited to their specific environments while ensuring transparency, comparability, and trust across Europe. The HUCO training architecture aligns with EQAVET principles by embedding continuous improvement, evidence-based evaluation, and stakeholder involvement (including companies and trainers) into the design and delivery of its programmes. This supports both the quality and the European transferability of HUCO training formats.

3 Competence Profile for HUCO Trainers

The successful implementation of the HUCO learning architecture depends not only on the quality of the competence framework, the module design, or the cooperation model between institutions and companies. It depends equally on the capabilities of those actors who are responsible for translating this architecture into meaningful learning processes in practice. For this reason, the definition of a clear competence profile for HUCO trainers is a central element of the Train-the-Trainer Programme.

Within the HUCO ecosystem, the term **trainer** is used in a broad and inclusive sense. It refers not only to teachers in Higher Vocational Education and Training (HVET), but also to university lecturers, researchers involved in teaching, company mentors, innovation managers, project supervisors, and other professionals who contribute to the facilitation, supervision, and assessment of learning. These actors work in different institutional contexts, bring different professional identities, and often operate according to different pedagogical assumptions.

Nevertheless, within the HUCO model they share a common responsibility: to support learners in developing research-oriented, innovation-related, and future-oriented competences in technically complex environments.

The competence profile for HUCO trainers is derived from two primary sources:

1. the **TRIComp Framework**, which defines the competence architecture for future-oriented technical professions and thus provides the substantive reference for what learners are expected to develop;
2. the **pedagogical requirements of the HUCO training modules**, which indicate how these competences are to be developed in practice through research-based, project-based, challenge-based, and work-based learning arrangements.

The trainer competence profile is therefore not a generic teaching profile. It is a **project-specific professional profile** that reflects the particular pedagogical, organisational, and collaborative demands of the HUCO learning environment. It includes competences related to innovation pedagogy, supervision of applied research, coordination of dual learning environments, digital and hybrid teaching, inclusion, co-teaching, and intercultural or inter-institutional mediation.

3.1 Innovation Pedagogy

A first core competence area for HUCO trainers is **innovation pedagogy**. Within the context of HUCO, innovation pedagogy refers to those pedagogical approaches that enable learners to engage productively with open-ended challenges, experimentation, creative problem solving, and collaborative solution development in authentic or near-authentic technical contexts.

This is of fundamental importance because the HUCO learning architecture is not limited to the transmission of established knowledge. Rather, it aims to prepare learners for technical and professional situations in which they must deal with uncertainty, explore alternatives, test assumptions, and co-create solutions with others. In such contexts, innovation is not an abstract concept added to technical learning. It becomes a mode of learning itself.

For this reason, HUCO trainers must be able to design, facilitate, and reflect on learning environments that support innovation-oriented competence development. This includes, in particular, the pedagogical use of:

- **Project-Based Learning (PBL)**, in which learners develop knowledge and competences through the structured implementation of complex projects with meaningful outputs;
- **Challenge-Based Learning (CBL)**, in which learning is organised around authentic, real-world challenges derived from industrial, technological, or societal problems;

- **Inquiry-Based Learning (IBL)**, in which learners investigate questions, generate evidence, analyse information, and develop reasoned conclusions or technical responses.

These approaches differ in emphasis, but they share several characteristics that are central to HUCO. They are learner-centred, competence-oriented, practice-connected, and focused on active engagement rather than passive reception. They require trainers to shift from the role of content transmitters to the role of facilitators, coaches, designers of learning processes, and mediators between knowledge, action, and reflection.

In the Italian EQF-5 pathway, for example, several modules already integrate inquiry-based learning scenarios in which students analyse real company cases, identify problems, collect and interpret information, and develop technical responses collaboratively. Such formats require trainers to guide students through open-ended problem-solving processes rather than providing ready-made solutions. This involves formulating meaningful tasks, structuring inquiry sequences, encouraging reflection, and helping learners connect concrete technical challenges with broader competence development.

Innovation pedagogy also requires trainers to develop a nuanced understanding of **productive openness** in learning. Learning tasks should be open enough to allow exploration, alternative solution paths, and genuine student agency. At the same time, they must be structured enough to remain pedagogically meaningful, feasible within the timeframe, and aligned with intended learning outcomes. Trainers must therefore be able to calibrate the degree of openness, define appropriate scaffolding, and intervene supportively without taking over the learning process.

A further dimension of innovation pedagogy is the ability to integrate **interdisciplinary collaboration** into teaching. Innovation in technical professions rarely results from isolated disciplinary expertise alone. It often emerges at the intersection of engineering, digital systems, sustainability concerns, user requirements, organisational realities, and communication processes. HUCO trainers therefore need to create learning situations in which students learn to collaborate across disciplinary boundaries, combine different forms of expertise, and negotiate solutions collectively.

Innovation pedagogy within HUCO is thus not reducible to a set of methods. It is a broader pedagogical orientation that combines creativity, experimentation, teamwork, critical inquiry, and applied problem solving. Trainers who develop this competence area are better equipped to support the kind of future-oriented technical learning that the HUCO project seeks to establish.

3.2 Supervision of Applied Research Projects

A second central competence area concerns the **supervision of applied research and innovation projects**. Applied research activities form a core element of the HUCO training

architecture because the project is based on the idea that learners at EQF Levels 5 and 6 should not only understand technical systems, but also contribute to their analysis, improvement, redesign, and innovation.

This has important implications for trainer competences. Supervising applied research differs significantly from delivering conventional classroom instruction. It requires trainers to accompany learners through iterative, evidence-based, and sometimes uncertain processes in which outcomes are not fully known in advance. Students are expected to participate in activities such as:

- data collection and analysis,
- interpretation of findings,
- prototyping and testing,
- evaluation of technical options,
- documentation of processes and results,
- and presentation or discussion of outcomes.

In the French EQF-6 pathway, for example, modules such as **Industrial Design Jams** and **Innovation Sprints** involve collaborative, multidisciplinary work on prototype development, design concepts, and innovation tasks. These formats demand a high level of trainer competence because they combine technical guidance, team facilitation, process moderation, feedback provision, and assessment support.

Trainers in HUCO must therefore be able to guide learners through the full cycle of applied project work. This includes helping students to clarify project goals, formulate relevant questions, identify appropriate methods, organise work steps, document progress, test assumptions, evaluate intermediate results, and communicate findings. In this role, trainers function not only as technical experts, but as **research and innovation mentors**.

A particularly important competence in this area is the ability to support **collaborative experimentation**. Applied research and innovation in technical fields are rarely linear processes. They involve iteration, revision, setbacks, and unexpected findings. Trainers must therefore create conditions in which experimentation is treated not as failure-prone deviation, but as a legitimate and productive part of learning. This includes supporting students in dealing constructively with ambiguity, uncertainty, and incomplete results.

At the same time, effective supervision of applied research requires methodological discipline. Trainers must help learners understand that experimentation and innovation are not merely creative acts, but also evidence-based processes. Students must learn to justify design decisions, make assumptions explicit, document procedures, evaluate evidence, and reflect on

the quality and limitations of their outcomes. Trainers therefore need competences in structuring inquiry, ensuring traceability, and making quality criteria visible.

Another important aspect concerns **team supervision**. Many HUCO project formats involve group-based work in which students collaborate in multidisciplinary teams. This means that trainers must be able to support not only technical task completion, but also coordination, communication, conflict management, role clarification, and collaborative reflection. In many cases, the quality of a project depends not only on technical content, but also on the effectiveness of teamwork and the capacity to integrate different perspectives.

The supervision of applied research projects also requires trainers to connect project work to broader competence goals. Within the HUCO model, project supervision is not only about reaching a deliverable or completing a technical task. It is also about fostering competences such as problem framing, innovation thinking, evidence-based reasoning, collaboration, project responsibility, and sustainability awareness. Trainers must therefore be able to recognise and support learning processes that extend beyond the immediate technical product.

In sum, this competence area positions HUCO trainers as facilitators of research-oriented and innovation-oriented learning. It requires a combination of methodological guidance, pedagogical sensitivity, technical understanding, and process facilitation, all of which are essential for the implementation of the HUCO pathways.

3.3 Dual Learning Environments

A third major competence area relates to the coordination and pedagogical shaping of **dual learning environments**. One of the defining characteristics of HUCO is that learning does not take place in one institutional setting alone. Instead, the HUCO modules combine and connect multiple learning environments, including:

- classroom-based teaching,
- laboratory experimentation,
- project-based work,
- and company-based learning.

This constellation reflects the project's broader ambition to create integrated pathways between HVET, higher education, and industry. However, such integration does not happen automatically. It requires trainers who are able to work across institutional boundaries, coordinate different learning logics, and ensure pedagogical coherence between settings that often follow different rhythms, priorities, and cultures.

The challenge here is both organisational and pedagogical. Organisationally, trainers need to coordinate schedules, responsibilities, communication flows, supervision roles, and

expectations across institutions and companies. Pedagogically, they need to ensure that learning remains coherent across contexts: what is introduced in one setting should be taken up, deepened, applied, or reflected on in another.

The module descriptions in HUCO explicitly highlight cooperation models in which HVET institutions provide the theoretical and pedagogical foundation, while companies contribute practical tasks, authentic contexts, and feedback on applied performance. Universities, where involved, may add stronger research-related, analytical, or methodological components. Trainers therefore need the competence to work within a **distributed pedagogical model**, where no single actor controls the entire learning process and where educational value emerges through coordination.

A key competence in this area is the ability to design and support **boundary-crossing learning**. Learners move between different environments and are expected to connect experiences from one context with requirements in another. Trainers must help them make these transitions meaningful. This may involve preparing learners for company-based phases, linking workplace tasks to competence goals, facilitating reflection after practical experiences, and helping students articulate what they have learned across contexts.

Another crucial competence concerns **collaboration with company mentors**. Within HUCO, company-based actors are not viewed merely as providers of placements or practical exposure, but as active pedagogical partners. This means that trainers from educational institutions must be able to communicate effectively with company staff, clarify expectations, align supervision approaches, and co-develop meaningful learning tasks. Conversely, company mentors need support in understanding the pedagogical purposes of the activities they host or supervise.

In this context, a particularly critical competence—especially for trainers coming from industry—is the **didactic translation of real-world industrial problems**. Many technical experts have deep knowledge of practical challenges, workflows, and innovation needs. However, the ability to transform these into educationally effective learning situations cannot be taken for granted. Trainers must be able to deconstruct complex everyday technical challenges into structured case studies, projects, or inquiry tasks that are accessible to learners while preserving authenticity and professional relevance.

This didactic translation requires several sub-competences. Trainers must identify the learning potential of a real-world challenge, reduce unnecessary complexity without oversimplifying the problem, sequence the task appropriately, define meaningful outputs, and anticipate where learners may require support. They must also ensure that industrial tasks become learning opportunities rather than mere operational exercises.

Dual learning coordination in HUCO also implies the ability to balance different forms of knowledge and authority. Educational institutions may prioritise structured learning outcomes,

progression, and assessment. Companies may focus on feasibility, productivity, deadlines, and real-world problem solving. Trainers must therefore mediate between these perspectives and create learning processes that are both educationally robust and professionally relevant.

This competence area is fundamental for the HUCO model because it ensures that the project's promise of integration between education and industry becomes pedagogically viable. Without trainers who can coordinate, translate, mediate, and align learning across contexts, dual learning environments risk remaining fragmented. With such competences, however, they can become one of the most powerful features of the HUCO ecosystem.

3.4 Digital and Collaborative Teaching Methods

A further essential competence area for HUCO trainers concerns the use of **digital and collaborative teaching methods**. Digital technologies play an increasingly important role both in innovation processes and in technical education itself. They shape how technical systems are designed, analysed, simulated, documented, and improved. At the same time, they influence how learning can be organised across locations, institutions, and professional communities.

For the HUCO project, digital competence is relevant on at least two levels. First, learners are expected to engage with digital technologies as part of technical and innovation-oriented work. Second, trainers themselves must be able to use digital tools to support teaching, supervision, collaboration, and assessment in complex, often hybrid and transnational learning arrangements.

HUCO trainers therefore need competences related to:

- digital collaboration platforms,
- online communication and coordination tools,
- simulation and modelling tools,
- digital documentation formats,
- data analysis methods,
- portfolio and feedback systems,
- and hybrid learning environments combining synchronous and asynchronous interaction.

These competences are particularly relevant for modules related to digital modelling, data literacy, AI-related applications, digital manufacturing, and collaborative project work across institutions. However, their importance goes beyond specific technical content areas. Digital and collaborative teaching methods are also essential for enabling transnational exchange, flexible supervision, and the continuity of learning across classroom, laboratory, and company contexts.

A first core competence in this area is the ability to use digital tools **pedagogically rather than instrumentally**. It is not sufficient for trainers to know how a platform or software tool works. They need to understand how digital tools can support specific learning purposes: collaboration, reflection, documentation, peer exchange, feedback, iteration, and competence development. This requires aligning technology use with pedagogical intent rather than treating it as an add-on.

A second competence concerns the facilitation of **hybrid and distributed learning environments**. In HUCO, learning may take place partly online, partly onsite, partly in institutions, and partly in companies. Trainers must therefore be able to maintain coherence across distributed settings, sustain interaction across distance, and ensure that learners remain connected to the learning process even when they are working in different places or timeframes.

A third competence area is **digital collaboration**. Many HUCO activities involve teamwork, co-design, shared documentation, joint problem-solving, and cross-institutional communication. Trainers must be able to set up and moderate collaborative workflows using appropriate digital environments. This includes clarifying roles, structuring contributions, supporting visibility of progress, and fostering meaningful interaction rather than merely technical connectivity.

Digital competences are also closely linked to **data-informed and evidence-based learning processes**. In research-based and innovation-oriented settings, learners increasingly work with digital datasets, modelling tools, simulation environments, or digital design artefacts. Trainers need sufficient familiarity with such environments to guide learners effectively, help them interpret digital outputs critically, and connect technical data work with broader learning goals.

Equally important is the capacity to use digital tools for **documentation and assessment**. Within the HUCO ecosystem, portfolios, project artefacts, intermediate outputs, digital feedback, and micro-credential-related documentation may all play an important role. Trainers need to understand how to collect, structure, interpret, and communicate evidence of learning in digital formats.

Finally, digital teaching in HUCO is inseparable from collaborative pedagogy. Digital tools are not primarily there to digitise traditional lecturing, but to support interaction, co-construction, reflection, and shared problem solving. Trainers must therefore combine digital fluency with facilitation skills that sustain learner engagement, cooperation, and pedagogical depth in digitally supported environments.

Table 1-Trainer Competence Areas

Competence Area	Description
Innovation Pedagogy	Ability to design, facilitate, and reflect on project-, challenge-, and inquiry-based learning environments that foster creativity, experimentation, and interdisciplinary problem-solving.
Research Supervision	Capability to guide applied research, innovation processes, and project-based experimentation, including data-based inquiry, prototyping, evaluation, and presentation of results.
Dual Learning Coordination	Ability to coordinate learning across educational institutions, laboratories, and company settings, and to ensure coherence between theoretical, practical, and research-oriented components.
Digital Teaching	Integration of digital tools, collaborative platforms, hybrid teaching formats, and digital documentation methods into competence-oriented learning environments.
Inclusive Pedagogy	Ability to adapt challenges, learning pathways, and supervision approaches to diverse learner profiles and needs, ensuring equitable participation in innovation-oriented learning.
Co-Teaching and Cultural Mediation	Ability to collaborate across professional, institutional, and national boundaries, including coordinated teaching, communication, and mediation between different pedagogical cultures and learning traditions.

3.5 Inclusive Pedagogy

In addition to methodological and organisational competences, HUCO trainers require competences in **inclusive pedagogy**. This is essential because the innovation-oriented and research-based learning environments developed within HUCO should not benefit only those learners who are already highly confident, academically experienced, or well aligned with dominant educational cultures. On the contrary, the project aims to create learning pathways that are accessible, motivating, and developmentally meaningful for a broad range of learners across institutional and national contexts.

Inclusive pedagogy in HUCO means recognising that learners enter the programme with different educational biographies, levels of prior knowledge, language repertoires, digital confidence,

social backgrounds, and experiences with self-directed or inquiry-based learning. Trainers therefore need the ability to design and facilitate learning in ways that do not reproduce exclusion through hidden expectations, overly narrow task formats, or unreflected assumptions about what counts as legitimate participation.

This is particularly important in challenge-based, inquiry-based, and project-based settings. These approaches can be highly empowering, but they can also create barriers if learners are left alone with excessive ambiguity, unclear expectations, or forms of collaboration that privilege only the most confident participants. HUCO trainers must therefore be able to provide structured support, differentiated access routes, and clear orientation while preserving the openness and authenticity that make innovation-oriented learning valuable.

Inclusive pedagogy in the HUCO context includes several dimensions. First, trainers must be able to design **accessible learning tasks**. This means formulating challenges and activities in ways that are understandable, relevant, and appropriately scaffolded. Complex technical problems need to remain intellectually demanding, but they should not become inaccessible due to unnecessary linguistic, procedural, or conceptual barriers.

Second, trainers should be able to provide **multiple pathways of engagement and expression**. Learners may contribute differently to innovation processes: some through technical analysis, others through communication, design thinking, documentation, coordination, or prototyping. A well-designed innovation environment recognises these differences and allows learners to demonstrate competence in more than one way.

Third, trainers need to be attentive to **participation patterns within teams and collaborative settings**. Innovation-oriented projects often rely heavily on group work, but group work is not automatically inclusive. Trainers must therefore observe whether all learners are able to contribute meaningfully, whether responsibilities are distributed fairly, and whether certain voices or skills are systematically overshadowed by others.

Fourth, inclusive pedagogy also means creating a learning culture in which uncertainty, experimentation, and developmental progress are treated positively. Learners should feel able to take intellectual risks, ask questions, and engage in iterative problem-solving without fear of being disqualified by early mistakes. In this sense, inclusion is closely connected to the creation of psychologically safe learning environments.

In the HUCO model, inclusive pedagogy is therefore not an additional social concern placed next to technical excellence. It is a condition for enabling broader and more equitable participation in innovation processes. Trainers who are competent in inclusive pedagogy contribute to stronger learner engagement, better collaboration, and more sustainable competence development across diverse learner groups.

3.6 Co-Teaching and Cultural Mediation

A final major competence area concerns **co-teaching and cultural mediation**. This competence area is particularly important in the HUCO project because the training architecture is explicitly transnational, cross-sectoral, and collaborative. Learning is not only distributed across institutions and settings, but also shaped by actors with different professional roles, pedagogical traditions, and national educational cultures.

Within such a context, effective training cannot rely on isolated teaching practice alone. It increasingly depends on the ability of trainers to work together across boundaries. HUCO trainers should therefore develop **international co-teaching competences**, enabling them to plan, coordinate, and synchronise instruction across different actors and institutions. A typical example would be an Italian HVET teacher collaborating with a researcher or university lecturer from another country, or an educational trainer co-designing and co-facilitating a learning unit together with a company mentor.

Co-teaching in HUCO is not simply a logistical arrangement in which several people appear in the same course. It is a pedagogical competence in its own right. It requires the ability to negotiate shared learning objectives, align roles and contributions, coordinate timing, create conceptual coherence, and respond flexibly to learner needs. Trainers must be able to make their expertise complementary rather than parallel, so that students experience the added value of multiple perspectives rather than fragmentation.

Co-teaching is particularly relevant in learning arrangements that bring together theoretical and practical perspectives. For example, a university-based actor may contribute research methods or analytical framing, while a company-based mentor contributes authentic industrial context and application relevance. A vocational educator may structure the didactic process, while another partner provides specialised technical input. The success of such arrangements depends on the ability of trainers to cooperate deliberately and pedagogically.

Closely connected to co-teaching is the competence of **cultural mediation**. HUCO operates across countries and educational traditions that differ in important ways: in teaching styles, conceptions of learner autonomy, relationships between theory and practice, understandings of assessment, communication norms, and expectations regarding trainer authority. Trainers must therefore develop the ability to navigate and reconcile different pedagogical cultures.

Cultural mediation does not mean erasing these differences. Rather, it means recognising them, making them discussable, and using them productively. Trainers should be able to bridge more practice-oriented and more theory-oriented teaching traditions, align different expectations regarding feedback or participation, and support learners in navigating these differences without

confusion. This is especially important in transnational team teaching or when learners move between settings shaped by different educational norms.

For trainers working with multinational groups or in cross-border collaborations, cultural mediation also includes communication sensitivity, role clarification, and awareness of how educational practices are interpreted differently in different contexts. Seemingly simple issues—such as how much guidance is expected, how openly disagreement is expressed, or how performance is discussed—can affect collaboration and learning quality significantly.

Within the HUCO project, co-teaching and cultural mediation are therefore not peripheral skills. They are strategic competences for building a shared pedagogical culture across the consortium. They enable collaboration between HVET institutions, universities, and companies not only at the organisational level, but at the level of everyday educational practice.

In addition to formal pedagogical competences, the HUCO Train-the-Trainer Programme explicitly recognises the importance of informal and intercultural dimensions of teaching and learning. Given the transnational nature of the HUCO ecosystem and the diversity of participating education and training systems, trainers must be able to navigate different educational cultures, communication styles, and expectations towards learning and collaboration.

Particular emphasis is placed on behavioural approaches that support exchange processes between higher vocational education, universities, and companies. Trainers are therefore expected to facilitate not only knowledge transfer, but also mutual understanding between actors with different professional and cultural backgrounds.

To support this, the programme promotes experiential and practice-based learning formats, including peer exchange, reflection on intercultural experiences, and engagement with real-world company environments. Practical experience in industry is considered a key asset for trainers, as it enables them to bridge the gap between academic and workplace cultures and to act as effective mediators within dual learning settings.

3.7 Synthesis: The HUCO Trainer as a Hybrid Professional Role

Taken together, the competence areas described above show that the HUCO trainer is best understood as a **hybrid professional role**. HUCO trainers are not only subject experts, and not only pedagogical facilitators. They combine technical, pedagogical, organisational, collaborative, and reflective capacities in order to support learning in environments that are at once research-oriented, innovation-driven, practice-connected, and transnational.

This hybrid role includes the ability to:

- design meaningful and future-oriented learning environments;

- guide learners through inquiry, experimentation, and innovation processes;
- coordinate learning across institutions and workplace contexts;
- use digital tools in pedagogically purposeful ways;
- create inclusive participation opportunities for diverse learners;
- and collaborate across professional, institutional, and cultural boundaries.

The Train-the-Trainer Programme developed in this deliverable is based on the assumption that these competences can and must be developed systematically. They should not be expected as a given, nor left to informal adaptation. Instead, they require structured professional development, opportunities for shared reflection, and engagement with the specific pedagogical demands of the HUCO model.

The competence profile presented in this chapter therefore serves as the conceptual foundation for the following chapters on pedagogical approach, programme architecture, module design, and assessment. It defines the capabilities that the Train-the-Trainer Programme seeks to strengthen and makes explicit the professional demands associated with implementing the HUCO ecosystem in practice.

4. Future Skills Literacy for Trainers of the Future

This chapter examines Future Skills Literacy as a foundational dimension of trainer development within the HUCO Train-the-Trainer Programme. It explains why trainers need not only awareness of emerging competence demands, but also the capacity to interpret, translate, and pedagogically operationalise them in dynamic educational and industrial contexts.

4.1 Why Future Skills Literacy Matters for Trainers

The transformation of technical education does not only require new competence profiles for learners. It also requires a new form of professional capability on the part of those who design, facilitate, supervise, and assess learning. Within the HUCO Labs project, this capability can be described as **Future Skills Literacy for trainers**.

This concept goes beyond the assumption that trainers merely need to know which future-oriented competences are currently being discussed in policy papers, labour market reports, or educational frameworks. Such lists may provide useful orientation, but they do not resolve the deeper pedagogical challenge. The more fundamental question is how trainers can develop the ability to understand, interpret, contextualise, and continuously reconfigure competence demands in dynamic environments. In this sense, the central task is not only to identify relevant Future Skills, but to cultivate the professional literacy required to create learning settings in which such competences can emerge, be observed, and be further developed (Ehlers, 2020, 2024).

This perspective is especially important in the HUCO context. The project does not operate with static occupational profiles or narrowly predefined technical routines. Instead, it seeks to prepare learners for participation in applied research, innovation processes, digital transformation, and sustainability-oriented development. Trainers working in such contexts must therefore be able to handle complexity, uncertainty, changing technological conditions, interdisciplinary cooperation, and shifting competence requirements. Their role is not limited to content delivery. They act as designers of learning architectures, facilitators of developmental processes, mediators between theory and practice, and reflective professionals capable of continuously adapting pedagogical approaches to emerging demands.

Future Skills Literacy for trainers can therefore be understood as a **second-order competence**. It does not refer primarily to the possession of a fixed competence catalogue, but to the capacity to make informed and reflexive judgments about competence needs, learning designs, pedagogical priorities, and developmental trajectories. This distinction between first-order competence and second-order competence is crucial. First-order competence asks: *Which competences should learners develop?* Second-order competence asks: *How do trainers decide which competences matter, how they are expressed in context, and how learning environments must be structured so that these competences can develop?* (Ehlers, 2024).

For the HUCO Train-the-Trainer Programme, this means that trainer development must be conceived in a broader and more strategic way. Trainers should not merely be introduced to a set of pedagogical methods. They must be supported in becoming literate actors within a shifting competence landscape. They need to be able to analyse competence frameworks critically, relate them to concrete institutional and industrial contexts, translate them into meaningful pedagogical practice, and reflect on their normative assumptions and implications. Future Skills Literacy is therefore not an optional add-on. It is a foundational capability for trainers of the future.

4.2 From Competence Lists to Competence Architecture

A key insight emerging from the Future Skills Literacy perspective is that competence lists alone are strategically insufficient. Lists can be useful as heuristics, but they tend to create the illusion that future-readiness can be ensured once the “right” set of competences has been identified. Yet the real challenge lies elsewhere: not simply in knowing which competences are currently relevant, but in ensuring that educators and institutions remain capable of deciding which competences will become relevant in changing futures. This marks a shift from a static to a reflexive understanding of competence (Ehlers, 2024).

For trainers, this insight is pedagogically decisive. If competence requirements are dynamic, context-sensitive, and normatively shaped, then training practice cannot be based on the transmission of fixed competence inventories alone. Instead, trainers need to understand

competence development as a process embedded in broader **competence architectures**. These architectures include not only intended learning outcomes, but also pedagogical formats, learning tasks, assessment logics, collaboration structures, institutional expectations, and the wider technological and societal conditions within which learning takes place.

This is highly compatible with the Future Skills approach developed in the NextSkills study. In *Future Skills: Lernen der Zukunft – Hochschule der Zukunft*, Ehlers (2020) shows that Future Skills are best understood not as isolated functional units, but as relational and developmental capacities. The NextSkills approach emphasises that future-oriented competence emerges at the intersection of self-relation, object-relation, and world-relation. This means that competence development always involves the interaction between personal agency, task-related engagement, and participation in broader social and organisational contexts (Ehlers, 2020).

For trainers, this has far-reaching consequences. It means that competence cannot be "installed" through instruction alone. It must be cultivated through environments that allow learners to engage with meaningful problems, connect knowledge to action, deal with uncertainty, collaborate with others, and reflect on the significance of what they are doing. Trainer professionalism therefore includes the ability to move from competence lists to competence architectures: from asking "Which skills should be taught?" to asking "How must learning be structured so that complex competence development becomes possible?"

This shift is particularly relevant in an educational landscape characterised by a rapid proliferation of competence frameworks. Different models emphasise different dimensions: employability, digital literacy, sustainability, ethical judgment, creativity, resilience, or AI-related capabilities. The increasing number of frameworks is not in itself a problem. It reflects the plurality of future scenarios, strategic priorities, and normative assumptions that currently shape debates on work, technology, and education. However, this plurality also means that trainers need more than awareness of multiple models. They need the ability to compare them, interpret them critically, and translate them into context-appropriate pedagogical designs.

Future Skills Literacy is therefore not about replacing one framework with another. It is about building the capacity to work reflexively with competence frameworks as pedagogical and strategic tools. In the HUCO context, this is especially important because the aim is not simply to implement one prefabricated competence model, but to create learning environments that remain responsive to ongoing transformation in technical professions.

4.3 Future Skills as a Process of Competence Development

Future Skills are not best understood as end states, but as developmental processes. This is one of the most important implications of the Future Skills discourse for trainer education. Learners

do not simply acquire Future Skills in the same way as they acquire factual knowledge. Rather, these competences evolve through cycles of engagement, experimentation, reflection, feedback, and transfer. Competence development is therefore recursive, situated, and relational.

This understanding frames Future Skills Literacy as a form of **meta-competence**: the ability to analyse, compare, contextualise, further develop, and normatively reflect on competence architectures (Ehlers, 2024). While this argument can be formulated at organisational level, it has direct pedagogical implications. If Future Skills development is recursive and adaptive, then trainers themselves must become capable of recognising and supporting these recursive developmental processes in learners.

This perspective is reinforced by several theoretical strands that converge around a shared insight: future-readiness depends less on static possession of competences than on adaptive learning capability. Dynamic capabilities research highlights the importance of reconfiguration in changing environments (Teece, 2018, 2020). Organisational learning theory draws attention to the difference between single-loop and double-loop learning, and thus to the importance of questioning assumptions rather than merely optimising routines (Argyris & Schön, 1978). Adaptive expertise research distinguishes between routine expertise and the ability to generate new solutions in unfamiliar contexts (Hatano & Inagaki, 1986; Schwartz et al., 2005). Ambidexterity research points to the challenge of balancing optimisation and innovation simultaneously (O'Reilly & Tushman, 2016). Together, these perspectives suggest that competence development must be understood as ongoing learning, reflection, and redesign rather than as simple competence acquisition.

For HUCO trainers, this means that they need to see learning not as linear progression from input to output, but as the guided development of competence through increasingly complex forms of participation. Learners must be enabled to frame problems, test assumptions, evaluate evidence, revise approaches, negotiate meanings with others, and integrate technical and transversal dimensions of action. Trainer competence therefore includes the ability to identify developmental stages, provide scaffolding at the right moment, and design tasks that make growth visible without overdetermining the process.

In this sense, Future Skills Literacy for trainers is closely linked to what may be called **development-sensitive pedagogy**. Trainers need to understand where learners currently stand, what kind of challenge is developmentally appropriate, how support can be differentiated, and how reflection can help transform experience into durable competence. This is especially important in dual, hybrid, and research-based settings such as those created in HUCO, where learners move between institutional contexts and where competence development often becomes visible only across time and through multiple forms of evidence.

Such a perspective also changes how progress is understood. Learning is no longer measured solely by the reproduction of content or the completion of isolated tasks. Instead, progress becomes visible in a learner's increasing ability to act with judgment, autonomy, adaptability, and responsibility in more complex situations. Trainers who are literate in Future Skills development therefore need to be attentive not only to what learners know, but to how they grow in their capacity to deal with ambiguity, integrate perspectives, and move productively between knowledge, practice, and reflection.

4.4 Experiential Learning as the Core Medium of Future Skills Development

If Future Skills are processual and context-dependent, then they require learning environments in which learners can act, experience, test, fail, revise, and reflect. This makes **experiential learning** central to Future Skills development. In the HUCO context, this is not a marginal methodological preference, but a structural necessity.

Technical and innovation-oriented competences cannot develop meaningfully through abstract instruction alone. Learners must encounter authentic or near-authentic situations in which they are required to mobilise knowledge, collaborate with others, interpret complexity, and make decisions under real constraints. Company-based challenges, inquiry-based tasks, prototyping settings, applied research activities, design sprints, and collaborative project work are therefore not simply attractive pedagogical formats. They are the primary developmental medium through which Future Skills can emerge.

At the same time, experience alone is not enough. Experience becomes educationally meaningful only when it is pedagogically structured. Trainers must therefore know how to turn practical activity into competence development. This includes selecting or designing suitable tasks, sequencing challenge levels, framing reflection, making criteria visible, encouraging articulation of reasoning, and connecting concrete experiences with wider conceptual, ethical, and strategic questions.

This point is strongly aligned with the Future Skills perspective developed by Ehlers. Future Skills involve self-organisation, agency, and responsible action in emergent contexts (Ehlers, 2020). Such capacities cannot be produced by transmissive teaching alone. They require learning settings that create space for initiative, uncertainty, and interpretation, while also offering sufficient support and structure. In other words, trainers must be able to combine openness and scaffolding productively.

For the Train-the-Trainer Programme, this means that experiential learning must be addressed on two levels. First, trainers need to understand why experiential, challenge-rich environments are important for learner development. Second, they must themselves experience and reflect on such environments during the programme. The professional development of trainers should

mirror the pedagogical logic they are later expected to enact. If trainers are expected to design competence-rich innovation environments for learners, they should themselves participate in professional learning formats that involve reflection, experimentation, collaborative design, and transfer into their own contexts.

Experiential learning is particularly valuable for Future Skills development because it links cognition, action, and reflection. It allows learners to experience the consequences of decisions, the complexity of collaboration, the challenge of incomplete information, and the productive role of iteration. In technical education, such experiences are indispensable because innovation competence cannot emerge from conceptual understanding alone. It develops when learners are invited to test ideas, confront constraints, evaluate alternatives, and rethink their assumptions in light of outcomes.

For trainers, this means that pedagogy must be designed around **meaningful developmental experiences** rather than around content blocks alone. The design of such experiences requires a high level of professional judgment. Tasks must be authentic without becoming overwhelming; open enough to invite agency, but structured enough to support progression; technically relevant, but also pedagogically purposeful. Trainers who develop Future Skills Literacy are therefore able to recognise that the quality of learning does not depend solely on curricular content, but on the architecture of experience in which learners engage.

4.5 Future Skills Literacy as Trainer Professionalism

A particularly important insight of the Future Skills Literacy perspective is that it is not just an individual cognitive ability. It is a structured professional and organisational capability that emerges through reflection, discourse, and institutionalisation. High levels of Future Skills Literacy are visible where actors do not simply adopt competence frameworks, but develop the ability to analyse, adapt, and redesign competence architectures over time (Ehlers, 2024).

Transferred to trainer professionalism, this means that excellent trainers of the future are not merely methodologically competent facilitators. They are reflective professionals who can:

- interpret and contextualise competence frameworks,
- recognise the normative assumptions embedded in them,
- connect competence development to technological, organisational, and societal transformation,
- design learning environments that support adaptive, reflective, and collaborative learning,
- and continuously revise their own pedagogical assumptions in light of experience and feedback.

This is where the concept of **Future Skills Literacy for Trainers of the Future** becomes especially powerful. It does not define trainer professionalism as the stable possession of a toolbox. Rather, it defines it as the capacity to continuously redesign the architecture of learning in response to changing competence demands.

A useful distinction can be made here between a **training culture** and a **competence culture**. In a training culture, the central question is: "Who has to learn what?" In a competence culture, the deeper question becomes: "How do we design the architecture of collective learning?" (Ehlers, 2024). This distinction can be directly translated into trainer education. The train-the-trainer programme should not merely ask what methods trainers should learn. It should ask how trainers can become capable of shaping learning architectures that allow future-oriented competences to emerge.

In this sense, trainer professionalism becomes a form of **second-order professionalism**. It includes not only the ability to act competently within established pedagogical routines, but also the ability to reflect on what competence means, how it changes, and how pedagogical environments must be reconfigured accordingly. This is particularly relevant in technically advanced and innovation-driven educational settings, where technological change, AI, sustainability challenges, and institutional hybridity constantly reshape the conditions of learning.

Such professionalism also implies epistemic humility and pedagogical openness. Trainers can no longer assume that one fixed pedagogical logic will remain sufficient. Instead, they need to develop the capacity to learn continuously, to interpret emerging developments critically, and to reframe their own teaching practices in relation to changing contexts. Future Skills Literacy thus becomes both a pedagogical and a professional orientation: a way of understanding trainer identity in times of accelerated transformation.

4.6 Implications for the HUCO Train-the-Trainer Programme

The concept of Future Skills Literacy has several direct implications for the design of the HUCO Train-the-Trainer Programme.

First, the programme should explicitly position trainer development as more than methodological upskilling. It should be framed as the development of a meta-level capability: the ability to recognise, interpret, and shape competence development in complex technical learning environments.

Second, the programme should integrate reflection on competence frameworks, not as an abstract theoretical exercise, but as part of trainer professionalism. Trainers should be enabled to understand how competence models such as TRIComp, Future Skills, and AI-related competence models function as interpretive and design resources. At the same time, they

should be encouraged to reflect critically on contextual appropriateness, pedagogical implications, and normative assumptions.

Third, the programme should place strong emphasis on the **design of learning environments**. If Future Skills develop through structured experience, collaboration, inquiry, and reflection, then trainer competence must centre on the ability to create exactly such settings. This includes challenge design, project supervision, reflective scaffolding, integration of workplace learning, competence-oriented assessment, and the use of digital tools to support collaborative learning.

Fourth, the programme should cultivate the trainer's ability to think in developmental rather than merely instructional terms. This means understanding competence growth over time, recognising progression, supporting transfer across contexts, and making learning visible through meaningful documentation and assessment.

Fifth, the programme should strengthen the trainer's ability to work with uncertainty and transformation. Since technical education increasingly takes place under conditions shaped by AI, digitalisation, sustainability pressures, and changing industrial practices, trainers need to become confident in designing learning for contexts that are themselves evolving. This requires the ability to think in scenarios, to work with emerging rather than fully stabilised competence requirements, and to support learners not despite uncertainty, but through it.

Finally, the programme should itself model the kind of literacy it aims to foster. It should not simply teach about Future Skills Literacy; it should embody it. Trainers should engage in collaborative reflection, analyse cases, redesign learning activities, discuss tensions and dilemmas, and develop implementation concepts that connect pedagogical principles with their own institutional realities.

4.7 Operational Conclusion

Future Skills Literacy for Trainers of the Future provides a strong conceptual foundation for the HUCO Train-the-Trainer Programme. It shifts attention away from the search for the supposedly correct competence list and towards the more important pedagogical and professional question of how trainers can become capable of shaping competence development under conditions of uncertainty, transformation, and complexity. The focus is therefore not only on competences to be developed by learners, but on the literacy of trainers to design, facilitate, supervise, assess, and continually reconfigure the learning architectures in which those competences emerge.

In the HUCO context, this is especially relevant because innovation-oriented technical education demands far more than the delivery of technical content. It requires trainers who can design authentic and reflective learning environments, mediate between institutional and industrial contexts, support developmental processes, and act as second-order professionals able to think not only within competence frameworks, but also about them. Future Skills Literacy

therefore becomes a key dimension of trainer professionalism in the age of research-based, innovation-driven, and transnational technical education.

At the same time, this perspective broadens the understanding of trainer competence itself. Trainers are no longer seen only as implementers of predefined programmes, but as active contributors to the continuous shaping of pedagogical and competence architectures. Their professionalism lies not only in facilitating learning effectively, but in ensuring that the environments in which learning occurs remain responsive to changing technological, organisational, and societal conditions. In this sense, Future Skills Literacy is not a peripheral refinement of trainer education. It is one of its central foundations.

5 Pedagogical Approach of the Train-the-Trainer Programme

This chapter explains the pedagogical approach underpinning the Train-the-Trainer Programme. It sets out the rationale, core educational principles, and methodological orientations through which the programme prepares trainers for research-based, innovation-oriented, and dual learning environments.

5.1 Pedagogical Rationale

The Train-the-Trainer programme is designed to prepare educators, mentors, and company-based trainers for the implementation of learning environments that differ fundamentally from traditional models of technical education. The HUCO training pathways do not focus solely on the transmission of technical content. Instead, they are based on the assumption that innovation competences emerge through active engagement with complex challenges, real-world industrial contexts, collaborative experimentation, and inquiry-based problem solving.

This pedagogical shift requires a corresponding evolution in trainer roles. In the HUCO model, teachers are not primarily positioned as transmitters of predefined knowledge, but as facilitators of learning, coaches of inquiry processes, mediators between theory and practice, and co-designers of research-oriented learning environments. Company mentors, in turn, are not only providers of work placements or practical exposure, but active pedagogical partners contributing to supervision, contextualisation, formative feedback, and competence development in authentic professional settings.

Crucially, industrial mentors and teachers are expected to develop the ability to work collaboratively, coordinating their efforts to co-intervene across sessions. By synchronizing their guidance and jointly shaping learning experiences, they ensure that the integration of theoretical and practical perspectives is seamless, fostering richer, more coherent learning for participants.

The pedagogical design of the Train-the-Trainer programme therefore follows two overarching principles. First, the programme must mirror the pedagogical logic of the HUCO training

pathways themselves. Trainers should experience, reflect on, and apply the same types of learning arrangements that they are later expected to facilitate with students. Second, the programme must support a transition from content-centred teaching to competence-oriented learning design. This includes the ability to formulate learning outcomes, structure complex tasks, create productive collaboration between institutions and companies, and assess innovation-related competences in transparent and practice-relevant ways. Importantly, this competence-oriented approach applies not only to student training but also to the assessment of trainers themselves, ensuring that their development, facilitation skills, and ability to guide competence-based learning are evaluated and strengthened throughout the programme.

The uploaded module handbooks provide a strong foundation for this pedagogical approach. The Italian EQF 5 pathway, for example, already integrates active, competence-oriented learning designs, including inquiry-based learning, project-based learning, company-based feedback loops, and practical laboratory activities. The French EQF 6 pathway extends this logic into more research- and innovation-oriented forms of experimentation, especially through project modules such as Sprint Innovation, Industrial Design Jam and Digitalisation of the function design/FabLab. These pathway designs show that the train-the-trainer model must not be generic; it must be specifically aligned with the pedagogical demands of dual, research-based, and innovation-oriented technical learning environments.

5.2 Core Pedagogical Approaches

The Train-the-Trainer programme combines several complementary pedagogical approaches. These are not presented as isolated teaching methods, but as elements of a coherent pedagogical concept for developing R&D competences in technical education.

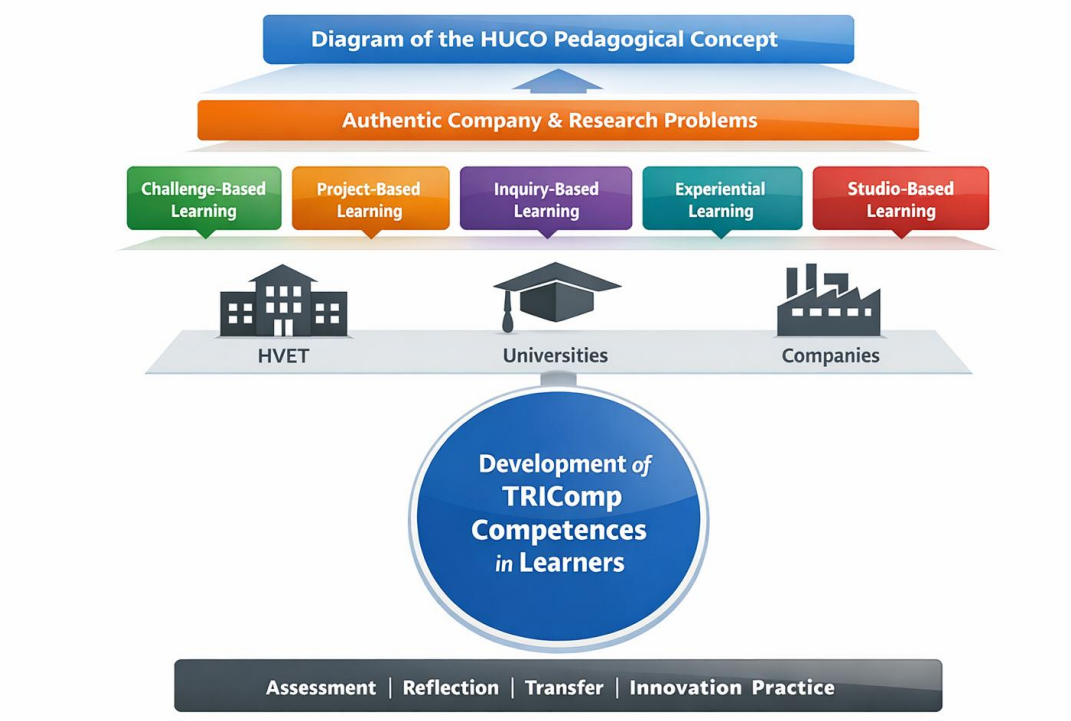

Figure 1-Diagram of HUCO Pedagogical Model (authors' own elaboration)

5.2.1 Challenge-Based Learning

Challenge-Based Learning (CBL) is particularly suited to the HUCO logic because it begins with real-world problems and invites learners to develop concrete responses to authentic challenges. CBL is defined as a guided-inquiry approach in which students use prior experience and case-based reasoning to construct solutions for complex, situated problems, rather than following a pre-determined content sequence (Gutiérrez-Martínez et al., 2021; van Erp, 2022).

In technical education, this means that students work on questions derived from industrial transformation processes, sustainability challenges, digitalisation tasks, or product and process innovation; such alignment with Industry 4.0 and sustainability objectives has been shown to increase relevance and student engagement (Gutiérrez-Martínez et al., 2021)

For trainers, this implies the ability to design learning activities that begin with a relevant challenge rather than with abstract content sequencing alone. Effective challenge-based learning (CBL) design requires trainers to formulate meaningful challenge prompts, scaffold team-based solution processes, integrate input from partner companies, and guide reflective debriefs that connect practical outcomes to underlying theoretical concepts (van Erp, 2022; Gutiérrez-Martínez et al., 2021).

A key component of this approach is Real Scenario Design: company mentors, who may not have prior pedagogical training, must be supported in transforming raw, complex technical problems

into structured, manageable learning projects. This process ensures that challenges remain educationally effective, balancing complexity with clarity, and preventing tasks from being either overwhelmingly intricate or reduced to purely operational exercises without substantial learning value.

Trainers must also balance openness and structure: challenges need to be authentic and complex, but still manageable within the educational setting. Research highlights that appropriate scaffolding and clear success criteria help maintain this balance, ensuring that tasks are sufficiently demanding to promote higher-order thinking while remaining achievable for learners (Gutiérrez-Martínez et al., 2021)

Challenge-Based Learning is especially relevant for modules such as the French Innovation Sprint and the Italian inquiry-based practical laboratories, which rely on authentic tasks, collaborative solution-finding, and iterative review processes.

A core responsibility for trainers is to ensure that challenges are designed following the principles of Universal Design for Learning (UDL). This involves creating flexible learning pathways that accommodate students with diverse educational backgrounds, language proficiencies, or physical and cognitive abilities. In the HUCO context, inclusion means providing multiple means of engagement and representation, ensuring that innovation-oriented tasks do not create barriers but rather leverage the diverse perspectives of the entire student group, ensuring that no learner is left behind in the transition to Industry 4.0.

5.2.2 Project-Based Learning (PBL)

Project-Based Learning (PBL) is a learner-centred methodology in which knowledge and skills are developed through the design and completion of projects that address authentic problems or challenges (Chen and Yang, 2019). Within the HUCO model, PBL represents a central pedagogical pillar, enabling learners to engage over an extended period in technically and organisationally meaningful tasks that result in concrete outputs, such as prototypes, technical reports, design concepts, workflow solutions, or process optimisation proposals.

PBL is particularly well suited to dual education systems, as it embeds learning within real workplace contexts and aligns closely with company needs. It promotes the practical application of knowledge, strengthens problem-solving capacity, and enhances learner motivation and long-term retention. In addition to technical competences, PBL fosters transversal skills such as teamwork, communication, and project management, which are essential in manufacturing and research and development (R&D) environments (Naseer et al.,2025).

The methodology is based on several key principles:

- Learning is practical and application-oriented, linking theory to real professional tasks.
- Collaboration is central, requiring learners to work in teams and develop coordination skills.
- Projects are grounded in real-world problems, ensuring relevance and transferability.
- Clear deliverables and acceptance criteria enable transparent and measurable assessment.

From a pedagogical perspective, trainers must be able to structure projects in ways that support both technical learning and transversal competence development. This includes defining project phases, establishing milestones, assigning meaningful roles, facilitating interdisciplinary collaboration, and assessing both product and process quality. Trainers are also expected to connect project work to broader competence frameworks such as TRIComp, including dimensions like project leadership, interdisciplinary collaboration, responsible research, and sustainability thinking.

Effective implementation of PBL follows a structured sequence aligned with professional project management practices. This includes defining learning outcomes based on qualification levels and company needs, identifying constraints (e.g., time, resources, safety, legal requirements), planning milestones and intermediate deliverables, conducting review stages to monitor progress, and assessing final outputs against predefined criteria. This structured approach enables trainers to manage project complexity while maintaining a clear pedagogical focus.

The relevance of PBL is reflected in the HUCO training pathways. In the Italian pathway, project-based elements are integrated into modules on applied R&D, prototyping, process optimisation, and inquiry-based laboratories. In the French pathway, project formats are prominently implemented in activities such as the Industrial Design Jam and the Innovation Sprint.

5.2.3 Inquiry-Based Learning (IBL)

Inquiry-Based Learning (IBL) is a pedagogical approach in which learners construct knowledge through questioning, investigation, data analysis, and evidence-based reasoning. (Korkman and Metin, 2021) Rather than receiving information passively, learners take on the role of active investigators, applying processes similar to those used in scientific and professional practice (Adhami and Taghizadeh, 2024)

IBL plays a central role in the HUCO model as it supports the development of research-oriented thinking and action. It is rooted in the constructivist tradition of John Dewey, who emphasised that learning emerges through active engagement with experience and reflective inquiry. Contemporary research further shows that IBL fosters deeper conceptual understanding and

strengthens learners' ability to generate and evaluate knowledge in technical education contexts.

This approach is particularly relevant in dual education systems, where critical thinking, curiosity, and methodological rigour are essential. IBL strengthens learners' ability to formulate meaningful questions, engage deeply with problems, and develop robust, evidence-based conclusions. It also supports the development of transferable competences such as analytical reasoning, problem formulation, and evidence-based decision-making.

The implementation of IBL follows a structured cycle:

- Identification of a relevant problem or phenomenon
- Formulation of researchable questions
- Design of the inquiry process (methods, variables, indicators)
- Systematic data collection and analysis
- Development of evidence-based conclusions
- Communication of results and reflective evaluation of both outcomes and process

Within this framework, trainers play a key role in stimulating curiosity and guiding inquiry processes. They must design authentic inquiry prompts, scaffold the research process while allowing for productive uncertainty, and support iterative reflection. Empirical studies highlight the importance of structured guidance and reflective debriefing for effective IBL implementation, particularly in engineering education contexts.

IBL can be operationalised through activities that closely mirror professional practice, including:

- Industrial case analysis, where learners evaluate alternative technical solutions
- Data-driven exploration, involving the analysis of experimental or operational datasets
- Process-design experimentation, where learners test and optimise technical systems

Examples from the HUCO context illustrate how IBL can be embedded across different subject areas:

- In Basic ICT and Digital Security, learners investigate how to protect sensitive corporate data by analysing threats and proposing security strategies.
- In Occupational Safety, students explore how modern technologies can minimise risks through evidence-based system design.
- In Technical English, inquiry is linked to communication challenges in international R&D teams, connecting language learning with real professional contexts.

These examples demonstrate that IBL can be effectively integrated even into traditionally content-driven modules, supporting the development of inquiry habits as a foundation for innovation.

5.2.4 Integrating Project-Based and Inquiry-Based Learning

Project-Based Learning and Inquiry-Based Learning are particularly effective when combined in a structured way, as this integration reflects the full sequence of professional practice in dual education systems. Typically, learning begins with inquiry—where learners analyse problems, formulate questions, and generate evidence—and then transitions into project work, where solutions are designed and implemented under real-world constraints.

In this integrated model:

- IBL supports understanding through questioning and evidence generation
- PBL enables the practical application of this understanding through solution development

This sequence mirrors real-world workflows in manufacturing and R&D, where diagnosis and analysis precede design, implementation, and testing. Examples include troubleshooting processes that lead to prototype development or environmental analyses followed by the design of remediation solutions.

The integration offers several advantages:

- It strengthens evidence-based practice by grounding decisions in data
- It creates a clear link between problem identification and solution development

- It enhances employability by reflecting authentic professional processes
- It supports quality assurance by combining methodological rigour with clearly defined deliverables and acceptance criteria

To support trainers in selecting the most appropriate methodology, Table 1 provides a decision matrix distinguishing between IBL, PBL, and hybrid approaches. While both methodologies have distinct strengths, their integration is often the most powerful model in dual contexts, where both rigorous inquiry and practical implementation are required.

This combined logic is further illustrated in Figure 2. (IBL–PBL Pipeline), which presents a structured workflow from inquiry (questions and evidence) to project execution (design, prototype, and assessment). The model emphasises traceability, alignment with evidence, and continuous improvement, ensuring that learning remains both academically rigorous and professionally relevant.

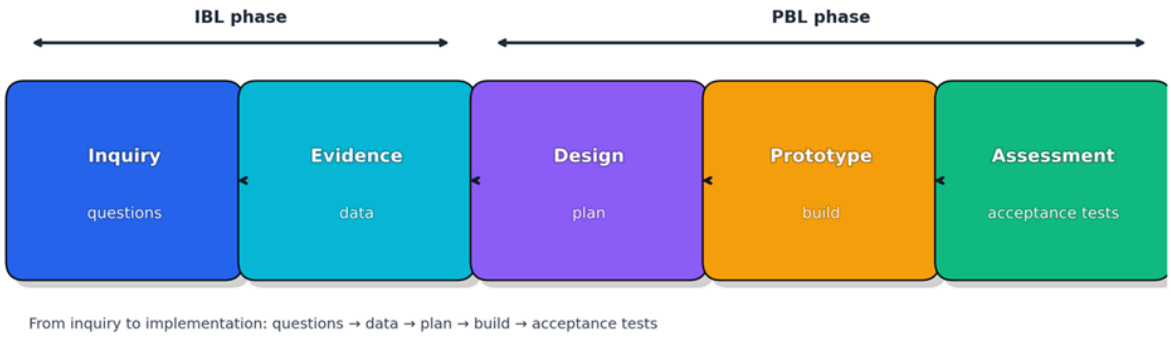

Figure 2- IBL to PBL pipeline (taken from Deliverable 5.3, credit goes to the authors of D.5.3)

5.2.5 Experiential Learning

Experiential learning is another foundational element of the HUCO pedagogical model. It is particularly relevant for work-based learning, internships, laboratory settings, prototyping phases, and design-oriented environments in which students learn through doing, testing, reflecting, and adapting. Experiential learning is rooted in Kolb's (1984) cyclical model, which comprises concrete experience, reflective observation, abstract conceptualisation, and active experimentation; this cycle enables learners to transform practical activity into deeper conceptual understanding (Radović et al., 2022).

For trainers, this means understanding how experience becomes learning. Practical exposure alone is not sufficient; learning requires guided reflection, conceptual framing, and re-

application. Trainers and mentors must therefore be able to structure experience-based tasks, facilitate reflection, and connect concrete action with broader concepts and competences. Guided reflection helps bridge the gap between practice and theory—a gap that internship programmes often leave unaddressed when they over-emphasise the practical component without systematic reflective activities (Stirling et al., 2017). Moreover, mentorship and structured reflection are identified as key components of successful work-based learning programmes, where learning coaches support students in articulating insights from workplace tasks and linking them to disciplinary knowledge (Mann et al., 2025). This is especially important in dual learning environments where students move between classroom, lab, and company settings, requiring intentional design that integrates authentic work experiences with academic scaffolding (Bouw et al., 2021).

Experiential learning is highly visible in both pathways, especially in internships, FabLab-based modules, and project modules. It is also crucial for trainers working with company partners, since many of the most meaningful learning processes occur in authentic work contexts rather than in traditional classroom settings. Research on integrative learning environments at the school-work boundary highlights that specific designs incorporating both incorporation and hybridisation of school and workplace elements foster the epistemic, spatial, instrumental, temporal and social conditions that support experiential learning across these contexts (Bouw et al. 2021) Source. Consequently, trainers must deliberately embed reflective prompts, conceptual discussions, and opportunities for re-application within internship and project activities to maximise the learning value of authentic work experiences (Stirling et al., 2017; Mann et al., 2025).

5.2.6 Studio-Based Learning

Studio-based learning (SBL) is especially effective for innovation-oriented technical education because it weaves together iterative development, peer feedback, coaching, rapid prototyping and structured critique into a single pedagogical loop. In a studio, learners begin with loosely defined ideas, create low-fidelity prototypes, test and refine them, and then present the evolving solutions for critique – a process that mirrors real-world product development cycles and has been shown to foster adaptive expertise in engineering students (Lande, et al., 2025). The frequent peer-to-peer critique sessions not only surface design issues early but also encourage students to articulate reasoning and negotiate design alternatives, which research identifies as a key driver of creative problem-solving and deeper conceptual understanding (Sopher et al., 2025; Süner-Pla-Cerdà et al., 2025).

For trainers, the shift from traditional lecturing to a studio mindset entail facilitating open-ended design processes without imposing premature solutions. Trainers must orchestrate iterative cycles by setting clear milestones, providing timely coaching, and curating critique sessions that

balance constructive challenge with psychological safety – an environment where learners feel free to experiment, fail, and iterate without fear of judgement (Whittle et al., 2014; Dors et al.,2020).

Effective facilitation includes:

- Designing iteration scaffolds (e.g., staged prototyping milestones that move from conceptual to functional to production prototypes) to guide learners while preserving autonomy (Lande, et al., 2025).
- Organising critique rituals that allocate equal speaking time to students and mentors, employ reflective questioning, and capture feedback in shared artefacts for later reference ((Sopher et al., 2025; Atkins et al., 2023).
- Embedding coaching moments that target specific skill gaps (e.g., material selection, modelling techniques) and reinforce the iterative mindset Source (Lande, et al., 2025; Fuchs et al., 2025)
- Cultivating a psychologically safe studio culture through explicit norms of respect, anonymity in early drafts, and encouragement of risk-taking, which research links to higher levels of creative output and learner-centred engagement (Dors et al.,2020; Mattioli et al., 2023).

These trainer competencies align directly with the students' project development. In the FabLab context, the studio's emphasis on rapid prototyping, hands-on material exploration and peer-driven feedback dovetails with the maker-culture ethos of FabLabs, enabling students to translate digital concepts into tangible artefacts while iterating based on real-time critique (Ryan et al., 2025). Similarly, product-development modules benefit from the studio's structured yet flexible workflow, which supports the translation of market-driven ideas into refined technical solutions through successive design-review loops and collaborative problem-solving (Süner-Pla-Cerdà et al., 2025; Fuchs et al., 2025).

5.3 Pedagogical Implications for Trainer Roles

The pedagogical approaches described above imply a significant redefinition of trainer roles. Within the HUCO ecosystem, trainers are expected to perform several functions simultaneously.

They are curriculum interpreters who translate broad competence frameworks into meaningful learning experiences. They are facilitators who organise collaborative inquiry and support productive team dynamics. They are methodological guides who structure problem-solving and research processes. They are mentors who accompany learners through uncertainty and

experimentation. And they are assessors who make complex competence development visible and evaluable.

Across all these functions, a critical competence, particularly for trainers coming from industry, is the didactic translation of real-world industrial problems. This requires the ability to deconstruct complex, everyday technical challenges into structured case studies and learning projects that are accessible and pedagogically effective for students, thereby ensuring that authentic industry contexts can be meaningfully integrated into learning processes.

This role complexity is one of the main reasons why a dedicated Train-the-Trainer programme is necessary. Many educators may already be highly competent in technical or disciplinary teaching, but less experienced in coaching innovation processes, guiding applied research tasks, or designing challenge-based and inquiry-based learning sequences. The HUCO programme therefore aims not only to inform trainers about new pedagogical concepts, but to enable them to enact these roles confidently and reflexively.

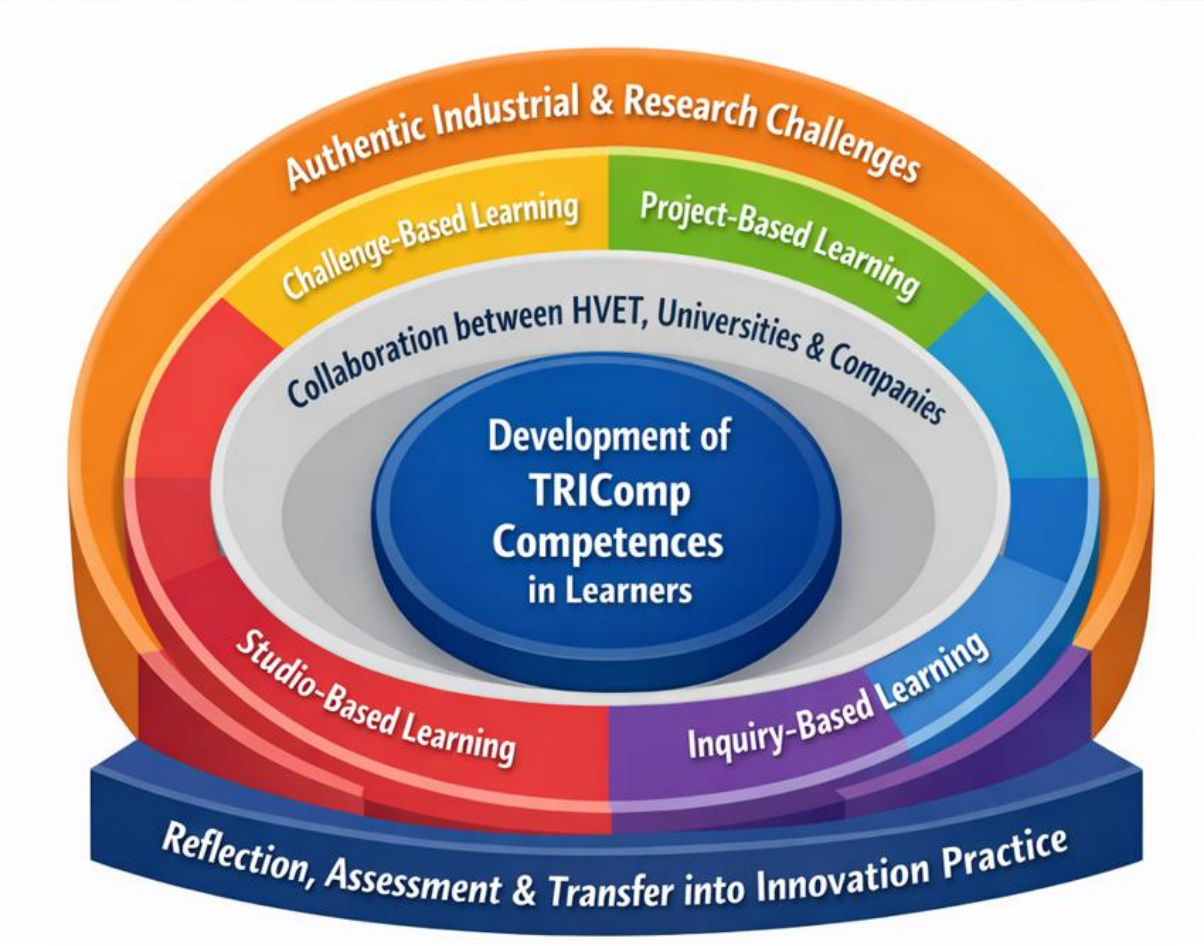

Figure 3-HUCO Pedagogical Model for Research-Based Learning (authors' own elaboration)

Trainers in the HUCO model are required to adopt a facilitative and mediating role that goes beyond formal instruction. In particular, they should be capable of supporting intercultural exchange processes and adapting to different educational cultures across partner countries. Prior practical experience in company settings is highly recommended, as it strengthens the trainer's ability to connect pedagogical approaches with real-world practices and to guide learners effectively in dual and applied learning environments.

6 Structure of the Train-the-Trainer Programme

This chapter outlines the structural design of the Train-the-Trainer Programme. It explains how the programme is organised in terms of delivery format, participant composition, and guiding design principles in order to support transnational, interprofessional, and practice-oriented trainer development.

6.1 General Design Principles

The Train-the-Trainer programme is conceived as a structured upskilling offer for approximately thirty participants from the HUCO consortium and associated partner environments. It is designed to be delivered later in the project as two online courses, thereby enabling broad participation across partner institutions and reducing barriers to access for company mentors and educators with ongoing professional responsibilities.

The programme structure follows six design principles.

First, it is transnational. Participants are drawn from different institutional and national backgrounds, including HVET institutions, higher education institutions, and companies. This reflects the HUCO cooperation model and ensures that the training itself becomes a space of European exchange and co-learning.

Second, it is interprofessional. The programme explicitly addresses different participant profiles, including vocational teachers, university lecturers, researchers involved in teaching, company mentors, and innovation managers. These groups bring different experiences and expectations, and one aim of the programme is to develop a shared pedagogical understanding across them.

Third, it is practice-oriented. The programme does not remain at the level of pedagogical theory but works through concrete cases, module examples, task formats, reflection on practice, and collaborative redesign of learning situations.

Fourth, it is competence-oriented. The focus is not only on what participants know about pedagogy, but on what they can do in designing, facilitating, and assessing innovation-oriented learning.

Fifth, it is transfer-oriented. Each participant should leave the programme not only with increased understanding, but with concrete materials, ideas, and implementation concepts that can be used within their own institutional and professional context.

Sixth and last, it is transformation-oriented. The programme incorporates a dedicated Change Management component designed to support senior educators and mentors in transitioning toward student-centered roles. It addresses the psychological and professional shift from being a “source of knowledge” to an “ecosystem facilitator.” By framing the “loss of lectern control” not as a reduction of authority, but as a strategic move to increase pedagogical effectiveness, the programme helps participants embrace their new role as coaches and mediators within the HUCO innovation environment.

6.2 Participant Profiles

The programme addresses four main participant groups.

HVET Teachers

These participants typically bring strong experience in technical teaching, curriculum implementation, and skills-oriented education. Their development needs may relate specially to research-based pedagogy, supervision of innovation projects, and coordination with universities and company mentors.

University Lecturers and Researchers

These participants often have strong academic and disciplinary expertise, but may have less experience in dual learning environments, vocational pedagogies, and work-based competence development. The programme supports them in understanding the logic of applied technical education and the practical realities of company-based learning.

Company Mentors and Trainers

These participants contribute strongly to the authenticity and relevance of learning, but may not always have formal pedagogical training. The programme supports them in mentoring students, structuring learning-rich work tasks, giving feedback, and collaborating with educational institutions as pedagogical partners.

Innovation Managers and Project Supervisors

These participants often operate at the interface between company development, organisational learning, and innovation implementation. Their participation can strengthen the link between education and innovation practice and support the transferability of the HUCO approach into company-based training environments.

Where possible, participants in the Train-the-Trainer Programme should bring strong prior experience from industry or applied research environments. Such experience is considered particularly valuable in the HUCO context, as it supports the integration of formal and informal learning processes and enhances the ability to operate across different organisational and cultural settings.

6.3 Overall Programme Architecture

The Train-the-Trainer programme consists of two online courses that are complementary in focus. Together, they guide participants from conceptual understanding to practical application in HUCO training.

Course 1 – Pedagogical Foundations for HUCO Trainers

This first course focuses on the conceptual and methodological foundations of the HUCO training model. It introduces the logic of TRIComp, the pedagogical approaches underpinning the learning pathways, and the specific role of educators and company mentors in dual and research-based settings.
Its main focus is on understanding:

- the HUCO competence architecture,
- the rationale of innovation pedagogy,
- the usage of appropriate English for instruction,
- the logic of challenge-, project-, and inquiry-based learning,
- the structure of dual learning environments, and
- the role of trainers in facilitating competence-oriented learning.

Course 2 – Design, Supervision, Assessment, and Transfer

The second course is more implementation-oriented. It focuses on the design of learning activities, the supervision of applied research and innovation projects, the assessment of innovation competences, and the transfer of learning into institutional practice.
Its main focus is on:

- designing learning sequences,

- supervising project and research work,
- assessing TRIComp-related competences,
- documenting learning outcomes, and
- building sustainable collaboration between educational institutions and companies.

Course Development and Delivery

- **Authors and Trainers:** Both courses are authored collaboratively by the HUCO project team, which includes pedagogical experts from [institution] and experienced HUCO trainers. Subject-matter specialists contribute to content on innovation pedagogy, competence assessment, and dual learning environments.
- **Work Sessions:** The development process is organized in iterative work sessions. Initial planning sessions define course objectives, content, and learning outcomes. Draft modules are reviewed in team workshops, with feedback from experienced trainers and pilot participants.
- **MOOC Delivery:** The courses will be delivered as interactive online modules (MOOCs) through the HUCO learning platform. Experienced HUCO trainers and facilitators will conduct live sessions, guide participants in project work, and moderate discussions. Asynchronous materials—videos, readings, and exercises—will support self-paced learning.

Together, the two courses form a structured progression: from understanding the pedagogical and conceptual foundations of HUCO (Course 1) to implementing, supervising, assessing, and transferring learning in practice (Course 2). This ensures that participants not only learn the theory but also gain practical experience in competence-oriented training.

6.4 Workload and Format

The programme is designed to be manageable for participants who are already working in demanding educational or professional contexts. It therefore combines synchronous and asynchronous elements.

The structure can be described as follows:

- synchronous online sessions for input, discussion, and collaborative work,

- asynchronous preparation and reflection phases,
- case-based and practice-based assignments,
- peer exchange activities,
- and final transfer tasks or implementation concepts.

The two-course model allows participants to build competence step by step rather than being overloaded in a single intensive format. It also supports iterative reflection between course phases.

A realistic model for implementation would foresee the following:

- Course 1: 12–15 hours total workload
- Course 2: 12–15 hours total workload
- Total programme workload: approximately 24–30 hours.

This format is substantial enough to support real professional development, but still feasible within the Erasmus+ project context; they can be revised after an initial pilot to adapt feedback and suggestions from Trainers and Students respectively.

Table 2- Train-the-Trainer-Programme Structure

Course	Focus	Main Topics	Format	Estimated Participants
Course 1	Foundations	TRIComp, innovation pedagogy, challenge- and inquiry-based learning, dual learning environments	Online	Approx. 30
Course 2	Application	Supervision, assessment, teaching design, digital collaboration, transfer into practice	Online	Approx. 30

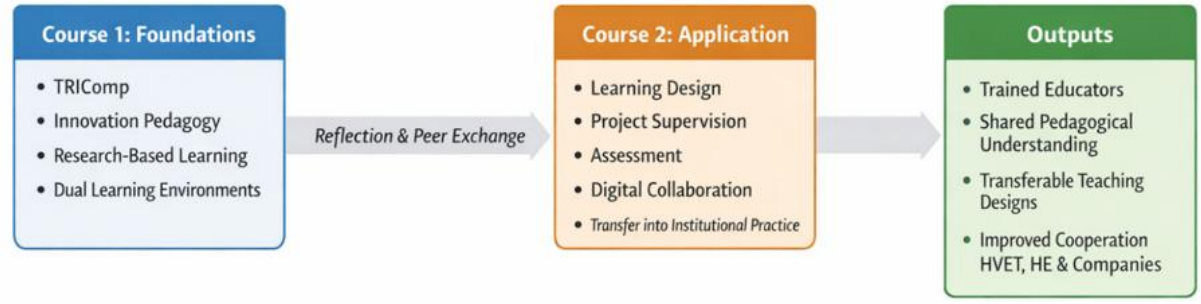

Figure 4- Train-the-Trainer Programme Structure (authors' own elaboration)

6.5 Trainer Passport and Recognition of Trainer Competence

To complement the competence-oriented design of the Train-the-Trainer programme, the HUCO model introduces a Trainer Passport (see also D5.3-Handbook for Training implementation quality insurance) as a structured instrument for documenting, validating, and communicating trainer competences. The Trainer Passport serves as a concise yet evidence-based record of a trainer's capabilities, supporting transparency, recognition, and mobility across institutions and organisations within the HUCO ecosystem.

The passport is designed as a living document, allowing partner organisations to quickly understand a trainer's qualifications, areas of expertise, and scope of responsibility. It includes:

- a competency map aligned with the HUCO maturity model,
- selected key artefacts from the trainer's e-portfolio,
- observation reports and moderation evidence,
- a continuous professional development (CPD) log,
- and, where relevant, role and scope descriptions, external sampling results, and exemplar contributions.

A typical Trainer Passport provides a structured overview of:

- the trainer's current competence level and target development level,
- the date of the last review,

- evidence of methodological strengths (e.g., inquiry protocols or assessment formats),
- moderation cases demonstrating reliable judgement,
- completed modules and micro-credentials,
- documented quality improvement actions (e.g., closed CAPA processes),
- authorised responsibilities (e.g., facilitation roles or assessment responsibilities),
- technical areas or processes the trainer is qualified to supervise,
- and the contexts (e.g., languages or sites) in which the trainer is able to operate.

Format and Governance

The Trainer Passport follows a "summary plus evidence" model, consisting of:

- a concise summary document (typically two pages),
- complemented by links to verifiable, view-only evidence stored in the trainer's e-portfolio.

It is issued by the responsible training provider or a joint governance body and includes key metadata such as a unique identifier, issuing organisation, EQF alignment, and issue or update dates. All documented competences must be evidence-based rather than self-declared, ensuring reliability and comparability across the HUCO network.

Lifecycle and Updating

The Trainer Passport is continuously updated based on relevant professional activities, such as:

- observed teaching or supervision practice,
- participation in moderation or quality assurance processes,
- completion of new modules or micro-credentials,
- or documented quality improvement actions.

As a general principle, competences that have not been evidenced within a period of 24 to 36 months should be refreshed through new documented practice. The passport is designed to be

portable, allowing trainers to carry their validated competences across institutions, while ensuring compliance with confidentiality, intellectual property, and data protection regulations.

Use within the HUCO Ecosystem

The Trainer Passport supports multiple functions within the HUCO model, including:

- staffing decisions and role allocation,
- assignment of trainers to modules and learning activities,
- quality assurance and external sampling processes,
- recognition of prior learning and professional development,
- and peer mentoring within the Community of Practice.

Overall, the Trainer Passport strengthens the competence-oriented approach of the Train-the-Trainer programme by making trainer capabilities visible, evidence-based, and transferable, thereby supporting both individual professional development and the long-term sustainability of the HUCO pedagogical ecosystem.

7 Training Modules

This chapter outlines the module structure of the Train-the-Trainer Programme. It explains how the programme is organised into competence-oriented modules that translate the pedagogical, organisational, and innovation-related requirements of the HUCO ecosystem into a coherent pathway for trainer development.

7.1 General Logic of the Module Design

The Train-the-Trainer programme is organised into five modules. These modules do not simply mirror the thematic sections of the HUCO deliverables; rather, they translate the overall project logic into a coherent educator development pathway.

Each module is competence-oriented and linked to specific tasks that trainers are expected to perform in the HUCO ecosystem. The modules are designed to balance conceptual understanding, analysis of concrete cases, reflective exchange, and practical application to participants' own teaching or mentoring contexts. Furthermore, the programme design incorporates Double-Loop Learning principles, encouraging trainers to question their underlying pedagogical assumptions through international peer-to-peer exchange. It also embraces the concept of Physical Training, preparing tutors to bridge the gap between digital collaboration and the physical reality of the production floor.

The five modules are:

1. Research-Based Learning in Technical Education
2. Supervising Innovation and R&D Projects
3. Dual Training Models and Industry Collaboration
4. Assessment of Innovation Competences
5. Digital Tools for Collaborative Learning

7.2 Module 1 – Research-Based Learning in Technical Education

This module introduces the conceptual foundations of research-based learning in technical and vocational education. It explores how students can be guided to move from problem identification to inquiry, investigation, interpretation, and solution development.

The module draws on examples from the HUCO pathways where inquiry-based designs are already explicitly described. The Italian handbook offers several such examples, showing how inquiry questions can be formulated in technically meaningful ways. These examples are highly useful for the trainer programme because they demonstrate that inquiry is not limited to academic research contexts; it can also be embedded in practical technical modules such as digital security, occupational safety, communication, or technical English.

The goals of this module are:

- to understand the rationale of research-based learning,
- to distinguish it from purely transmissive teaching,
- to identify inquiry-friendly elements in technical modules,
- and to design small research-based learning tasks in participants' own contexts.

Typical learning activities include:

- analysis of exemplary module descriptions,
- redesign of traditional teaching sequences into inquiry-based tasks,
- and reflection on student support in open-ended learning processes.

7.3 Module 2 – Supervising Innovation and R&D Projects

This module focuses on the supervision of applied research, innovation projects, design tasks, and project-based learning formats.

It is especially informed by the French pathway, where modules such as the Innovation Sprint, Industrial Design Jam, and Digitalisation of the Design Function demand intensive coaching, iterative project support, and interdisciplinary team guidance. These formats require trainers to accompany not only technical work, but also ideation, prioritisation, documentation, pitching, team coordination, and interaction with company feedback.

The goals of this module are:

- to understand the trainer role in innovation-oriented projects,
- to structure supervision processes,
- to facilitate team-based project learning,
- and to support experimentation and prototyping processes productively.

Typical learning activities include:

- supervision case analysis,
- design of milestone structures for projects,
- coaching simulations,
- and reflection on common tensions in project supervision, such as balancing autonomy and guidance.

7.4 Module 3 – Dual Training Models and Industry Collaboration

This module addresses the pedagogical and organisational logic of dual learning environments. It is especially relevant because the HUCO pathways rely on systematic cooperation between training institutions and companies.

The Italian handbook explicitly formulates a cooperation model in which HVET institutions provide the pedagogical framework and tutoring, universities contribute research-related and theoretical foundations, and companies deliver a major share of practical and applied training. The French pathway also integrates company roles strongly, especially in project modules and the professional experience component.

The goals of this module are:

- to understand the structure of dual and collaborative learning environments,
- to clarify trainer and mentor roles across institutional settings,
- to improve communication and coordination between educational and company actors,
- to develop the ability to deconstruct real-world technical scenarios into manageable educational modules,
- English for Instruction" skills, moving beyond general language proficiency to the specific ability of leading technical workshops in international contexts
- and to design learning activities that remain coherent across classroom, lab, and company phases.

Typical learning activities include:

- mapping local cooperation arrangements,
- analysing company roles in the existing HUCO modules,
- developing shared supervision and feedback concepts,
- and working on scenarios of institutional coordination.

7.5 Module 4 – Assessment of Innovation Competences

This module focuses on the assessment of competences that are central to HUCO but often difficult to evaluate through traditional methods. These include, for example, creative problem-solving, interdisciplinary collaboration, sustainability thinking, project leadership, and applied innovation research.

Because the HUCO pathways are based on TRIComp, assessment must move beyond factual recall and capture the ability to act in complex and dynamic contexts. This means that trainers need methods for assessing not only technical outputs, but also process quality, reasoning, communication, and collaboration. At the same time, they must develop the capacity to design and carry out evidence-based assessment processes that ensure validity, transparency, and reliability of judgments.

The goals of this module are:

- to understand competence-oriented assessment principles,
- to align assessment with learning outcomes and pedagogy,
- to develop assessment tools for innovation-oriented tasks,
- to apply evidence-based approaches to assessment design and decision-making, and
- to combine academic and company-based perspectives on evidence of learning.

Typical learning activities include:

- analysis of current assessment formats from the module handbooks,
- development of simple rubrics,
- reflection on practice reports, portfolios, prototypes, and presentations as evidence,
- discussion of joint assessment models with company mentors, and
- application of criteria to ensure evidence-based, transparent, and consistent assessment practices.

7.6 Module 5 – Digital Tools for Collaborative Learning

The final module addresses the use of digital tools to support collaboration, communication, hybrid learning, and project supervision in the HUCO ecosystem.

Because the programme itself will later be implemented in online format, participants should not only learn about digital tools conceptually but also experience how they can support collaborative pedagogies. This includes shared workspaces, structured communication tools, collaborative design platforms, digital reflection tools, and mechanisms for remote peer exchange.

The goals of this module are:

- to strengthen participants' confidence in digital collaborative teaching,
- to identify suitable tools for hybrid and transnational training contexts,
- to connect digital tools with pedagogical aims rather than using them as isolated add-ons,

- to facilitate Double-Loop Learning through international cooperation, allowing trainers to reflect on and adapt their teaching methodologies based on diverse European practices.
- and to support sustainable cross-institutional exchange.

Typical learning activities include:

- guided exploration of digital platforms,
- small collaborative assignments,
- peer-sharing on digital teaching practice,
- Peer-to-Peer Shadowing assignments: structured virtual or physical observation sessions (e.g., an Italian trainer shadowing a French colleague) to compare and absorb different field-based methodologies.
- and design of digitally supported learning sequences.

Table 3-Learning Outcomes of the Programme

Module	Main Learning Outcomes for Participants	Indicators of Trainers' Success
Research-Based Learning in Technical Education	Participants can design inquiry-based and research-oriented learning tasks in technical education	Number of learning tasks successfully implemented; student feedback on engagement and relevance
Supervising Innovation and R&D Projects	Participants can structure and coach innovation-oriented project work	Number of projects translated into structured learning challenges; feedback from students and company mentors
Dual Training Models and Industry Collaboration	Participants can coordinate learning across HVET, HE, and company settings	Evidence of synchronized co-teaching sessions; satisfaction ratings from students and partner organizations

Assessment of Innovation Competences	Participants can assess TRIComp-related competences using suitable tools and evidence formats	Number of competence assessments completed; quality of feedback provided; alignment with TRIComp framework
Digital Tools for Collaborative Learning	Participants can use digital tools to support hybrid, collaborative, and transnational learning and engage in Double-Loop Learning through Peer-to-Peer Shadowing and international exchange.	Frequency and quality of digital tool usage; peer/shadowing feedback; documented improvements in collaborative learning processes

8 Implementation of the Training Programme

This chapter outlines the implementation model of the Train-the-Trainer Programme. It describes the delivery format, learning activities, and practical arrangements through which the programme is translated from pedagogical design into a transnational professional development offer.

8.1 Delivery Format

The Train-the-Trainer programme will be delivered as two online courses within the framework of Work Package 4 (TESTING OF THE HUCO ECOSYSTEM TRAINING OFFER). Alternatively, the HUCO Labs Consortium could create a video that explains the HUCO Labs approach and can be viewed by prospective Trainers in their own time. This format is explicitly aligned with the project plan and enables the participation of educators and mentors from different countries and institutional contexts.

The online format is not merely a logistical compromise. It also reflects the project's emphasis on transnational exchange, digital collaboration, and the development of a European community of practice around research-based technical education.

Each course combines:

- synchronous online workshops,
- asynchronous preparation and follow-up,
- collaborative activities,

- case-based discussion,
- and reflective tasks.

This blended online format supports both flexibility and depth.

8.2 Learning Activities

The implementation model combines several types of learning activities.

Interactive Input Sessions

Short expert inputs provide conceptual orientation and connect the programme to the broader logic of the HUCO project, including TRIComp, module architecture, and pedagogical design principles.

Case-Based Workshops

Participants work with concrete cases derived from the Italian and French module handbooks (D.2.2), analysing how learning activities are structured and how they can be adapted, transferred, or improved.

Peer Exchange

Participants share experiences from their own institutional settings, compare teaching and mentoring practices, and reflect on differences between national and institutional models.

Collaborative Design Activities

Small groups co-design learning tasks, supervision concepts, or assessment formats that can be used in the HUCO implementation phase.

Reflective Transfer Tasks

Participants are asked to relate the programme content to their own practice and develop transfer ideas for implementation in their own institution or company context.

8.3 Roles of Partners in Delivery

The Train-the-Trainer programme should itself reflect the HUCO cooperation logic. According to the project plan, delivery responsibility for the two online training courses lies with CMQ MSI, with contributions from all project partners. In substantive terms, this means that the programme is designed to draw on the complementary expertise of HVET partners, higher education institutions, and company-based actors. HVET partners contribute expertise in competence-oriented vocational pedagogy, dual learning structures, and practical training design. Higher education partners contribute perspectives on research-based learning,

academic standards, and the supervision of inquiry and project work. Company partners contribute authentic innovation cases, mentoring perspectives, and practical knowledge about industrial research and transformation environments. This shared delivery model is pedagogically important because it demonstrates the collaborative approach that the HUCO project aims to institutionalise more broadly.

9 Assessment and Certification

This chapter outlines the assessment and certification approach of the Train-the-Trainer Programme. It explains how participants' learning is evaluated and recognised in ways that reflect the programme's focus on pedagogical application, reflective practice, and transfer to HUCO-related educational and professional contexts.

9.1 Rationale for Assessment in the Train-the-Trainer Programme

The assessment concept of the Train-the-Trainer programme is aligned with the overall pedagogical logic of the HUCO project. Since the programme does not merely aim to transmit declarative knowledge about pedagogy, but to enable participants to design, facilitate, supervise, and assess innovation-oriented learning processes, its own assessment strategy must also be competence-oriented.

This means that participants are not assessed primarily on their ability to reproduce theoretical concepts, but on their capacity to apply those concepts to educational practice. The assessment approach therefore focuses on participants' pedagogical judgment, their ability to translate the HUCO framework into practice, and their capability to reflect critically on their own trainer role in research-based and dual learning environments.

The module handbooks and pathway concepts developed within HUCO strongly supports this orientation. Both the Italian and French pathway documents emphasise practical outputs, project work, applied problem-solving, and competence development rather than purely content-based examination. The Train-the-Trainer programme follows the same philosophy by making pedagogical application and reflective transfer the centre of assessment (Cheviet and Didier, 2026; Patella and Romanini, 2026).

9.2 Principles of Assessment

The assessment strategy for the programme is built on five core principles.

First, the assessment is authentic. Participants are asked to work on tasks that reflect the actual pedagogical challenges they face in HUCO-related contexts, such as designing learning sequences, developing supervision concepts, or creating assessment tools for innovation-oriented modules.

Second, the assessment is development-oriented. The purpose is not only to verify achievement, but to support the further development of participants as trainers and mentors. Assessment therefore includes formative elements, especially peer feedback and iterative refinement.

Third, the assessment is practice-based. Outputs are directly linked to concrete educational settings rather than abstract theoretical exercises.

Fourth, the assessment is reflective. Participants are expected to articulate the pedagogical reasoning behind their decisions, reflect on challenges, and position their learning in relation to their own institutional context.

Fifth, the assessment is transfer-oriented. The programme aims to generate outputs that can later be used in the implementation of the HUCO pathways.

9.3 Assessment Instruments

The Train-the-Trainer programme combines several complementary assessment instruments.

Reflective Portfolio

Each participant develops a reflective portfolio documenting their learning progress, pedagogical insights, and developing understanding of the HUCO training model. The portfolio can include short reflections on course content, commentary on case studies, notes on peer exchange, and reflections on transfer possibilities within the participant's own institution or company.

The reflective portfolio is implemented as a structured, digital tool within the HUCO learning platform. Participants are guided through specific prompts and milestones for reflection at each stage of the courses. For example:

- **Weekly reflections** on course modules or case studies, supported by guiding questions.
- **Peer exchange entries**, where participants comment on or discuss each other's insights.
- **Integration of applied work**, such as documentation of supervised projects or transfer attempts within their own institution or company.
- **Instructor feedback**, where facilitators provide targeted guidance on reflections and progress.

This approach ensures that the portfolio is both reflective and actionable, supporting pedagogical self-awareness while linking professional development directly to practice. It allows participants to track growth, identify areas for further development, and plan concrete steps for applying HUCO principles in their own teaching or mentoring contexts.

Teaching or Mentoring Design Proposal

A central summative element of the programme is the development of a teaching or mentoring design proposal. This output requires participants to translate the HUCO pedagogical logic into a concrete implementation concept.

Depending on the participant's profile, this proposal may take different forms, for example:

- a redesigned learning sequence for an existing module,
- a supervision concept for an innovation project,
- an assessment plan for competence-based learning,
- or a company mentoring concept for work-based learning phases.

This proposal functions as the main transfer product of the programme.

Peer Feedback

Peer feedback is an important part of the programme's assessment logic. Participants are expected to discuss draft ideas, provide structured feedback to each other, and refine their concepts in dialogue with colleagues from other institutions and countries. This supports not only improvement of the products, but also the development of a community of practice.

Participation in Collaborative Activities

Because the programme places strong emphasis on exchange, collaborative design, and interprofessional dialogue, active participation in workshops and joint tasks is also an important aspect of the overall learning process. Participation should not be understood as mere attendance, but as meaningful engagement in collaborative activities.

9.4 Certification and Micro-Credentials

The Train-the-Trainer programme should culminate in a formal recognition of participation and learning achievement. In line with the broader HUCO approach to micro-credentials and competence-oriented certification, the programme may award micro-credentials for specific trainer competences developed during the courses.

To ensure harmonization across countries, these micro-credentials are designed according to shared European principles for transparency and comparability (e.g., learning outcomes, workload, and competence levels). At the same time, they are adaptable to national contexts:

- Each partner institution aligns the micro-credentials with its **national qualification frameworks** and existing professional development structures.

- The defined competences (e.g., based on TRIComp) serve as a **common reference**, while allowing flexible integration into local certification or training systems.
- Where possible, micro-credentials can be **recognized, stacked, or embedded** within existing Train-the-Trainer programmes or institutional accreditation schemes.

This dual approach, **shared standards with local adaptation**, ensures that the micro-qualifications are both internationally comparable and nationally relevant, supporting their practical use within different education and training systems.

Possible credential areas include:

- innovation pedagogy,
- supervision of applied research and innovation projects,
- dual learning environment facilitation,
- competence-oriented assessment,
- and digital collaborative teaching.

Such micro-credentials would be particularly useful because they make the professional development of trainers visible and portable across institutional contexts. They also support the project's long-term ambition to create sustainable ecosystems of collaboration and recognition.

Table 4-Assessment Elements of the Train-the-Trainer Programme

Assessment Element	Purpose	Evidence
Reflective Portfolio	Document learning development and pedagogical reflection	Reflection entries, case notes, transfer reflections
Teaching/Mentoring Design Proposal	Demonstrate practical application of programme learning	Learning design, mentoring concept, supervision plan
Peer Feedback	Support iterative development and collaborative learning	Feedback forms, comments, revision evidence
Participation in Collaborative Activities	Show active engagement in joint professional development	Contributions to workshops, discussions, group tasks

10 Integration into the HUCO Ecosystem

This chapter outlines the function of the Train-the-Trainer Programme within the broader HUCO ecosystem. It explains how the programme contributes to pedagogical alignment, supports the implementation of the pathway modules, strengthens cooperation between educational institutions and companies, and fosters a transnational community of practice.

10.1 Function of the Train-the-Trainer Programme within the Ecosystem

The Train-the-Trainer programme is not an isolated professional development offer. It is a structural element of the HUCO ecosystem and contributes directly to the effective implementation of the project's training architecture. The HUCO ecosystem is based on the collaboration of HVET institutions, higher education institutions, and companies. This cooperation is not limited to administrative arrangements or curriculum design. It also requires shared pedagogical understanding, aligned expectations regarding supervision and assessment, and a common language for competence development across institutional boundaries. The Train-the-Trainer programme addresses precisely this need. It creates a structured space in which educators and company mentors from different contexts can develop a shared understanding of:

- the TRIComp competence framework,
- the pedagogical logic of the HUCO pathways,
- the design of research-based and innovation-oriented learning,
- and the practical implications of dual and transnational collaboration.

By doing so, the programme strengthens the pedagogical coherence of the ecosystem.

10.2 Contribution to Module Implementation

The HUCO module handbooks for the Italian EQF 5 and French EQF 6 pathways already provide a rich variety of pedagogical designs, teaching examples, cooperation models, and competence mappings. However, the effective implementation of these modules depends on trainers being able to understand and enact these designs appropriately. The Train-the-Trainer programme supports module implementation in several ways.

First, it familiarises participants with the competence logic underpinning the pathways. Trainers learn to interpret the relationship between technical content and TRIComp development, and to design learning situations that foster both dimensions simultaneously.

Second, it strengthens trainers' ability to implement the active pedagogies described in the handbooks, including inquiry-based learning, project-based learning, company-supported problem solving, and FabLab-based experimentation.

Third, it helps participants understand the cooperation models defined in the pathways, especially the structured interplay of HVET institutions, universities, and companies.

Fourth, it strengthens the assessment capacity required to evaluate innovation-oriented learning outcomes in ways that are meaningful, fair, and transferable.

In this sense, the Train-the-Trainer programme acts as an enabling layer between curriculum design and curriculum implementation.

10.3 Support for Cooperation Between Educational Institutions and Companies

One of the most distinctive features of the HUCO project is its attempt to move beyond traditional and often loosely structured forms of cooperation between education and industry. The project aims to establish a more integrated model in which companies are not only providers of internships, but active pedagogical partners in challenge definition, mentoring, feedback, and innovation practice.

This ambition has strong implications for trainer development. Teachers need to understand the realities of company-based learning. Company mentors need to understand the pedagogical and assessment logic of education providers. Universities, where involved, need to understand how research-oriented learning can be meaningfully combined with applied technical training.

The Train-the-Trainer programme provides a space where these different perspectives can be brought into dialogue. This helps create mutual understanding and supports the development of shared practices across institutional settings.

10.4 Building a Community of Practice

A particularly important function of the programme is the development of a transnational community of practice. Such a community is essential for the sustainability of the HUCO ecosystem because it supports exchange beyond the formal timeframe of the training itself. Participants in the programme are not only recipients of professional development; they are also contributors to a shared pedagogical culture emerging within the project. Through collaborative tasks, peer dialogue, and joint reflection, they begin to build relationships and working habits that can continue into later implementation and scaling phases. This community dimension is especially important in Erasmus+ projects, where long-term impact often depends on whether professional networks remain active after the formal end of project activities. Concrete action that can be undertaken includes for example the creation of a permanent Community of Practice

(CoP) among the trained teachers, who will continue to exchange case studies through the digital platforms created by the consortium.

11 Evaluation and Continuous Improvement

This chapter outlines the evaluation and continuous improvement approach for the Train-the-Trainer Programme. It explains how feedback, evidence of learning, and follow-up processes can be used to refine the programme over time and strengthen its impact within the HUCO ecosystem.

11.1 Evaluation Logic

The evaluation of the Train-the-Trainer programme should be designed as a continuous improvement process rather than a one-time quality check. Since the programme itself is part of an innovation project, its implementation should be accompanied by systematic feedback and reflection that allow for refinement, adaptation, and future transfer.

Evaluation should focus on three dimensions:

- participant experience,
- participant learning and competence development,
- and transfer potential into educational and workplace practice.

11.2 Participant Feedback

A first level of evaluation concerns participants' perceptions of the programme. This includes the relevance of the content, the usefulness of the activities, the balance between theory and practice, the usability of the online format, and the perceived value of peer exchange.

Participant feedback can be gathered through:

- online questionnaires after each course,
- short reflection prompts after workshops,
- and end-of-programme qualitative feedback.

Such feedback is especially important because the participant group is likely to be diverse, including vocational teachers, academic staff, and company mentors. Their perspectives may reveal different needs and strengths of the programme.

11.3 Learning Process Analysis and Evidence of Competence Development

A second level of evaluation concerns the learning process itself. This may include analysis of:

- portfolio development,
- quality of design proposals,
- participation patterns in collaborative activities,
- and the progression of participants' pedagogical reflection.

Because the programme is online, digital traces of participation and task completion can also provide useful learning analytics, as long as they are interpreted thoughtfully and in line with ethical standards. The aim is not to reduce learning to metrics, but to use available evidence to understand how participants engage with the programme and where further support may be needed.

11.4 Follow-Up and Improvement Loops

The most valuable evaluation takes place not only immediately after the programme, but also in follow-up phases when participants begin applying what they have learned in practice.

Possible follow-up measures include:

- short post-course check-ins,
- follow-up workshops,
- exchange sessions during module implementation,
- and collection of examples of teaching or mentoring practice influenced by the programme.

This follow-up dimension is crucial since transfer into practice is one of the programme's main objectives. It also supports a continuous improvement loop for future iterations of the training.

12 Sustainability and Transferability

This chapter outlines the sustainability and transferability perspective of the Train-the-Trainer Programme. It explains how the programme can strengthen long-term implementation within the HUCO project, support adaptation to other sectors and national systems, and contribute to the development of a lasting pedagogical infrastructure for innovation-oriented technical education.

12.1 Sustainability Within the HUCO Project

The first dimension of sustainability concerns the role of the Train-the-Trainer programme within the ongoing HUCO project. The programme supports the implementation of the pilot pathways and helps ensure that the project's pedagogical innovations are not limited to written module descriptions, but are actually enacted in educational practice.

As more trainers and mentors become familiar with the HUCO model, the project strengthens its internal implementation capacity and reduces dependence on a small number of highly involved individuals. This is especially important in collaborative European projects, where sustainability often depends on whether knowledge and practice are distributed across the consortium.

12.2 Transferability to Other Sectors and Contexts

Although the HUCO training pathways are currently situated in advanced manufacturing and related technical contexts, the Train-the-Trainer programme has significant transfer potential beyond these specific domains.

The pedagogical principles developed here are relevant wherever technical education needs to integrate:

- research-based learning,
- innovation projects,
- dual learning environments,
- and cross-sector cooperation.

This means that the programme can be adapted for other sectors such as green technologies, mobility, energy systems, digital production, or healthcare technologies, provided that the technical cases and examples are adjusted to the relevant professional field.

12.3 Transferability Across European Education Systems

The programme also has significant relevance across different national education systems. The HUCO project already works across countries with different traditions in vocational education, higher education, dual systems, and work-based learning. The Train-the-Trainer programme contributes to the development of a shared European pedagogical language for innovation-oriented technical education.

This is particularly valuable because many of the challenges addressed by HUCO are not country-specific. Across Europe, educational institutions and companies face similar questions:

- how to better connect education and innovation,
- how to prepare technicians for participation in research and transformation processes,
- how to design learning environments that combine theory, practice, and experimentation,
- and how to support cooperation across institutional cultures.

The programme therefore has the potential to become a transferable model for European educator development in higher vocational and applied technical education.

12.4 Long-Term Perspective

In the long term, the Train-the-Trainer programme, while being a requirement for professionals and organizations seeking to be a part of the HUCO Labs ecosystem, can also support the development of a HUCO pedagogical infrastructure in a sustainable, long-term perspective. This includes:

- reusable course materials,
- trainer competence frameworks,
- self-assessment tools,
- shared case collections,
- and a network of trained educators and mentors.

If maintained and updated over time, these elements can contribute to the consolidation of the HUCO ecosystem as a sustainable platform for collaborative innovation-oriented education.

13 Conclusion

The Train-the-Trainer Programme developed within the HUCO Labs project represents a key strategic instrument for translating innovative training concepts into effective educational practice. While the HUCO training architecture provides a robust framework for integrating research, innovation, and dual learning, its success ultimately depends on the competences of the educators and mentors responsible for its implementation.

This deliverable demonstrates that trainer development is not a supplementary activity, but a central condition for systemic change in vocational and higher technical education. The programme addresses this need by equipping trainers with the pedagogical, methodological, and collaborative skills required to operate in complex, innovation-driven learning environments. It supports a transition towards roles that combine facilitation, mentoring, coordination, and assessment within interdisciplinary and transnational contexts.

Beyond its immediate function within the HUCO project, the programme contributes to broader European objectives. It strengthens the professionalisation of VET educators, enhances cooperation between education and industry, and supports the development of competence-oriented, future-proof learning systems aligned with the green and digital transitions.

Importantly, the programme is designed with sustainability and transferability in mind. Its modular structure, competence-based approach, and integration of tools such as micro-credentials and the Trainer Passport enable adaptation across sectors, institutions, and national systems. The establishment of a transnational community of practice further reinforces its long-term impact by fostering continuous exchange, peer learning, and innovation beyond the project lifecycle.

In this sense, the Train-the-Trainer Programme is not only a deliverable, but a foundational component of a broader pedagogical ecosystem. It enables the HUCO model to move from concept to practice and provides a scalable approach to educator development that can support the ongoing transformation of technical education across Europe.

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