



Innovative VET Scalable Micro-Credential Solutions that Engage, Explore, Explain, Elaborate and Evaluate

D2.2

Guidelines for Common Competence Frameworks Applying Micro Courses and Harmonized Competence Units, Leading to Micro Credentials

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<https://www.stimuli2.no/project/five>

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D2.2 Initial- and Continuing VET and Higher VET: A Holistic Framework for the delivery of Micro Courses applying Competence Units leading to Micro-Credentials

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Harmonized standards for delivery

Courses are structured and organized in a number of **Competence Units (CUs)**.

Each CU applies standardized **Learning Outcomes (LOs)** descriptions that specify:

- **Knowledge** - a description of what the student should have knowledge about....
- **Skills** - a description of what the student will be able to do
- **Competence** - a description of what the student should be able to do

1. The training paths for **Initial VET micro courses** leading to a National Qualification or an International Diploma, applies the sequence:

Knowledge --> Skills --> Competence

2. The in-company training paths for **Continuing VET micro courses**, applies the sequence:

Which Competence is needed ? ---> To provide sufficient Knowledge + work-based Skills that let the staff acquire this competence.

Initial VET micro courses leading to a NQ, an International Diploma, or an International Micro Specialization Diploma

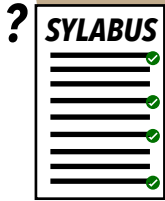


The European approach to Micro-Credentials (MCs) provides a common definition that applies across various sectors of education and the workforce. It reflects the societal mission of educational and training institutions, including higher education, vocational education and training (VET) institutions, non-formal providers, as well as employers and labor market stakeholders. MCs are designed to certify the learning outcomes of short-term learning experiences, such as short courses or training activities.

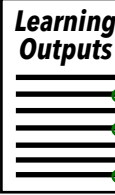
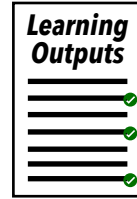
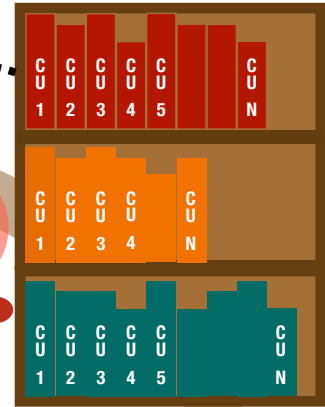
MCs provide a flexible, targeted approach that helps individuals develop their knowledge, skills, and competencies needed for personal and professional growth. An MC should document the learning outcomes a learner has achieved after completing a small volume of learning, with these outcomes assessed against clear and transparent standards.

However, without the development of common standards to ensure their quality, transparency, cross-border comparability, recognition, and portability, MCs cannot fully realize their potential within various industry production sectors. Courses leading to MCs should be designed to equip learners with specific knowledge, skills, and competencies that address both personal and labor market needs. MCs are intended to be owned by the learner, allowing them to be shared and portable across different contexts. They can function as standalone qualifications or be combined into larger credentials. They are supported by quality assurance processes, adhering to agreed-upon standards within the relevant sector or field of activity. The figure on the next page illustrates key features for how the basic VET courses could be set up, organized and delivered to the students by applying CUs leading to MCs.

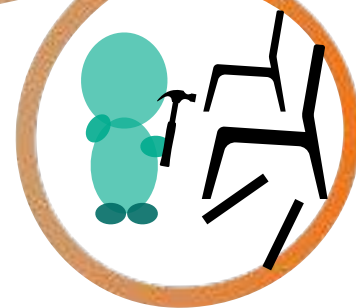
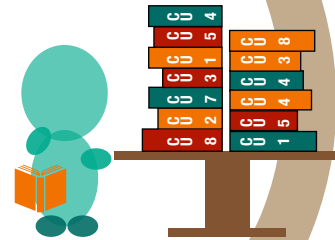
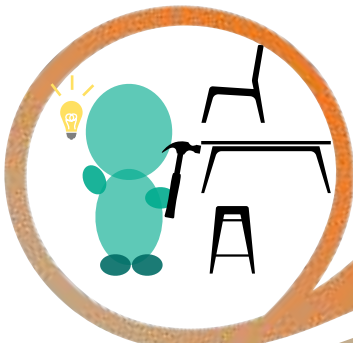
What should Initial VET micro courses focus on ?



KNOWLEDGE:
Should have knowledge of



COMPETENCE:
Should be able to do



SKILLS:
Will be able to do

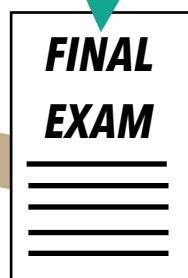
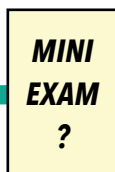
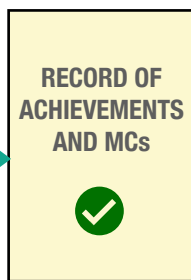


Figure 1. The structure of the Initial VET micro courses

The European Context

Basic VET education courses are usually comprehensive and several years of study (often 3-4 years) leads to a National Qualification or an International Diploma issued by European Welding Federation (EWF). These training activities mix theoretical and work-based training practices, often delivered in partnerships between public institutions and industry, or as a private and harmonized education system offered by EWF, and driven by European industry that is joining metals.

In the northern- and central part of Europe the NQ approach is common and has a strong foothold, while in the southern and eastern part of Europe the private and harmonized EWF system has a strong foothold.

Five re-structures Initial VET fish-farming courses into standardized CUs that improves the young students (age 16-20) understanding of what the required knowledge, skills and competences are in fish farming courses leading to a traditional NQ.

Adult staff from farming industry may study one or several of these CUs.

The IMiS Diploma

The Five project tests, evaluates and validates a new, harmonized basic VET system solution applying CUs leading to MCs, to provide a new **International Micro Specialization (IMiS) Diploma** in selected, specialized fish farming sectors.

This diploma is issued by providing small learning experiences organized and delivered as harmonized and standardized short training activities (the CUs) that are enhancing targeted acquisition of skills and competences. A CU leads to a standardized Micro-Credential (MC) that is easily understood and recognized by the industry, the employers, their staff, the learners, VET- and higher VET institutions.

The intention does not replace the traditional NQ or international Diplomas. The new system solution is adapted to provide and deliver competence and recognition of this, to staff in a fast changing society according to labour market needs.

The IMiS diploma is developed and issued in a partnership between VET schools providing the basic education, and farming industry providing specialized continuing training, where both apply the same harmonized standards.

Application of modern ICT tools help reducing the training delivery time while increasing the quality of the training, but without increasing the training delivery costs.

The Initial VET education delivery

The Five project develops harmonized minimum standards with specifications for how to (Figure 1):

- transfer a curriculum into a syllabus that is including and focusing towards measures for competence
 - specify Learning Outcomes (LOs) structured into
 - General Learning Outcomes (GLO) descriptions that transforms the syllabus into brief, clear and specific measurable statements addressing: KNOWLEDGE - SKILLS - COMPETENCES
 - Special Learning Outcomes (SLO) descriptions that transforms the GLO into the operational level, by specifying COMPETENCES - KNOWLEDGE - SKILLS
 - provide a system solution that let VET and Higher VET providers cooperate and collaborate about developing, sharing and using harmonized digital libraries that are applying standardized Competence Units (CUs)
 - learn to write GLO- and SLO descriptions specifying
 - KNOWLEDGE : What should students have knowledge about
 - SKILLS: What the students will be able to do
 - COMPETENCES: What the students should be able to do
-
- include work-based training practices into blended learning courses that's is combining on-site training, with on-line courses applying synchronous and asynchronous video for enhanced, flexible and cost-effective communication, cooperation and collaboration
 - structure a course into standardized CUs, each containing micro-course tests leading to Micro-Credentials (MCs) with subsequent issuing of Records of Achievements
 - combine the continuous assessment practices from the micro-course tests, with a possible mini-exam to issue the IMiS Diploma
 - prepare for a final exam leading to a National Qualification or an EWF based International Diploma
 - provide external quality assurance that is based primarily on the assessment of the providers and the effectiveness of of their quality assurance procedures
 - continuous gather learners and peers feedback during their learning experiences leading to the MC
 - assess MCs against transparent standards
-
- support flexible learning pathways where it is possible to stack, validate and recognize MCs across different providers of VET and Higher VET
 - apply the new European digital wallets to store and share the MCs

Continuing VET micro-courses leading an International Micro Specialization Diploma, or a NQ or an International Diploma



Learning opportunities with a smaller training volume compared to traditional National Qualification-based courses in VET could be structured around the proposed Competence Units. These units can be quickly developed within VET to address the production industry's demand for more flexible, learner-centered training formats.

This training can be described as both lifelong and "life-wide," as it occurs in various settings such as at the workplace, at home, among employed individuals, and even those currently unemployed but seeking to qualify for a job. The use of MCs enables the targeted, flexible acquisition and recognition of knowledge, skills, and competencies to meet the evolving needs of the labor market. Importantly, MCs do not replace traditional qualifications; rather, they should complement them and offer lifelong learning opportunities for all. Due to their flexibility, MCs can be designed and delivered by a wide range of providers in both formal, non-formal, and informal learning environments.

There is an ongoing discussion in Europe about establishing common definitions and standards for MCs to describe and recognize them effectively. This raises concerns about their value, quality, recognition, transparency, and "portability." Portability refers to the transferability of MCs between and within education and training sectors, across labor markets, and across countries. These concerns currently hinder trust, understanding, broader acceptance, and uptake, which in turn limits the potential of MCs to support flexible learning and career pathways.

The new continuing in-company VET micro-course curriculums will offer shorter learning opportunities compared to traditional national qualifications, allowing them to be transferable into MCs. The figure on the next page illustrates key features for how continuing VET micro-courses could be set up, organized and delivered to the students as CUs leading to MCs.

**Which competences are needed
in Continuing VET micro courses?**

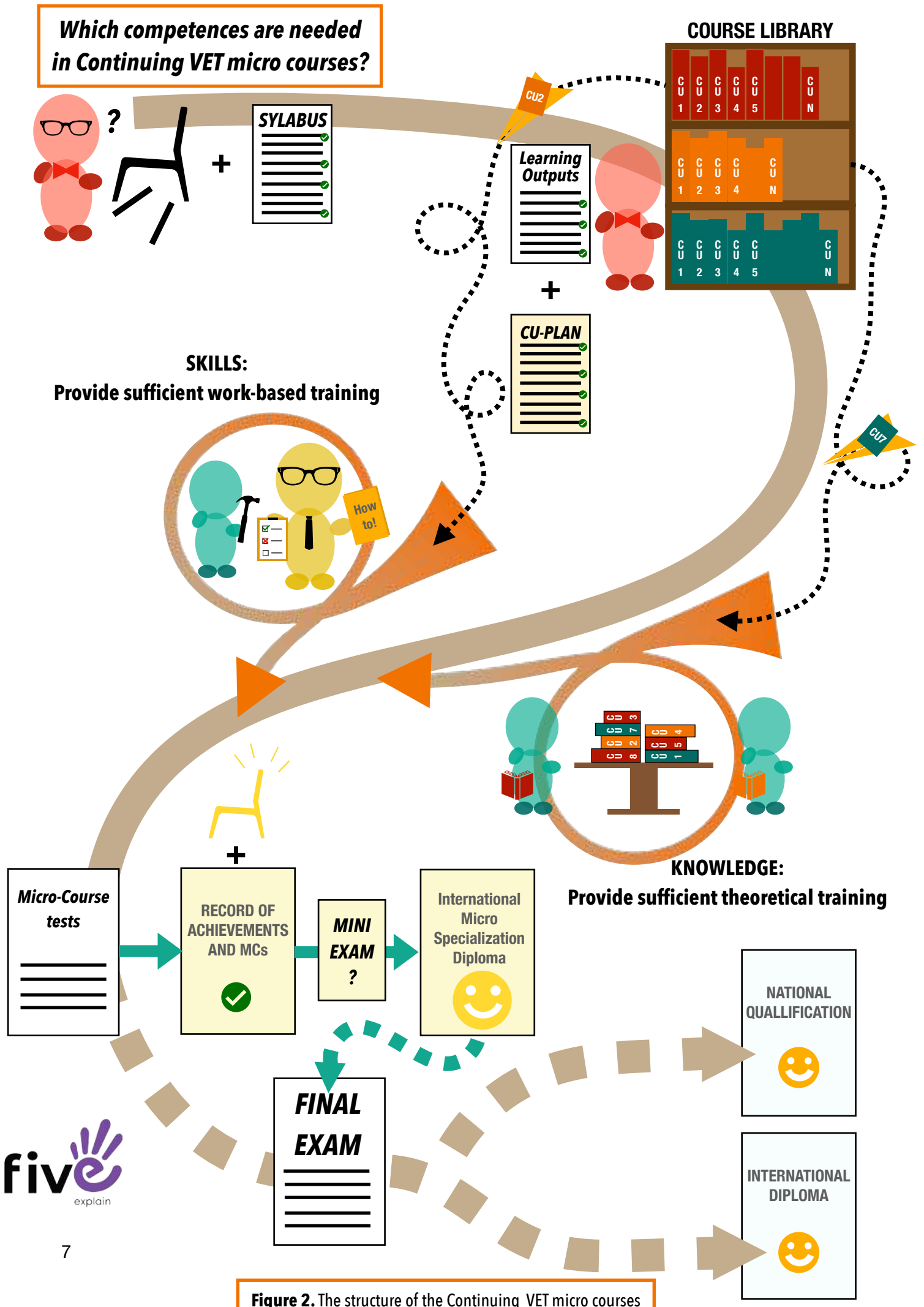


Figure 2. The structure of the Continuing VET micro courses

The European Context

Continuing VET education courses creates opportunities for workers and staff to attain skills, improve competences and advance their careers. Continuing VET education is a more formal part of the professional development and refers to different avenues for staying current with industry regulations, exploring new technological advancements, and enhancing skills and competences. Professional development is a broader term that covers various methods by which employees can acquire and improve skills for use in the workplace.

Continuing education options include self-paced online courses, classes provided by professional organizations, and degree programs offered by VET and higher VET colleges, or specialized degree programs offered by universities. Employees who pursue continuing education often do so to qualify for a job or secure a raise, while others take courses for personal enrichment and enjoyment.

Continuing VET education lets staff build a professional network, get an option to earn more money, to increase their creativity or confidence, and to learn and acquire new skills and competences. The staff will bring the new competences to their workplace.

The IMiS Diploma

The Five project tests, evaluates and validates a new, harmonized continuing VET system solution applying CUs leading to MCs, to provide a new **International Micro Specialization (IMiS) Diploma**. This includes applying VET in selected, specialized fish farming areas, and VET that addresses the European standard that regulates the fabrication and assembly of steel and aluminium structures (EN1090), which are recognized by the Construction Products Regulation.

This diploma is issued by providing small learning experiences organized and delivered as harmonized and standardized short training activities (the CUs) that are enhancing targeted acquisition of skills and competences. A CU leads to a standardized Micro-Credential (MC) that is easily understood and recognized by the industry, the employers, their staff, the learners, VET- and higher VET institutions.

The new system solution is adapted to provide and deliver competence and recognition of this, to staff in a fast changing society according to labour market needs. By taking a final exam, the IMiS diploma could be extended and transferred into a traditional NQ or an international Diploma.

The IMiS diploma is developed and issued by providers of specialized continuing training that is applying the same harmonized standards.

Application of modern ICT tools help reducing the training delivery time while increasing the quality of the training, but without increasing the training delivery costs.

The Continuing VET micro course delivery

The Five project develops harmonized minimum standards with specifications for how to (Figure 2):

- transfer a curriculum into a syllabus that is including and focusing towards measures for competence
- specify Learning Outcomes (LOs) structured into
 - General Learning Outcomes (GLO) descriptions that transforms the syllabus into brief, clear and specific measurable statements addressing the required Competences, to be supported by descriptions of provision of sufficient Knowledge and Skills
 - Special Learning Outcomes (SLO) descriptions that transforms the GLO into the operational level by specifying the required Competences, to be supported by descriptions of provision of sufficient Knowledge and Skills
- provide a system solution that let VET and Higher VET providers cooperate and collaborate about developing, sharing and using harmonized digital libraries containing courses that are applying standardized Competence Units (CUs)
- learn to write GLO- and SLO descriptions specifying
 - Competences: What the students should be able to do
 - Knowledge : What should students have knowledge about
 - Skills: What the students will be able to do
- include work-based training practices into blended learning courses that's is combining on-site training, with on-line courses applying synchronous and asynchronous video for enhanced, flexible and cost-effective communication, cooperation and collaboration
- structure a course into standardized CUs, each containing micro-course tests leading to Micro-Credentials (MCs) with subsequent issuing of Records of Achievements
- combine the continuous assessment practices from the micro-course tests, with a possible mini-exam to issue the IMiS Diploma
- prepare for a final exam leading to a National Qualification or an EWF based International Diploma
- provide external quality assurance that is based primarily on the assessment of the providers and the effectiveness of their quality assurance procedures
- continuously gather learners and peers feedback during their learning experiences leading to the MC
- assess MCs against transparent standards
- inform HR responsible for developing CU-plans supporting industrial companies development of their staffs skills and career plans
- support flexible learning pathways where it is possible to stack, validate and recognize MCs across different providers of VET and Higher VET
- apply the new European digital wallets to store and share the MCs

D2.2 The Learning Outcome (LO) Protocols

The 4 Steps in Vocational Education and Training

STEP 1: BEFORE TRAINING

CONTENT	GLO	SLO	ACCESS CONDITIONS
Informational materials transforming the curriculum into short content descriptions.	General Learning Outcomes (GLO) transforms the Content into brief, clear and specific measurable statements addressing: - KNOWLEDGE - SKILLS - COMPETENCES	Specific Learning Outcomes (SLO) transform the GLO into the operational level, by specifying: - KNOWLEDGE - SKILLS - COMPETENCES	Terms and conditions for accessing the training courses.

STEP 2: DURING TRAINING

TEACHER GUIDELINE	STUDENT GUIDELINE	ASSIGNMENTS	LEARNING MATERIALS	RPL
Provides a structured pedagogical framework containing comprehensive and continually optimized instructions that transforms the LOs.	Provides an Open and Distance Learning toolkit addressing the stages: - planning - content developing, - finalizing and distribution.	A specific piece of work or task, that let students get the opportunity to learn, practice and demonstrate that they have achieved the Learning Goals.	This is resources guiding the learning process. They are used in teaching and learning to enhance the knowledge, skills and competences.	Recognition of Prior Learning (RPL) lets individuals and groups, gain recognition of the knowledge, skills and competences from their prior experiences.

STEP 3: AFTER TRAINING

MICRO CREDENTIALS (MCs)	RECORD OF ACHIEVEMENTS /CERTIFICATE	NATIONAL QUALIFICATION
Provides a record of the LOs that a learner has acquired by following a small volume of learning structured and organized like a Competence Unit. The LOs have been assessed against transparent and clearly of defined open standards.	Applies the MC(s) to provide a statement of the educational development of a learner. The basis is 10 mandatory MC elements, and a number of optional elements.	A framework system that records the credits assigned to specific levels of learning achievements, in a formal way. They ensures that knowledge, skills and competences have been learnt and recognized at national or European level.

STEP 4: BEYOND TRAINING - IN THE LABOUR MARKET

CERTIFICATION	CERTIFICATION SCHEME	INDUSTRY RECONGITION
Certification of personnel is a procedure leading to a written testimony of an individual's competence. This is demonstrated by examination and assessment of experience, and subsequent surveillance, to confirm that the competence has been retained. The certificate issued has a validity period.	Validates the required academic and professional qualifications, addressing: - KNOWLEDGE - SKILLS - COMPETENCES Assessing whether someone has achieved the necessary level of competency, or condition required in a particular profession. Applicable to various professional levels and approval tests based on industry standards. Ensures the certification process is developed in a harmonized way, e.g. issuing certificates under the EWF umbrella.	Supports companies seeking compliance with industrial standards, e.g. EN ISO, among others.



GLO in AQ (EQF 4)

General Learning Outcomes



These descriptions are indicating the Learning Outcomes (LOs) relevant to the qualifications at level 4 in the EQF system from two perspectives. The LOs include descriptions of:

Knowledge: The candidate should have knowledge of.....

- EQF: Factual and theoretical knowledge in broad contexts within a field of work or study
- Industry: Have the overview of the National Qualification curriculum.

Skills: The candidate will be able to.....,

- EQF: Advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialized field of work or study
- Industry: Will be able to recognize and apply the National Qualification curriculum on standard problems.

Competence (EQF - Responsibility and autonomy): The candidate should be able to

- EQF: Manage complex technical or professional activities or projects, taking responsibility for decision making in unpredictable work or study contexts, take responsibility for managing professional development of individuals and groups
- Industry: Should be able to apply the National Qualification curriculum on new, non-standard problems.

References: EQF - Europass <https://europass.europa.eu/en/description-eight-efq-levels>



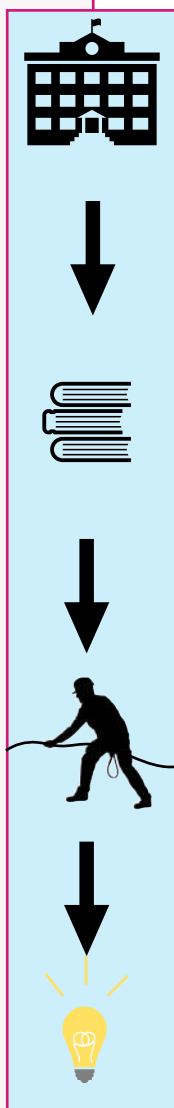
EXAMPLE

VET leading to a National Qualification, Competence Unit 5.00 (Fish Diseases):

Knowledge

The candidate should have knowledge of:

- Plan and carry out work in aquaculture facilities in line with current regulations for HSE (health, safety and environment).
- Describe the importance of good cage maintenance and cleaning/maintaining of equipment used in the aquaculture industry and in accordance with procedures and regulations.
- Explain the environmental factors in the aquatic environment and assess the factors based on the species' environmental requirements and tolerance limits.
- Assess the behavior, appearance and state of health of aquaculture organisms and implement measures in line with regulations for preventive health work and animal welfare.





- Discuss how aquaculture activities can be run in coexistence with other activities and interests.
- Understand quality control and monitoring in aquaculture.
- Reflect on how the operation of an aquaculture facility affects fish welfare and the environment, and how the operation can contribute to added value.
- Handle dead aquaculture organisms in accordance with current regulations.
- Husbandry of aquaculture organisms in line with animal welfare principles.
- Assess the health and welfare status of various aquaculture species and implement necessary measures.
- Register, monitor and interpret aquatic environment parameters and implement necessary measures.
- Take samples of aquaculture organisms and fish feed for further analysis.
- Apply contingency plans and notification routines according to the company's organization.

Skills

The candidate will be able to:

- Complete the Fish Welfare course.
- Learn the Welfare Indicators.
- Exercise a high ethical standard.
- Read and understand the description of "Infection screening tests"

Competence

The candidate should be able to:

- Detect indications of good/bad Fish Welfare.
- Be able to conduct a dialogue with the supervising veterinarian regarding fish health.
- Be able to detect changes in relation to welfare indicators.
- Apply welfare indicators.
- Manage a system for dead fish handling.



EXAMPLE CONTINUING VET

In-company continuing VET micro-training: CU 5.01, 5.02, 5.03, etc. (Fish Diseases)

Students should understand the three terms knowledge, skills and competence from their NQ. The in-company continuing micro training starts with the competence, and then add the required knowledge and skills. Each CU could with minor adjustments lead to a record of achievement. The key questions to address for the teacher or instructor, are:

Which competences are needed?

How to provide sufficient theoretical knowledge and practice through work-based training that let the staff acquire the skills and competences?



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SLO in AQ (EQF 4)

Specific Learning Outcomes



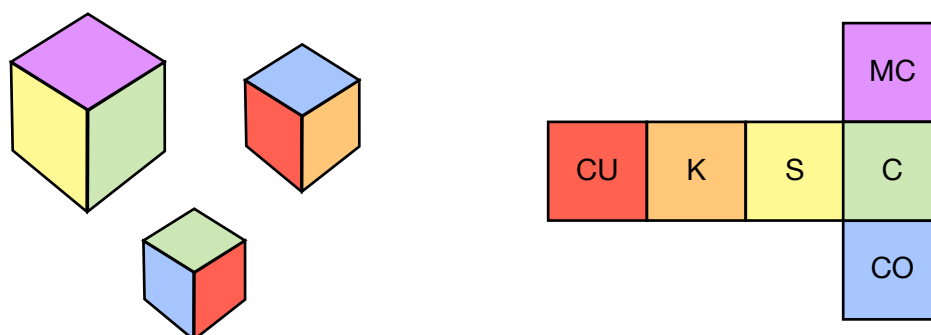
The SLO applies the GLO framework, structured like measurable descriptions that are organized in the categories «Knowledge, Skills and Competences».

The SLO transforms these into a flexible, operational training framework that is applying measurable descriptions by applying the same categories «Knowledge, Skills and Competences».

CU LEADING TO MICRO CREDENTIALS (MC)

The training materials and micro learning and micro training activities are structured around the CUs. A CU should contain two types of assessment solutions:

- Micro training applying e-learning should be assessed by applying multiple choice tests. This will typically be relevant for theoretical training.
- Work-based training practices should be assessed and approved by a manager, for instance the manager at a fish farm.



The generic CU-cube:

A CU contains information about the Content, and Learning Output descriptions with measures for Knowledge (K), Skills (S), Competence (CO), and Micro Credentials (MC), and Cooperation and Collaboration in professional work (CO).

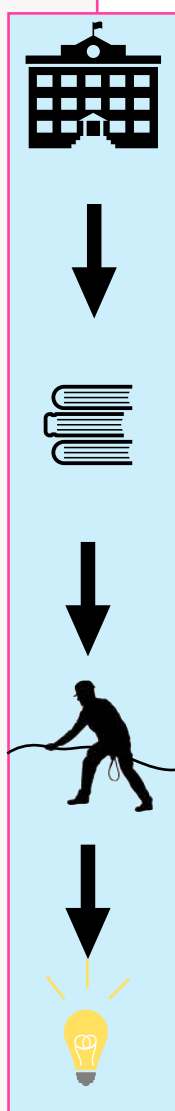
A course will consist of be a number of CU-cubes. Courses and micro training could be organized in flexible ways, e.g. into a pyramid, a row, a layer or a "wall", by applying the common standard outlined in the GLO and the 6 points displayed above.

CU LEADING TO COOPERATION AND COLLABORATION (CO)

A CU should contain learning materials and activities that are describing, stimulating and preparing students in applying cooperation and collaboration in their professional work. These features are deeply needed by industry in advanced manufacturing and fabrication processes.

This includes collaboration and cooperation within a discipline, and between disciplines:

- Materials and activities should investigate work processes and contexts in the work that professional staff should perform, i.e. what are the consequences of not delivering professionally quality work?
- What should a professional worker do if the materials they receive is not professionally good enough? This entails a responsibility to speak up if their start-up materials is not good enough and that they are responsible for ensuring that the work they deliver is of a good professional standard.





The cube metaphor emphasizes that each competence unit is multidimensional, integrating learning, assessment, delivery, quality assurance, and recognition of prior learning into a single, reusable building block. It is the visual and modular representation that organizes all the essential elements required to design, deliver, assess, and recognize learning within a competence-based education and training system.

It includes the name of the Unit with its unique identification code. A brief description of the occupational function or professional competence the unit develops. It applies clearly defined statements describing what learners are expected to know, understand, and be able to do upon successful completion. The level of independence, decision-making, and accountability expected, should be aligned with EQF descriptors. The qualification level corresponding to the European Qualifications Framework (EQF) or National Qualifications Framework (NQF) must be included. ECVET, ECTS, or institutional credits should be allocated to the unit, where applicable, as well as the estimated learner effort expressed in hours or learning time.

EXAMPLE

VET in the National Qualification framework, CU 5.00 (Fish Diseases)

Knowledge

The candidate should have knowledge of:

- Salmon's anatomy and physiology
- What characterizes a healthy fish?
- How does illness occur?
- The difference between viruses and bacteria
- Vaccination resistance
- Parasites
- Disease prevention
- Measures against diseases



Skills

The candidate will be able to demonstrate the ability to:

- Apply critical observation and attention to detail.
- Analyse information to support decision-making.
- Solve routine fish health problems systematically.
- Prioritize tasks during disease incidents.
- Work safely in accordance with health, safety, and environmental regulations.
- Adapt to changing environmental and production conditions.
- Demonstrate responsibility for animal welfare and environmental sustainability.
- Reflect on practice and contribute to continuous improvement.

The skills should focus on the practical abilities required to recognize, prevent, monitor, and respond to fish health issues while working under established procedures and relevant legislation.

Competence

The learner should at the completion of a micro course with the CU, be able to

- monitor fish health,
- recognize common disease symptoms,
- implement biosecurity and preventive measures,
- support disease investigations and treatments,
- maintain accurate health records, and
- contribute to effective fish health management while ensuring high standards of animal welfare, environmental responsibility and compliance with industry regulations.

Which competence is needed?

Provide sufficient theoretical knowledge and practice through work-based training that let the staff acquire the competence.



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TEACHER GUIDELINE

A PRACTITIONER DEVELOPMENT GUIDELINE



BLOOMS TAXONOMY - FOR e-LEARNING PRACTICES

Bloom's taxonomy (1956) was developed for teaching of specific skills, and is one way of describing different types of knowledge. It could become a useful tool. The taxonomy is often seen as different levels of knowledge, where the student first must acquire the knowledge before it is possible to apply it. Bloom's taxonomy is often drawn as a pyramid, with factual knowledge at the bottom and to create at the top. The first three levels (remember, understand and apply) are considered hierarchical, and to build on each other.

A VET course is organized into independent Competence Units (CUs), each containing an assessment procedure, leading to one Micro Credential (MC) containing an assessed Record of Achievement.

The assessment procedure could contain four types of knowledge questions:

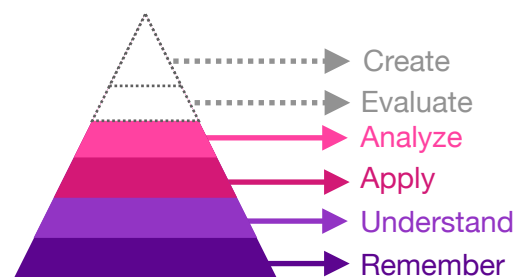
Remember: Ability to memorize information and reproduce factual knowledge. It should be possible for a student to recognize that he/she knows something, to know that they have seen it before. This includes recalling and remembering simple facts, basic concepts, moments and aspects, without necessarily demonstrating any context between them.

Understand: Ability to interpret meaning and reformulate knowledge in your own words. The students should know how to explain ideas or concepts. This includes seeing simple contexts, understanding a meaning, giving an example, identifying and classifying solutions, compare and provide simple explanations.

Apply: Ability to apply knowledge, techniques and methods in new situations to solve problems. Being able to carry out and apply the information in new situations, demonstrate and operate new solutions, or to decide something based on the knowledge.

Analyse: Ability to recognize connections. This includes "cutting" knowledge into pieces and see how the different parts relate to each other and to the overall goals and contexts. Students should train and learn how to distinguish between essential and irrelevant information, structure knowledge, and extract the views of others.

Blooms Taxonomy Pyramid:



The MC with a Record of Achievement from a CU, is a diploma, with an annex that includes a written documentation that is containing the standardized, basic level description of the CUs learning goals:

- General Content
- General Learning Outcomes, including KNOWLEDGE, SKILLS and COMPETENCES
- Specific Learning Outcomes, including KNOWLEDGE, SKILLS and COMPETENCES





The standardized, basic level descriptions of the CUs, as displayed above, will make it possible for students and training providers to compare, validate and recognize CUs and MCs delivered by other VET providers.

In this way, the MC with the Record of Achievement will provide a written specification that the student or the staff may use as documentation of the obtained knowledge and competence. Refugees, as an example, may use this material as a formal documentation when applying for their first job, or they get a temporary employment.

MILLERS TAXONOMY - FOR WORK-BASED PRACTICES

Millers taxonomy (1990) was originally developed as a framework for clinical practices at the workplace. It is thus widely used in healthcare education - containing a lot of practice - as a tool for assessing work-based competence (i.e. the outputs of education and training). This model includes 4 levels of clinical competence, often visualized like a pyramid:

Knows: Gathering Facts - Demonstrates that she/he has the knowledge to perform practical tasks and activities. May be assessed through observations.

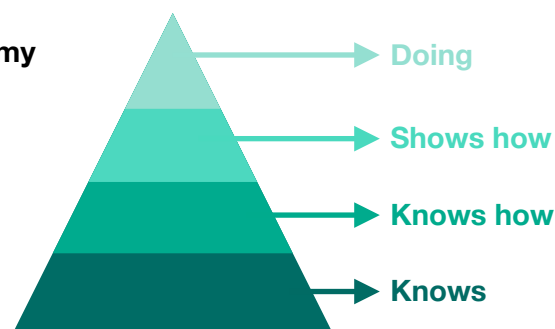
Knows how: Interpret and apply - She/he knows how to apply the knowledge. This includes using short answer assignments, oral exams or practical test.

Shows how: Demonstration of learning - Demonstrates that she/he not only has the knowledge or knows how to apply it, but can show how to use a method or a tool. Simulation and long/short cases may test this.

Doing: Performance integrated in to practice - Demonstrates what the student does when operating and functioning in practice/real work. To apply checklists could be part of testing and documenting this knowledge. This is the highest level that has the highest professional authenticity.

For each level, the professional authenticity of knowledge, skills and competence increases from novice- to expert level.

Millers Taxonomy Pyramid:





THE ROLE OF BLOOM'S AND MILLER'S TAXONOMIES IN A VET PRACTITIONER DEVELOPMENT PERSPECTIVE

A comprehensive VET Practitioner Development Guideline should provide educators with evidence-based frameworks that support the design, delivery, assessment, and continuous improvement of VET. Among the most valuable educational models are Bloom's Taxonomy and Miller's Pyramid of Clinical Competence (commonly referred to as Miller's Taxonomy). Although developed for different educational contexts, both frameworks complement each other and help VET practitioners create competence-based learning experiences that progress from knowledge acquisition to independent workplace performance. Including these taxonomies within a VET practitioner guideline enables teachers, trainers, workplace mentors, and assessors to develop learning outcomes, teaching activities, and assessment methods that accurately reflect the vocational competences.

Bloom's Taxonomy provides a structured hierarchy of cognitive learning that assists practitioners in designing learning outcomes and selecting appropriate teaching strategies. The revised taxonomy consists of the six cognitive levels: Remember, Understand, Apply, Analyse, Evaluate, and Create. Those help explaining that learning should progressively move learners from acquiring factual knowledge towards solving authentic workplace problems and developing innovative solutions. For each cognitive level, it is recommended to include examples of suitable action verbs, learning activities, digital learning resources, and assessment methods. For example, learners may first remember technical terminology and workplace regulations, then explain production processes, apply procedures during practical exercises, analyse faults, evaluate alternative solutions, and finally design or improve work processes. Such progression ensures that vocational learning develops higher-order thinking alongside technical competence.

It is useful to demonstrate how Bloom's Taxonomy supports the writing of measurable learning outcomes within CUs in the micro courses. Learning outcomes should use observable verbs that clearly describe expected learner performance rather than vague statements such as "understand" or "know." Practical examples from different vocational sectors, including engineering, construction, healthcare, aquaculture, manufacturing, and information technology, will help practitioners understand how Bloom's Taxonomy should be adapted across disciplines. This includes explaining how digital pedagogies, project-based learning, simulation, collaborative learning, and problem-based learning will support progression through the different cognitive levels.

While Bloom's Taxonomy focuses primarily on cognitive development, vocational education requires demonstration of practical competences in authentic working environments. For this reason, it is useful to introduce Miller's Pyramid as a framework for competence-based assessment. Miller's model consists of four progressive levels: Knows, Knows How, Shows How, and Does. These levels represent the transition from theoretical knowledge to independent workplace performance, making the framework particularly relevant for vocational education, apprenticeships and work-based learning practices.

The first level, Knows, focuses on factual knowledge, such as understanding occupational regulations, technical terminology, health and safety requirements, and industry standards. Assessment at this stage typically includes quizzes, written examinations, oral questioning and digital knowledge tests.



The second level, Knows How, requires learners to explain how knowledge is applied in practical situations. Case studies, problem-solving exercises, production planning, and technical calculations provide appropriate assessment opportunities at this level.

The third level, Shows How, shifts learning into simulated or controlled practical environments where learners demonstrate technical skills under observation. Practical demonstrations, laboratory exercises, simulation activities, workshops, role-play, and structured practical assessments allow learners to show that they can perform vocational tasks safely and correctly. The guideline should encourage practitioners to use assessment rubrics and observation checklists to ensure objective and consistent evaluation.



The highest level of Miller's Pyramid, Does, represents competent performance in authentic workplace settings. Learners demonstrate that they can independently perform occupational tasks consistently over time while meeting quality, safety, productivity, and professional standards. Assessment at this level may involve workplace observation, employer feedback, portfolios of evidence, competency interviews, digital workplace records, and recognition of prior learning. The guideline should emphasize that competence is demonstrated through sustained performance rather than a single successful assessment.

A useful feature is the explanation of how Bloom's Taxonomy and Miller's Pyramid complement each other. Bloom's Taxonomy assists practitioners in designing learning outcomes and selecting instructional methods, while Miller's Pyramid provides a framework for assessing whether learners can transfer knowledge into competent workplace performance. Together, they create constructive alignment between learning objectives, teaching activities, and assessment strategies. For example, learners may first analyse production problems using Bloom's higher cognitive levels before demonstrating practical problem-solving through Miller's "Shows How" and "Does" stages during workplace learning.

This will encourage practitioners to map both taxonomies to CUs and micro-credentials. Each CU could specify the expected Bloom's cognitive level for each learning outcome and identify the corresponding Miller assessment level. This approach ensures that assessment accurately reflects the intended competence and supports transparency for learners, educators, employers, and qualification authorities. It also facilitates modular learning, stackable micro-credentials, and Recognition of Prior Learning (RPL) by providing clear evidence of demonstrated competence. Case studies from vocational sectors could be used to illustrate how practitioners design learning pathways that move learners from theoretical understanding to confident workplace performance. This could include examples of authentic assessment tasks aligned with Miller's Pyramid, lesson planning templates, assessment rubrics, observation forms, self-evaluation questionnaires, etc.

In conclusion, Bloom's Taxonomy and Miller's Pyramid provide complementary frameworks that strengthen competence-based vocational education. Bloom's Taxonomy supports the systematic development of cognitive skills, while Miller's Pyramid ensures that these skills are translated into competent occupational practice. Incorporating both frameworks into VET is enabling educators to design coherent learning experiences, develop meaningful assessments, and monitor learner progression. It will, in addition, ensure that vocational graduates possess not only knowledge but also the practical competence, professional judgement and workplace readiness required by modern manufacturing and fabrication industries.



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STUDENT GUIDELINE

A PRACTITIONER DEVELOPMENT GUIDELINE



The micro training activities should be designed to help students learn and understand the differences between Knowledge, Skills and and Competences. In continuing VET the micro training activities, which the students from industry will receive when they start on a micro courses, these three terms will be widely used.

Improved Mastering Experiences Through Customized Training

Learning is a social experience that requires interactions and interactivity between the students, and between the students and their teachers. The training should be delivered as problem based learning that follows the industrial production process. Theoretical knowledge should be transferred into work-based learning by providing regular feedback of students learning that is linked to work-based practice. Moving some tasks to an online format, suggests that many training activities that have traditionally been synchronous and instructor-paced in a class-room, can be made asynchronous and self-paced by use of e-learning. This helps supporting delivery of training that better reflects companies production schedule, without increasing training delivery costs.

A micro course will combine theory and work-based training, by applying

- e-Learning to communicate and deliver materials, tasks and define learning activities for the students.
- work-based learning to investigate and solve the tasks and activities done by the students.
- e-learning to deliver the materials from the student to the teacher, or from a student to the other students.

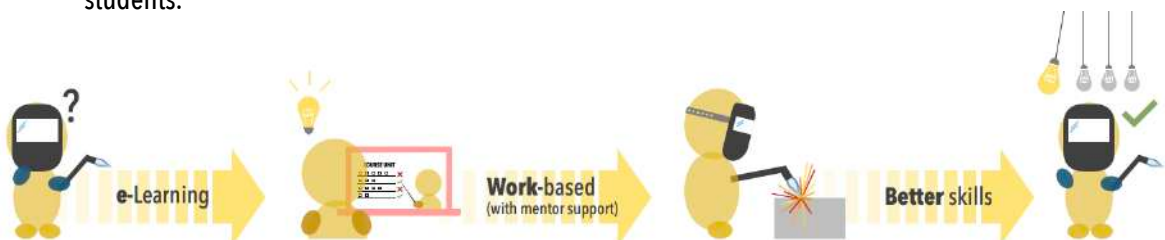


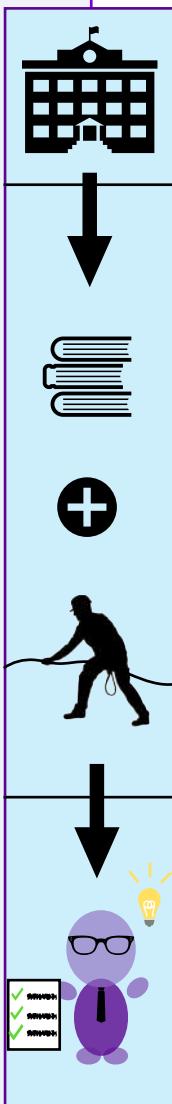
Figure 1: A VET venue that is combining theory with work-based practices in new ways.

The work-based learning applies learning outcome descriptions: What knowledge, which skills, and which competences are wanted?

Mapping and Recognition of Prior Learning (RPL)

A class consists of many students that have obtained different knowledge from industry. They have different experiences from the production when they start at a course, whereby they have got various type of skills. Some students will have a lot of knowledge and skills from previous experiences, while others will have relatively fresh knowledge and less experience.

In order to make the teaching process more effective, the teacher can apply online tools and services that help recognizing students' previous knowledge, skills and competences. For instance, with the help of quick surveys, the teacher will better adapt the teaching to the students' needs. At the same time, the students will benefit more from the teaching practices.



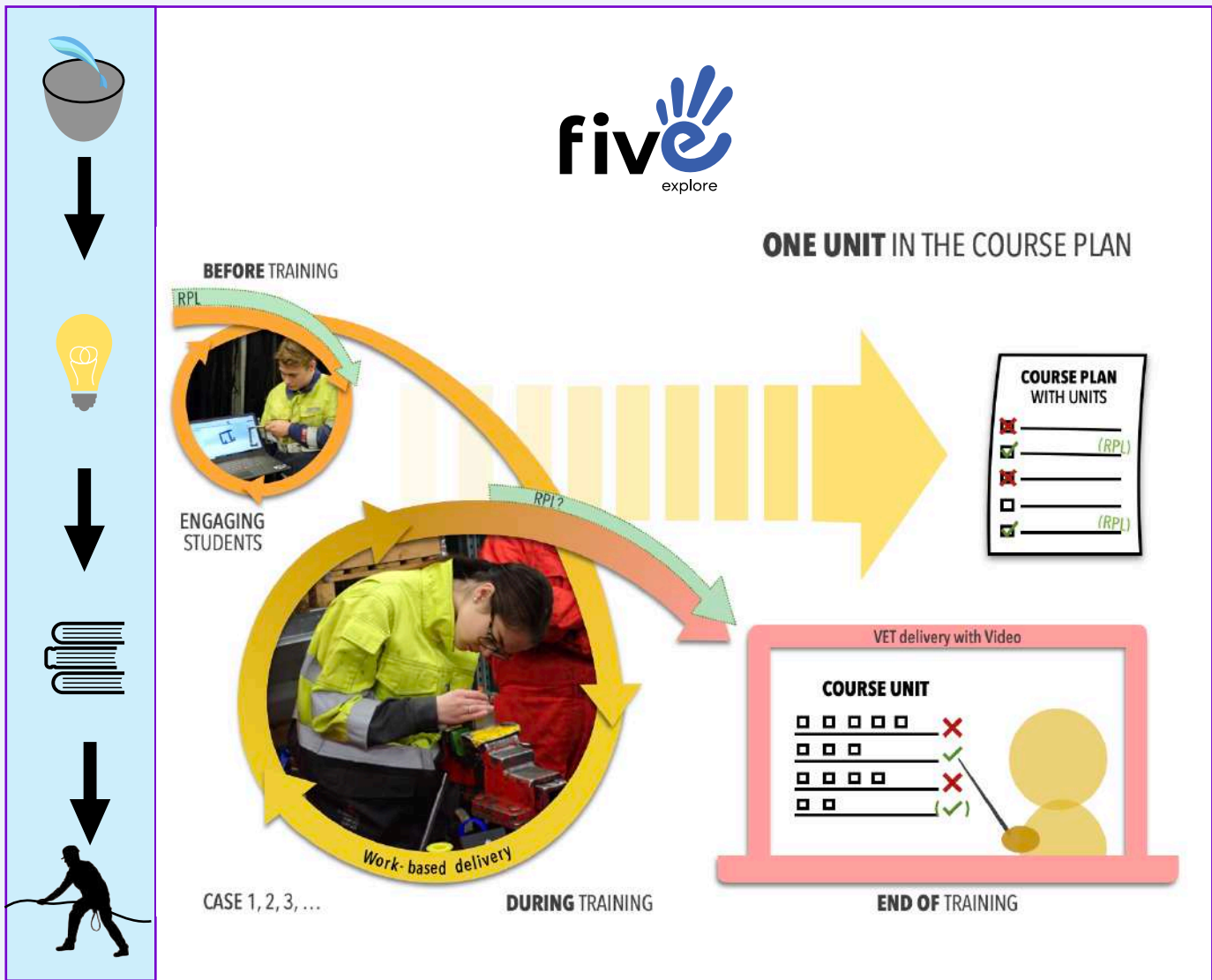


Figure 2: A VET venue that is applying RPL together with work-based practices in new ways.

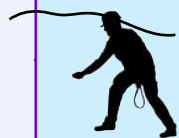


Optimize the effect of training in micro courses (before training):

- Apply Recognition of Prior Learning (RPL) with pre-testing of students knowledge and skills
- Analyze feedback and adjust course plan for the class and for each student
- Prepare and apply cases that stimulate and trig discussions to optimize the effect of training

Methodology applied during micro courses (during training) :

- Individual thinking periods to suggest best practices
- Group discussions to draft best practices
- Class discussions to define best practices
- Teacher verification of best practices



RPL and provision immediate or nearly immediate feedback in micro courses

These methodology will support learners throughout their vocational education journey by providing clear information on how previous knowledge and experience are recognised and then accredited. The continuous feedback during micro courses will accelerate skills and competence development. Two fundamental elements of an effective competence-based learning system are RPL and the optimization of training through immediate or nearly immediate feedback. Together, these approaches create personalised, efficient, and learner-centred vocational education by recognising students existing skills and competences, reducing unnecessary repetition, and enabling learners to continuously improve their performance through timely guidance.

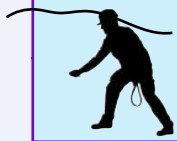
It is necessary to introduce the concept of RPL and explain its purpose within vocational education and training. RPL is a formal process through which learners receive recognition for skills and competences acquired through previous education, work experience, apprenticeships, volunteering, non-formal learning, or even informal learning. Rather than requiring learners to repeat learning they have already mastered, RPL allows existing skills and competences to be identified, documented, assessed, and formally recognised against the learning outcomes specified in the CUs for the micro courses. This approach promotes lifelong and life wide learning, increases access to education, shortens training pathways, and improves learner motivation.

It is necessary to to describe **the four main stages of an RPL process:**

- **The first stage**, Identification, enables learners to recognise the knowledge, skills, and competences they have already acquired through different learning experiences. Learners should be encouraged to reflect on previous employment, vocational training, practical projects, including voluntary activities.
- **The second stage**, Documentation, involves collecting evidence that demonstrates competence. Examples include certificates, employment records, portfolios, photographs, videos, supervisor testimonials, work samples, logbooks, digital badges, and reflective journals.
- **The third stage**, Assessment, compares this evidence with the learning outcomes of the relevant micro course CU by using interviews, practical demonstrations, workplace observations, portfolios, written assessments, or professional discussions.
- **Finally**, the fourth stage, Recognition and Certification, formally validates successfully demonstrated competences, allowing learners to receive exemptions, credits, micro-credentials, or partial qualifications where appropriate as micro qualifications leading to a Micro Specialization Diploma.

It must be emphasized for the students that the principles for RPL is based on demonstrated skills and competences rather than the way learning was acquired by them. The learners should understand that previous experience alone does not automatically lead to recognition. Instead, they must provide sufficient evidence that they meet the required learning outcomes and performance standards as described in the micro courses CU specification. This could encourage the learners to maintain an up-to-date digital portfolio that documents their achievements throughout their education and employment. Such portfolios simplify future RPL applications and support lifelong and life wide professional development.





Alongside RPL, the teachers should explain the importance of applying immediate or nearly immediate feedback in vocational learning. Feedback is one of the most powerful tools for improving skills and competence because it enables learners to identify mistakes, reinforce correct performance, and make adjustments before misconceptions and misunderstandings become established. In vocational education, where practical skills, safety, and professional judgement are critical, timely feedback significantly enhances learning effectiveness.

Thus, it is necessary to explain that feedback should be specific, constructive, timely, and linked directly to the learning outcomes and assessment criteria. Rather than simply indicating whether a task was correct or incorrect, effective feedback explains why a performance met or failed to meet the expected standard and provides practical guidance for improvement. Learners should be encouraged to view feedback as an opportunity for continuous development rather than as criticism.

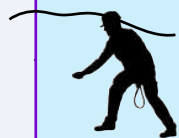
Various forms of immediate feedback should be tested and demonstrated during a micro course. During practical workshops, instructors can provide verbal feedback while learners perform tasks, allowing corrections to be made immediately. Digital learning platforms provide opportunities for automated feedback following quizzes or simulations, enabling learners to revisit concepts and change their mind without any delay, when the «learning window» is still open and the students memorize the details. Workplace mentors could offer coaching during apprenticeships, while peer feedback during collaborative activities encourages reflection and shared learning. Inclusion of self-assessment evaluations and reflective journals enable learners to monitor their own progress and identify areas requiring further practice.

To encourage the use of digital technologies to support rapid or nearly immediate feedback is important to better support the learning progression. Learning management systems, student response systems, mobile learning applications, simulation software, virtual laboratories, augmented reality, and artificial intelligence-supported learning tools will all provide learners with immediate performance information. Digital dashboards that display learner progression, completed micro courses, assessment results, and personalised recommendations and feedback help learners take ownership of their learning journey and monitor progress toward the qualification goals.

Immediate or nearly immediate feedback is particularly valuable within skills and competence-based assessment. Rather than waiting until the end of a course, learners benefit from frequent formative assessments throughout the learning process. Short practical demonstrations, workplace observations, digital quizzes, simulation exercises, and micro-assessments enable practitioners to identify learning gaps early and adapt instruction accordingly. Learners can then practice targeted skills before undertaking final summative assessments, increasing confidence and improving success rates.

The teachers must be aware of how RPL and immediate feedback complement one another. Following an RPL assessment, learners often demonstrate strengths in some skills and competences, while requiring further development in others. Immediate feedback allows assessors to identify these development needs and recommend personalised learning pathways that focus only on missing competences. This targeted approach optimizes training time, reduces unnecessary learning activities, and enables learners to progress more efficiently toward their qualifications.





The VET provider and their teachers should try to encourage learners to adopt to applying a mindset of continuous improvement and lifelong learning. RPL demonstrates that learning occurs throughout life and in many different settings, while timely immediate or nearly immediate feedback supports ongoing skills and competence development by promoting reflection, practice, and improvement. Together, these approaches create a flexible and learner-centred vocational education system that recognises existing achievements while continuously strengthening professional competence. Thus, a VET Student Practitioner Guideline should provide clear procedures for RPL alongside practical strategies for obtaining and using immediate or nearly immediate feedback continuously throughout the learning process. By recognising existing skills and competences in combination by providing timely guidance for improvement, this methodology enables learners to personalise their education, optimise training efficiency, enhance workplace performance, and develop the confidence and competence required for successful lifelong careers in vocational professions.

The methodology described above, and to applied during the micro-courses is designed to actively engage learners in the co-creation of knowledge while encouraging critical thinking, collaboration, and reflective practices. Rather than relying solely on traditional lectures, each micro-course could apply a structured four-stage learning process that enables participants to identify, discuss, validate, and apply best practices relevant to their vocational field. This learner-centred methodology promotes deeper understanding and supports the development of both technical and transversal competences.

-The first stage consists of individual thinking periods, during which learners are given time to reflect independently on the topic being studied. Based on their previous knowledge, workplace experience, or newly acquired information, participants identify potential best practices, solutions, or recommendations. This individual reflection encourages active cognitive processing, develops critical thinking skills, and ensures that every learner contributes with original ideas before being influenced by others. Individual thinking also supports RPL by allowing learners to draw upon their existing professional experiences.

- The second stage involves small group discussions, where learners work collaboratively to compare their individual ideas, discuss different perspectives, and collectively draft a preliminary set of best practices. Through dialogue and peer learning, the students evaluate the strengths and limitations of different approaches, justify their opinions with evidence, and negotiate common solutions. These collaborative activities strengthen communication, teamwork, problem-solving, and decision-making skills while exposing learners to diverse workplace experiences.
- During the third stage, class discussions bring together all groups to present and compare their proposed best practices. The teacher should encourages constructive debate, allowing participants to question assumptions, clarify concepts, and identify common themes across the different group proposals. The objective is to reach a shared understanding and produce a consolidated list of best practices that reflects both vocational standards and practical workplace realities.
- Finally, the teacher verifies the proposed best practices by comparing them with recognised industry standards, occupational requirements, legislation, scientific evidence, and learning outcomes. Where necessary, the teacher provides clarification, corrects misconceptions, and supplements the discussion with additional professional insights. This verification process ensures that the agreed best practices are accurate, evidence-based, and aligned with current industry expectations. Immediate feedback is provided throughout the process, enabling learners to refine their understanding and confidently apply the validated practices in real workplace situations.





What is RPL ?

Recognition of Prior Learning is a process that evaluates and acknowledges students skills, knowledge, and competencies/experiences that someone has gained through work, life experiences, or formal education, even if these weren't acquired through traditional academic programs. A variety of documentation may be used to apply RPL. This includes, but are not limited to records of completing the training, when transferring them to current training requirements.

The main points of RPL includes:

Assessment: Individuals learning outcomes are assessed on their existing knowledge, skills and competences acquired through non-formal or formal learning. This can include interviews, practical demonstrations, exams, or reviewing portfolios of previous work.

Certification: If the assessment of the learning outcomes shows that the person meets the required standards, they can receive formal recognition, such as a certificate, diploma, or even partial credit toward a degree or qualification.

Time and cost-efficient: RPL save time and money by allowing individuals to bypass courses or training they don't need, as they've already mastered the material.

Access to further education: It provides a pathway to further education or career advancement by recognizing non-formal learning.

In summary, RPL is a way of validating and recognizing the value of what people have learned outside of traditional education, giving them formal credit for their existing knowledge and skills. Thus, the RPL focuses on making visible the outcome of learning processes and (in)formal training activities. Such process involve gathering evidence of prior learning, assessing that evidence against specific learning outcomes or skills and competences, and making a judgement about the level of credit or recognition that should be awarded.

«What's in it for various stakeholder groups» ?

As a provider of work-based VET:

- Efficient and effective work-based learning system supported by learning and communication technologies.
- Cost-effective flexible delivery through assessment 'fast tracking' of experienced learners.

As VET-teachers and assessors:

- Discrete 'learning episodes' mapped to the National Qualification standards and multiple-choice question banks.
- Better targeting learning interventions informed by the RPL processes.
- Automation of knowledge, skills and competence assessment through the Accreditation of Prior Learning (APL) processes.

Production industry:

- The staff gets improved knowledge and skills in areas that are directly relevant for the production.
- Their staff may start earlier on the process to receive a national qualification.





Work-based learners:

- Learning tailored to specific needs as revealed by RPL.
- Ownership of the learning process through individual learning plans.
- Time efficient pathway to National Qualifications achievement as a result of RPL to inform individual learning plans.
- A fast track to NQ achievement for more experienced learners provided by APL.

Common challenges?

Some common challenges include:

- Do you have students who do not participate in class?
- Do the students really understand the goal of your course?
- How do you provide learning feedback to students so as to resolve misunderstandings and remove misconceptions?
- How to eliminate the duplication of learning, meaning that the students don't have to relearn things they already know.
- The fear of not having their skills recognized can deter many students from participating in the RPL process.
- RPL is an assessment process that requires students to provide evidence of what they have done. They typically need to answer questions, often through an interview, to demonstrate that the required knowledge, skills and competences.

Methodology - Individual follow up

Work-based learners with a wide range of experience need to demonstrate they have the underpinning knowledge, skills and competences specified within their micro courses. The teachers need to establish the learner's knowledge, skills and competence gaps to inform their individual learning and assessment plans.

1. Undertake multiple choice assessment to recognize the prior learning.
2. Gather evidence of prior learning satisfying the requirement for Accreditation of Prior Learning (APL).
3. Define knowledge gaps to inform individual learning plans.
4. Targeted learning in preparation for summative assessment and the completion of their micro courses.

How is it done ?

Learners undertake multiple choice questions prior to the start of a new micro course with the associated Competence Unit (CU) or topic designed to establish the learner's knowledge, skills and competences in relation to the requirement. These questions can be presented via a Virtual Learning Environment (VLE) or Student Response Systems (SRS) and accessed from a PC or smartphone under invigilated conditions.

The results of the multiple choice questions are gathered by the tutor as evidence of knowledge that can be submitted for accreditation. The learner's 'knowledge gaps' are determined, and individual learning and assessment plans formed that are compatible with the work demands and suit the pace set by the learner.

Discrete learning episodes related to the knowledge and skills gaps established through RPL are offered to the learner. This helps them to target their studies, supported by their mentors and/or tutors, thus preparing them for a summative assessment once they have addressed their specific knowledge gaps.



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STEP 3: AFTER TRAINING

MICRO CREDENTIALS (MCs)	RECORD OF ACHIEVEMENTS /CERTIFICATE	NATIONAL QUALIFICATION
Provides a record of the LOs that a learner has acquired by following a small volume of learning structured and organized like a Competence Unit. The LOs have been assessed against transparent and clearly of defined open standards.	Applies the MC(s) to provide a statement of the educational development of a learner. The basis is 10 mandatory MC elements, and a number of optional elements.	A framework system that records the credits assigned to specific levels of learning achievements, in a formal way. They ensures that knowledge, skills and competences have been learnt and recognized at national or European level.

- Micro Credentials:
- Record of achievement / Certificate:
- National Qualification / EWF Diploma:



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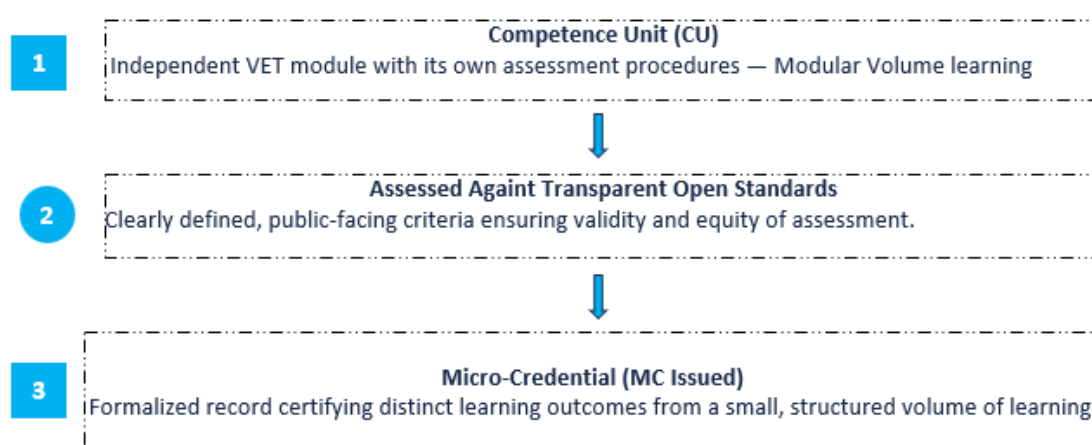
AFTER TRAINING – MICRO-CREDENTIALS

(Implementation & Pedagogical Guide)

The intent of using Micro-credentials (MCs)

Strategic Overview

Micro-credentials (MCs) may soon serve as the foundational building blocks of the modern Vocational Education and Training (VET) ecosystem. In a modular training framework, learning is broken down into independent, highly focused units. This document outlines how teachers can effectively implement, track, and validate micro-credentials following the completion of a training cycle.



What do you need to know about MCs ?

Micro courses are structured by using harmonized Competence Units. By passing the assessment that is part of a CU, this will issue a Micro-Credential.

Core Definitions and Educational Framework

- **Micro-Credential (MC):** A formalized record certifying the distinct learning outcomes that a student has acquired by completing a small, structured volume of learning.
- **Micro Courses with Competence Unit (CU):** A CU is an independent module within a VET micro course that contains its own specific assessment procedures and acts as the structural blueprint for a micro-credential.
- **Transparent Open Standards:** Clearly defined, public-facing criteria used to objectively assess a learner's performance to ensure the validity and equity of the micro-credential.

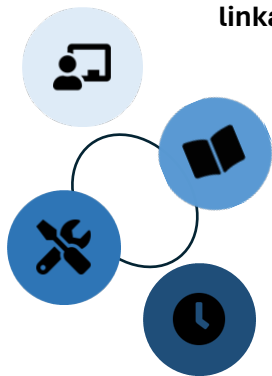
Step by step don't forget!

Teacher Implementation Checklist

- **Align with Competence Units:** Verify that each micro-credential maps directly to an independent Competence Unit (CU) or clearly defined combination of CUs established during the training Course design phase.
- **Execute Consistent Assessments:** Evaluate students using the predefined, transparent assessment procedures embedded within the CU. What does it mean ? **No surprises for the student, no guesswork for the teacher.** Everything about how the student will be graded is completely decided and shared upfront (See Classroom Example: # Welding CU)
- **Document Volume of Learning:** Clearly log the small, structured volume of learning associated with the micro-credential to maintain transparency for external auditors (i.e. keep is a formal way of measuring the **total estimated time** a typical student spends to achieve the learning goals);

Students “workload “

- Workload /volume of learning (possible) with **breakdown in 4 areas, and with linkage to ECTS points**



- **Face-to-Face / Direct Instruction:** Time spent in your classroom, lab, or live online webinars.
- **Independent Study:** Time spent reading manuals, watching instructional videos, or reviewing notes, for instance by using virtual learning systems.
- **Practical Practice / Homework:** Time spent working on assignments, practicing tasks in a workshop, or using learning materials.
- **Assessment Time:** The hours required to take the final knowledge quizzes or practical performance tests.
- **A workload of 25 hours** is equivalent to approximately **1 ECTS point**.

What works when using MCs ?

Operational Best Practices for Teachers

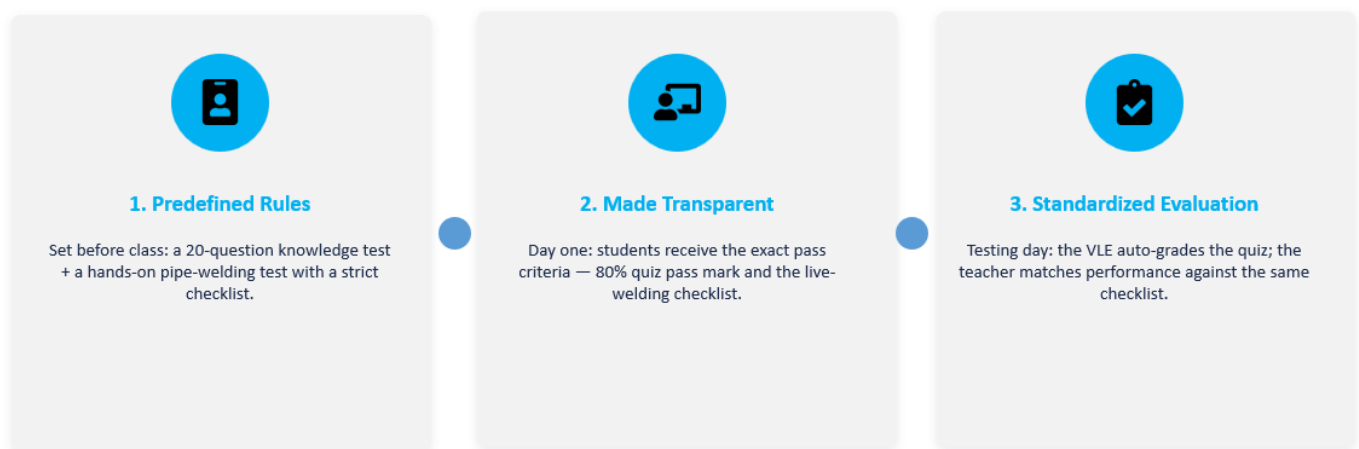
- **Pedagogical Note:** Micro-credentials are front-loaded with design time. To maximize their value, teachers must ensure that the assessment mechanisms (such as objective testing or practical simulations) directly measure the intended level of Bloom's or Miller's taxonomy specified by the curriculum.
- **Maintain a Digital Grade Book:** Use a Virtual Learning Environment (VLE) Grade Book to compile micro-credential outcomes automatically. This acts as a localized e-Portfolio showcasing student progression.
- **Provide Targeted Feedback:** When releasing MC assessment results, ensure feedback includes specific, actionable insights (and multimedia elements where applicable) to deepen the learning experience.

- **Promote Lifelong Learning Pathways:** Instruct students on how stackable micro-credentials can be accumulated over time to fulfill broader professional goals or combine into larger qualifications.
- **Effective quality-control of written tests: Use** post-assessment data to optimize test /examination design; if certain wrong options (distractors) were never selected by students, remove and replace them for future cohorts. In a multiple-choice question, a "**distractor**" is simply the technical term for a **wrong answer**.

Execute Consistent Assessments: Classroom Example:

Welding Competence Unit (CU)

Imagine you are teaching a modular VET course on "**MIG Welding for Industrial Piping**"



No surprises for the student, no guesswork for the teacher. Everything about grading is decided and shared upfront.

1. The Predefined Rules (Created Before the Class)

Before the course even started, the curriculum developers built the assessment directly into this Competence Unit. They decided that to earn this Micro-Credential, a student must pass two specific assessments:

- **Assessment A (Knowledge):** A digital, objective test consisting of 20 multiple-choice questions about safety pressures, gas mixes, and defect identification.
- **Assessment B (Practical Skill):** A hands-on test where the student must join two pipes together under observation using a strict, step-by-step grading checklist.

2. Making it Transparent (Shared with the Student)

On day one of the module, you hand your students a 1-page sheet. You explicitly tell them:

"To pass this unit, you will take a digital quiz where you need a "80 %"score to pass. You will also do a live welding test. Here is the exact checklist I will be holding while watching you weld. I will be checking if you wear your helmet, how you set your gas flow rate, and the uniformity of your final weld bead."

Because the criteria are out in the open, the assessment is **transparent**. The students know exactly what success looks like, eliminating anxiety and subjective bias.

3. Executing the Standardized Evaluation (The Testing Day)

When it is time to grade, you do not subjectively guess if a student "feels" like a good welder. You execute the predefined plan exactly as written:

- **For the Knowledge Component:** The students log into the Virtual Learning Environment (VLE). They take the multiple-choice test. The system automatically grades it against predetermined right and wrong answers, completely removing human bias or opinions.
- **For the Practical Component:** You stand next to the student with the official checklist.
 - *Did they check the gas levels?* Yes (Check).
 - *Is the weld bead consistent?* No (No check).

You are simply matching their real-world performance against the standardized framework.



AFTER TRAINING – Record of achievement / Certificate

(Verification & Execution Guide)

The intent of using Record of Achievements /Certificates

Strategic Overview

- The Record of Achievement (or Certificate) acts as the formal, comprehensive evidence of a student's educational and practical development. It aggregates the individual milestones achieved during the training cycle into a portable document that students can present directly to employers or licensing bodies.

What do you need to know about RoA /Certificates

Core Definitions and Educational Framework

- **Record of Achievement / Certificate:** An educational statement and diploma that builds upon a rigorous foundation of specific mandatory and optional elements to document a learner's progress.
- **Mandatory MC Elements:** The **10 baseline components** that must be structurally included within the certification profile to ensure institutional compliance and validity.
- **Portfolio Annex:** A written, standardized documentation attached to the diploma that provides an explicit, basic-level breakdown of the completed learning goals.

Step by step don't forget!

Teacher Implementation Checklist

- **Verify the 10 Mandatory Elements:** Prior to signing off on a Certificate, audit the documentation to guarantee that all **10 mandatory micro-credential elements** are fully satisfied.
- **Compile the Standardized Annex:** Populate the certificate's documentation annex with clear, baseline descriptions of the learning goals. Every annex must explicitly include:
 - The **General Content** covered during the training program.
 - The **General Learning Outcomes (GLOs)**, clearly broken down into Knowledge, Skills, and Competences.
 - The **Specific Learning Outcomes (SLOs)**, detailed at an operational level across Knowledge, Skills, and Competences.

- **Authorize Tiered Access:** Set up appropriate permissions within your institution's tracking system so that mentors, employers, and students can access verified records securely.

What works when using RoA /Certificates?

Operational Best Practices for Teachers

Certification Step	Teacher's Core Responsibility	Quality Assurance Focus
Summative Evaluation	Execute final judgments regarding candidate achievements against open objectives.	Ensure transparency and eliminate grading subjectivity.
Annex Standardization	Translate classroom performance into standardized K/S/C profiles.	Ensure data clarity so external providers can validate results.
Disadvantaged Support	Expedite certification processing for vulnerable groups, such as refugees.	Provide rapid, formal documentation for immediate job placement.



Warning: Ensure final summative testing evaluates true competence and conceptual synthesis — not just whether students learned "how to pass the test" during formative stages.

AFTER TRAINING – National Qualification / EWF Diploma

(Broad Recognition Frameworks)

The intent of using Recognition Frameworks

Strategic Overview

To bridge the gap between vocational training classrooms and international industry standards, learning achievements must align with broader national and European qualification frameworks. This document provides teachers with a roadmap to guide students from local institutional success to recognized national qualifications and harmonized industry diplomas.

What do you need to know about National & International Qualifications

Core Definitions and Educational Framework

- **National Qualification Framework:** A system that systematically records and assigns credits to specific, formalized levels of learning achievements.
- **European Alignment:** A harmonized structural standard ensuring that knowledge, skills, and competences are recognized uniformly across national borders
- **International Qualification** A unified, international framework that coordinates the development and issuance of harmonized professional certificates to ensure cross-border validity. EWF Diploma and qualifications are recognized by industry and is aligned with its standards.



Step by step don't forget!

- *Teacher Implementation Checklist*
 - **Cross-Reference Qualifications:** Use standardized baseline descriptions of Competence Units to compare, validate, and align institutional learning with external VET providers.

- **Map to Formal Credits:** Ensure that completed training blocks are logged accurately so they can be assigned formal credits within the national or European framework system.
- **Incorporate Prior Learning (RPL):** Leverage Recognition of Prior Learning protocols to help individuals or groups transfer their past experiential knowledge, skills, and competences directly into the formal qualification pathway.
- **Prepare for Industry Alignment:** Design course benchmarks so they feed directly into recognized, harmonized umbrellas (such as EWF), preparing students for subsequent labour market certification.

What works when using Recognition Frameworks

Operational Best Practices for Teachers

- **Integration Insight:** National qualifications and harmonized diplomas exist to assure the public and industry that a standard level of professional capability has been achieved. Teachers should explicitly teach students how these qualifications map directly to the strict compliance demands of modern businesses.
- **Emphasize Multi-Method Validations:** Because objective tests (such as multiple-choice questions) are limited in evaluating high-level synthesis, practical skills, and communication, combine them with project-based work or practical checklists to satisfy national qualification standards.
- **Incorporate Industrial Benchmarks:** Actively align your upper-level curriculum targets with established industrial specifications, such as EN ISO standards, to enhance the direct market value of the qualification.
- **Counsel Students on Portability:** Explicitly instruct graduating cohorts on how their formal credits and harmonized diplomas allow them to transition seamlessly between different European jurisdictions and professional tiers.

STEP 4: BEYOND TRAINING - IN THE LABOUR MARKET

CERTIFICATION	CERTIFICATION SCHEME	INDUSTRY RECONGITION
Certification of personnel is a procedure leading to a written testimony of an individual's competence. This is demonstrated by examination and assessment of experience, and subsequent surveillance, to confirm that the competence has been retained. The certificate issued has a validity period.	Validates the required academic and professional qualifications, addressing: - KNOWLEDGE - SKILLS - COMPETENCES Assessing whether someone has achieved the necessary level of competency, or condition required in a particular profession Applicable to various professional levels and approval tests based on industry standards Ensures the certification process is developed in a harmonized way, e.g. issuing certificates under the EWF umbrella.	Supports companies seeking compliance with industrial standards, e.g. EN ISO, among others.

BEYOND TRAINING IN THE LABOUR MARKET – CERTIFICATION

(Verification & Retention Guide)

The intent of Personnel Certification

Strategic Overview

Personnel Certification serves as the final, formal bridge between vocational training and the labor market. It provides employers with a trustworthy, written guarantee that an individual possesses the practical competence required to perform specialized industrial tasks safely and effectively.

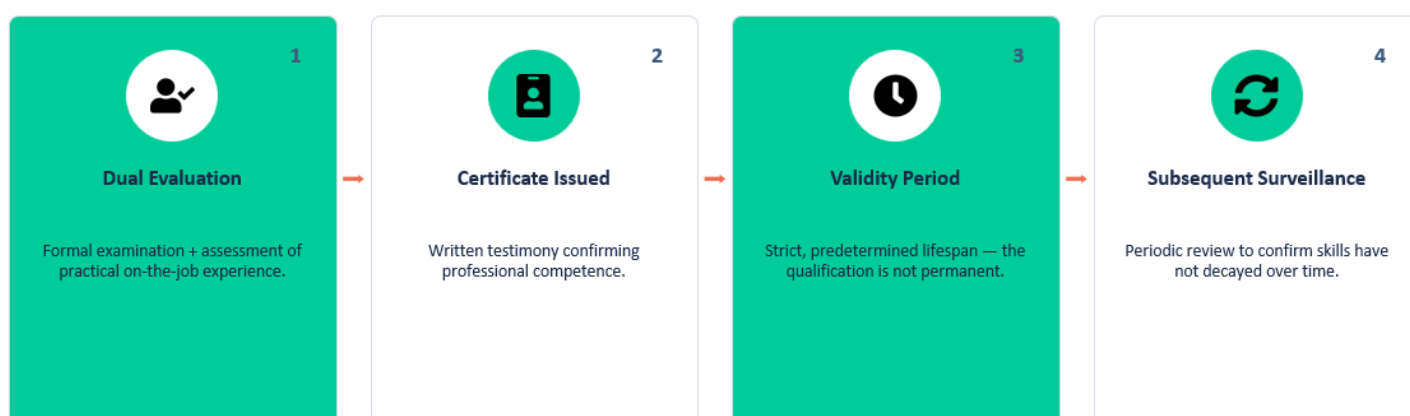
What do you need to know about Personnel Certification ?

Core Definitions and Educational Framework

- **Personnel Certification:** A formal quality-assurance procedure resulting in a written testimony that officially confirms an individual's professional competence.
- **Competence Verification:** The dual-method evaluation process requiring both a formal examination (testing knowledge) and a structured assessment of practical on-the-job experience.
- **Subsequent Surveillance:** The mandatory, periodic review process conducted after a certificate is issued to verify that the professional has maintained their skills and has not experienced competency decay over time.
- **Validity Period:** The strict, predetermined lifespan of the issued certificate, meaning the qualification is not permanent and will expire unless renewed

Step by step don't forget!

Teacher Implementation Checklist



↻ Cycle repeats: continuing competence, not a one-time achievement

- **Prepare Students for Dual Evaluation:** Instruct students that gaining a certificate requires passing both a formal examination and a verified assessment of their hands-on background.
- **Emphasize the Validity Lifespan:** Clearly communicate to graduating cohorts that their certificate carries an explicit validity period. They must actively track their expiration dates to remain legally compliant in the workforce.
- **Train for Ongoing Surveillance:** Educate learners on the reality of subsequent surveillance. Explain that inspectors or auditors will periodically review their work logs and performance to confirm their competence has been successfully retained.
- **Incorporate Maintenance Habits:** Teach students how to properly log their workplace hours, specialized tasks, and continuing education credits so they possess the documentation required during surveillance audits.

How to make it work!

Operational Best Practices for Teachers

- **Pedagogical Note:** Because personnel certification requires passing a formal examination, teachers must design upper-level VET classroom quizzes to mirror the format, rigor, and technical depth of official licensing exams.
- **Simulate Certification Testing:** Use your Virtual Learning Environment (VLE) to deploy strict, timed summative assessments that accurately simulate external certification environments.
- **Integrate Practical Checklists:** Utilize strict performance checklists during workshop sessions. This teaches students how to work under the same exact step-by-step observation standards they will face during an official practical assessment.
- **Deliver Reality-Based Counseling:** Explicitly counter the misconception that graduation equals permanent qualification; instill a professional mindset of lifelong learning and continuous skill verification.



BEYOND TRAINING IN THE LABOUR MARKET - CERTIFICATION SCHEMES

(Framework & Standards Alignment)

The intent of Certification Schemes

Strategic Overview

An industrial certification scheme establishes a unified, predictable pathway for validating multi-tiered professional qualifications. By organizing evaluation criteria into a standardized framework, a scheme ensures that every professional—regardless of where they trained—meets the identical criteria required for high-stakes technical professions.

What do you need to know about Certification Schemes ?

Core Definitions and Educational Framework

- **Certification Scheme:** A comprehensive validation framework that systematically outlines the required academic credentials, professional qualifications, theoretical knowledge, practical experience, and hands-on skills needed for a profession.
- **Approval Testing:** Standardized technical examinations engineered to test and testify that a candidate meets the precise performance conditions required for specific industrial tasks.
- **Professional Tiers:** Multi-level advancement structures within a scheme that cater to different tiers of expertise (e.g., from basic operator to advanced supervisor).
- **EFW Certification:** A unified, international cooperative system in Welding that ensures the entire certification process is developed and administered in a harmonized, identical manner across different borders

Academic & Professional Background

Technical Knowledge (concepts, parameters, theory)

Practical Skills & Field Experience

Approval Testing (standardized exams)

EFW Professional Certification

Step by step don't forget!

Teacher Implementation Checklist

- Map Curriculum to Scheme Criteria: Ensure your day-to-day teaching directly covers the multi-dimensional requirements of the scheme:
 - Academic and professional background prerequisites.
 - Technical Knowledge (concepts, parameters, and theory).
 - Practical Skills and field experience.
- Prepare for Multi-Level Testing: Align course modules with the specific professional levels and specialized approval tests established by current industry standards.
- Enforce Harmonized Operational Rules: Familiarize students with the global standards of the EWF umbrella. Ensure your classroom grading methods respect this harmonized approach so students transition smoothly to international testing.
- Deconstruct Condition Requirements: Teach students the exact parameters, environmental factors, and material behaviors they must master to pass specialized task-based approval tests.

How to make it work!

Operational Best Practices for Teachers

Scheme Component	Teacher's Instructional Target	Target Outcome
Comprehensive Qualification	Balance deep theoretical lectures with rigorous, logged lab hours.	Students satisfy both the knowledge and experiential prerequisites.
Multi-Level Progression	Design scaffolded modules that transition from novice concepts to expert applications.	Students can confidently enter the specific professional tier matching their career goals.
EFW Harmonization	Eliminate localized grading criteria; use international EWF-compliant scoring rubrics.	Issued qualifications carry immediate, cross-border validity in the labor market.



Warning: Failing to align classroom assessments with official scheme criteria will result in students who pass their school courses but fail their professional licensing exams.



BEYOND TRAINING IN THE LABOUR MARKET – INDUSTRY RECOGNITION

(Compliance & Standards Support)

The intent of Industry Recognition

Strategic Overview

The true value of VET is realized when its graduates directly solve market problems. Modern industrial companies face severe pressure to prove they comply with rigid global safety and quality baselines...

but:

how can formal training directly support corporate compliance, making student highly competitive job candidates?

What do you need to know about Industry Recognition?

Core Definitions and Educational Framework

- Industry Recognition: The widespread commercial acceptance and validation of a worker's credentials by the corporate sector.
- Industrial Standards (e.g., EN ISO): Rigorous, universally accepted engineering and manufacturing specifications designed to ensure global quality, safety, and operational consistency.
- Compliance Support: The operational benefit a certified worker brings to an employer by allowing the company to legally qualify for corporate contracts and maintain its mandatory quality certifications

Step by step don't forget!

Teacher Implementation Checklist

- Embed Global Standards into Lessons: Do not teach skills in a vacuum. Explicitly integrate international specifications, such as EN ISO benchmarks, directly into your technical lectures and workshop projects.
- Connect Training to Corporate Survival: Teach students *why* companies care about certifications. Explain that businesses cannot legally operate or win industrial contracts unless their workforce is proven to be compliant with standard benchmarks.
- Train for High-Authenticity Scenarios: Design advanced classroom projects that replicate real-world industrial compliance audits. Force students to work under strict documentation, inspection, and quality-control constraints.
- Highlight the Competitive Advantage: Guide students on how to feature their standard-compliant training on their resumes, making it clear to hiring managers that they are ready to step onto the production floor with zero compliance risk

How to make it work!

Operational Best Practices for Teachers

- **Integration Insight:** Industry recognition means training students to understand the "Why" behind strict workplace rules. When a student understands that an incorrect procedure violates an EN ISO standard and can cost an employer its license, they transition from a mere student to a highly responsible professional.
- **Use Standard Documentation:** Have students fill out real-world industry inspection logs, material datasheets, and quality-assurance checklists during their shop sessions.
- **Invite Industry Auditors:** Bring in external quality-control managers or compliance inspectors as guest evaluators for final student projects to provide authentic feedback.
- **Audit Workshop Equipment:** Ensure your school's training tools, calibration metrics, and safety rules match current EN ISO industrial environments exactly. This eliminates "culture shock" when students exit training and enter the labor market

The Real World: Turning Competence into Employment

When considering the role of the labour market in the context of VET, its primary function is to act as the **ultimate validator of the training's quality and relevance**. The labour market dictates the standards that training programs must meet to ensure graduates are immediately employable.

Key **tips for teachers** to **optimize** how they align their training with the needs of the labour market:

Remind students that entering the labour market means shifting from a



Focus on Continuing Competence

Shift from "passing a course" to "retaining capability"; certifications require periodic surveillance.

mindset of "passing a course" to "retaining capability". Personnel certifications issued in the market have strict validity periods and require periodic surveillance to confirm that technical competence has not degraded over time.

Help students understand that companies must comply with rigid industrial standards (such as EN ISO) to win contracts and operate legally. When students realize that following procedures is tied to corporate survival, they become highly valued, responsible job candidates.



Teach the "Why" Behind Standards

Companies comply with EN ISO to win contracts and operate legally — students become responsible professionals.

Align your classroom evaluations with widely recognized frameworks like the EWF Qualification and Certification Schemes. This ensures that the certificates your students eventually earn have a harmonized structure, making them highly portable across different companies and national borders.



Leverage International Umbrellas

Align evaluations with EWF Qualification and Certification Schemes for portable, harmonized certificates.

Structure your advanced modules to reflect the real-world certification



Prepare for Multi-Tiered Pathways

Blend academic qualifications, theory, and documented hands-on experience for career progression.

schemes of the industry. Ensure students know how to satisfy the blend of academic qualifications, theoretical knowledge, and documented hands-on experience required to move from entry-level positions to higher professional tiers

D2.2 Aquaculture Continuing VET Courses in Norway



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1. Internal training in the ASC standard (CU)

Mandatory for: DL

Relevant for: Husbandry operatives

Competence: Must be able to perform work according to the requirements of the standard. This includes:

- No discrimination
- Environment and sustainability
- Social responsibility
- Fish welfare

Training content, methodology, scope and documentation requirements:

- Practical training: Participate in conducting and discussing risk assessments
- Theoretical training/background knowledge:
 - Completion of Xtremile non-discrimination training or implementation of «Dealing with Misconduct, Discrimination and Bullying/Harassment in the Workplace.» (Valid)
 - HSE course for managers (only applies to managers)
- Documentation:
 - Confirmation of achieved internal competence in Competence Module



2. Equipment specific use of fleet (CU)

Mandatory for: Site technicians. Those who will perform the task.

Relevant for: Husbandry operatives, DL

Competence: Be able to explain the structure of the site's fleet, its utilization characteristics and areas, its operation, maintenance and control. Including

- Operating all technical equipment on the fleet
- The fleet's original characteristics with regard to load and stability.
- The fleet's current characteristics with regard to load and stability in relation to locality class

Training content, methodology, scope and documentation requirements:

- Practical training:
 - Review and demonstration of the fleet's fitted equipment and operation
- Theoretical training/background knowledge:
 - Review user manuals and location class, cf. «Control form and equipment-specific training fleet.» (Valid)
 - Familiarize yourself with loading instructions and load calculations
- Scope:
 - Applies to all equipment that is mounted and in use on the fleet
- Documentation:
 - Confirmation of achieved internal competence in Competence Module, attached completed list from Control form, equipment specific training fleet (Valid) for each individual person.



3. Raising and lowering of bottom ring (CU)

Mandatory for: Those who will perform the task

Relevant for: All.

Competence: Must be able to raise and lower the bottom ring. Including:

- Must be able to raise and lower bottom rings according to user manuals for the various rings and nets in use at the facility.
- Use of correct protective equipment during the operation.
- Read and understood «Operation of nets, floating collars and moorings (Valid), Operation of nets, floating collars and moorings (Under development)»
- Understanding of recognized risk elements.

Training content, methodology, scope and documentation requirements:

- Practical training:
 - Participate in the execution of raising and lowering of bunkering under supervision.
 - Correct use of protective equipment.
 - Participate in the review and discussion of risk assessments.
- Theoretical training/background knowledge:
 - Review of relevant procedures and user manuals
- Documentation:
 - Confirmation of achieved internal competence in Competence Module.

4. Course in escape protection (CU)

Relevant for: All.

Competence: Have an understanding of the risk of escape from marine facilities, and recognize the main causes of escape. Including:

- Rules and regulations.
- What are the requirements for equipment.
- How can I prevent catastrophic incidents with simple precautions?
- Risk assessment of escape hazards.
- Review of risk elements related to escape hazards.
- What are the most important safety measures that can be taken at a facility?
- Emergency response exercises.
- Emergency procedures.
- Incident reports.

Training content, methodology, scope and documentation requirements:

- Practical training:
 - Participation in emergency response exercise.
 - Participate in review and discussion of risk assessments.
- Theoretical training/background knowledge:
 - Web-based emergency evacuation course on Xtramile.
 - Risk elements are reviewed on site.
 - Review of relevant procedures.
- Supporting theoretical training:
 - <http://hindrerommning.no>
 - <https://www.fiskeridir.no/Akvakultur/Erfaringsbaase>
- Documentation:
 - Course certificate uploaded in Competence Module



D2.2 EXAMPLES AND REFLECTIONS AROUND NORWEGIAN LEARNING OUTCOMES DESCRIPTIONS IN HIGHER EDUCATION

SUMMARY

According to the OsloMET description (Norway), as an example, a learning outcome is the knowledge, skills and ability to leverage those, as a result of a learning process. Expected learning outcomes must be described on two levels:

- Overall – for the entire education program
- Course level – for each part of the education that results in credits gained

Description of the learning outcome is the basis for assessment. Since assessments are linked to credits, measuring of achieved learning outcome will happen at the course level.

Expected learning outcomes for a study program must be described in the categories knowledge, skills and general competence. These are defined as follows:

Knowledge: Understanding of facts, concepts, principles, procedures and theories within subjects, subject areas and/or professions.

Skills: Ability to apply knowledge to solve problems and tasks. There are different types of skills – cognitive, practical, creative and communicative skills.

General competence: To be able to apply knowledge and skills independently in various situations by showing cooperation, collaboration, responsibility, ability to reflect and critical thinking in studies and profession.

The qualifications framework aims to shift the emphasis from teaching to learning, focusing on learning outcomes rather than inputs.

The examples that follow below, however, demonstrate that it is still up to the teacher how these general description (or recommendations?) should be interpreted, understood and implemented. There is currently not available any specification at national level in Norway, describing what a minimum standardization for learning outcome descriptions should contain, and how the structure of the learning outcomes descriptions should look like.



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1. COGNITIVE PSYCHOLOGY AT THE INNLAND UNIVERSITY OF APPLIED SCIENCES (Fall 2024)

Course content

The course provides a general introduction to cognitive processes that are involved in and affected by perception, attention, memory and language, and how these processes are distributed in the brain. Some of the main topics are attention, automatic and controlled processes' effects on behavior, memory processes and systems, decision making, problem solving, language and cognitive disorders. Students will also learn how cognitive psychology can be applied in everyday situations (e.g. media and advertising, environmental behavior or criminal investigation).

Learning outcomes

Upon passing the course, the student has achieved the following learning outcomes:

Knowledge

The student

- understands theoretical approaches and explanations of cognitive processes
- has knowledge of measurement and research methods in cognitive psychology
- has knowledge about evaluation of specific cognitive functions
- has knowledge of how individual differences, experience or disorders affect cognitive processes

Skills and abilities

The student

- can explain terminology and theoretical approaches in cognitive psychology
- be able to discuss theories and empirical research results analytically and critically
- be able to use measurement tools for cognitive functions
- be able to plan and carry out a research project in cognitive psychology, as well as analyze and report research results

General competence

The student

- understands the interaction between biological, psychological and social factors in cognitive processes
- can communicate about the factors that influence cognitive processes

Work and teaching methods

Lectures, seminars, practical exercises and evaluations, problem solving, cooperative learning, case-based learning and supervision.

Compulsory activities

Participation in compulsory seminars and approved submission of written work or oral presentation of a research project. Further information (e.g. number, scope, time, content and form) will be provided by the course coordinator at the start of the semester.

CONTENT (The curriculum is transformed into short descriptions of the course content.)

The course provides a general introduction to cognitive processes that are involved in and affected by perception, attention, memory and language, and how these processes are distributed in the brain. Some of the main topics are attention, automatic and controlled processes' effects on behavior, memory processes and systems, decision making, problem solving, language and cognitive disorders. Students will also learn how cognitive psychology can be applied in everyday situations (e.g. media and advertising, environmental behavior or criminal investigation).

GENERAL LEARNING OUTCOMES (The content is transformed into brief, clear and specific measurable statements including knowledge, skill and competences.)

Upon passing the course, the student has achieved the following learning outcomes:

Knowledge, the student

- understands theoretical approaches and explanations of cognitive processes
- has knowledge of measurement and research methods in cognitive psychology
- has knowledge about evaluation of specific cognitive functions
- has knowledge of how individual differences, experience or disorders affect cognitive processes

Skills and abilities, the student

- can explain terminology and theoretical approaches in cognitive psychology
- be able to discuss theories and empirical research results analytically and critically
- be able to use measurement tools for cognitive functions
- be able to plan and carry out a research project in cognitive psychology, as well as analyze and report research results

General competence - The student

- understands the interaction between biological, psychological and social factors in cognitive processes
- can communicate about the factors that influence cognitive processes

SPECIFIC LEARNING OUTCOMES (Transforms the general learning outcomes into the operational level, specifying knowledge, skill and competences.)

Work and teaching methods - Lectures, seminars, practical exercises and evaluations, problem solving, cooperative learning, case-based learning and supervision.

Compulsory activities - Participation in compulsory seminars and approved submission of written work or oral presentation of a research project. Further information (e.g. number, scope, time, content and form) will be provided by the course coordinator at the start of the semester.

2. PROJECT MANAGEMENT AT THE INNLAND UNIVERSITY OF APPLIED SCIENCES (Fall 2024)

Course content

- Initiation and design of projects, including feasibility studies, pre-projects and sub-projects
- Functions and roles in a project
- Stakeholder analysis
- Budgeting, follow-up and resource management
- Dealing with uncertainty and risk
- Project management tools
- Learning and competence transfer in projects
- Communication and conflict resolution

Learning outcomes

The course will provide knowledge, skills and understanding of various aspects of leadership and management of projects in different types of businesses, including planning, implementation and evaluation of projects.

Work and teaching methods

- Lectures
- Streamed lectures
- Group work
- Self-study
- Writing assignments
- Use of digital learning platform
- Use of templates for project management

Compulsory activities

3-5 assignments consisting of hand-in assignments and multiple choice assignments

CONTENT (The curriculum is transformed into short descriptions of the course content.)

- Initiation and design of projects, including feasibility studies, pre-projects and sub-projects
- Functions and roles in a project
- Stakeholder analysis
- Budgeting, follow-up and resource management
- Dealing with uncertainty and risk
- Project management tools
- Learning and competence transfer in projects
- Communication and conflict resolution

GENERAL LEARNING OUTCOMES (The content is transformed into brief, clear and specific measurable statements including knowledge, skill and competences.)

The course will provide knowledge, skills and understanding of various aspects of leadership and management of projects in different types of businesses, including planning, implementation and evaluation of projects.

SPECIFIC LEARNING OUTCOMES (Transforms the general learning outcomes into the operational level, specifying knowledge, skill and competences.)

Work and teaching methods

- Lectures
- Streamed lectures
- Group work
- Self-study
- Writing assignments
- Use of digital learning platform
- Use of templates for project management

Compulsory activities

3-5 assignments consisting of hand-in assignments and multiple choice assignments

3. INFORMATION SYSTEM AT THE UNIVERSITY OF BERGEN (Fall 2024)

Objectives and content

The course will provide the theoretical basis for participation in work with information systems, whether it concerns administration, investigation or assessment work or planning and implementation of projects.

The course presents different types of information systems on an individual, group and organizational level and discusses how they support modern businesses in different ways. Key issues related to the administration, development, acquisition, introduction, operation and further development of information systems are presented and discussed, together with issues related to security, privacy and ethics. A practical project is carried out as a mandatory course assignment.

Learning outcomes

Upon completion of the course, the student will have the following learning outcomes defined in terms of knowledge, skills and general competence:

Knowledge

The candidate

- has a basic understanding of the role of information systems in organizations and society.
- has knowledge of the purposes and architectures of information systems.
- has knowledge of security, privacy and ethics in relation to information systems.
- has knowledge of the development of information systems.

Proficiency

The candidate can

- discuss information systems from a strategic, user and process perspective.
- explain the differences between different ways of developing information systems.

CONTENT (The curriculum is transformed into short descriptions of the course content.)

The course will provide the theoretical basis for participation in work with information systems, whether it concerns administration, investigation or assessment work or planning and implementation of projects.

GENERAL LEARNING OUTCOMES (The content is transformed into brief, clear and specific measurable statements including knowledge, skill and competences.)

Upon completion of the course, the student will have the following learning outcomes defined in terms of knowledge, skills and general competence:

Knowledge

The candidate

- has a basic understanding of the role of information systems in organizations and society.
- has knowledge of the purposes and architectures of information systems.
- has knowledge of security, privacy and ethics in relation to information systems.
- has knowledge of the development of information systems.

Proficiency

The candidate can

- discuss information systems from a strategic, user and process perspective.
- explain the differences between different ways of developing information systems.

SPECIFIC LEARNING OUTCOMES (Transforms the general learning outcomes into the operational level, specifying knowledge, skill and competences.)

The course presents different types of information systems on an individual, group and organizational level and discusses how they support modern businesses in different ways. Key issues related to the administration, development, acquisition, introduction, operation and further development of information systems are presented and discussed, together with issues related to security, privacy and ethics. A practical project is carried out as a mandatory course assignment.

4. 3D DIGITAL MODELLING AT THE NORWEGIAN UNIVERSITY OF SCIENCE AND TECHNOLOGY (Fall 2024)

Course content

Teaching in lecture room, field data collection and labor experiments.

Learning outcome

Knowledge: The candidate should have knowledge of:

- the working principle of a laser scanner, the classifications and parameter settings, the error sources and calibrations
- the differences of laser scanning and photogrammetry
- the data format and characteristics of Laser scanning point clouds
- the process of data preprocessing including noise filtering, strip adjustment and data registration
- principles and algorithms of classifications and segmentations, and the object detection as well

Skills: The candidate is able to:

- process the raw data acquired directly from an airborne laser scanner and terrestrial laser scanner
- model fittings by using RANSAC or improved RANSAC
- merge point clouds acquired from UAV borne and terrestrial laser scanner by using different registration methods
- adapt and apply filters from digital image process for 3D point clouds
- detect buildings, trees, street lights and power lines from 3D point clouds
- modelling the detected objects in CityGML

General competence: The candidate can:

- understand the relations and transformations among different coordinate system induced by the sensors (GNSS, INS, Laser transmitter, scanner)
- classify 3D point clouds into several classes (bare earth, cars, buildings and other man-made objects, power lines, pole-like objects)
- segment the 3D point clouds of a building into individual plane or curved facets and model them in 3D either by using data-driven method or model-driven method
- generate CityGML data files for the 3D objects
- understand and use professional terminology within the discipline
- work independently and in team and take the necessary initiatives
- identify common fields between this discipline and other professional disciplines and be open for inter disciplinary approach and cooperation

Learning methods and activities

Teaching in lecture room, field data collection and labor experiments.

Further on evaluation

The students will be given one project with individual task and data under the same topic. Students will be asked to develop their own algorithm based on the knowledge taught during the lecture and implement their algorithm for experimental test. A final report together with digital results are expected for the final evaluation.

Portfolio assessment is the basis for the grade in the course. The portfolio includes a report (70 %) and evaluation of two exercises (30 %). The results for the parts are given in %-scores, while the entire portfolio is assigned a letter grade. For a re-take of an examination, all assessments during the course must be re-taken.

CONTENT (The same principles applied as in example no. 3.)

Teaching in lecture room, field data collection and labor experiments.

GENERAL LEARNING OUTCOMES (The same principles applied as in example no. 3.)

Knowledge: The candidate should have knowledge of:

- the working principle of a laser scanner, the classifications and parameter settings, the error sources and calibrations
- the differences of laser scanning and photogrammetry
- the data format and characteristics of Laser scanning point clouds
- the process of data preprocessing including noise filtering, strip adjustment and data registration
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Skills: The candidate is able to:

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- generate CityGML data files for the 3D objects
- understand and use professional terminology within the discipline
- work independently and in team and take the necessary initiatives
- identify common fields between this discipline and other professional disciplines and be open for inter disciplinary approach and cooperation

SPECIFIC LEARNING OUTCOMES (The same principles applied as in example no. 3.)

Teaching in lecture room, field data collection and labor experiments.

The students will be given one project with individual task and data under the same topic. Students will be asked to develop their own algorithm based on the knowledge taught during the lecture and implement their algorithm for experimental test. A final report together with digital results are expected for the final evaluation.

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5. ELECTROMAGNETISM AT THE UNIVERSITY OF OSLO (Fall 2024)

Course content

The course describes basic electrical and magnetic phenomena, as well as laws for electrical circuits, both at direct current and alternating current. The course gives a thorough introduction to Maxwell's equations, and how to use them to derive the characteristics of electromagnetic waves.

Learning outcome

After having completed the course:

- you have extensive knowledge of electrical and magnetic fields, sources of fields, Maxwell equations in integral and differential form, and you can calculate such fields using analytical and numerical methods.
- you can account for electrical and magnetic forces, as well as energy stored in electrical and magnetic fields.
- you know basic phenomena in electricity and magnetism and can account for a range of technological solutions that many use daily.
- you can analyze a linear electric circuit and calculate currents and voltage differences in different parts of the circuit, both for DC and AC.
- you have knowledge of why both traditional and numerical solution methods are important to the subject and have experience in applying both types of methods to electromagnetic issues.
- you can present a chosen topic from relevant physics for fellow students.

Teaching

The first lecture is mandatory. If you are unable to attend, the Department of Physics has to be informed no later than the same day, or else you will lose your place in the course.

The course extends over a full semester with 6 hours of teaching per week:

- 2 hours of interactive lectures
- 2 hours of full class seminars
- 2 hours of full class tutorials with numerical and theoretical assignments

The course includes the following mandatory exercises that must be approved before you can sit the final exam:

- Approved completion of a minimum of 30 learning activities, consisting of: Submission of assignment and correction of a fellow student, both of which must be approved (2 points each, 20 possible); participation in seminars (2 points each, 20 possible); participation in tutorials (1 point each, 10 possible); submission of projects (10 points each, 20 possible)
- Written submission and oral presentation of Computational Essay

CONTENT (The curriculum is transformed into short descriptions of the course content.)

The course describes basic electrical and magnetic phenomena, as well as laws for electrical circuits, both at direct current and alternating current. The course gives a thorough introduction to Maxwell's equations, and how to use them to derive the characteristics of electromagnetic waves.

GENERAL LEARNING OUTCOMES (The content is transformed into brief, clear and specific measurable statements including knowledge, skill and competences.)

After having completed the course:

- you have extensive knowledge of electrical and magnetic fields, sources of fields, Maxwell equations in integral and differential form, and you can calculate such fields using analytical and numerical methods.
- you can account for electrical and magnetic forces, as well as energy stored in electrical and magnetic fields.
- you know basic phenomena in electricity and magnetism and can account for a range of technological solutions that many use daily.
- you can analyze a linear electric circuit and calculate currents and voltage differences in different parts of the circuit, both for DC and AC.
- you have knowledge of why both traditional and numerical solution methods are important to the subject and have experience in applying both types of methods to electromagnetic issues.
- you can present a chosen topic from relevant physics for fellow students.

SPECIFIC LEARNING OUTCOMES (Transforms the general learning outcomes into the operational level, specifying knowledge, skill and competences.)

The first lecture is mandatory. If you are unable to attend, the Department of Physics has to be informed no later than the same day, or else you will lose your place in the course.

The course extends over a full semester with 6 hours of teaching per week:

- 2 hours of interactive lectures
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RECOMMENDATIONS FOR FURTHER WORK

A STUDENTS EXPERIENCE

As a student it is important to know what is expected from you in every course. As these examples show there is a lack of standardization in the different course descriptions. This makes it unnecessarily difficult for students to figure out what the course contains and what it delivers. The lack of standardization can lead to students having to guess what the teacher will teach in class. Not knowing how assignments and classes will be set up creates uncertainty and many questions for every student as well as an unnecessary difficulty in maneuvering the course and course materials.

If there was a standardized layout for every course description, the students would better know and know where to find the information they need. In addition, the amount of questions from students to the teacher would be reduced. Students often end up sending numerous emails to the teacher if something is unclear. Having a standardization in the description of the courses would reduce the amount of emails with different questions from the students. The overall experience from the course will be better as well. Anything that can help a student understand what is expected from them is much appreciated. Especially because students often study several courses simultaneously and a standardized system description will lower the levels of stress related to practical information about the courses.

EMPLOYERS NEEDS

Rather than focusing on learning activities and how students will learn, the emphasis should be on the competencies students achieve. It can be helpful to view employers as the target audience, as they are typically more interested in the problems and tasks students can solve using their skills than in the specific activities or assignments completed during their education. What is particularly relevant for employers are descriptions that are highlighting practical abilities, such as problem-solving, teamwork, communication, and technical skills, directly applicable to the workplace.

The description of knowledge should outline the theoretical understanding required for a specific industry or job role, ensuring graduates are prepared to handle job-specific challenges. The ability of transferring skills in the descriptions of learning outcomes, should address broader skills like adaptability, critical thinking, and time management, which are valuable across various roles and sectors. Last but not least, performance-based results containing descriptions that focus on what learners can achieve or produce, showcasing their ability to meet professional standards is of added value.

ALIGNING LEARNING OUTCOMES WITH EMPLOYERS' NEEDS IS AN OPTION

An well structured industry collaboration and cooperation program involving employers in designing qualifications ensures outcomes are relevant and aligned with current job market demands. This includes applying a competence focus that is emphasizing measurable, practical competencies prepares learners to perform effectively in real-world settings. Employers value outcomes that demonstrate learners' ability to apply knowledge and skills to resolve workplace outcomes that demonstrate learners' ability to apply knowledge and skills to resolve workplace challenges is supported by including a problem solving orientation of the

CONCLUSION

learning outcomes descriptions. Learning outcomes should prepare graduates for evolving industry needs and encourage continuous learning by underlying the importance of adaptability and application of lifelong learning methodologies.

Employer aligned learning outcomes will help securing that graduates are better equipped to meet job requirements, increasing their chances of securing employment. It means that the employers clearer expectations and more easily assess whether a candidate's qualifications match their job roles and needs. This indeed enhances relevance of the training programs, since the they remain up-to-date with industry standards.

In summary, aligning learning outcomes with employers' needs helps bridge the gap between education and the workplace, ensuring graduates are well-prepared to excel in their chosen fields.

ASSIGNMENT DESCRIPTIONS

Incorporating assignment texts into learning outcome descriptions serve as an effective alignment tool. It allows the assignment itself to clarify the broader purpose of the task for students. This approach also encourages students to reflect on what they are learning, how they are learning it, and why it matters. Additionally, it helps students identify which aspects of the learning outcomes are most relevant to the task and consider the best ways to demonstrate their competence through the assignment.

Clear and well-understood descriptions, paired with assessment methods designed to accurately evaluate whether the intended competencies have been achieved, can help prevent unexpected challenges for students during their education. In this way learning outcome descriptions will serve as a shared agreement between the institution, lecturers, and students, since they clearly outline expectations for both the staff and the students.

In most subjects, the emphasis on knowledge, skills, and general competence will vary. Some courses are primarily designed to provide students with a fundamental knowledge base to build upon in future courses. Others focus on developing practical skills and proficiency in specific methods and techniques. Still, others aim to equip students with training and competence in interdisciplinary collaboration. While it is important to have clear and specific learning outcome descriptions, they should not be so rigid that any changes in the study program would require revisions of the learning outcomes.

Competence descriptions at the course level must be designed to effectively evaluate the skills and knowledge acquired. Additionally, the learning activities and assessment methods should be clearly aligned with these competence descriptions. It is essential for course descriptions to clearly outline the core aspects of the course and for the learning methods to effectively support the development of the intended competencies. Throughout the course and at its conclusion, assessment methods should accurately measure whether students have achieved the expected competencies. The choice of teaching methods significantly influences what students perceive as important within the subject, and the assessment methods must be both relevant and aligned with the way students have been taught, what they have learned and the work-based training received.