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

D7.1

Framework for harmonized Micro-Courses applying Competence Units (CUs) to provide Micro-Credentials (MCs) and Micro-Qualifications (MQs), through shared Learning Outcome Protocols.

The purpose and application of Learning Outcomes (LOs) within Unitized Micro-Course VET programs:

- Initial- and Continuing Aquaculture VET Courses (20 pages)
- Continuing VET Courses for EN 1090 Inspectors (25 pages)

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

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Framework of Shared CUs with MCs

Learning Outcome Protocols

Aquaculture VET training structured into Micro-Courses, applying CUs and Micro-Credentials



five

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The purpose and application of LOs within Unitized Micro-Course VET programs.

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A Framework for the Learning Outcome Protocols in Aquaculture MC

Learning outcomes based on established 'Occupational Standards' play a crucial role in advancing collaborative Vocational Education and Training (VET) initiatives and in harmonizing aquaculture micro-qualifications. These standards offer a structured framework to guide both non-formal and formal VET development at the company, national, and potentially European levels, and they can be adapted to various formats. While the methodologies for developing Occupational Standards differ across countries, the use of Learning Outcomes is widespread in European VET systems. This prevalence makes Learning Outcomes an effective foundation for creating shared frameworks that facilitate collaborative VET development.

While «competence» is often perceived as a non-technical term, numerous education authorities, agencies, and academics have proposed various definitions, some of which have significantly influenced European VET design. Most occupational standards regard «competence» as a key parameter. Published literature highlights the strong connection between «competence» and «professionalization», demonstrating that evolving definitions of competence have been a driving force behind VET development in many established industry sectors.

The European Qualifications Framework (EQF) serves as a fundamental translation tool to facilitate the recognition of equivalent qualifications across countries, with competence as a key parameter. However, when a country lacks robust or well-defined methodologies for developing occupational standards, the reliability of the EQF-based recognition process is significantly weakened.

Recommendations

Learning Outcomes that are widely used across Europe, often focus on basic definitions of the knowledge, skills and competence (e.g. the level of autonomy) needed to perform specific tasks. Interestingly, most farming companies collaborating with the aquaculture VET partners are Norwegian-owned multinationals with established Standard Operating Procedures (SOPs).

These SOPs could serve as a foundation for defining common tasks. This, in turn, could guide the creation of a Framework of Shared Learning Outcomes (FSLOs).





Framework of Shared Learning Outcomes

The FSLOs can serve as a foundation for developing a more flexible, modular curriculum that can be shared among aquaculture VET providers. Ultimately, this curriculum could also be adopted by other institutions in northern Europe to deliver Aquaculture National Qualifications (NQs) to unqualified employees within the workforce.

The relevant VET partners must choose their preferred Learning Outcome (LO) protocol and presentation style. This decision requires a thorough understanding of the purpose and application of LOs within unitized VET programs. It should as well include a comprehensive knowledge of the other components of a unit that are essential for developing and delivering a unitized curriculum based on standardized LO descriptions.

SOPs are designed to underpin and control the operational management of fish production and processing from «egg to plate».

Key Concepts and Methodology

Occupational profiles can be developed to outline the knowledge, skills, and competences needed to perform specific roles. Previous research conducted within the BlueEDU project (2016-19) indicates that employer expectations regarding responsibilities and levels of autonomy can vary between countries. For instance, husbandry operatives on Norwegian cage farms are often expected to perform tasks typically handled by the site manager during periods of absence and may also play a greater role in farm data collection and analysis. Identifying whether similar distinctions exist between Norwegian and Icelandic, Swedish and Finish operatives is essential for the development of a Common Competence Framework (CCF) for fin-fish aquaculture farming.

Once a Common Competence Framework (CCF) is established to outline employer expectations in the partner countries farming fin-fish, it can serve as a reference for VET designers in creating a Shared Framework of Learning Outcomes (SFLOs). This framework will identify the commonalities in Aquaculture VET across the partner countries, providing a solid foundation for collaborative VET development.

Competence

Competence is generally linked to a person's ability to perform specific tasks. Standards and frameworks centered on competence have traditionally been used to certify practitioners as «fit to practice». However, concerns have been raised about the extent to which degree skills, or attribute-based models accurately reflect the realities of day-to-day work. In response, capability-based models have emerged, emphasizing adaptability to changing contexts, evolving practices, and ethical considerations. Although less concrete, the concept of capability is increasingly shaping the development of «competence profiles» across various professions.

In aquaculture, competence has traditionally been defined in a task-oriented manner. However, the recent BlueEDU project qualitative surveys in Norway suggested that less tangible capabilities, such as collaboration, cooperation, problem-solving, and the use of initiative, are increasingly valued to the forefront by an increased number of companies. These capabilities are more difficult to define and pose significant challenges for developing reliable assessment strategies within a modern VET system.

Some aquaculture employers have already acknowledged these challenges, recognizing that traditional examinations of theoretical understanding offer limited practical value in assessing such capabilities. Instead, effective work-based assessment is emerging as crucial for gathering reliable evidence of capability-based competences, which are behavioral in nature. These competences can only be demonstrated through consistent, insightful observations of learners by experienced and well-trained managers.

To ensure consistency and fairness in managerial assessments, robust systems for standardizing assessments and ensuring quality assurance are becoming increasingly important. Such systems are essential to align judgments across different managers and maintain reliability in evaluating capability-based competences.

Skills-based competence systems remain very relevant to aquaculture, due to their practical and applied nature. Capability-based definitions are gaining recognition and widening the scope, e.g. such as «Soft Skills».

Some definitions of competence emphasize «degrees of autonomy» as a key factor in determining «skills-based» competence. In practice, this is reflected in the level of supervision needed to apply a skill or skill set to complete a task. This concept is captured in the European Qualifications Framework (EQF), which highlights 'responsibility and autonomy' as essential components.

From a practical standpoint, evaluating a person's competence can be done by assessing their ability to perform a 'specified task to a required standard' using the following scale:

A. The skill(s) required to complete the task need further development.
B. The skill(s) can be applied to complete the task under supervision.
C. The skill(s) can be applied to complete the task with limited supervision.
D. The skill(s) can be applied to complete the task independently.
E. The person can supervise others in applying the skill(s) to complete the task.



• In summary, while skills-based competence systems remain essential to aquaculture for their practical and applied focus, capability based definitions are increasingly gaining recognition and expanding the concept of competence. This shift is evident among Quality and Human Resource Managers in larger aquaculture companies, who are developing their own competence frameworks and emphasizing the significance of less tangible, more transversal capabilities, such as «soft skills.»

Standard Operating Procedures (SOP)

The production of fin-fish for high-volume export markets is largely controlled by multinational companies. These companies, employing hundreds of staff across multiple farm sites, typically implement Standard Operating Procedures (SOPs) to manage and standardize the fish production and processing from «egg to plate». Operations are heavily regulated and quality assured to meet a wide range of criteria, driven primarily by stringent food safety and animal welfare legislation, as well as the quality assurance (QA) demands of a powerful food retail sector.

Consequently, consistency in task execution across farms and processing facilities is critical, along with meticulous record-keeping to ensure accountability and traceability throughout every stage of the production process.

Many tasks and operations require the use of increasingly advanced equipment and digital technologies. As technology evolves, SOPs must be updated accordingly. Technology suppliers often assist farms in revising SOPs when introducing new equipment. However, this process essentially involves a 'task-based' analysis. Once developed, the SOP definitions typically remain the intellectual property of the company.

Prescriptive LOs apply performance criteria and assessment requirements that are mandatory.



While a well-defined set of SOPs outlines tasks that are often specific to a species or technology, they do not always specify who is responsible for each component of the task. In some cases, companies have taken this a step further by assigning tasks to specific roles, thereby creating comprehensive competence and skills profiles for each occupation within their organization.

National Occupational Standards (NOS) underpin National Qualifications

Occupational specifications or job profiles provide a comprehensive description of the knowledge, skills and competences necessary to perform the tasks and responsibilities associated with a specific role. When all occupations within a sector are defined in this way, the sector establishes a National Occupational Standard (NOS) encompassing all occupational levels. This NOS serves as a foundation for designing National Qualifications (NQs).

In some countries, the national VET system requires the creation of National Occupational Standards (NOS) for each sector to guide the development of National Qualifications (NQs). For public-sector agencies responsible for organizing standards, development committees and task groups ensuring effective employer representation presents a significant challenge. Ideally, the process should include input from all vested interests, ensuring both small and large companies have a voice.

Learning Outcomes

The adoption of Learning Outcome (LO)-based VET systems has gained widespread acceptance across Europe. Over the past decade, most EU member states have integrated LOs into their VET systems. Additionally, many of these countries have transitioned to a unitized system, where each unit is structured around clearly defined LOs.

In systems such as those in Scotland, Ireland, and Finland, Learning Outcomes (LOs) tend to be relatively prescriptive, often accompanied by mandatory performance criteria and assessment requirements.

Broadly defined LOs specify knowledge, skills and competence gained by the learner, as a direct result of a learning activity, whatever is its nature.

five explain

Advocates of these systems argue that, despite their standardization and quality assurance measures, they remain adaptable to the needs of local employers and individual learners by allowing for customization in the delivery of NQs.

This approach, for instance underpins the Scottish Modern Apprenticeship (MA) in Aquaculture, an NQ designed to accommodate a wide range of roles, whether in shellfish or fin-fish farming, and in hatcheries or on-growing sites. This flexibility is achieved through a mandatory and optional unit structure, which offers significant choice, and by aligning standards with company SOPs rather than conflicting with them. As a result, the framework can be used by any farm to support its staff development programs, making the NQ more accessible. This accessibility is further enhanced when delivery systems incorporate individualized learning and assessment plans.

In contrast, the Norwegian VET system requires learners and teachers to address all the 36 competence goals and describe them by applying Learning Outcomes (LOs). This helps preparing the students for any role within the fish farming process, preventing delivery in a narrow, farm-specific context.

The aquaculture curriculum in Norway is structured into three main modules:

- **Operation and Production** (17 LOs),
- **Farms and Techniques** (9 LOs), and
- **Farming and Environment** (10 LOs).

These LOs are broadly defined to align with the curriculum's descriptions. Although all LOs are mandatory, VET schools have the flexibility to prioritize certain LOs by dedicating additional time to them.

The LO specifies the knowledge, skill and competence a learner will acquire as a direct result of a learning activity, regardless of its nature. Consequently, LOs align with National Occupational Standards (NOS) where such standards exist. However, in some VET systems, like Ireland's, NOS may not be part of the framework. Instead, employers collaborate with VET providers to develop a unitized VET system, which achieves a similar alignment with industry standards.

Occupational standards may be represented as National Occupational Standards (NOS) at the national level. Standard Operating Procedures (SOPs) at the company level, and incorporated into Learning Outcomes at both national and local levels.

Occupational standards in Norway:

- **Aquaculture NOS** - No, but companies may locally influence VET providers to prioritize certain Learning Outcomes (LOs). However, all the LOs must still be delivered.
- **Learning Outcomes** - Yes, they are broadly defined at the national level and further detailed locally in collaboration with industry.
- **SOP Company level** - Yes, and connected to quality assurance (QA) and company training.

In summary, while National Occupational Standards (NOS) are absent in most Northern European countries except Scotland, the majority of these countries do implement Learning Outcomes (LOs).

Occupational Standards is expressed as NOS at national level, SOPs at company level and reflected in LOs at national or local levels.

EQF



The European Qualifications Framework (EQF) serves as a tool for interpreting and comparing qualifications by assessing the levels of knowledge, skills, and competences required to meet specific Learning Outcomes. The EQF system defines these elements as follows:

- Knowledge - Described as either theoretical or factual.
- Skills - Categorized as cognitive involving logical, intuitive, and creative thinking, or practical involving manual dexterity and the use of methods, materials, tools, and instruments.
- Competence - Defined in terms of responsibility and autonomy.

The EQF is utilized to identify qualification equivalencies necessary for completing the VET supply analysis. Its inclusion of competences, particularly those defined by levels of autonomy, reflects the real-world demands of the aquaculture workplace. This makes the EQF a valuable common framework for determining qualification equivalencies.

The role of NOS

Some critics argue that **National Occupational Standards (NOS)** have limited value due to their potential to become outdated quickly, which can indeed be a significant concern. A NOS written in broad, generic terms is less likely to become outdated quickly, as specific details can be addressed within supplementary standards. Typically, a generic NOS is shaped by the following:

a) Industry Codes of Good Practice

b) Technical Certificates issued by recognized awarding bodies

c) Company Standard Operating Procedures (SOPs)



Occupational standards are formal guidelines defining the skills, knowledge, and competences required to perform specific tasks or roles in a particular job or industry.



While the two first points remain consistent at the national level, company **Standard Operating Procedures (SOPs)** will and often do vary to some extent. There are, however, commonalities across the cage farming industry in Europe, as it often relies on the same service sector companies regardless of the species being farmed. For instance, commercial feed companies supply balanced diets suitable for various fin-fish species farmed in both northern and southern Europe. While feeding behaviors differ between species, the core principles such as feeding regimes, feed distribution, growth and food conversion, remain consistent. This is just one example suggesting significant common ground that can be clearly defined.

The aquaculture service sector, including companies supplying consumables like health products and feeds, as well as those supply companies providing equipment and technology, is well-positioned to contribute meaningfully to the development of occupational standards. It is arguably in their interest to help aquaculture clients maximize the value of their products. For equipment and technology supply providers, supporting well-designed VET could help reduce customer support costs, offering further incentive to engage. Properly trained farm operators who understand the operational requirements of their equipment can minimize risks of accidents, damage, and suboptimal performance, benefiting all stakeholders.

Regulatory adherence

Fish farming inherently carries risks that can impact human health and safety, the aquatic environment including its flora and fauna, and animal (fish) welfare to varying degrees. In Europe's sophisticated society, the public demands robust assurances, regardless of when, where and whether they consume fish. As a result, the farming industry operates as a highly regulated food producer.

Consequently, the European and national legislative frameworks exert significant direct and indirect influence on the development of occupational standards.

Furthermore, aquaculture equipment is becoming increasingly large and sophisticated, necessitating specialized operators who are trained, assessed, and certified by recognized awarding bodies to demonstrate their competence. This is evident in the operation of work- and supply boats, radio communications, and land-based vehicles such as forklift trucks, all of which require certified operators.

Some **Codes of Good Practice (CoGP)** are highly comprehensive, outlining both the legal obligations fish farms must adhere to and providing best practice guidelines for a wide range of essential fish farming activities.

The role of CoGP

All SOPs must comply with legally binding directives, making well-established CoGP a valuable resource for cross-country comparisons. Since many directives are derived from the same European statutes, which are incorporated into national laws before being detailed in the Codes, a high degree of commonality is expected.

To ensure industry compliance, national producer organizations frequently update these Codes, making them an essential reference for comparing and defining standards.

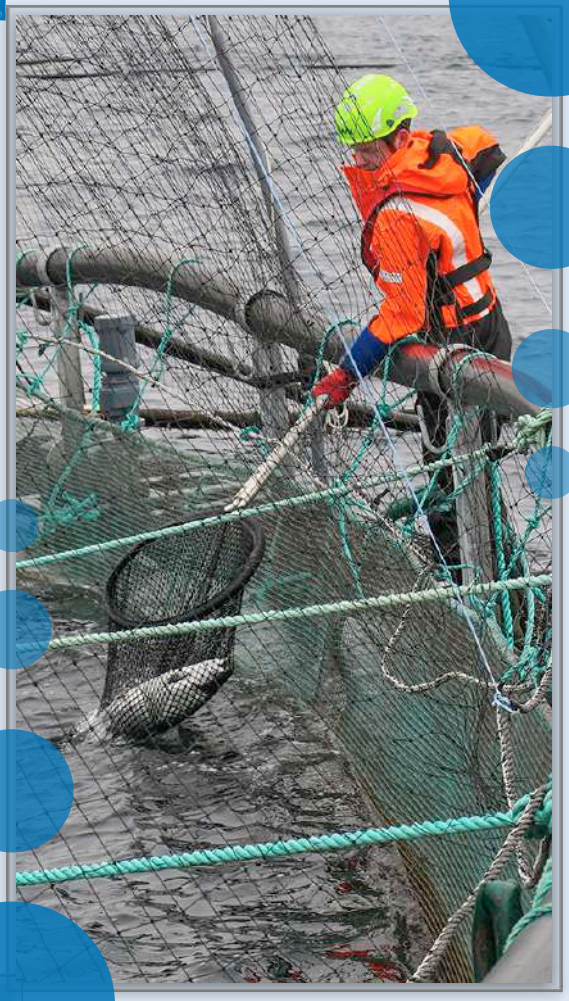
CoGP is providing good practice guidelines across a wide range of core fish farming activities.

Farming applies a plethora of different QA standards.

Certified fish production

The aquaculture industry supplies fish products to the influential food retail sector, its primary buyer, necessitating the implementation of numerous quality assurance (QA) standards. The primary goal of most food retail quality assurance (QA) schemes is to reassure consumers. This is accomplished by placing contractual requirements on the QA systems of their fish suppliers. These demands significantly influence the design of company training including non-formal VET, linking occupational standards to the industry's ongoing challenge of preparing documentation for multiple audits.

An example of this is the Norwegian global producer company Salmar, which ensures that only staff with documented skills and competences are deployed for fish farming operations. These qualifications are obtained through in-company training, NQs, or certifications from specialized technical training providers. All staff skills and competences are systematically recorded in their QA and HR systems.





- Modern fish consumers demand products that are nutritious, flavorful, and safe, requiring full accountability and traceability from «egg to plate». Beyond these expectations, many consumers also seek assurances about producers' responsibility toward the environment and animal welfare. This has led to the adoption of additional standards, such as «Freedom Foods» and Organic Food certifications, particularly for niche markets. Both in-company training (non-formal VET) and National Qualifications (formal VET), guided by National Occupational Standards (NOS) or their equivalents, must align fully with the quality assurance (QA) requirements that companies are obligated to meet.

Educational LO protocols refer to a set of standardized guidelines, rules, or procedures used to design, deliver, and evaluate educational activities and programs

The Framework of the Learning Outcome Protocols

Discussions with industry members have highlighted the necessity for fish producers to be well-prepared, legally compliant, and current with their documentation to manage multiple audits effectively. These demands have shaped the development of company SOPs. Consequently, many in-company training programs, including the non-formal VET, prioritize training operators to adhere to SOPs that address all aspects of external regulatory requirements.

For an aquaculture NQ to gain respect, there must be a clear and consistent connection between the «quality-assured assessment process» required for NQ completion and the company SOPs, which reflect the legislative and quality assurance (QA) standards governing salmon and trout farming. When industry representatives participate in NOS and VET development committees, they often prioritize their own company SOPs.

The industry places the highest value on the «practical competence» of its staff, which, for many, simply means the ability to perform their assigned tasks safely, efficiently, and in alignment with company SOPs, ensuring legal compliance. Discussions with industry partners about education and training frequently center around the concept of competence. Therefore, within the this project, developing a Common Competence Framework (CCF) that is supported and endorsed by industry partners would be a significant asset for Micro-Courses.

Once established, a Framework of Shared Learning Outcomes (FSLO) can be developed, outlining the knowledge, understanding, and skills learners need to acquire. This FSLO would be aligned with the framework of competences endorsed by industry partners. Once created, it can serve as a reference for VET development teams, supporting the creation of VET resources that can be shared across multiple aquaculture farming countries.

These resources can ultimately be organized into **Competence Units (CUs)**, which could also be shared internationally.

Since each CU will consist of defined LOs, it is essential for partners to agree on the protocols for formulating LOs at the outset before developing shared outcomes. While many European countries now use LOs, the style, format, quality, and practicality of LOs for supporting a quality-assured assessment process vary significantly in practice.

In the most advanced national VET systems, the description of LOs has become more structured, concise, and prescriptive. This approach promotes brevity, clarity, and precision, making it easier for all stakeholders to standardize and ensure the quality of both continuous and final assessments. The emphasis should be placed on the outputs of VET, focusing on the achievement of LOs rather than on the inputs, such as the curriculum or syllabus. These inputs can be left to experts to design. Well constructed NQs provide the flexibility needed to meet the diverse needs of learners and employers, while maintaining the integrity of the NQ.

The proposed CUs which will be the smallest Unit**,** is a clearly defined segment of a micro-course or a component in amicro-qualification, that focuses on a specific set of skills, knowledge, and competences required to perform particular tasks or roles effectively in a workplace or professional context. It is designed to assess and certify a learner's capability in a specific area of competence.

The FSLO is outlining the knowledge, skills, and competences learners need, and could be created based on the competence framework endorsed by industry partners.

The Structure of Units

In many European VET systems, Units serve as the building blocks of NQs and must maintain integrity through a quality-assured LO-driven assessment process that is accessible and achievable for all learners. While the nature, style, presentation, and purpose of Units within NQs differ across national systems, most are based on LOs. Over time, various types and styles of LOs have evolved, with the most effective being concise, clear, and precisely defined. To achieve this level of clarity, the methodology for developing LOs must be standardized before partners can create a Framework of Shared Learning Outcomes (FSLO).

Some Unit formats are more detailed than others, and the purpose of each component must be clearly defined and understood by all stakeholders involved in the VET delivery and assessment process.

In many European VET systems, units are the foundations of NQs.





The Content statement

Offers a concise overview of the knowledge, skills, and competences learners will acquire from the Unit, along with its occupational level. This summary is typically presented as a brief paragraph at the start of the Unit descriptor.

The Learning Outcomes

They define what a learner «must be able to do» upon completing a Unit and serve as its foundational framework. Some outcomes focus on cognitive abilities, while others emphasize the development and application of practical skills.

Cognitive LOs can be grouped into two primary categories:

- Demonstration of knowledge: Learners showcase their grasp of specific concepts.
- Application of knowledge: Learners use their knowledge to complete cognitive tasks.

five explain

Cognitive LOs require learners to show they understand and know a concept, or apply that knowledge to complete a specific task.

In both cases, it is essential to keep learning outcomes concise and to carefully selecting the active verb, as this determines the LO's nature and level. Bloom's Taxonomy provides a hierarchy of active verbs, ranging from simple to more complex, to guide the design of LOs.



Knowledge

The hierarchy of active verbs for this category might range from basic terms like «name» and «state» to more demanding ones such as «explain» and «evaluate». The active verb indicates the depth of knowledge and understanding required and the type of evidence needed to demonstrate achievement:

- Basic Verbs: At the lower end, verbs like «name» might require only one-word answers, such as identifying a fish species.
- Advanced Verbs: Verbs like «explain» demand more comprehensive responses, requiring learners to articulate their understanding of concepts or processes in depth.

Application of knowledge

For applying knowledge, the active verbs reflect increasing levels of complexity, such as: «calculate», «analyse», «evaluate», «formulate», and «develop». However, the difficulty and complexity of the LO also depends on the specific task.

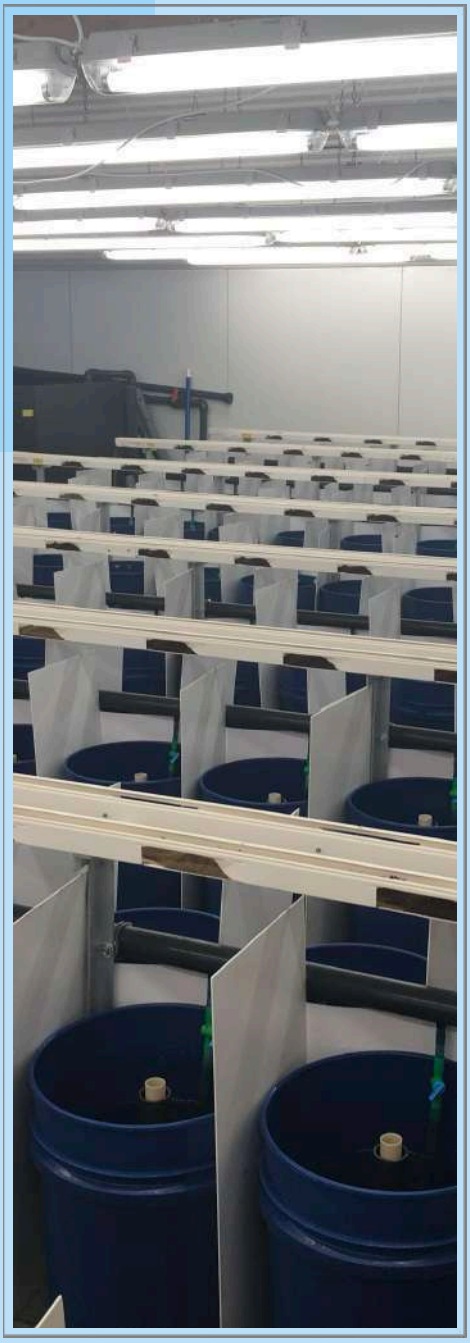


To ensure effective leveling and alignment within national qualification frameworks, analyzing cognitive tasks for each vocational level is essential.

Cognitive tasks generally do not require access to practical facilities. For example, the LO «develop a feed schedule for a population of farmed fin-fish» does not necessitate a fish farm, but benefits from tools like a PC and spreadsheet software. This flexibility allows cognitive LOs to be achieved without resource-intensive setups.

Practical skills- and competence based LOs typically require access to appropriate facilities to produce the evidence needed to demonstrate their achievement. In some NQs, it is acceptable to meet these outcomes through simulations, in demonstration-scale facilities, or practical outcomes

Blooms revised taxonomy (2001) adds a dynamic perspective on learning by focusing on cognitive processes and knowledge dimensions.



be demonstrated on a commercial farm, permitting simulation only for a limited number of specified tasks. These considerations are critical when developing and drafting LOs.

The active verbs «assist», «contribute to», «conduct», «supervise», and «manage» represent an ascending hierarchy, each indicating progressively higher levels of complexity and responsibility. «Assist» is a basic requirement, slightly more advanced than work shadowing. Certain aspects of a task may allow for assistance, while others may not, making it essential to specify these distinctions in the «evidence of assessment».

The required level of autonomy increases progressively from EQF levels 3 to 6. At the lower end of the spectrum, learners are typically expected to conduct tasks with or without assistance.

In contrast, at higher levels, they are required to supervise others in performing tasks. Autonomy is a key component of competence, and learners must provide evidence of their ability to operate at the appropriate level to demonstrate that the learning outcome has been achieved.

Skills and competence performance statements

The terms «performance criteria» and «skills and competence statements» are interchangeable and convey the same meaning. Regardless of which term is used in Unit descriptors, the skills and competences required to meet specific learning outcomes (LOs) must be clearly and unambiguously defined to ensure consistent interpretation by all assessors. Skills and competences can be described using concise, single-sentence statements, with brevity being highly encouraged.

For instance, the skills statement «Recommend disease management and treatment options» is concise and precise. However, to assess this skill effectively, additional details and criteria would need to be specified, which can be provided in the assessment evidence section below.

Practical skills based LOs.

Practical skills statements often provide reference to industry standards or SOPs. For example, «Monitor fish for the presence of disease or parasites in accordance with industry standards».

As noted earlier, companies typically align their SOPs with the same industry standards referenced in performance criteria or skills and competence statements.

Evidence of assessment
The assessment evidence outlines the type and quantity of evidence needed to meet the standards specified in the Unit. For example, the evidence requirements for the skills statement mentioned earlier «Recommend one appropriate disease management option for any two of the following four disease conditions: bacterial, fungal, internal parasitic, external parasitic».

Additionally, assessment guidelines are usually provided:





- This outcome could be assessed through performance evidence documented on an observation checklist.
- The candidate should also provide clear and accurate records of all disease diagnoses.

By interpreting the skills statement, evidence requirements, and guidelines, it becomes clear what the learner must demonstrate to the assessor and how this demonstration should take place. While this approach to skills assessment is concise and prescriptive, it also allows for flexibility. For instance, the example above, from the Fish Health CU, permits the learner to select two out of four disease conditions without specifying the exact diseases for which management options must be recommended.

This flexibility enables the skill to be demonstrated in various contexts, ensuring there are no unreasonable barriers to achievement, provided the learner has access to farmed fish stocks with diseases on at least two occasions.

Performance criteria for skills and competence statements.

Statements involving range or scopes

Some Units incorporate range or scope statements to provide greater specificity and/or prescriptiveness. A range statement is often applied to a single word or concept. For example, if it were deemed essential for learners to be assessed on recommending disease management options that include vaccination, chemical addition to water, and chemical addition to food, these three options could be explicitly defined through a range statement, as follows:

Disease management options: must include one example from each of the following categories: vaccination, chemicals added to fish feed, and chemicals added to water.

This added specificity requires that all three types of treatment are addressed at least once, ensuring that learners demonstrate a wider variety of disease management methods, resulting in a broader skill set.

Core skills and competences

Core skills and competences is incorporated into Units in different ways, ranging from a lighter touch to a more detailed approach. For instance, in the Fish Health CU mentioned above, opportunities for core skills development are identified, specifying which skills can be developed and the corresponding SCQF level. However, it also clarifies that these skills are not automatically certified, and additional steps would be required if certification is needed.

The Units component summary

- Content statements
- Learning Outcomes
  - Performance criteria
  - Knowledge statements
  - Applied knowledge statements
  - Skills and competence statements
  - Core skills and competence delivery statements
  - Assessment criteria
  - Requirements for evidences



Selecting protocols and specifications

As outlined above, protocols for LOs cannot be viewed in isolation from the overall Unit specification, which underpins the NQ and reflects the ethos of the national VET system.

All LOs share certain common elements. They define and prescribe the expected learning outputs, which equals the «outcomes», and carry assessment implications. These implications vary in their level of prescriptiveness across different unitized systems, regardless of the balance between continuous and final assessments.



While LOs are central to all the examples discussed, there are notable variations in their presentation, precision, and level of detail. Currently, Norway lack a unitized national VET system. As a result, any move toward unitization is determined at the institutional level, with institutions selecting a Unit style that aligns with the partnership's short- and long-term purposes, or hybridizing of existing styles to create a new and more tailored, effective approach.

Initial VET

Develop Knowledge -> Skills -> Competence

The delivery of Micro-Course based training, that is part of Initial VET leading to a NQ or an International Diploma, applies the following harmonized structure and sequence of the key components:

Competence Units contain structured and harmonized minimum specifications for delivery, organized like this:

1. **Content** description: This is informational materials transforming the curriculum into short content descriptions.
   - Optional: High level description of expected competences to be achieved.
2. **General Learning Outcomes (GLO)** description: They transforms the Content into brief, clear and specific measurable statements by providing:
   - KNOWLEDGE: Describe what the student should have knowledge about….
   - SKILLS: Describe what the student will be able to do …..
   - COMPETENCES: Describe what the student should be able to do ….
3. **Specific Learning Outcomes (SLO)** description: They transforms the GLO into the operational level, by describing the practical and actionable insight that supports the effective delivery and smooth operation of the training activities, by providing
   - KNOWLEDGE: Describe what the student should have knowledge about….
   - SKILLS: Describe what the student will be able to do …..
   - COMPETENCES: Describe what the student should be able to do ….
4. **Access Conditions** description: Terms and conditions for accessing the training courses or micro-courses.

Initial VET - Micro-Course Tests

The delivery of a micro-course ends by providing a test that focuses towards and is designed to evaluate and assess the limited scale learning episodes.

Objective tests, which could be part of e-learning delivery, is used for assessing factual knowledge and specific skills.

They apply multiple choice questions that require a user to choose or provide a response to a question whose correct answer is pre-determined. There is no room for a subjective response or opinions from the user. The options themselves must be either right or wrong, so that the question can be marked objectively.

Given this definition, objective tests can go well beyond the simple «choose one correct answer from four or five listed». For example:

- Multiple choice: select one, multi-answer, or multi-answer with all or nothing marking,
- True or False, which is the simplest of a multiple choice test alternative,
- Fill in the blanks in the text from the drop-down boxes,
- Type in the answer, e.g. for short answers,
- Drag and drop: words into the text, or answers onto an image, or markers/target, or to match images, or text/images to create a sequence,
- Matching questions with phrases.

Objective tests are commonly used in educational settings, certification exams, and standardized tests due to their efficiency in testing large groups and the ease of automated grading.

Validity of the Micro-Credential is secured by applying accredited and recognized training providers.

Work-based delivery tests, involves evaluating and assessing the knowledge, skills and competencies that learners acquire in real-world work environments.

They require that clear objectives have been specified, which identify the learning outcomes and competences that the micro-training is designed to achieve. They should be aligned with the relevant industry standards and qualification frameworks.

Work-based training often requires a combination of approaches to comprehensive evaluate students performance. This includes direct observations, workplace evidences, peer and supervisor feedbacks, self assessments and knowledge and skills assessments.

Performance criteria must be set and define the benchmarks for success. This could for instance include accuracy of work, adherence to safety protocols and company policies, efficiency during operations, problem solving and decision making skils. The assessment should be aligned with real world tasks and continuous feedback should be provided during the tests.



• After passing the test, a **Record of Achievement** is issued to the student, and the descriptions in the Content, GLO and SLO are automatically transferred to the corresponding Micro-Credential.

The Record of Achievement is a formal document or portfolio that tracks and highlights an individual's accomplishments of knowledge, skills, competencies and qualifications. It provides evidence of what the individual has achieved and serves as a reference for employers, assessors, or educational institutions.

Several Micro-Credentials may be combined and lead to a **Micro-Qualification**, which is documented by issuing an **International Micro Specialization (IMiS) Diploma.**

The IMiS Diploma is designed to document specialized expertise without applying the extensive time commitment that are part of traditional NQ degrees and International Diploma programs. It offers a practical and efficient means to acquire specialized knowledge, skills and competences that are directly relevant for industry needs.

The **Micro-Credentials and the Micro-Qualifications apply**:

- Focused curriculum that concentrate and offer in-dept knowledge, skills and competences by focusing on particular subjects,
- Flexible learning methods that are often available online, allowing companies and their staff to access and complete training at their own convenience,
- Short duration micro-courses that is enabling completion within a shorter time-frame, leading to a fewer credits deployed as ECTS points,
- Micro-Credentials that are stackable, whereby credits earned sometimes could be applied towards more advanced degrees, facilitating Lifelong Learning with continuous learning pathways.

Continuing VET

Specify Competence -> Add Knowledge and Skills

The delivery of Micro-Course based training that is part of Continuing VET, applies the following structure and sequence of the components:

Competence Units contain structured and harmonized minimum specifications for delivery, organized like this:

1. **Content** description: This is informational materials transforming the curriculum into short content descriptions.
   - Optional: High level description of expected competences to be achieved.
2. **General Learning Outcomes (GLO)** description: They transforms the Content into brief, clear and specific measurable statements by providing:
   - COMPETENCES: Describe which competence that is needed ….
     - KNOWLEDGE: Describe how to provide sufficient knowledge that let the staff acquire this competence ….
     - SKILLS: Describe how to provide work-based skills that let the staff acquire this competence …..
3. **Specific Learning Outcomes (SLO)** description: They transforms the GLO into the operational level, by describing the practical and actionable insight that supports the effective delivery and smooth operation of the training activities, by providing
   - COMPETENCES: Describe which competence that is needed ….
     - KNOWLEDGE: Describe how to provide sufficient knowledge that let the staff acquire this competence ….
     - SKILLS: Describe how to provide work-based skills that let the staff acquire this competence …..
4. **Access Conditions** description: Terms and conditions for accessing the training courses.

Continuing VET - Micro-Course Tests
The delivery of a micro-course ends by providing a test that focuses towards and is designed to evaluate and assess the limited scale learning episodes.

Objective tests, which could be part of e-learning delivery, is used for assessing factual knowledge and specific skills.

They apply multiple choice questions that require a user to choose or provide a response to a question whose correct answer is pre-determined. There is no room for a subjective response or opinions from the user. The options themselves must be either right or wrong, so that the question can be marked objectively.

Given this definition, objective tests can go well beyond the simple 'choose one correct answer from four or five listed'. For example:

- Multiple choice: select one, multi-answer, or multi-answer with all or nothing marking,
- True or False, which is the simplest of a multiple choice test alternative,
- Fill in the blanks in the text from the drop-down boxes,
- Type in the answer, e.g. for short answers,
- Drag and drop: words into the text, or answers onto an image, or markers/target, or to match images, or text/images to create a sequence,
- Matching questions with phrases.

Objective tests are commonly used in educational settings, certification exams, and standardized tests due to their efficiency in testing large groups and the ease of automated grading.

An International Micro Specialization Diploma offers a practical and efficient method for acquiring specialized knowledge, skills and competences.

Work-based delivery tests, involves evaluating and assessing the knowledge, skills and competencies that learners acquire in real-world work environments.

They require that clear objectives have been specified, which identify the learning outcomes and competences that the micro-training is designed to achieve. They should be aligned with the relevant industry standards and qualification frameworks.

Work-based training often requires a combination of approaches to comprehensive evaluate students performance. This includes direct observations, workplace evidences, peer and supervisor feedbacks, self assessments and knowledge and skills assessments.

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The Record of Achievement is a formal document or portfolio that tracks and highlights an individual's accomplishments of knowledge, skills, competencies and qualifications. It provides evidence of what the individual has achieved and serves as a reference for employers, assessors, or educational institutions.

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Example of how an Aquaculture Initial VET Course is structured and delivered.

Program for candidate course in aquaculture in Norway, structured and delivered as 12 Micro-Courses.

1. **Operation and Production (Micro 1.00)**
   - Applicable regulations. HSE, risk assessment.
2. **Operation and Production** and **Farming and Environment (Micro 2.00)**
   - Nutrition and growth.
3. **Farms and Techniques** and **Operation and Production (Micro 3.00)**
   - Water treatment, water transport and plant construction. RAS .
4. **Operation and Production** and **Farming and Environment (Micro 4.00)**
   - Production plan for Aquaculture 1.
5. **Farming and Environment (Micro 5.00)**
   - Health, Safety and Environment.
6. **Operation and Production (Micro 6.00)**
   - Feeding theory.
7. **Farming and Environment (Micro 7.00)**
   - Environmental challenges in Aquaculture.
8. **Operation and Production (Micro 8.00)**
   - Salmon lice and lice control.
9. **Farming and Environment (Micro 9.00)**
   - Diseases and fish health.x+
10. **Farms and Techniques (Micro 10.00)**
    - Plant construction and the path to a plant certificate.
11. **Operation and Production** and **Farming and Environment (Micro 11.00)**
    - Production plan for Aquaculture 2.
12. **Operation and Production** and **Farming and Environment (Micro 12.00)**
    - Repetition and review.

five explain

By completing the 12 micro-courses (containing 12 Competence Units with tests, leading to 12 Micro-Credentials), the students will receive **3 Initial VET Micro-Qualifications** covering the specialization areas:

- **Operation and Production**
- **Farms and Techniques**
- **Farming and Environment**

The 3 micro-qualifications include 36 learning goals. They are organized into delivery of 12 micro-courses with their CUs, each containing standardized and harmonized LOs description of the Content, GLO and SLO, leading to 12 Micro-Credentials.

The students will after completing micro-course no. 12.00, sign up for the NQ exam. When they pass that exam, they will receive a **National Qualification in Aquaculture** for husbandry operatives.

The micro-courses are designed to support customized VET delivery, while remaining adaptable for use in alternative delivery modes.

They apply short episodes of focused learning that are related to a specific topic. When used in line with a dedicated pedagogy, they enable learners to identify their areas of weakness and focus their studies more effectively.

This includes applying Recognition of Prior Learning, Guided Self-Studies and Summative Assessment Accreditation.

A Micro-Course delivery undertake applying multiple choice question for the unit, automated RPL , self studies and open text submission with evaluations.

D7.1 Framework of shared CUs with MCs, MQs and the Learning Outcome Protocols for EN1090 inspectors



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Contents

1. Purpose and Scope of the EN 1090 Framework 2
2. Key Concepts and Methodology 3
2.1 Competence-Based Learning Outcomes in EN 1090 3
Degrees of Autonomy in EN 1090 4
Ensuring Quality and Reliability in Assessments 4
Blooms taxonomy 5
2.2 The Role of Standards in EN 1090 5
3. Structure of the EN 1090 Competence Units (CUs) 5
3.1 Content Statement 5
3.2 General Learning Outcomes (GLOs) 6
3.3 Specific Learning Outcomes (SLOs) 6
3.4 Performance Criteria 6
4. Delivery of EN 1090 Micro-Courses 8
4.1 Work-Based Training and Assessment 8
4.2 Micro-Course Testing 10
4.3 Record of Achievement and Certification 15
5. CPR Regulatory Adherence and Quality Assurance 15
5.1 Regulatory Compliance 15
5.2 Factory Production Control (FPC) 15
5.3 Codes of Good Practice (CoGP) 16
6. Example EN 1090 Course Structure 16
6.1 Micro-Course Modules 16
6.2 Work-Based Assessment Delivery 17
7. References 19
8. Spare pictures 21

1. Purpose and Scope of the EN 1090 Framework

The purpose of this framework is to establish a common structure for developing, defining and using Learning Outcomes (LOs), consisting of their general (GLO) and specific version (SLO). Using the critical definitions to advance Vocational Education and Training on the European level.

The framework will try to align modern teaching principles with the practice of internationally recognized ISO and EN standards, focusing on EN 1090 as a part of European regulative for the construction and control of steel and aluminium constructions.

New trainings will focus on practical skills and competence of EN 1090 inspectors, furthering quality assurance of such constructions and ensuring workforce readiness of staff when completing such courses. The same system can use at the same time Quality Assurance responsible persons in production companies.

Speciality of this framework should be the suitability for use in development of all the EN1090 competence units. EN1090 inspector and quality assurance personnel should get multidisciplinary knowledge which can be logically divided in several micro courses. For each micro course we have found from best practice different optimal ways how to build the system of single CUs as micro courses, work-based training and how to include high variety of attendees and their needs. There is an expectation that in some CUs we will have attendees from EQF level 3 to 8 with big differences in starting point knowledge. This framework therefore generally describes the common methodologies and at the same time allows best options for detailed micro course organization.



Figure 1: steel gas pipeline construction

2. Key Concepts and Methodology

Occupational profiles can be developed to outline the knowledge, skills, and competences needed to perform specific roles. Previous research indicates that employer expectations regarding responsibilities and levels of autonomy can vary between countries.

Once a Common Competence Framework (CCF) is established to outline employer expectations it can serve as a reference for VET designers in creating a Shared Framework of Learning Outcomes (SFLOs). This framework will identify the commonalities, providing a solid foundation for collaborative VET development.

2.1 Competence-Based Learning Outcomes in EN 1090

Competence in the context of EN 1090 is generally linked to a person's ability to perform specific tasks to a required standard, ensuring compliance with ISO and EN regulations. Traditional frameworks for competence focus on skills-based models, certifying practitioners as "fit to practice" based on their ability to execute defined tasks. However, emerging demands in modern fabrication environments highlight the need to incorporate capability-based models, which emphasize adaptability, problem-solving, and the ability to respond to evolving practices and contexts.

In structural steel and aluminium fabrication under European harmonized standard EN 1090, competence can be assessed across two critical dimensions:

- Task-Oriented Competence: Ability to perform welding inspections, quality control, and production tasks in line with EN ISO 3834 and Factory Production Control (FPC) systems.
- Capability-Based Competence: Skills such as decision-making, collaboration, initiative, and adherence to quality assurance protocols, which are behavioural in nature and often observed through real-world performance.

To address these dimensions effectively, reliable work-based assessment becomes essential. Traditional examinations may fall short in assessing these practical and intangible capabilities. Instead, competence must be demonstrated through practical tasks, observed systematically by qualified supervisors, and evaluated using consistent performance benchmarks aligned with EN 1090-2/3 Execution Class (EXC) requirements.



Degrees of Autonomy in EN 1090

Competence is also defined by levels of autonomy, as highlighted in the European Qualifications Framework (EQF). These levels reflect the extent of supervision required to apply skills in practice and align with the practical execution of tasks under EN 1090. Competence can be evaluated using the following scale:

1. Developing: The skill(s) required to complete the task need further improvement.
2. Supervised Application: The task can be completed under supervision.
3. Limited Supervision: The task can be performed with minimal oversight.
4. Independent Execution: The task can be completed autonomously to a required standard.
5. Supervisory Level: The person can supervise others in performing the task effectively.

This structured approach ensures that learners progress from basic levels of competence to higher levels of autonomy and responsibility, aligning with the demands of EN 1090 certification across Execution Classes 1–4 (EXC1–EXC4).

Ensuring Quality and Reliability in Assessments

To maintain consistency and fairness in assessing competence:

- Robust systems for standardizing assessments must be implemented.

- Performance evaluations should align with SOPs, ISO 3834 quality management requirements, and EN 1090 quality assurance criteria.

- Observations should be conducted systematically by well-trained managers or assessors to ensure objective and reliable outcomes.

In summary, skills-based competence remains essential for its practical focus in EN 1090 contexts. However, capability-based approaches are increasingly recognized as critical for ensuring workers' ability to adapt to quality, safety, and evolving industry standards. This holistic model supports the development of a well-rounded, competent workforce ready to meet the demands of modern fabrication under EN 1090.

Blooms taxonomy

Based on Bloom's Taxonomy:

- **Knowledge**: Recall and explain theoretical concepts (e.g., material properties, welding principles).
- **Application of Knowledge**: Perform tasks such as calculating welding parameters or executing inspections.
- **Practical Skills**: Demonstrate welding, testing, and fabrication tasks in line with EN 1090 requirements.

2.2 The Role of Standards in EN 1090

- All metal constructions in EU shall be built according Construction Products Regulation (CPR) under which is obligatory use of standards **EN 1090-1/2/3**.
- Adherence to **ISO 3834** (Quality in Welding) and **EN 1090-1/2/3** standards.
- In **EN 1090-1/2/3** standards are cited tenths of production standards, which should be used by production.
- Alignment with Codes of Good Practice (CoGP) for quality and compliance in cases when standards for any reason cannot be used.
- Integration of Standard Operating Procedures (SOPs) to ensure task consistency.

3. Structure of the EN 1090 Competence Units (CUs)

3.1 Content Statement

- Provides a summary of key knowledge, skills, and competences for the Unit.
- Offers a concise overview of the knowledge, skills, and competences learners will acquire from the Unit, along with its occupational level. This summary is typically presented as a brief paragraph at the start of the Unit descriptor.

3.2 General Learning Outcomes (GLOs)

Define broad capabilities related to EN 1090 tasks, such as:

- Knowledge of material standards (ISO 15614, EN 1090-2) and other harmonized standards.
- Ability to prepare, execute, and inspect workplans, construction plans, welds, mechanical fastening, anti-corrosion protection, NDT, erection of constructions and final quality with dimensions.
- Understanding of Factory Production Control (FPC) requirements.

3.3 Specific Learning Outcomes (SLOs)

Detailed, task-specific statements such as:

- Calculate and select appropriate welding processes for EXC1–EXC4.
- Perform non-destructive testing (NDT) on structural components.
- Document quality control results according to EN 1090.

3.4 Performance Criteria

Criteria to evaluate achievement of LOs:

- Learning outcomes should be defined as exactly as possible, LO description should be written on each MC document of achievement, therefore should be defined short and longer version of outcomes.
- The range of LOs description goes from a single word or concept up to many sentences.
- The greatest challenge will be to balance flexibility to achieve market needs and international recognition at the same time.
- The highest level of flexibility is to compare only the estimated MC workload with rough content statements and inhouse final exams. As we go into greater harmonization, we would lose flexibility.
- On other side highly harmonized outcomes and common (international) exams are possible and ideal for some CUs, but development of such course is very slow and not flexibility of courses is lost. In this case usually common teaching materials and examination questions can be used.
- In last years blended learning and remote exams are widely used what brings optimization of costs and international cooperation as well.
- In the same way LOs should be defined as achieved knowledge, core skills and advanced skills as well as competences. In EN1090 some MCs should be finalized by final accredited and defined certification, because of standard requirements. For non-destructive testing and welding for example this is for now only wide recognized method.
- For cutting and mechanical fastening for example standardized conclusion of micro courses is not yet defined.
- For inspection of welds for example international welding inspector courses with harmonized exams and diplomas is used and recognize.

- For some CUs of EN1090 inspector courses requires new system similar to National Vocational Qualification system shall be developed and used.
- Content statements, Learning Outcomes, Performance criteria, Knowledge statements, Applied knowledge statements, Skills and competence statements, Core skills and competence delivery statements shall be defined in each curricula of any micro course.
- Complete quality assurance system for all of the courses shall be developed including: Assessment criteria, Requirements for evidences, selecting protocols and many other specifications shall be defined and published in the way that any institution who wants to recognize any MC can easily check.
- Specifications as outlined above shall be developed under European MC guidelines, National MC guidelines, Training provider guidelines and requirements of any type of Accreditation body who will check the courses. Use of any training or educational standard is highly recommended.

4. Delivery of EN 1090 Micro-Courses

4.1 Work-Based Training and Assessment

Practical delivery aligned with EN 1090 tasks, including:

- Quality assurance and inspection protocols for design review on practical samples,
- inspection of practical samples of workplans and quality control plans,
- cutting process practical workshop with quality assessment by standards,
- Welding practice (MIG/MAG, TIG, etc.) on 3 or more levels.
- NDT practical workshop (VT, UT, RT, PT and MT) on practical samples, analyse of defects. This part can be structured on 3 levels, depending on course user needs.
- Mechanical fastening practical workshop including factory assessment about mechanical fastening.
- Practical or video workshops about all practical steps to achieve anti corrosion protection of metal structures including different preparation stage methods, Primers, Paints, Paints and 3 metallization methods.
- Practical work as a seminar work with attendees' presentation and teacher assessment of a metal civil building final documentation.
- Use of tools and software for structural or company assessments.



Figure 2: Cutting process inspection

The delivery of Micro-Course based training, that is part of Basic VET leading to a NQ, International recognized standardized Certificate or an International Diploma, applies the following harmonized structure and sequence of the key components: Competence Units contain structured and harmonized minimum speciation's for delivery, organized like this:

1. Content description: This is informational materials transforming the curriculum into short content descriptions. - Optional: High level description of expected competences to be achieved. Description should be used on course advertising and as a part of a Certification (Education) scheme used for attendees' information and accreditation of the course.

2. General Learning Outcomes (GLO) description: They transforms the Content into brief, clear and specific measurable statements by providing:

- KNOWLEDGE: Describe what the student should have knowledge about ...

- SKILLS: Describe what the student will be able to do ...

- COMPETENCES: Describe what the student should be able to do ....

3. Specific Learning Outcomes (SLO) description: They transforms the GLO into the operational level, by describing the practical and actionable insight, that supports the effective delivery and smooth operation of the training activities, by providing practical information what the teachers should deliver to achieve by curricula defined (internationally harmonized) Knowledge, Skills and Competences. For teachers can be added practical cases and best practice suggestions with an respect of teacher independence and knowledge of the attendees needs as needs in local environment.

4. Access Conditions description: Terms and conditions for accessing the training courses or micro-courses. Example: For complete EN1090 course or joined course for company responsible EN1090 coordinators at least EQF 6 achieved on technical faculty is required. For parts of the course as NDT even level EQF 4 is enough. When several micro credentials would be recognized as longer and more complex course, organization issuing the diploma or certificate should be aware of course minimum requirements and differences in qualification frameworks through Europe. If attendee has minimum requirements for some CU and not for all of them, he can attend only a part of the course.

4.2 Micro-Course Testing

Objective Testing: Knowledge assessments

Different types for assessment of knowledge achieved during micro-credential training were considered. As we are talking about very short teaching units that incorporate Recognition of Prior Knowledge and work-based learning assessments, the list of possible methods is shortened. Priority was given to assessment methods that enable the teacher and student to use automatic grading systems and test factual knowledge of the subject at hand. Most of the examples recognized by this framework are implementable into a e-learning platform. Such assessment systems do come with some common problems, as they don't allow any subjective response, and the correct answer is always predetermined. Each of the presented options must always be either right or wrong.

During the process different question types were identified, such as:

- Multiple choice questions: select one, multi-answer, or multi-answer with all or nothing marked
- True or false questions, being the simplest form of a multiple-choice question
- Fill in the blanks with text from dropdown boxes
- Type in short answers
- Drag and drop questions: drag either text or images onto a main image
- Drag and drop images / terms to create a sequence
- Matching Questions with phrases

Such objective tests are commonly used in educational settings and certification exams and standardized tests due to their discriminatory efficiency in testing large groups and focusing on automated grading systems.

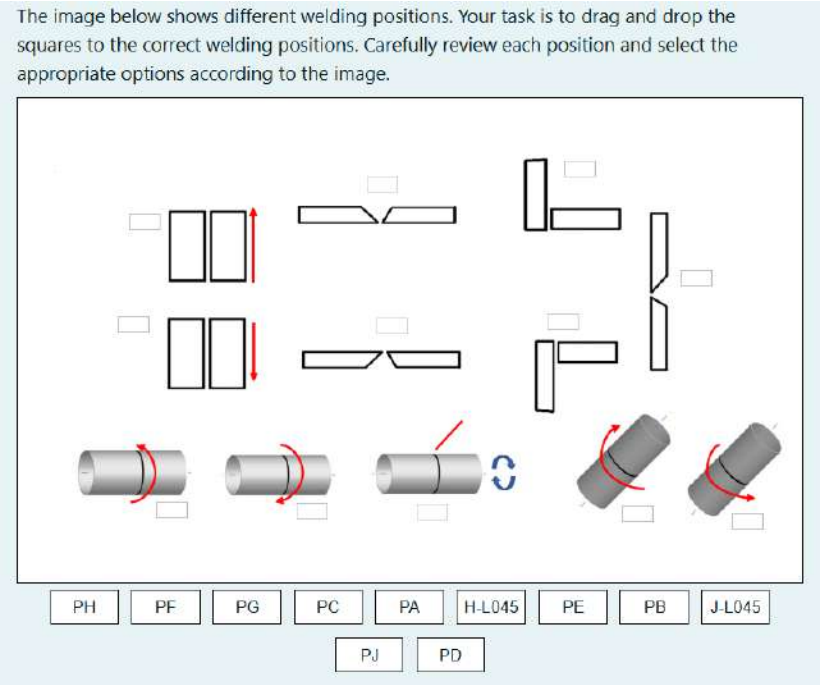

Figure 3: Drag and Drop question example: drag and drop text of welding positions to an image

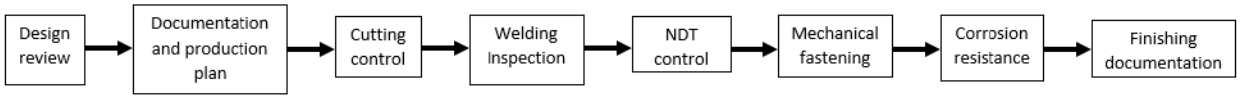

Figure 4: Sequence question, where student defines the points in a general EN1090 inspection plan

Performance Testing Example: Practical demonstrations and NDT evaluations.

The students should be able to see how mechanical and NDT testing is done inside of a laboratory and on the field. Different defects and their detection methods should be observed for the new inspectors to be able to perform the more basic of tests or analyse the reasons for different unconformities found during inspection or production.



Figure 5: Inspection of bend tested specimens from a steel construction



Figure 6: Inspection of material brake after mechanical testing

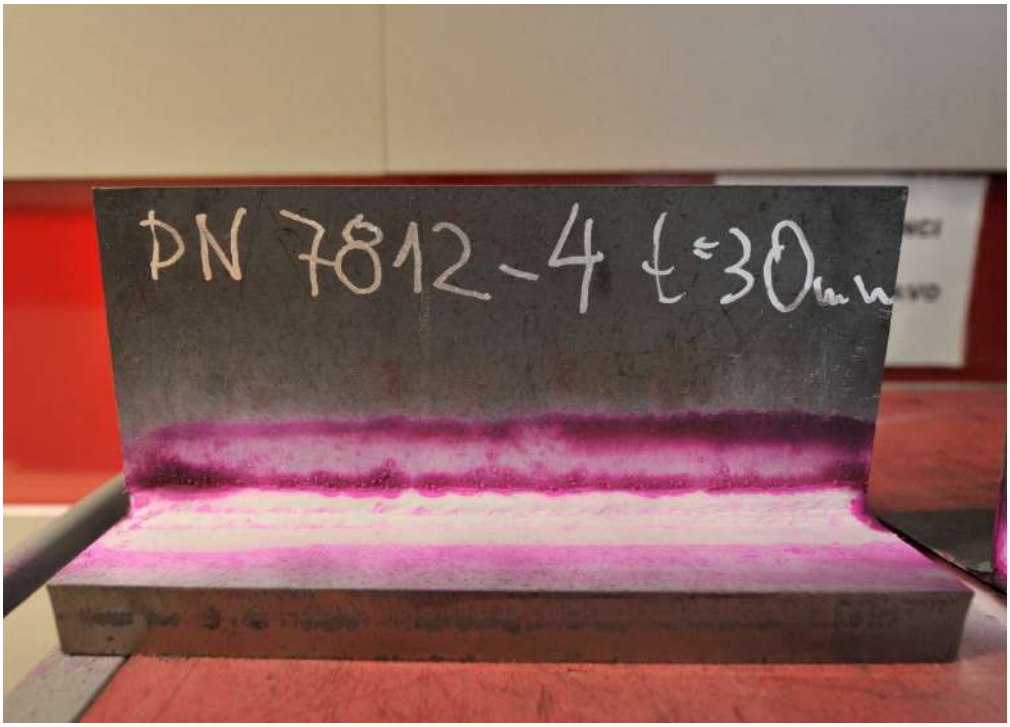

Figure 7: Penetrant tasting of sample welds for a EN1090 construction, showing indications of defects



Figure 8: Penetrant testing of welded construction

Evidence-Based Assessment: Supervisor observations, logs, and reports.

A debate can be established between inspectors, who act as supervisory personnel and quality assurance personnel in companies, fostering an understanding of manufacturing problems and regulatory requirements for steel constructions.

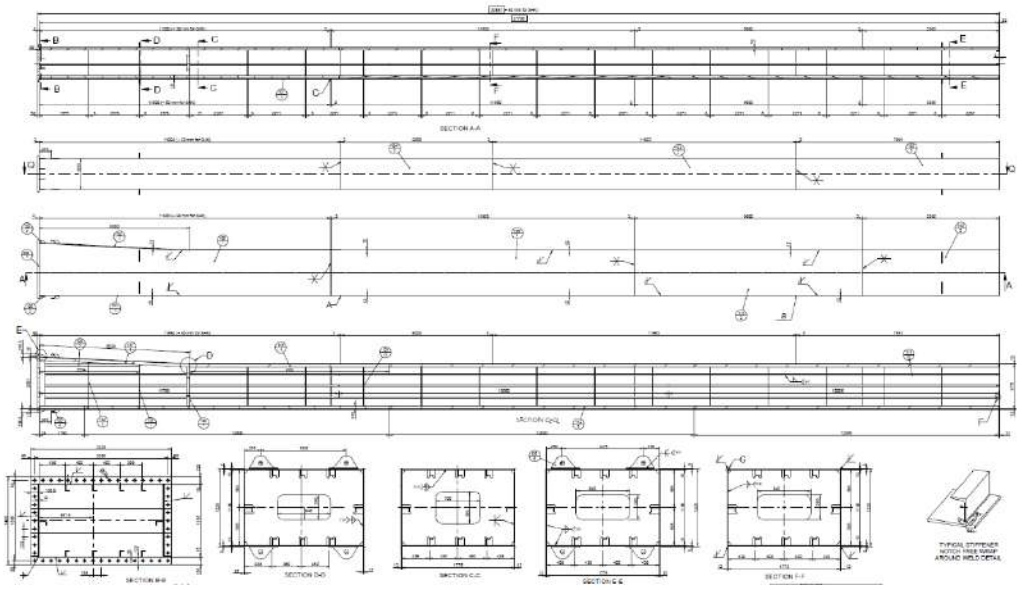

Figure 9: Design review of a steel structure component



Figure 10: Debate of inspectors and quality managers

4.3 Record of Achievement and Certification

Each CU culminates in a **Micro-Credential** documenting achievement.

Stackable Micro-Credentials lead to a **Micro-Qualification** and EN 1090 Certification.

The Micro-Credentials and the Micro-Qualifications apply:

- Focused curriculum that concentrate and cover in-dept knowledge, skills and competences by focusing on particular subjects,
- Flexible learning methods that are often available online, allowing companies and their stuff to access and complete training at their own convenience,
- Short duration micro-courses that are enabling completion within a shorter time-frame, leading to fewer credits deployed as ECTS points,
- Micro-Credentials that are stackable, whereby credits earned sometimes could be applied towards more advanced degrees, facilitating Lifelong Learning with continuous learning pathways.

5. CPR Regulatory Adherence and Quality Assurance

5.1 Regulatory Compliance

Align with legislative and quality requirements:

- Construction Products Regulation CPR 305/2011 is an EU regulation which as of now is still being implemented in most of the member countries as part of national regulations. Education of EN1090 and FPC inspectors inside of the EN1090 standard is very loosely defined but required. Each inspector and quality responsible in producer company shall have “adequate education”. Regular school system is not providing any appropriate course. If European Accreditation auditors would request any harmonized certificate as they should, a big need for an EU harmonized VET system is expected to emerge. Micro credentials are one of the possible ways to solve this problem.
- EN 1090 for structural component execution.
- EN ISO 3834 for welding quality management.
- ISO and EN, NDT standards.
- ISO educational and examination standards.
- Many (over 100) (harmonized) production and material standards.

5.2 Factory Production Control (FPC)

Implement systems to document and inspect compliance with production and inspection requirements.

5.3 Codes of Good Practice (CoGP)

Adopt industry-standard guidelines for safety, production, and quality which are not European harmonized.

6. Example EN 1090 Course Structure

6.1 Micro-Course Modules

- CU1 - Introduction to using modern ICT tools for communication between student and teacher, and between students.
- CU2 - Evaluating an inquiry. Assess the scope and type of inspection based on the request.
- CU3 - Design review. Evaluate solutions in terms of fabrication, production equipment and available resources.
- CU4 - Documentation and Production Plan: Prepare documentation requirements and scope.
- CU5 - Greener Economics in Welding and Inspection. Assess the best economic and environmental welding and cutting methods.
- CU6 - Non-Destructive Testing and Inspection: Introduction to NDT methods and their scope of use.
- CU7 - Mechanical Fastening and Erection of the Structure. Introduction to bolt connections and the requirements for these seen in the context of installation of structures.
- CU8 - Surface protection and Dimensional control. Reviewing alternative methods of surface protection, as well as methods of dimensional control.
- CU9 - Dimensional Control and Delivery Documentation. Documentation of work performed and delivery documentation.
- CU10 – Summary with project and practical work about assessment of finalized construction product about all construction requirements and examination.
- Final exam.

They are organized into delivery of 10 micro-courses with their CUs, each containing standardized and harmonized LOs description of the Content, GLO and SLO, leading to 10 Micro-Credentials. By completing the 10 micro-courses (containing 10 Competence Units with tests, leading to 10 Micro-Credentials), the students will receive a certificate. It is fine if CU1 is done first. The last 10th CU should be done last, by the final document provider. All other CUs are designed as independent units and can be done in any order. A time limit for completion of all CUs should be defined. At the end a final exam national or international can be required. When they pass that exam, they will receive a National Qualification as an EN1090 inspector, QA leader or appropriate diploma from an international recognized organization or a Certificate when appropriate EU standard will define this curriculum as recommended.

As for all micro credential courses most important is that the flexibility reflects industry or labour market needs and evolution, considering international recognition and workforce migrations at the same time. Speciality of this system is high knowledge diversification needed for different CUs as well as different levels of minimum access conditions for different CUs from EQF3 to EQF6, thus making such a structure viable for all levels of employees.

6.2 Work-Based Assessment Delivery

Real-world tasks that are carried out under supervision. As many lectures as possible are based on practical examples and are usually carried out in classrooms, industry environments or mechanical laboratories. If delivered remotely, they should be designed as individual or group seminar tasks.

Continuous feedback and assessments are needed according to performance criteria.

WBL involves the evaluation and assessment of the knowledge, skills and competences that students acquire in a real work environment. It is necessary to prepare enough practical tasks that require clearly defined objectives that define the learning outcomes and competences that the micro-training should achieve. They must be aligned with relevant industry standards, in our case mainly the requirements of EN1090 and its subordinate standards and regulations and qualification frameworks. On-the-job training often requires a combination of approaches to comprehensively assess student performance. This includes direct observations, on-the-job evidence, peer and supervisor feedback, self-assessment and assessments of knowledge and skills. Performance criteria should be established and benchmarks should be proposed. For example, this could include accuracy of work, adherence to safety protocols and company policies, efficiency during operations, problem solving and decision-making skills. Assessment should be aligned with the tasks of steelwork production, and continuous feedback should be provided during practical work. In theory, international supervision of candidates' practical achievements is also possible via video links.



Figure 11: Peer review during Inspector education proccess in industrial environment

After passing the final examination, the student is issued with a Record of Achievement, and the descriptions of the micro credential content, GLO and SLO are automatically transferred to the appropriate micro-authorization. The Record of Achievement is a formal document or portfolio that tracks and highlights an individual's achievements of knowledge, skills, competencies and qualifications, which also includes descriptions of the results achieved through practical tasks. It provides evidence of what an individual has achieved and serves as a reference for employers, assessors or other educational institutions. Several micro credentials can be combined and lead to a micro qualification, which is documented by the award of an International Micro Specialisation (IMiS) diploma. The IMiS diploma is designed to document specialised professional knowledge. Micro courses can become part of traditional NVQ qualifications, various national or international specialisations that result in diplomas or records of achievement, industry-required educational credentials or certification schemes. The MC system offers a practical and effective means of acquiring specialised knowledge, skills and competences that are directly relevant to industry or labour market needs.



Figure 12: Quality assessment of produced steel structures in a factory



Figure 13: Penetrant test of bolted structure

7. References

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Standards:

EN1090 /1/2/3

EN ISO 3834

ISO 29993 International Standard Service Management System for Non-Formal Education and Training

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Cedefop: Validation of non-formal and informal learning: European inventory on validation: 2014 update: http://www.cedefop.europa.eu/en/events-and-projects/projects/ validation-non-formal-and-informal-learning/european-inventory

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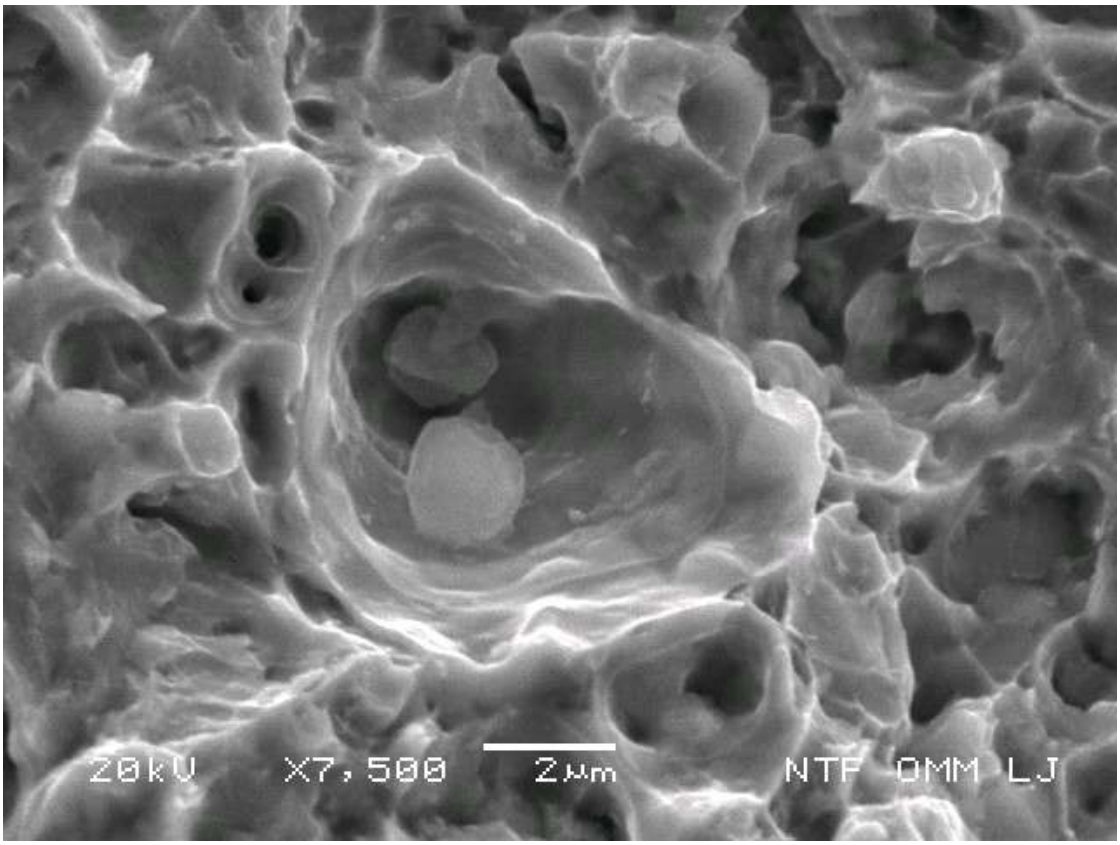
8. Spare pictures





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