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CONDAP REPORT

O2-T1 CLUSTERING OF LEARNING OUTCOMES INTO CONDAP LEARNING UNITS

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List of Abbreviations/Acronyms

BIM	Building Information Modelling
CAD	Computer Aided Design
CONDAP	Digital skills for workplace mentors in construction sector apprenticeships
CPD	Continuing Professional Development
DFMA	Design for Manufacture and Assembly
ECTS	European Credit Transfer and Accumulation System
ECVET	European Credit Transfer System for Vocational Education and Training
EQF	European Qualifications Framework
EU	European Union
ICT	Information and Communications Technology
IoT	Internet of Things
MOOC	Massive Open On-line Course
VET	Vocational Education and Training
VOOC	Vocational Open On-line Course
VR	Virtual Reality
WBL	Work-based learning

1 CONDAP Intellectual Output O2

The second Intellectual Output of CONDAP (O2) aims to define the curriculum structure for employers and VET providers in order to train in-company mentors in digital construction methods, as well as related innovative pedagogical orientations for teaching the use of digital methods in the context of apprenticeships.

In order to achieve this objective, the following activities are carried out:

O2-T1 – Clustering of Learning Outcomes into CONDAP Learning Units.

O2-T2 – Development of CONDAP Learning Units for Construction Apprenticeships.

O2-T3 – Innovative Pedagogical Orientations for Learning and Teaching Digital Construction Methods and Tools.

This Report encloses the first task which groups CONDAP learning outcomes into learning units for the following thematic topics:

1. Energy efficiency & sustainable construction.

2. BIM and other digital construction methods.

3. Organisational, management & communication skills.

2 Clustering of Learning Outcomes (O2-T1)

2.1 ECVET Framework

The European Credit Transfer System for Vocational Education and Training (ECVET) is a common methodological framework, which facilitates the recognition and transfer of learning credits from one qualification system to another within the European Educational System. ECVET works hand in hand with the European Qualifications Framework (EQF) to provide greater transparency in European qualifications, promoting the mobility of workers and learners, and facilitating lifelong learning.

ECVET implementation requires that qualifications be described in terms of learning outcomes; with learning outcomes brought together in units; and units often accumulated to form the basis of qualifications. Assessment, validation and recognition processes must also be agreed among all those participating and should respect existing national, regional, sectoral or institutional practice. ECVET is not intended to replace national qualification systems, but to provide a greater degree of comparability and compatibility between them.

Furthermore, ECVET requires the use of units to facilitate the transfer, recognition and accumulation of assessed learning outcomes of individuals who are aiming to achieve a professional profile. In cases where credit is able to be certified, a points system might also be considered with points directly attributed to ECVET units and qualifications.

Main objectives of ECVET framework are:

- Facilitate the validation and recognition of professional skills and knowledge acquired in different systems and countries so that stakeholders can appropriately include them in their professional qualifications curricula.
- Enhance the attractiveness of mobility between different countries and educational environments.
- Increase the compatibility between different European vocational education and training systems and the qualifications they provide.
- Increase the employability of vocational training graduates and the confidence of employers that each VET qualification requires specific skills and knowledge.

ECVET applies to all the results obtained by an individual in the different education and learning systems which are transferred, recognised and aggregated in order to provide a qualification. This initiative makes it easier for European Union (EU) citizens to have their education, skills and

knowledge recognised in an EU country other than their own. ECVET complements the European Credit Transfer and Accumulation System (ECTS), establishing a link between Vocational Education and Training and Higher Education.

2.2 What is a learning unit

The description of qualifications in terms of units of learning outcomes is one of the main elements of ECVET. Learning unit is a training element that responds to a series of learning outcomes, defined in terms of knowledge, skills and competences which can be evaluated, validated and certified. Units of learning outcomes can be specific to a single qualification or common to several qualifications and may also describe so-called additional qualifications which are not part of a formal qualification or curriculum. They are subjected to assessment and validation which verify whether the learner has achieved the learning outcomes expected. Learning units enable progressive achievement through transfer and accumulation of learning outcomes. They define evidence-based Learning Outcomes for mentors in construction sector apprenticeships.

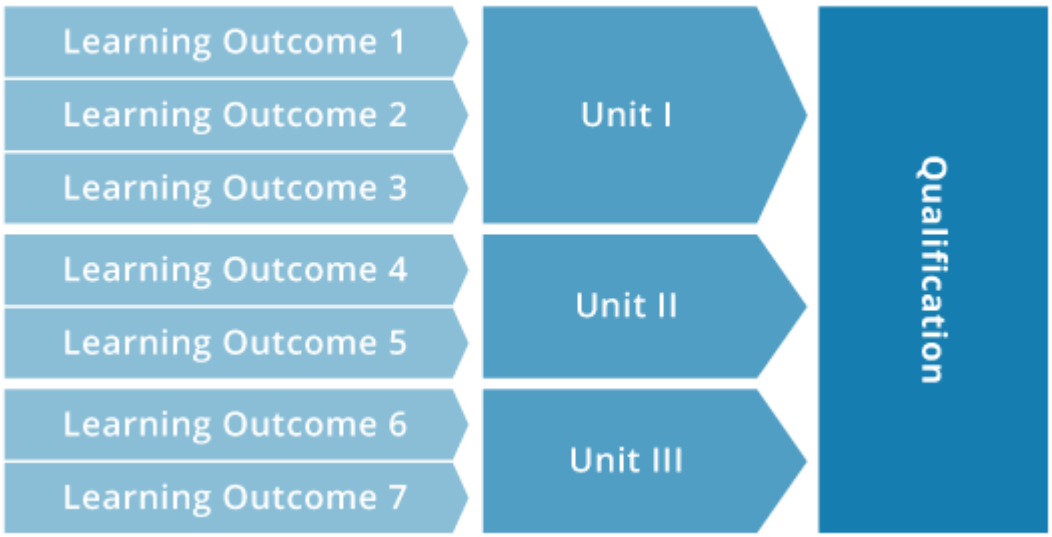

Figure 1: ECVET Diagram[1]

[1] http://www.ecvet-toolkit.eu/ecvet-toolkit/identify-units-learning-outcomes

2.3 Grouping Learning Outcomes into Learning Units

Learning units are based on the learning outcomes identified in previous intellectual output (O1) as the result of the desk research carried out within the industry and academic community. The research denoted the interest of the stakeholders of the following capacities:

Methods, skills and technologies (combined)	Average Weighting Score
Use of electronic means of communication and collaboration tools	4.4
Energy efficiency and sustainable construction digital solutions	4.3
Search for and collect information online	4.2
Computer-aided Design (CAD)	4.2
Building Information Modelling (BIM)	4.2
Create documents using standard office software	4.2
Use of company-specific software	4.1
Digital Data management including Data analytics	4.0
Design for Manufacture and Assembly (DFMA)	3.8
Augmented Reality (AR) and Virtual Reality (VR)	3.7
Internet of Things	3.6
Use of HR management systems	3.6
Create a website / blog	3.0

Data analysis resulted in the definition of three learning units based on the most demanded topics:

1. Energy efficiency & sustainable construction. It includes the basics of energy efficiency in buildings, minimum energy demand construction and renewable energy integration in the construction sector.

2. BIM and other digital construction methods. This Learning unit will enclose the basics of Computer-aided Design (CAD), Building Information Modelling (BIM) and standard office package.

3. Organisational, management & communication skills. Responding to the research results, this learning unit will deal with the specifics of information management, project management, data flow and analysis and the use of electronic means of communication and collaboration tools.

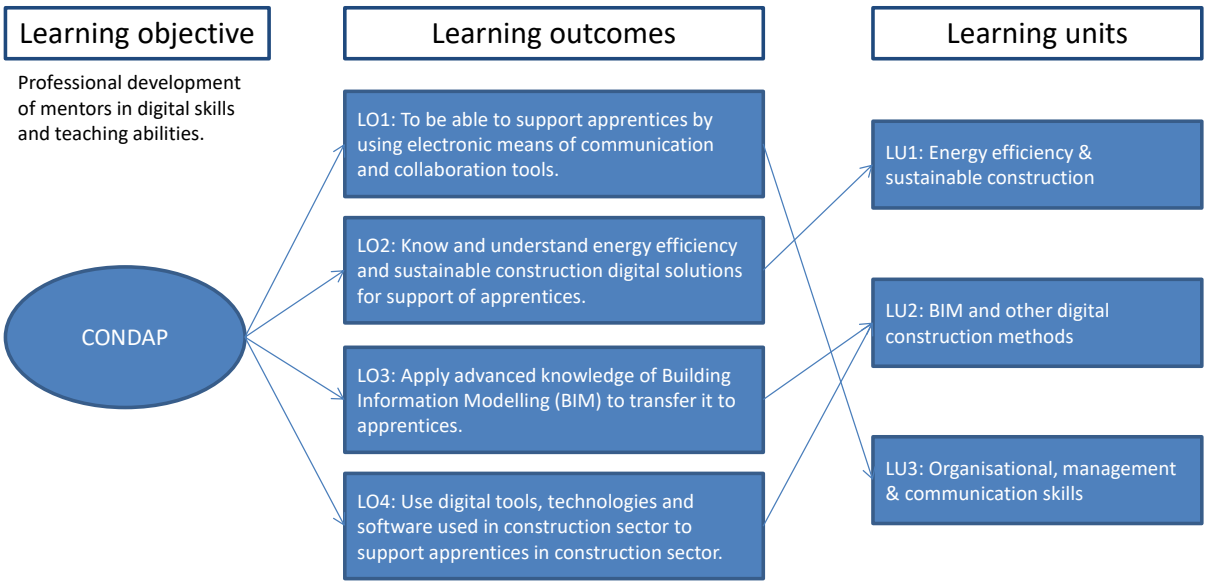

Figure 2: Clustering CONDAP's Learning Outcomes

Furthermore, as suggested by the European principles, learning units will also respond to the following characteristics:

- Units of learning outcomes can be completed and assessed, as independently as possible from other units of learning outcomes.
- Units of learning outcomes are structured in such a way that the relevant learning outcomes can be achieved in a specific time interval. Units of learning outcomes should therefore not be too extensive.
- Units of learning outcomes include all necessary learning outcomes in order to cover the objectives of the units.
- Units of learning outcomes are designed to be assessable.

2.3.1 Learning Unit 1: Energy efficiency & sustainable construction

Learning unit 1 responds to Learning Outcome 2, "*Know and understand energy efficiency and sustainable construction digital solutions for support of apprentices*". It focuses on sustainable construction, considering energy efficiency and renewable technologies integration. The learning unit encloses the basis of energy legislation and certifications, characteristic of sustainable construction (passivhaus standards and Nearly Zero Energy Building specifications), bioclimatic strategies measures, and integration of renewable energy systems.

Learning Outcome 2: Know and understand energy efficiency and sustainable construction digital solutions for support of apprentices		
Knowledge	**Skills**	**Competence**
Knows/Aware of: - Principles of energy efficiency - Principles of sustainable construction - Sustainable building concepts - Renewable energy sources - Circular economy - Smart technologies and tools - Energy monitoring tools in consumption and generation.	Ability for: - Building apprentices' knowledge about principles of energy efficiency and sustainable construction - Understanding the benefits of using renewable sources of energy - Use of energy monitoring tools in consumption and generation - Use of smart technologies.	Able to: - Support apprentice's knowledge of energy efficiency and sustainability to reduce the consumption of energy - Update apprentices on the evolution of new technologies in energy efficiency and sustainable construction - Transfer knowledge of using energy conservation equipment and smart technologies - Amplify apprentice's knowledge about the benefits of energy efficiency.

2.3.2 Learning Unit 2: BIM and other digital construction methods

Learning unit 2 replies to Learning Outcome 3, "*Apply advanced knowledge of Building Information Modelling (BIM) to transfer it to apprentices*" and Learning Outcome 4 "*Use digital tools, technologies and software used in construction sector to support apprentices in construction sector*".

Learning Unit 2 mainly focuses on the Building Information Modelling (BIM) methodology considering its immediate application in the professional field. It introduces a practical knowledge on the methodology through setting up BIM-capable software and files for building design drafting projects. In addition, this learning unit will include the basics of additional digital design tools and smart technologies.

Learning Outcome 3: Apply advanced knowledge of Building Information Modelling (BIM) to transfer it to apprentices		
Knowledge	**Skills**	**Competence**
Knows/Aware of: - BIM concept and main terminology - Benefits of using BIM - Use of BIM in a specific construction sector (architecture, civil engineering, etc.) - Project management using BIM.	Ability for: - Delivering competitive advantage of using BIM - Managing BIM process - Delivering bespoke BIM training to increase apprentice's competence - Analysing the dataset and information model - Information management and implementation - Structuring stages of a project - Collaborative working with a project team.	Able to: - Engage with apprentices to increase their levels of competence in using BIM - Manage and coordinate apprentice's activities at different stages of a project management - Understand barriers of BIM implementation and ways to overcome them - Empower the decision making with apprentice and wider team.

Learning Outcome 4: Use digital tools, technologies and software used in construction sector to support apprentices in construction sector		
Knowledge	**Skills**	**Competence**
Knows/Aware of: - Relevant software and databases used in construction works - Digital design tools, such as CAD or BIM. - Digital tools and smart technologies (VR/AR, mobile devices, automated technologies, Artificial Intelligence, software, apps, etc.) - Automation technologies.	Ability for: - Building up knowledge about specific sector of construction industry and effective use of the digital tools - Competency management to identify and address the gaps, mismatch and misalignment in skills - Technical knowledge of software and digital tools - Raising numbers of skilled workers.	Able to: - Utilise the relevant software - Recommend training courses for digital skills related to the construction sector - Create a specific job profile with relevant digital tools and software required - Identify the scope of digital skills and ways of embedding them - Provide continuous training improvement offering courses with innovative digital construction methods and tools.

2.3.3 Learning Unit 3: Organisational, management & communication skills

Learning Unit 3 reacts to Learning Outcome 1 "*To be able to support apprentices by using electronic means of communication and collaboration tools*". This leaning unit encloses the description of different communication methods, use of actual digital technologies for communication, and advantaging from collaborative tools and platforms.

Learning Outcome 1: To be able to support apprentices by using electronic means of communication and collaboration tools.		
Knowledge	**Skills**	**Competence**
Knows/Aware of: - Various methods of communication (written, verbal, non-verbal, face-to-face, remote) - Virtual interaction, remote connection tools for mentor/apprentice communication - Communication through virtual environment for immersive learning - Digital technologies for communication - Collaboration tools and platforms for communication. - Social media platforms for collaborative work - Digital marketing tools	Ability for: - Mentor-apprentice interaction/communication - Mentor-apprentice matching process - Personal plan development based on apprentice's job profile - Continuing Professional Development (CPD) plan - Mentoring and coordination of apprentice's daily activities - Regular meetings - Progress reviews/monitoring.	Able to: - Embrace digital technologies for communication - Use digital technologies and collaboration tools for communication with apprentice(s) - Understand apprentice's job profile and skills requirements - Understand the role of apprentice's manager - Identify specific areas of training based on the learning requirements.