BLOCK.ED

GUIDE FOR DESIGNING MICROCREDENTIALS

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Abstract

The Block.Ed project addresses the skills gap in developing e-learning courses by integrating micro-credentials and blockchain technology. The project will develop a framework for designing and validating micro-credentials, an e-course for adult trainers, and a blockchain-enabled Open-Source credential provisioning platform. This “Guide for designing microcredentials” focusses on the design, the implementation and assessment of microcredentials. Furthermore, it describes the advantages of using blockchain to drive the adoption and effectiveness of microcredentials as also its challenges to overcome. It encompasses the lifecycle of a microcredential, tools and methods for assessment, quality, verification, reliability and the importance of an awarding body.

Keywords

Microcredentials, E-learning, Blockchain, Skills, Instructional Design, ESCO (European Skills, Competences, and Occupations), EQF (European Qualification Framework), Validation, Learning Pathways, Assessment, Competency-Based Education, Digitalisation, Awarding Body

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1 SCOPE OF THE GUIDE

1.1 Objective and Target Audience

The scope of this guide is to walk you through the design of microcredentials from inception till implementation. We will also hone in on the role of blockchain technology in this context.

This guide will deliver a set of parameters to design microcredentials within recognised quality frameworks and advise on how to implement the microcredentials in established more traditional run learning environments. The approach will contribute to the standardization and recognition of competencies and skills acquired through microcredentials in the participating partners in this project and beyond.

The initial and main target group is adult education institutions, but with this said more organizations in secondary and tertiary education benefit directly or indirectly from the standardised approach of designing microcredentials and its embedding in Quality Frameworks. Furthermore, it will increase recognition of microcredentials in the labour market[1].

Direct

- Educational institutions: curriculum developers, instructional designers, facilitators & trainers; administrators
- Technology providers: LMS developers/administrators, edtech companies
- Government & regulatory bodies: ministries/departments & accreditation bodies

Indirect

- Quality Assurance & Assessment Entities
- Community & Non-Profit Organizations
- Funding & Financial Entities
- International Organizations supporters of educational initiatives
- Professional Associations, Professional Bodies

1.2 What are microcredentials?

The definition of a microcredential is based upon the European approach to microcredentials is described in the EU Recommendation of 2022, as follows: "*A micro-credential is the record of the learning outcomes that a learner has acquired following a small volume of learning. These learning outcomes have been assessed against transparent and clearly defined standards. Courses leading to micro-credentials are designed to provide the learner with specific knowledge, skills and competences that respond to societal, personal, cultural or labour market needs. Micro-credentials are owned by the learner, can be shared and are portable. They may be standalone or*

[1] https://blocked-project.eu/

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combined into larger credentials. They are underpinned by quality assurance following agreed standards in the relevant sector or area of activity"[2]

It needs to be clarified that the EU definition above refers to microcredentials as a record of new acquired skill or knowledge. When designing a microcredentials the following aspects should be addressed:

- **Quality[3]:** Micro-credentials are subject to internal and external quality assurance with regard to the overall quality, alignment with existing European and other public quality instruments to instil trust..
- **Transparency:** Clear information on learning outcomes, workload, and content.
- **Relevance:** meeting the needs as distinct, targeted learning achievements, and learning opportunities leading to fill the needs of the labour market and learners.
- **Valid assessment:** Learning outcomes are assessed against transparent standards.
- **Learning Pathways:** Supports flexible learning pathways both in the formal and informal education
- **Recognition:** Recognized for academic or employment purposes based on standard procedures and comparability across Europe.
- **Portability:** Owned by the learner and easily shared, including through digital wallets like Europass or Open Badge 2.0/3.0
- **Learner-centred:** Designed to meet learners' needs and involves them in quality assurance processes. The MC is issued by an organisation but is owned by the learner.
- **Authentic**: Micro-credentials contain sufficient information to check the identity of the credential-holder (learner), the legal identity of the issuer, and the date and location of issuance of the micro-credential
- **Information & Guidance:** Microcredentials should be incorporated into lifelong learning, enhancing accessibility to learning, supporting education, personal development, training and career choices.

1.3 Why microcredentials?

On the question why would you invest in microcredentials there are several discussions ongoing about how we can apply and reap the benefit of microcredentials.

In the workplace for example it can multiple benefits, it is a cost effective way to boost employees engagement, offer continuous learning, build an adaptive business as you drive the up- and/or reskilling of your employees[4]. In the Energy Industry world for example new tools are developed or improved allowing for effective maintenance of

[2] A European approach to micro-credentials brochure

[3] Council recommendation of 22 May 2017 on the European Qualifications Framework for lifelong learning and repealing the recommend; Standards and Guidelines for Quality Assurance in the European Higher Education Area; C_2020417EN.01000101.xml

[4] https://deakinco.com/resource/why-you-should-invest-in-micro-credentials/

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power plants machinery. Therefore, the users need to be schooled and credentialised to use these tools. The organisation is quicker to respond to these needs if there is an in-house training path.

If organizations do not provide internal microcredentials, close networks with lifelong learning institutions should be established to step into this knowledge gap. Educational institutions also play a forefront role in ensuring diversity and inclusion of all target groups. It is important to provide all accessible training benefiting both the learner and the labour market.

In terms of designing the microcredential it could be integral part of many instructional design methods, from the 9 steps of Kemp's Design Model[5] to the task-oriented approach of Merrill's principles (MPI)[6]. In this guide we will primarily focus on the action words of the revised Bloom's taxonomy. When you have decided on designing a microcredential it is advisable to reverse back from the achieved learning outcome to identify the skills, related activities, evidence and required assessment. The rest of this chapter contextualises each step and how to approach the design with use of quality frameworks and awarding bodies.

1.4 Objective of the project

The Block.Ed project addresses the skills gap in developing e-learning courses with the use of microcredentials resulting in flexible and on demand learning pathways. The project aims to upskill adult trainers in terms of instructional design for the development of micro credentials, thus, improving the quality of offered courses awarding micro credentials. The project promotes the use of ESCO and integrates blockchain technology, in order to increase trust in microcredentials. The project aims to:

- Develop a framework for designing and validating microcredentials.
- Create an e-course for adult trainers on integrating microcredentials into e-learning.
- Develop use cases (short e-learning courses leading to microcredentials) in green transition and inclusion.
- Integrate blockchain technology for secure and transparent microcredential provisioning.

1.5 Sectors

The guide will encompass various learning providers in order to meet the required learning outcomes personalised for its needs and those of the learners.

- Educational institutions
- Public administrations
- Commercial organisations
- Non-Governmental organisations

[5] https://whatfix.com/blog/instructional-design-models/#kemp
[6] https://whatfix.com/blog/instructional-design-models/#merrill

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2 DESIGN

2.1 The fundamentals

In order to focus on how to design and set up a microcredential we need to understand that the starting point is different from instructional design for a course.[7]

The term 'learning' used should not be confused with 'course'. Learning is the process of acquiring knowledge, skills and behaviours. A course is a structured programme that covers content about a subject or a set of skills. Whilst speaking about microcredentials we deliberately refer to the term 'learning' in order to disassociate them from course design as even today 'course design' is often associated with a focus on curricular content rather than learning outcomes

The main reference for the design of microcredentials at European level is Annex 2 to the 2022 Recommendation: European principles for the design and issuance of micro-credentials.

It establishes the 10 principles that specify the nature of microcredentials and offer guidance to Member States, public authorities and providers on the design and issuance of microcredentials and systems for microcredentials. The principles highlight the key characteristics of the European approach to microcredentials that can enable the trust and quality of microcredentials. The principles are universal and may be applied in any area or sector, if appropriate.

In the table below we find an overview of the pedagogical impact of each principle, starting with the description that can be found in Annex 2 of the EU Recommendation.

PRINCIPLE	PEDAGOGICAL ANALYSIS
Quality	Internal Quality Assurance is mainly based on. - Microcredential itself (based on compliance with criteria below). This means that the micro-credential, its data structure, must be designed to include elements that meet the various requirements, so that it cannot be published without all requirements having been met. - Feedback from learners and peers (other stakeholders) - Quality of the course, learning pathway
Transparency	Dimensions - **Notional workload**: credit system (ECTS, Annex V of EQF) - **Referenced on NQF**: National Qualification Framework, work based repertory, ISO/UNI standards - **Information and guidance**: on MC itself, on providers, on learning opportunities

[7] Ten Facts You Need to Know About Micro-Credentials | Welcome to TeachOnline, A European approach to micro-credentials, Micro-Credentials | Kaplan Assessments. How Microcredentials Are Changing Higher Education | AACSB

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PRINCIPLE	PEDAGOGICAL ANALYSIS
Relevance	Dimensions - **Labour market intelligence**: MC learning achievements to be connected with skills shortages - **Ongoing updates**: alignment of information - **distinct, targeted learning achievements**
Valid assessment	Dimensions - **Standards**: definition of criteria and indicators formalised in a rubric - **Types**: practical / on-the-job, oral, written - **Supervision**: unsupervised with no identity verification, supervised with no identity verification, supervised online or onsite with identity verification
Learning pathways	Dimensions - **Stackability**: modular approach, MC can be combined by ed. provider or employer based own practices as well as on the goals and needs of the learner - **Flexibility**: validation and recognition of MC increase visibility on learning achievements and facilitate access to further learning - **Non-formal and informal learning**: MC can be issued based on formal, informal and non-formal learning pathways - **Individualisation**: MC can be linked to individual learning plans
Recognition	Dimensions - **Learning Outcomes**: MC to be based on clearly defined Learning Outcomes - **Evidence based**: MC to be linked to evidences and supporting materials - **Comparability**: MC to be understandable by ed. providers and employers, also across countries
Portability	Dimensions - **Ownership**: the credential-holder is the owner of the MC - **Storing**: easy and safe archiving process - **Sharing**: easy and safe access to MC information
Learner-centred	Dimensions - **Holistic approach**: MC are linked with individual learner personal and professional development plan - **Continuous improvement**: feedback from credential-holder is acquired and used to improve MC process and outcomes
Authentic	Dimensions - **Identity**: MC to easy the fact checking of information on credential-holder, issuer legal identity, date and location of issuance, etc.
Information and guidance	Dimensions - **Orientation**: support credential-holders to acquire information on MC offers, connected with learning offers and job opportunities - **Inclusion**: accessibility for all

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It should be noted that the learning pathway is also included among the principles, but it is understood as a tool to help the learner achieve his or her goals. This approach emphasises how the training pathway is at the 'service' of the user in order to acquire competences in a granular manner and to be able to aggregate them in order to obtain larger credentials.

In terms of the scope of the Block.Ed project we will focus on the ESCO Classification of European Skills & Competences, Qualifications and Occupations[8]. The current live version is now 1.2. There are 3 pillars of the International Standard Classification of Occupations (ISCO), to which the ESCO Skill pillar is mapped. Within the skill pillar there are 4 categories: The Transversal skills and competences, language skills and knowledge, skills, and knowledge. It has to be clarified that the ESCO classification recognises no difference between skill and competence. The third pillar is the formal outcome of an assessment and validation process. These are displayed and mapped by the Europass's European Qualifications Framework (EQF).[9] The overall aim is: *"Europass is an EU framework that aims to support communication of information on skills and qualifications to support a more effective and efficient labour market and education and training system."*

2.2 Skills

2.2.1 Closing the need gap

To build valuable microcredentials, first pinpoint your target audience and the specific skills gap you aim to fill. Skills are defined as specific, learned abilities that can be measured and applied to job tasks. Examples include programming languages, data analysis, project management, and proficiency in software applications. [10]Research industry trends, talk to employers, and define the exact skills learners will gain, using clear, straightforward language. Make sure these skills directly match the microcredential's learning goals and how you will assess them. Think about how the microcredential could stack towards a larger qualification and how to formally recognize learners' achievements. Stay flexible and refine your microcredential based on shifts in the labour market or resulting from peer reviews. In short a skill answers "What can you do?" or "What are you able to do?".

2.2.2 Referencing the skills

It is vital to reference skills to ensure alignment with established quality standards with a view to enhance clarity and comparability. Only by doing this portability of the acquired skill can be confirmed and recognition a cross-border acknowledged.

[8] https://esco.ec.europa.eu/
[9] Courses | Europass
[10] https://www.talentguard.com/blog/whats-difference-skills-competencies

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Available recommendations are[11]:

- European: ESCO (European Skills, Competences, Qualifications and Occupations), EURES (European Job Mobility Portal) - These provide standardized classifications and descriptions for skills and occupations across Europe.[1]
- Global: O*NET (Occupational Information Network), ILO's ISCO (International Standard Classification of Occupations) - Offer internationally recognized frameworks for describing occupations and their associated skills.[2]
- National Skill databases or job profile databases: Refer to your country's specific skills frameworks or occupational classifications.
- Internal: Align with any internal competency frameworks or skills taxonomies used within your organization.

Methods for Demonstrating Alignment:

- Mapping: Systematically map your skills against the chosen frameworks, providing clear links and evidence.
- Descriptors & ontology: Utilize standardized descriptors and terminology from the databases to describe skills.
- Coding: Where applicable, use relevant codes (e.g., ESCO codes) to classify skills.

The standardisation of skills descriptions facilitates understanding, and enable effective skills matching and development nationally and internationally.

As referred to in paragraph 2.1 the ESCO database and EQF are our reference in order to ensure interoperability and to ensure European recognition.

2.2.3 Mapping to Qualifications and Occupations

Before highlighting the various approaches to stackability of microcredentials we need to recognise that an alignment with the existing ESCO database[12] should be sought. As the design of Microcredentials has different parameters than the current qualifications and learning pathways. There is a need to identify new descriptors within the existing frameworks. From the 2 examples highlighted in the matrix below,you can see that the skill and knowledge groups are less granular than a microcredential. However, a newly developed framework should be mapped against the existing recognised set of data.

[11] https://esco.ec.europa.eu/en/classification/skill_main ; https://eures.europa.eu/jobseekers/europass_en; https://www.onetcenter.org/dataUpdates/categories/Skills, https://www.ilo.org/international-labour-standards; https://ilostat.ilo.org/methods/concepts-and-definitions/classification-occupation/

[12] ESCO Skill-Occupation Matrix Tables: linking occupation and skill groups Technical Report – April 2021

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KNOWLEDGE_OCCUPATION MATRIX												
Reference	Occupation	generic programmes and qualifications	education	arts and humanities	social sciences, journalism and information	business, administration and law	natural sciences, mathematics and statistics	information and communication technologies (icts)	engineering, manufacturing and construction	agriculture, forestry, fisheries and veterinary	health and welfare	service
ESCO_ISCO C141	Hotel and restaurant managers	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.1	0.0	0.0	0.4
ESCO_ISCO C142	Retail and wholesale trade managers	0.0	0.0	0.1	0.0	0.6	0.0	0.0	0.2	0.0	0.0	0.1

Figure 1 Knowledge Occupation Matrix

SKILLS & OCCUPATION MATRIX									
Reference	Occupation	handling and moving	information skills	working with computers	constructing	management skills	working with machinery and specialised equipment	assisting and caring	communication, collaboration and creativity
ESCO_ISCO C141	Hotel and restaurant managers	0.0	0.2	0.0	0.0	0.3	0.0	0.2	0.3
ESCO_ISCO C142	Retail and wholesale trade managers	0.0	0.2	0.0	0.0	0.2	0.0	0.2	0.4

Figure 2 Skills Occupation Matrix

2.3 Stackability

2.3.1 Stackability approach

There are two primary models:

- **Vertical Stacking (Progressive Pathway):** Each microcredential serves as a prerequisite for the next, leading to a more advanced competency or certification.
- **Horizontal Stacking (Complementary Pathway):** Standalone microcredentials that collectively contribute to a larger certification or qualification but do not require sequential completion.

2.3.2 Stackability Criteria

To ensure microcredentials can be effectively stacked, establish clear criteria:

- **Content Progression (for Vertical Stacking):** Higher-level MCs must require competencies from previous ones.
- **Skill Contribution (for Horizontal Stacking):** Each MC must add distinct value while contributing to a broader qualification.
- **Assessment & Recognition:** Define standard assessment mechanisms to validate learning outcomes and enable credentialing portability.
- **Credit Transferability:** If linked to formal education, align with **ECTS (European Credit Transfer System)** or equivalent frameworks.

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2.3.3 Methods for Stacking Implementation

- **Modular Curriculum Design:** Break down learning into stackable modules with defined interdependencies.
- **Badging System:** Issue **digital badges** to validate completion and signify stackable credentials.
- **Portfolio-Based Learning Paths:** Allow learners to accumulate and showcase microcredentials toward a broader qualification.
- **Recognition of Prior Learning (RPL):** Enable credit for previously earned credentials.

2.4 Activities

Activities provide tangible proof of skills by requiring learners to actively demonstrate their newly acquired competencies.[13]

There are two aspects we need to consider whilst designing the activities. First of all, the learning experience is becoming more important and has to be more creative than in the traditional learning methods[14]. It is not only acquiring knowledge; the delivery of the learning has changed. Learning(or e-Learning) Experience Design LXD becomes more challenging as it combines 3 features: **Is transdisciplinary**, **Is complex**, **Requires multiple literacies**[15] as the figure below illustrates. Further to this it is important to provide a challenging, but also an achievable task where the learner is stimulated and continues to be motivated.

Hence, the design of activities also for a microcredential should be aligned to meet the new User Experience (UX) of the learner. Cross disciplinary projects, simulations, or real-world, real-time tasks provide the learners a method to apply knowledge, solve problems, and showcase their competence of their mastery of the targeted skill.

The other aspect is the **revised Bloom's taxonomy**. Whilst designing the microcredentials, its skills and related activities it is recommended to follow these proven steps: remember, understanding, application, analysis, evaluation and creation. The latter 2 are sometimes swapped around.[16]

In order to design an appropriate microcredential the approach should be that after identifying the need you start with defining the learning outcomes and its assessment and consequently establish which skills need to be addressed and how they can be achieved through activities.

[13] Defining 'Skill' and 'Competence'
[14] Qualities of a LX designer - Learning Experience Design
[15] Understanding the complexity of Learning Experience Design | by Matthew Schmidt | UX of EdTech | Medium
[16] EDU6147 4. What is Blooms Taxonomy? - The University of Sheffield Kaltura Digital Media Hub

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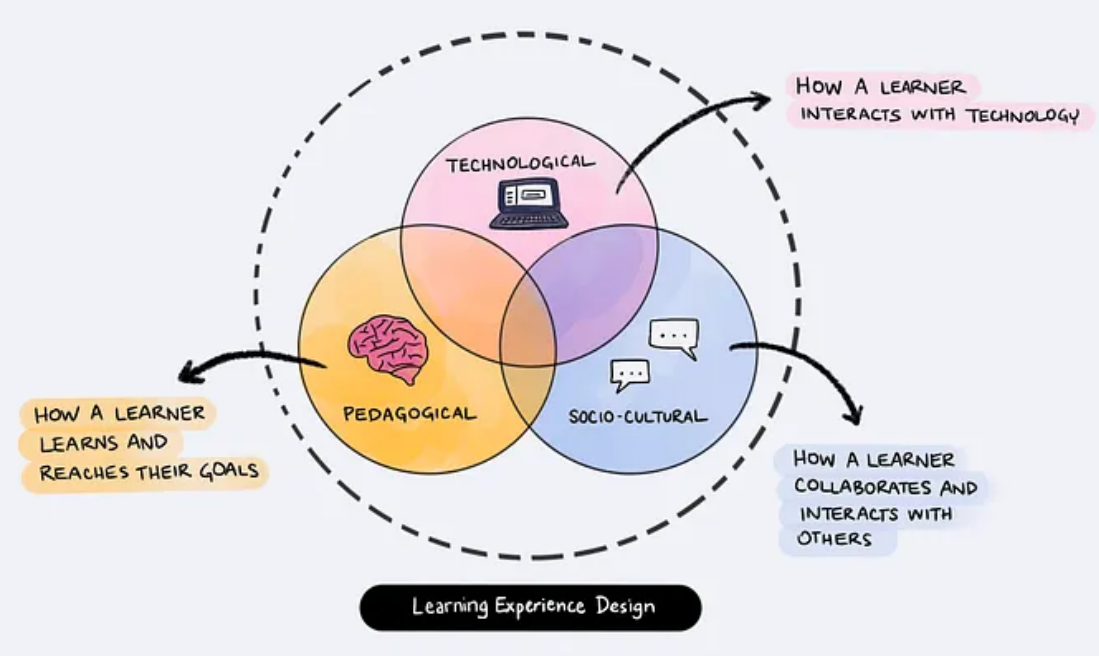

Figure 3 UX Learner[17]

Level	Verbs	Example Learning Outcome
Remember	Commemorate, Define, Describe, Identify, Label	By the end of the training course, the learner can recite company values.
Understand	Associate, Characterize, Compare, Conceive, Describe	By the end of the training course, the learner will be able to explain a marketing strategy in their own words.
Apply	Adapt, Administer, Assign, Calculate, Classify	By the end of the training course the learner will be able to classify a marketing lead.
Analyze	Audit, Break down, Characterize, Compare, Diagnose	By the end of the training, the learner will be able to draw conclusions from distinct marketing audiences.
Evaluate	Appraise, Assess, Calculate, Compare, Critique	By the end of the training, the learner will be able to determine the ROI of a specific campaign.
Create	Arrange, Build, Categorize, Compose, Develop	By the end of the training, the learner will be able to create and execute their own ad campaign.

[17] By Aletheia Délivré

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Below in the table we list some examples of defining activities in relation to the expected learning outcomes. Make sure to clearly use action verbs to make the learner aware of the exacting task.

Table 1 Defining activities - Service Industry - Restaurant Manager

Skills	Activity	Learning Outcomes
Staff Management	Conducting interviews	Identify key competencies required for various restaurant positions.
	Creating staff schedules	Develop schedules that optimize labour costs and ensure adequate coverage during peak times.
	Training new employees	Demonstrate effective onboarding and training techniques to ensure new staff can perform their duties.
	Providing performance feedback	Deliver constructive feedback to staff to improve performance and maintain motivation.
Customer Service	Handling customer complaints	Resolve customer issues effectively and professionally to ensure customer satisfaction.
	Overseeing service quality	Monitor staff interactions with customers to maintain high service standards.
	Managing reservations	Organize and manage reservations to optimize seating and minimize wait times.
Operations Management	Managing inventory	Implement inventory control procedures to minimize waste and ensure adequate stock levels.
	Ensuring food safety and hygiene	Implement and enforce food safety and hygiene standards to comply with regulations and prevent foodborne illness.

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Skills	Activity	Learning Outcomes
	Overseeing restaurant maintenance	Coordinate maintenance and repairs to ensure the restaurant's facilities and equipment are in good working order.
Financial Management	Managing budgets	Develop and manage budgets to control costs and maximize profitability.
	Analysing sales data	Analyze sales data to identify trends and make informed business decisions.
	Processing payments	Ensure accurate and efficient processing of customer payments.

Referring to the skill level above mapping to the ESCO skill framework is possible. The granularity is more specific but in terms of knowledge it could fall under “Services” and skills “Communication, collaboration and creativity”. As seen in Figure 1 and Figure 2 of this document.

Table 2 Defining activities - Creative sector - Photographer

Skill - Use of Photoshop	Activity	Learning Outcome
Basic Photo Editing	Cropping and resizing an image	Can accurately adjust image dimensions and resolution for various purposes (e.g., social media, printing).
Layer Management	Creating and organizing layers for a multi-element composition	Can effectively use layers to manipulate individual elements without affecting others, maintaining a non-destructive workflow.
Creative Effects	Applying filters and blending modes to create a stylized image	Can use Photoshop's tools to achieve unique artistic effects and explore different visual styles.
3D Manipulation	Creating and manipulating 3D objects within Photoshop	Can integrate 3D elements into a 2D design and adjust lighting, materials, and perspectives.

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Looking at the skill level above mapping to the ESCO skill framework is possible if we look at a combination of occupations, but the granularity is so specific it could relate to photographers, and information and communication technology from a point of view of occupation and information skills or communication, collaboration and creativity.

2.5 Evidence

Evidence of learning has transformed alongside teaching methods. Traditional education relied heavily on exams and essays, primarily testing knowledge recall. Modern learning, including microcredentials, emphasizes practical skills and their application. Evidence now takes diverse forms, such as projects, simulations, and multimedia presentations, allowing learners to showcase abilities in authentic contexts. This shift reflects a move towards competency-based education, where learners demonstrate mastery through real-world tasks and problem-solving, providing tangible proof of their skills. This broader scope of evidence encompasses cognitive, practical, and soft skills, offering a more comprehensive and relevant assessment of learning. Whilst exams and quizzes are still used by many training institutions to assess and evaluate, it should gradually be more aligned to competency-orientated approaches as agreed on European level.[18] The change in approach may take a while to be embedded, but for microcredentials this should be applied from the start as it is central to its approach. The identification of evidence for concise tasks requires a different mindset. Below you will find in the table below some examples of evidence for microcredentials.

Table 3 Evidence examples by skill group

Mechanical Skill	Activity	Evidence Guideline
Precision Fastening	Assemble a device using a torque wrench. Tighten fasteners to spec.	Submit a 1-minute video showing the assembly process.
Bearing Installation/Maint.	Remove, inspect, lubricate, and reinstall a bearing. Select the correct type.	Send 4 pictures: before, during (2), and after.
Hydraulic System Troubleshooting	Diagnose a hydraulic system fault. Use gauges and schematics. Find the cause.	Submit a written report detailing the troubleshooting steps.
Interpreting Tech. Drawings	Analyze a complex drawing. Identify dimensions, materials, and instructions.	Submit a marked-up drawing with annotations and explanations.

[18] Council Recommendation on Key Competences for Lifelong Learning - European Education Area

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Receptionist Skill	Activity	Evidence Guideline
Professional Phone Etiquette	Answer a simulated incoming call. Transfer the call correctly.	Submit an audio recording of the call.
Appointment Scheduling	Schedule and manage appointments using a calendar system. Handle changes.	Submit screenshots of the appointment schedule before and after changes.
Visitor Management	Greet and direct a visitor. Complete the sign-in process.	Submit a short video demonstrating the greeting and sign-in procedure.
Mail and Package Handling	Sort and distribute incoming mail and packages. Prepare outgoing shipments.	Submit photos of organized mail/package areas and a sample shipping label.

Software Skill	Activity	Evidence Guideline
Unit Testing	Write unit tests for a specific function or module. Achieve 90% code coverage.	Submit the unit test code and a code coverage report.
Version Control (Git)	Commit code changes to a Git repository. Resolve a merge conflict.	Provide a link to the Git repository showing the commit history and the resolved conflict.
Code Debugging	Debug a provided code snippet with a known bug. Identify and fix the issue.	Submit the corrected code with a description of the bug and the fix.
API Integration	Integrate a third-party API into a simple application.	Submit the application code demonstrating the API integration and a description of the process.

Nursing Skill	Activity	Evidence Guideline
Medication Dosage Calculation	Calculate the correct dosage for a prescribed medication.	Submit a worksheet with dosage calculations for various scenarios.
Medication Administration (Oral)	Administer oral medication to a simulated patient following protocol.	Submit a video recording of the simulated administration, following checklist criteria.

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Nursing Skill	Activity	Evidence Guideline
Medication Reconciliation	Reconcile a patient's medication list. Identify discrepancies.	Submit a documented medication reconciliation form with identified discrepancies.
Safe Medication Handling	Prepare and handle medications according to safety guidelines.	Submit a checklist demonstrating proper handling techniques (e.g., hand hygiene, labelling).

2.6 Learning Pathways

In many circumstances microcredentials are offered as an add on in the academic world to an existing curriculum, however there is a growing tendency to unbundle and provide a more modular approach allowing a module to have a standalone value. This allows for more flexibility of the learner, lower cost and a lower threshold to enter academic education. This approach is already deployed in adult education, where more granular and specific courses relevant to the service and production industry, public sector and other organisations are developed. The challenge in the non-formal education however is international standardisation and cross border recognition.

Even though standalone achievements are valuable in several circumstances it is advisable that others be part of a broader learning programme. For the individual learner it is a cost-effective and time-efficient way to start their learning journey and can overtime stagger the modules to complete their end goal.

2.7 Assessment

Before describing assessment methods and the process for microcredentials let's reiterate the difference again between learning outcomes, skills and competencies.

Definition of Learning Outcomes

- Clearly articulate the skills and competencies the learner must demonstrate.
- Use measurable and action-oriented language (e.g., according to the Bloom's Taxonomy[19]).

Though we are seeking to map microcredentials against ESCO it should be recognised that there are several approaches to explaining the difference between **competencies** and **skills**, each offering a unique perspective. Below are the key approaches:

Conceptual Approach (Definition-Based)

- **Skills** refer to the **specific abilities** required to perform a task (e.g., coding in Python, public speaking).
- **Competencies** encompass **skills, knowledge, and attitudes** required to perform effectively in a job or role.

[19] https://en.wikipedia.org/wiki/Bloom%27s_taxonomy

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- **Example:**
  - Skill: Writing SQL queries.
  - Competency: Data analysis (which includes SQL skills, problem-solving, and data visualization).

Hierarchical Approach (Micro vs. Macro)

- **Skills** are individual **building blocks** of performance.
- **Competencies** are **broader capabilities** that integrate multiple skills along with knowledge and attitudes.
- **Example:**
  - Skill: Conflict resolution techniques.
  - Competency: Leadership (which requires conflict resolution, decision-making, and emotional intelligence).

Functional Approach (Task-Oriented)

- **Skills** answer **"What can you do?"** (specific technical or soft abilities).
- **Competencies** answer **"How well can you apply those skills in a real-world scenario?"**
- **Example:**
  - Skill: Programming in Java.
  - Competency: Software development (applying Java skills to design, build, and test applications).

Outcome-Based Approach (Performance & Adaptability)

- **Skills** are task-specific and can be taught and measured.
- **Competencies** involve the ability to **adapt skills to different situations** and solve complex problems.
- **Example:**
  - Skill: Negotiation techniques.
  - Competency: Business negotiation (adapting techniques based on stakeholder interests and cultural differences).

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Industry-Based Approach (Workplace Perspective)

- Employers often require **competencies** rather than just **skills**, since competencies indicate the ability to **apply** skills in practical contexts.
- **Skills** are often **listed in job descriptions** (e.g., "Excel proficiency").
- **Competencies** appear in **performance evaluations** (e.g., "Analytical thinking in financial modelling").

Table 4 Summary Table

Feature	Skills	Competencies
Definition	Specific learned ability	Combination of skills, knowledge, and behaviour
Scope	Narrow	Broad
Focus	Task execution	Effective performance in real situations
Measurement	Easily measurable	Context-dependent
Example	Writing reports	Business communication

The evaluation applied to microcredentials must take into account certain characteristics inherent to this approach, first and foremost granularity and skill-based.

Focusing on very specific aspects of a job profile or a task allows the focus to be on skills. This is because the skill is the most observable component of the competence, the one that can be assessed most objectively.

2.7.1 Assessment Tools

In general, the tools used for assessing learning are well-known such as tests, quizzes, oral presentations, interviews, project-based centric, per reviews, self-reflection.

Assessment instruments must be aligned with the skills and knowledge they are intended to measure.

To ensure this alignment we can again use Bloom's taxonomy, which helps us to establish a relationship between a specific level and the most appropriate assessment instrument(s).

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Bloom's Taxonomy Levels & Aligned Assessment Methods (knowledge based)

1. **Remember (Knowledge Recall)**
   - **Assessment Tools**: Multiple-choice quizzes, fill-in-the-blank tests, flashcards, fact-recall exercises
2. **Understand (Comprehension)**
   - **Assessment Tools:** Short-answer questions, summary writing, concept mapping, paraphrasing exercises
3. **Apply (Use of Knowledge in New Situations)**
   - **Assessment Tools:** Problem-solving exercises, case studies, simulations, coding tasks, role-playing
4. **Analyze (Breakdown & Examination of Information)**
   - **Assessment Tools:** Data analysis, research projects, essays with critical argumentation, comparative analysis
5. **Evaluate (Judgment & Justification of Decisions)**
   - **Assessment Tools:** Debates, peer reviews, reflective journals, critique assignments, case evaluations
6. **Create (Production of New Ideas, Concepts, or Products)**
   - **Assessment Tools:** Research papers, design projects, business plans, artistic creations, prototype development

This framework helps align the assessment method to the cognitive skill being evaluated.

Bloom's Taxonomy Levels & Aligned Practical Assessment Methods (skills based)

1. **Remember (Basic Skill Recall)**
   - **Assessment Tools**: Skill demonstrations with step-by-step recall, checklists, basic drills, oral questioning
2. **Understand (Comprehension of Procedures & Concepts in Practice)**
   - **Assessment Tools**: Hands-on demonstrations with explanations, process-based assessments, guided practice tasks
3. **Apply (Performing Skills in Real or Simulated Contexts)**
   - **Assessment Tools**: Practical assignments, role-playing scenarios, structured labs, work-based assessments
4. **Analyze (Breaking Down a Process or Technique)**
   - **Assessment Tools**: Performance troubleshooting, diagnostic tasks, case-based practical exercises, process improvement tasks
5. **Evaluate (Judging Performance & Making Decisions)**

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- **Assessment Tools**: Self and peer assessments, real-time feedback tasks, supervisor evaluations, decision-making simulations

6. **Create (Developing New Techniques, Products, or Solutions)**
   - **Assessment Tools**: Capstone projects, prototyping, independent practical problem-solving, innovation challenges

This version emphasizes hands-on performance, decision-making, and real-world application.

2.7.2 Assessment Process & Methods for Microcredentials

The evaluation process must take into account the context in which it takes place. In fact, once skills and knowledge have been clearly defined, and these have been referenced to official repertoires of competences, such as DigComp, EntreComp or LifeComp. It is necessary to define the evaluation methods and organisational arrangements. It has to be said that these frameworks are mapped to ESCO, but provide a more contextual framework at a more granular level. Digcomp for the digital sector, EntreComp for Entrepreneurship.

In order to facilitate the definition of the assessment to be carried out, it is useful to define a series of activities, which are able to give a context to the skills being assessed. Indeed, it is not possible to assess a competence or an element of competence outside a context.

The activities described in this way make it possible to design a specific type of assessment in a precise manner, such as a workplace coaching, an in-person examination, an online interview, and so on.

Once the mode of evaluation has been determined, it will be easier to prepare specific tools, such as a quiz, an observation grid, a case study or other. It will also be more difficult to make alignment errors, such as using the questionnaire instrument, typically suited to assessing knowledge, to evaluate the execution of a procedural task or the management of a complex situation.

Selection of Assessment Methods

- Choose the most appropriate methods based on the nature of the skills (see below for examples).
- Ensure alignment with the set of skills/knowledge previously defined

Assessment Criteria & Rubrics

- Define transparent evaluation criteria that specify performance expectations.
- Develop rubrics with clear descriptors for different levels of proficiency

Evidence Collection & Submission

- Specify how learners will submit evidence of their skills
- Provide guidelines for documentation and format.

Evaluation & Feedback

- Assess submissions using predefined rubrics and criteria.

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- Provide constructive, actionable feedback to support learning and improvement.

Verification & Validation

- Ensure authenticity and reliability of submitted work (e.g., plagiarism checks, supervisor endorsements).
- Involve subject matter experts or industry professionals when needed.

Recognition & Certification

- Award the microcredential upon successful demonstration of competency.
- Use digital badges or certificates to validate achievements.

Continuous Improvement

- Gather feedback from learners and assessors to refine the assessment process.
- Update criteria and methods based on industry trends and best practices.

When we talk about learning outputs we mean the result of any activity involving learning, and these are expressed using descriptors based on skills and competences.

Here's a short list of **evidence types** a learner can produce to demonstrate proficiency in specific **skills or knowledge**:

1. **Performance Demonstrations** – Live or recorded practical execution of a task (e.g., lab work, simulations, role-playing).
2. **Portfolios** – Collection of work samples (e.g., designs, projects, reports) showcasing skills over time.
3. **Case Studies & Reflections** – Written or verbal analysis of experiences, problem-solving approaches, and decision-making.
4. **Projects & Prototypes** – Tangible outputs (e.g., code, business plans, technical builds, creative works).
5. **Presentations & Reports** – Structured explanations of knowledge application (e.g., research findings, project summaries).
6. **Self & Peer Assessments** – Reflective documentation or feedback demonstrating critical thinking and evaluation skills.
7. **Certifications & Practical Exams** – Official tests, competency-based assessments, or industry-recognized credentials.

Microcredentials utilizes a competency-based assessment approach, ensuring learners can demonstrate their skills and knowledge effectively. There are various streams which can be considered and several key aspects to take into account when establishing a thorough assessment process.

For each piece of evidence produced, an evaluation method must be defined to determine its validity: through a score, a rating scale, outcome or performance descriptors that enable the evaluator to establish the actual competence of the evaluated user.

Here's a list of the **main evaluation tools** used to assess learning activities:

1. **Rubrics** – Structured scoring guides with criteria and performance levels (e.g., analytic, holistic rubrics).

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2. **Checklists** – Yes/no or completed/not completed lists to track task completion.
3. **Rating Scales** – Numeric or descriptive scales (e.g., Likert scales) to measure performance or attitudes.
4. **Scored Questions** – Multiple-choice, true/false, short-answer, or essay questions with predefined point values.

2.8 Quality Framework & Awarding Body

2.8.1 Quality Framework

In order to ensure the microcredential will adhere to the quality standards required by the intended labour sector it is vital that the learning outcomes are defined referencing the recommended quality framework for this sector.

The quality frameworks in play are on different levels:

1. European level, i.e. Explainers ECEC[20]
2. National or regional level, i.e. NQF in Australia[21]
3. Internal quality standards, as per Quality frameworks for Schools (CEDOFOP)[22]
4. Product or service related quality standards, i.e. ImF[23] Institute for Manufacturing

Your initial needs assessment led you perhaps to a local or regional gap in the skill market, however in the transferable world we are operating in it is essential to ensure that your set of standards are linked to comparable standards such as the EQF[24]. This will increase the value of the microcredential as also the benefit for the learner.

2.8.2 What is an Awarding Body?

According to the London School of Planning and Management the definition of an Awarding body is: *"An awarding body is an organization responsible for designing and awarding qualifications, certifications, and awards to individuals who have successfully completed a course or program. These bodies ensure that the qualifications they offer meet certain standards and are recognized by employers and educational institutions. Awarding bodies play a crucial role in the education and training sector by providing a reliable and credible assessment of individuals".* Awarding bodies do differ in various countries based on local laws and regulation and/or function, structure and governance.

So, why is it important to engage with an Awarding body? The awarding body is essential to provide a framework for the issuing organization (training provider) to verify

[20] The EU Quality Framework for Early Childhood Education and Care
[21] Guide to the National Quality Standard
[22] Quality framework for schools | CEDEFOP
[23] Quality Framework.
[24] https://europass.europa.eu/en/europass-digital-tools/european-qualifications-framework

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the learning outcomes by provision of a quality framework as well as the recognition of the certification to be achieved by the learner.

The collaboration with the relevant Awarding Body will both enhance the value of the microcredential and promote recognition of the accreditation. Awarding bodies must be reputable and quality assured. They need accreditation and recognition, ensuring industry relevance and quality. Clear standards, robust assessments, and transparency are crucial. Ethical considerations include accessibility, data privacy, and fairness. Ultimately, their sponsorship of the microcredential should boost learners' skills and transnational or national employability, providing value in the job market.

Once the relevant quality framework and Awarding Body has been identified the following steps should be followed:

1. **Understand the Framework:** Align with external acknowledged quality frameworks as mentioned in paragraph 2.3.2 of this document
2. **Assessment:** Assess how your organization's microcredential's learning outcomes match and/or fit within the framework's criteria.
3. **Co-develop skills and activities:** Always ensure to map them in line with the quality framework of the Awarding Body.
4. **Evaluation and Review:** Regularly evaluate both the learning outcomes and its alignment with the expectations of the evolving job market.

2.8.3 Defining the MoU in collaboration with the Awarding Body

In order to write the MoU we can refer to two relevant examples. Good pointers can be found here: Memoranda of Understanding (MoU) Writing Guidelines. A relevant example is the Memorandum of Understanding of the National NCVET in India with Centurion University, recognises them as an Awarding Body.[25]

Another interesting example of an MoU is the one established within the ECVET[26] scheme, where there was a need to establish mutual recognition of the value of the results of an educational pathway. The model can be found here.

The MoU needed for a Microcredential though would be between an Issuing Organization of Microcredential, i.e. a VET school or training institution, other public or commercial organization who issuing the microcredential and an Awarding Body, who is providing the Quality framework related to skill acquired through the microcredential. So, if you are active in more than one sector it could be you will have several Awarding bodies involved.

The key purpose is to clarify intention, strategic planning and alignment of objectives, establish a preliminary framework, and facilitate transparent communication. The content is not legally binding like a contract, but can be in case you use binding terminology in the text such as "agree", "must" etc. [27]

[25] https://cutm.ac.in/wp-content/uploads/2024/11/NCVETCUTM-Awarding-Body-MoU_07-02-2023-1.pdf
[26] European credit system for vocational education and training (ECVET): https://www.cedefop.europa.eu/en/projects/european-credit-system-vocational-education-and-training-ecvet
[27] Memorandums of Understanding (MOUs) | Office of General Counsel.

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In terms of MoU content it can differ by country. In the table below you see an example structure of a MoU.

Table 5 MoU Sample Structure

	Section Title	Proposal for Content*
1	Preamble	Rationale for the collaboration and full details of partners involved
2	Purpose of the MoU	State the scope and intent between the two organisations
3	Areas of Collaboration	Define the x areas of cooperation
4	Responsibilities of the Issuing Organisation	Rights and obligations of Issuing organisation (IO), examples deliver training following the quality framework as set up by the Awarding Body, use of logo, accepting quality assurance from Awarding Body
5	Responsibilities of the Awarding Body	Rights and obligations of Awarding Body, Quality Assurance of IO, Continued communication in case amendments, provision of marketing material, etc.
6	Joint Responsibilities	Mutual collaboration, promotion
7	Duration and Termination	Determine period and renewal
8	Financial Arrangements	None or if applicable when you advertise and get a revenue stream
9	Intellectual Property	Yes, important to agree on IP
10	Confidentiality	In the public domain, but only signatories reserve the right to change
11	Communication and Reporting	reporting cycle
12	Dispute Resolution	as per local law
13	Governing Law	if existing
14	Annexes	if existing
15	Signatures	
		* Always check with a legal advisor

As also is stated in for example in the MoU guidelines of the NSO (National Statistic Offices) the MoU may not legally binding it is an intent and if there are no governing laws in place, it encourages to still draft one, but with a view to amend if there is a law established.[28]

[28] https://unstats.un.org/UNSDWebsite/resourceCatalog/documents/MoUGuidelines_v5_EN.pdf

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3 IMPLEMENTATION

3.1 Operational phases

Upon the design of the microcredential the following step is that we need to implement and roll out the microcredential to the learners internally and/or externally. It is paramount that both the microcredential managers as well as the assessors need to be equipped with relevant knowledge to do so.

The implementation phase is therefore the phase where the model that has been designed must be operationalised in accordance with criteria of efficiency and effectiveness.

- Efficiency

The relationship between the costs incurred and the benefits obtained must be positive, in order to make the implementation sustainable.

- Effectiveness

Being effective means achieving the learning objectives that have been defined in the design.

The main challenge in setting up an organised microcredential system is the small size of microcredentials. In fact, the following application phases have to be considered

- user acquisition;
- programming of training activities;
- delivery of contents and educational activities;
- evaluation;
- issuing;
- achieving.

Each of these steps necessarily entails costs, which must be covered by the registration fee or by any form of financing. The most popular model for determining the tuition fee is the one that starts with the number of course hours and thus the duration. In the case of microcredentials this model is penalized by definition, because we are talking about short duration by default.

This is why management costs for all implementation phases must be minimised through the use of technology.

Another technology starting to get a foothold is the embedding of gamification. In 2016 educators were talking about the potential of gamification as a tool in education[29], now in 2025 it is a well-recognised instrument, however as the technology and connectivity progresses, it will require further exploration on how to design it to ensure the learning

[29] (PDF) Potential of Gamification as Assessment Tool

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outcome is feasible and applicable, credible and validated.[30] Game-based learning such as Virtual reality, Augmented reality are becoming part of the regular toolset. The main objective is to enhance the UX experience and adapt learning to the technologies available.

In general terms to set up a microcredential management system for a Vocational and Educational Training (VET) provider, the following steps should be implemented.

3.1.1 Define the Microcredentials Strategy

Before designing a microcredential it is paramount that the overall strategy needs to be clarified, i.e. what would you like to achieve with a singular microcredential or several microcredentials, as they may be stackable? This entails to:

- identify the target learners (young/adult learners in industry, tourism, crafts, etc.),
- define the learning outcomes and competencies aligned with industry needs,
- Ensure alignment with national/international qualification frameworks (e.g., EQF, NQF, ESCO),
- establish partnerships with employers and stakeholders to ensure recognition.

This step requires the organisation to be aware of the need to clearly define the outcomes to be validated by the microcredential, expressing them in the language of competencies and not in the language of content.

Moreover, the first step to ensure the recognisability of results is to establish an alignment with institutional frameworks, or to establish relations with local stakeholders to meet their needs.

Figure 4 Microcredential operational lifecycle [31]

Main output: A clearly defined strategy for which audience the microcredential is intended and which skill gap is being addressed.

3.1.2 Establish Governance and Policies

In order to implement your strategy, you need to:

[30] https://buildempire.co.uk/author/laurabuildempire/
[31] Made by AZULchain

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- define the institution's role as a microcredential issuer,
- set up quality assurance policies for curriculum design, assessment, and certification,
- establish data privacy and compliance measures (e.g., GDPR),
- decide on stackability (how microcredentials can be combined into larger qualifications).

This step requires a strong awareness of the need to guarantee a quality process that complies with applicable regulations and ensures the achievement of measurable and concrete results. In addition, a strategy of aggregating MCs into higher-level clusters is required in order to overcome the main risk of this approach, i.e. fragmentation.

Main output: Transparent guidelines stating how your microcredential implementation falls within national, regional and/or local laws regulations

3.1.3 Develop the Learning and Assessment Model

The development of an assessment model should be accomplished by:

- choosing competency-based, modular learning format,
- defining assessment methods (e.g., portfolio, project-based, exams, workplace evaluation),
- ensuring learning pathways are flexible and support recognition of prior learning (RPL),
- developing digital learning options if applicable.

This step is particularly important, because it is the one that contains the methodology, both to ensure learning and to evaluate it effectively.

Basically, it is necessary to understand that microcredentialing is not a microcourse, but it is the evaluation scheme that needs to be applied in order to validate the actual learning of skills and competences. The process that the individual undertakes to obtain the skills is independent: it may be a course, it may be a job shadowing, it may be volunteering or something else.

The training course, if any, will have to be designed to produce useful evaluation data to contribute to the assessment phase. The assessment methodology will have to acquire assessment data and evidence produced during the course and proceed to the overall assessment in relation to the skills to be validated.

Main output: a robust assessment scheme that meets all learning criteria and quality requirements

3.1.4 Set Up the Digital Infrastructure

The digital infrastructure for MCs is probably the most challenging part of the process. This is inherently due to the granularity of this approach: the need to implement the various steps in a tight timeframe and on an individual, rather than group, basis makes IT support essentially indispensable.

Considering the existence of preparatory training paths for the acquisition of MCs, we can list the following steps:

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- Implement or integrate a Learning Management System (LMS) that supports microcredentials (e.g., Moodle, Canvas).
- Use digital credentialing platforms (e.g., Open Badges, Europass Digital Credentials).
- Ensure interoperability with other systems (blockchain verification, API integrations).

If one wants to ensure the assessment of competences in a manner independent of the training context, it will be necessary to have a dedicated digital technology solution, such as the case of MICOO, AZULchain's MC management product that is used in the Block.Ed project.

Main output: a reliable technology to administer the microcredentials ensuring quality criteria and qualifications are met.

3.1.5 Issue and Manage Microcredentials

Once the assessment has been successfully carried out, the MC is issued and made available to the recipient, who becomes its owner.

At this stage, the key element is the usability of the MC, i.e. the possibility for the owner to distribute it, publicise it and make use of any services that may be made available.

This means that the following elements must be defined:

- a digital container (wallet) in which to store and manage one's MCs;
- Export functionality in different formats;
- tool for sharing the MC on social networks and institutional repositories (e.g. Europass);
- system for receiving notifications and managing external interaction (contact from stakeholders, renewal on deadline, training and job opportunities).

Main output: a reliable tool to store the issued microcredentials and a functioning link to websites with capability to verify the validity.

3.1.6 Ensure Industry and Market Recognition

This particular phase is closely linked to your strategy as you upfront should identify and discuss with relevant stakeholders that your microcredential will be recognised by and supported by the relevant industry. Therefore, it is important to:

- engage industry partners for validation and co-design of credentials,
- promote employer awareness of microcredentials,
- establish pathways for credit recognition in formal education.

Main output: Establish a Memorandum of Understanding with the relevant stakeholder (e.g. Awarding body) to provide recognition.

3.1.7 Monitor, Evaluate, and Improve

Continuous improvement is key to providing learners with the latest learning materials. This ensures that competencies and skills are evolving alongside the ever-changing requirements from the labour market. Therefore, you should

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- collect feedback from learners, employers, and educators,
- track employment outcomes and credential uptake,
- regularly update credentials based on market and technological changes.

Main output: Establish a lesson learnt feedback system to ensure learnings are being fed into the next cycle of Microcredential designs and strategy.

3.2 The advantage of Blockchain

Blockchain in Education is a concept relatively new to the education sector, primarily because its potential is not fully understood by many learning institutions. Besides this, it has also to overcome the negative connotation it has with many in the educational field as it is seen or understood as synonymous with Bitcoin.

3.2.1 What is Blockchain?

Not diving into the technical detail on how to implement Blockchain we refer here to the explanation of the European Commission: *"Blockchain/web3 technology allows people and organisations who may not know or trust each other to collectively agree on and permanently record information without a third-party authority. By creating trust in data in ways that were not possible before, blockchain has the potential to revolutionise how we share information and carry out transactions online*."[32]

The mentioned Web3 technology refers to creation of a digital wallet. It may sound like a bitcoin reference, but in reality any type of documentation can be validated, credited and stored in a digital wallet.

Blockchain has already been on the market since 1994, the first generation of Blockchain was primarily adopted by the Bitcoin industry, but used in anger starting from 2008 onward. However, since its inception it is now deployed in many different areas of our society. As UNIBS (University of Brescia) states in their research on Blockchain application, many areas are already benefiting from the now second generation Blockchain, such as in Healthcare, Supply Chain, e-Voting and other sectors. At the time of this research 2020, 2021 education was not yet mentioned.[33]

In generic terms Blockchains advantage are listed below:

- **Enhanced security:** Blockchain's decentralized and encrypted nature makes it extremely difficult to tamper with or hack, ensuring data integrity and security.
- **Greater transparency:** All network participants can access the same information simultaneously, promoting trust and accountability whether this is in a public, private or hybrid environment or in a consortium.
- **Increased efficiency and speed:** Blockchain streamlines processes, eliminates intermediaries, and automates tasks, leading to faster and more efficient transactions.

[32] Blockchain and Web3 Strategy | Shaping Europe's digital future

[33] A Blockchain Definition to Clarify its Role for the Internet of Things

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- **Instant traceability:** Blockchain creates an audit trail, documenting the provenance of an asset at every step, which is crucial in industries concerned with ethical sourcing or counterfeiting.
- **Automation:** Smart contracts automate transactions when pre-specified conditions are met, reducing human intervention and reliance on third parties.
- **Decentralization:** Blockchain operates without a central authority, distributing control among network participants, making it resistant to censorship and single points of failure.

3.2.2 Blockchain in Education

Blockchain Technologies are and will become gradually more integral part of the education system at all levels. It is supported by Professor Asha Kanwar, President and CEO of the Commonwealth of Learning and Stefania Giannini, UNESCO Assistant Director-General for Education. Together they produced a comprehensive study on the necessity of and hindrances and/or limitations of Blockchain in Education in cooperation with UNESCO.[34]

At the moment many efforts are being undertaken to embed Artificial Intelligence in education as a method to enrich the learning content and adapt and modernise the learning experience. The focus of this project though is Blockchain, and whilst these two pieces of separate technology are often implemented simultaneously, our focus is on the Blockchain technology and its benefits in education.

Let's clarify the main difference between Artificial intelligence and Blockchain Technology. Artificial Intelligence works on the foundation of algorithms and computer programs that help machines perform complex tasks without human intervention.

Blockchain are nodes in a decentralized blockchain network that enables documentation, tracking, and verification of all types of transactions on the network.[35]

In order to clarify the function of Blockchain in relation to other activities on the internet, we need to refer to 2 terms called “The Internet of Things and Web 3.0”. In essence, the **Internet of Things** provides t**he data, blockchain** provides the **trust and security**, and **Web 3.0** provides the **platform for a more decentralized and user-centric internet**, which could facilitate many transactions in education. The term Internet of Things (IoT), has been invented by Kevin Ashton, the technology pioneer, he states: *"The Internet of Things means sensors connected to the Internet, behaving in an Internet-like way by making open, ad hoc connections, sharing data freely, and allowing unexpected applications, so computers can understand the world around them and become humanity's nervous system".*[36] Examples are devices connecting through sensor software, Bluetooth and other smart connections on the internet.[37]

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[34] https://oasis.col.org/server/api/core/bitstreams/2ff41b2d-3d0b-4f4f-acf5-49b46a203953/content , © UNESCO and COL, 2022 Revised version,ISBN 978-1-7772648-8-8

[35] https://101blockchains.com/ai-vs-blockchain/

[36] https://www.historyofinformation.com/detail.php?id=3411

[37] https://www.lamar.edu/it-services-and-support/security-test/awareness/internet-of-things.html#:~:text=The%20Internet%20of%20Things%20
IoT,buildings%2C%20and%20other%20items%20%2D%20%22

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The discussion on how to start the inclusion of blockchain into education has become more a must than a wish to explore in the early twenties of this century[38]. In effect, also due to increased necessity of connectivity between learners and educational institutions during the lockdown. Even today it is clear there is still a long way to go to convince and/or implement blockchain technology into the education sector, despite the recognition that it could revolutionize the education system.[39]

3.2.3 How can blockchain technology improve the learner's experience?

The following advantages are identified which benefits the learner:

- **Empowering learners with ownership of their data:** Blockchain allows learners to own and control their learning records, including credentials, achievements, and skills. It decreases reliance on centralized institutions and gives learners a lifelong, verifiable record of their educational journey.
- **Personalized and flexible learning:** Blockchain can facilitate personalized learning pathways by tracking learners' progress and suggesting relevant resources. It can also support microcredentials and alternative forms of learning, allowing learners to gain recognition for skills acquired outside traditional education.
- **Enhanced security and trust:** Blockchain's immutability ensures that learning records are tamper-proof and authentic. This builds trust in the credentials earned by learners and reduces fraud.
- **Improved accessibility and affordability:** Blockchain can enable access to educational resources for learners in remote areas or those who cannot afford traditional education. It can also facilitate peer-to-peer learning and knowledge sharing, reducing the reliance on expensive intermediaries.

Detailing this for the Block.Ed project environment it means that **accessibility** for the learners to their certification needs to be a priority. The **empowerment of the user** to validate the microcredential (certificate) is paramount as well as **adhering to privacy laws and inter-operability** with other platforms.

The fact the learner can proactively define his or her own learning journey is hugely motivating for the student, and has a positive impact on their learning outcomes and ability to perform those skills. It also has a positive impact on the labour market as obviously skilled labour ensures effectiveness and productivity.

[38] Example Research Paper: https://www.researchgate.net/publication/344053445_Blockchain_in_education_Opportunities_applications_and_challenges; Steiu, Mara-Florina, 2020/08/24

[39] Blockchain: Research and Applications, Volume 4, Issue 4, December 2023, 100165, by Amr El Koshiry a b, Entesar Eliwa c d, Tarek Abd El-Hafeez d e, Mahmoud Y. Shams f

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3.2.4 How can blockchain technology improve the performance of educational institutions?

Blockchain technology is slowly being adopted in several academic institutions, i.e. University of Nicosia, Cyprus and for example the University of Melbourne, but it is still considered to be in an explorative phase. The University of Nicosia (UNIC) uses it for a payment process and issuing of academic certificates using Bitcoin Technology and the University of Melbourne for secure certificate management, and digital identity management.[40]

The below lists the key benefits to Education institutions in general:

- **Streamlined administrative processes**: Blockchain can automate administrative tasks such as student enrollment, transcript issuance, and fee payments, reducing costs and increasing efficiency.
- **Enhanced transparency and accountability:** Blockchain can create a transparent record of institutional activities, fostering accountability and trust among stakeholders. This includes tracking student performance, resource allocation, and institutional achievements.
- **Improved collaboration and knowledge sharing:** Blockchain can facilitate secure and efficient data sharing among institutions, enabling collaboration on research, curriculum development, and student support.
- **Increased reputation and trust:** By issuing verifiable credentials and maintaining transparent records, institutions can enhance their reputation and build trust with learners, employers, and other stakeholders.

Detailing this for the Block.Ed project environment it means that a **seamless integration** for the institutions of blockchain is required. The issued certification needs to **have high-level security.** And the solution with Blockchain needs to be **scalable t**o manage an increased number of learners.

All the above points rely on the validity of the transaction which depends on the reliability of the digital signature whether it is not forged and real. The below graph shows the verification process of the authenticity of the signature.

[40] link to PDF :JRC108255/jrc108255_blockchain_in_education%281%29.pdf

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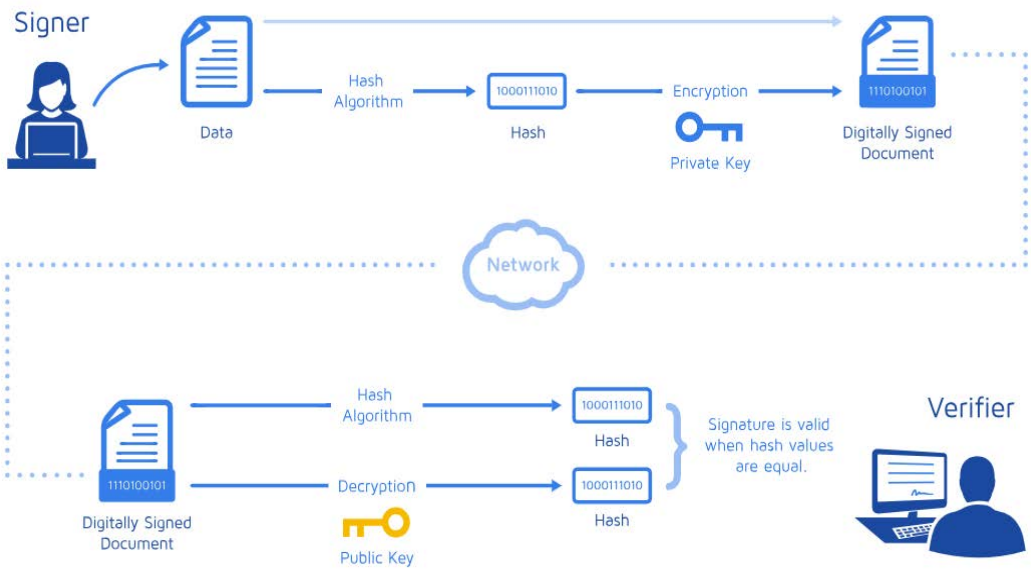

Figure 5 source: Docusign

Till date the issuing of certificates in tertiary education is the most used application of Blockchain technology in the education sector alongside the more traditional use of payment transactions.

Blockchain in learning content is however in its infancy.

3.2.5 What challenges are still to be overcome?

As the figure below shows there are still many challenges to overcome, but as educators we need to embrace change as also the new generation learners at any competency level are absorbing learning in a different way than the previous generation. The blockchain technology can help in steering these individuals' learning methods without losing quality and standardisation out of sight.

- **Scalability:** Current blockchain technology may not be able to handle the large volume of data generated by educational institutions.
- **Interoperability:** Lack of standardization and compatibility between different blockchain systems can hinder data sharing and collaboration.
- **Regulation; Regulatory and legal frameworks:** Clear legal and regulatory frameworks are needed to address issues such as data privacy, security, and liability in the context of blockchain-based education.
- **Adoption and acceptance:** Widespread adoption of blockchain in education requires overcoming resistance from stakeholders who may be hesitant to embrace new technologies.
- **Cost and complexity:** Implementing blockchain solutions can be expensive and require specialized expertise, which may be a barrier for some institutions.

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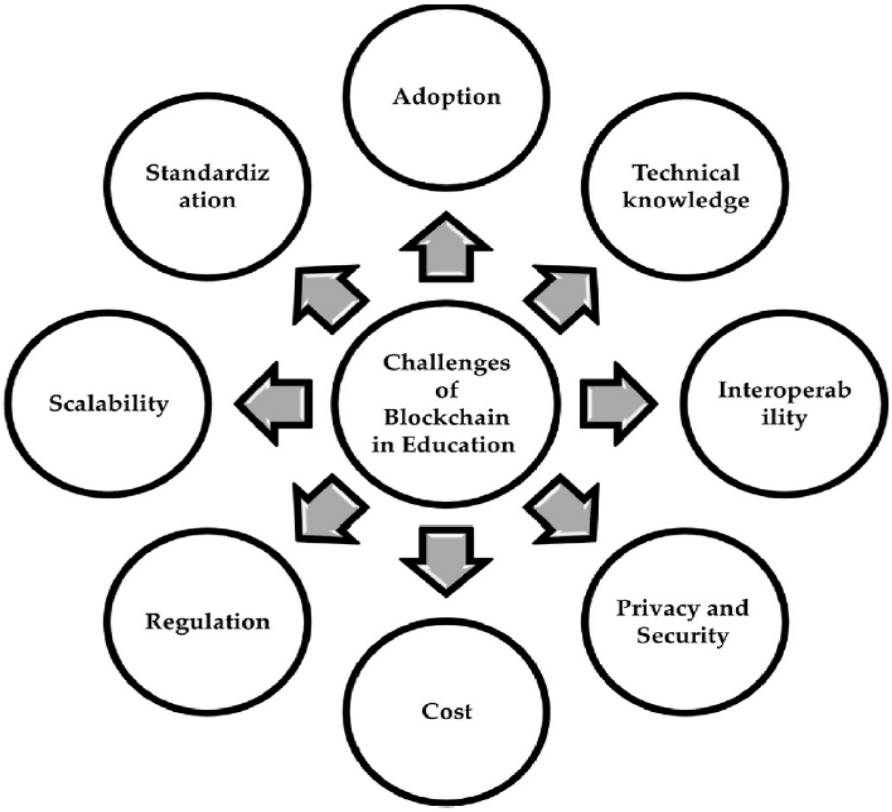

Figure 6Blockchain: Research and Applications, Volume 4, Issue 4, December 2023

Despite these challenges, blockchain technology has the potential to revolutionize education by empowering learners, improving institutional performance, and fostering a more secure, transparent, and accessible learning environment. Overcoming the remaining impediments will require collaboration among stakeholders, technological advancements, and supportive policies.

3.2.6 Blockchain Technology & Microcredentials

Microcredentials are often mentioned as the technology to create and manage microcredentials as they are more focussed and smaller entities.[41]

Granular microcredentials may have a standalone value; however, it should not be forgotten that they also have the potential to be stackable and part of a larger learning pathway.

One of the pioneering countries is New Zealand where the first Microcredentials were rolled out by Philip Ker and Oonagh McGirr and their team for Aotearoa, known as

[41] Blockchain: Research and Applications | Vol 4, Issue 4, December 2023 | ScienceDirect.com by ElsevierUnlocking the power of blockchain in education: An overview of innovations and outcomes Amr El Koshiry a,b,*, Entesar Eliwa c,d, Tarek Abd El-Hafeez d,e,**, Mahmoud Y. Shams f

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Edibits[42]. Now almost 7 years later after the initial start Microcredential are an integral part of the New Zealand education system, but slightly different than set out in 2018. Initially it was meant to be recognised as part of the established learning pathways, however they are now more established as separate routes to credentialising. Many lessons can be learnt from these pioneers.

From the other perspective unbundling from an existing learning curriculum could be a way to achieve microcredentials and make the learning journey more flexible for the individual earner.[43]

In terms of developments to date we see that for example the **Interactive Learning Experience Platform (ILEP):** This e-learning platform is a proof of concept developed by researchers from University College London, leveraging Blockchain technology. The primary objectives of the platform are to enhance transparency in assessments and enable personalized curriculum delivery within the higher education context. The platform can automate assessments and issue credentials using Blockchain technology.[44]

3.3 Evaluation of microcredentials

Microcredential assessments focus on demonstrating practical skills and competency mastery. This directly measures a learner's ability to apply knowledge in real-world scenarios. Evaluation also shifts from grades to competency-based feedback, highlighting specific skills gained and areas for improvement. This approach aligns with the microcredential's goal of rapid, targeted skills development for immediate application in the workplace.

The role of assessment will be continuously changing as it needs to adapt to the advancement in technology. The European Commission formally introduced the concept of Industry 5.0 in its 2021 publication, "Industry 5.0: Towards a sustainable, human-centric and resilient European industry." This document emphasizes the human-centric approach and sustainability focus of this new industrial era.

Blockchain Technology should not be ignored, but embraced as a means to improve the learners' flexibility as well as improve the institute's process improvement. From both perspectives trust, credibility and recognition

This means that also the education sector needs to change, adapt and pro-actively work towards closing the need gaps of new skills in the labour market. The type of evidence required from the learner/earner to prove their capabilities needs to evolve. Hence the up- and reskilling is also required from the assessor to meet the requirements of the new world. Familiarisation with the embedding of Virtual and

[42] https://drive.google.com/file/d/15XTYRy6xQMsRlGI_844338bM7qyHTOJL/view

[43] Sood, Ira & Pirkkalainen, Henri & Camilleri, Anthony. (2020). Can Blockchain Technology Facilitate the Unbundling of Higher Education. 228-235. 10.5220/0009339202280235

[44] MDPI and ACS Style Bidry, M.; Ouaguid, A.; Hanine, M. Enhancing E-Learning with Blockchain: Characteristics, Projects, and Emerging Trends. Future Internet 2023, 15, 293. https://doi.org/10.3390/fi15090293

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Augmented reality, dynamic simulation programmes and project decision games are a few examples.

At the moment various projects or consortium are working towards using blockchain technology, i.e. DC4EU or ebsi-vector, and Odznaka is building national standards[45].

[45] We are building a Polish standard for microcredentials

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4 VALIDITY & RELIABILITY

4.1 Reliability of the learner

As proctoring of each individual earner is not feasible, there is some level of trust involved. However, there are certain methods to ensure that the evidence submitted is truthful. Written text should be checked for plagiarism, ask the earner in audio to identify him or herself, in a video presentation only accept evidence with the earner visible to the camera. Blockchain technology and NFT (Non-Fungible tokens) are essential contributors to an increased secure and data protected environment.

4.2 Validity of Microcredential

4.2.1 Validity of the duration of the microcredential

Once designing a microcredential, always be aware of the fact that the newly acquired skill will be overtaken by either new technologies or a changing environment. Therefore, anticipate the validity of the microcredential in terms of months or years. Is it a skill for life not influenced by the changing environment, then there is no need for upskilling? The upskilling microcredential aligned to the new needs of that particular skill can be even more granular and concise.

4.2.2 Credibility of the microcredential

There are several websites you can use to verify the badge or credential. The technology behind this cryptography, such as metadata and blockchain, are providing a safe digital signature or “fingerprint”. When sharing your earned credential this verification can be essential to new employers and convince them of your acquired skill. Examples of relevant verifiers are: https://europa.eu/europass/en or https://badgecheck.io/ (Open Badge 2.0 validator)

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5 EXAMPLES MICROCREDENTIALS

Researching microcredentials the below results pop up and they all are moving towards bitsize learning. Some use microcreds or similar, but not all. Note they do not all reflect the granular approach and adhere to the same quality standards. Global standardisation and recognition are still to be further developed and implemented. Organizations such as the World Alliance for Microcredentials Foundation will be influential in achieving this goal.[46]

5.1 Tools

[1.] **Academic:** Micro-credentials | University College Cork (bitsize Academic Credentials)
[2.] **VET:** Micro-credentials – Digital Promise
[3.] **Coursera:** (www.coursera.org) Offers a huge range of microcredentials, often in partnership with universities and companies. Look for their "Professional Certificates" as a good example.
[4.] **edX:** (www.edx.org) Similar to Coursera, with a strong focus on university-backed microcredentials.
[5.] **MICOO:** https://micoo.io/
[6.] **Udacity:** (www.udacity.com) Known for its "Nanodegree" programs, which are often microcredential-like, focused on specific tech skills.
[7.] **LinkedIn Learning:** (www.linkedin.com/learning) Integrates with the LinkedIn platform, making it easy to showcase microcredentials to potential employers.

[46] https://wam.foundation/

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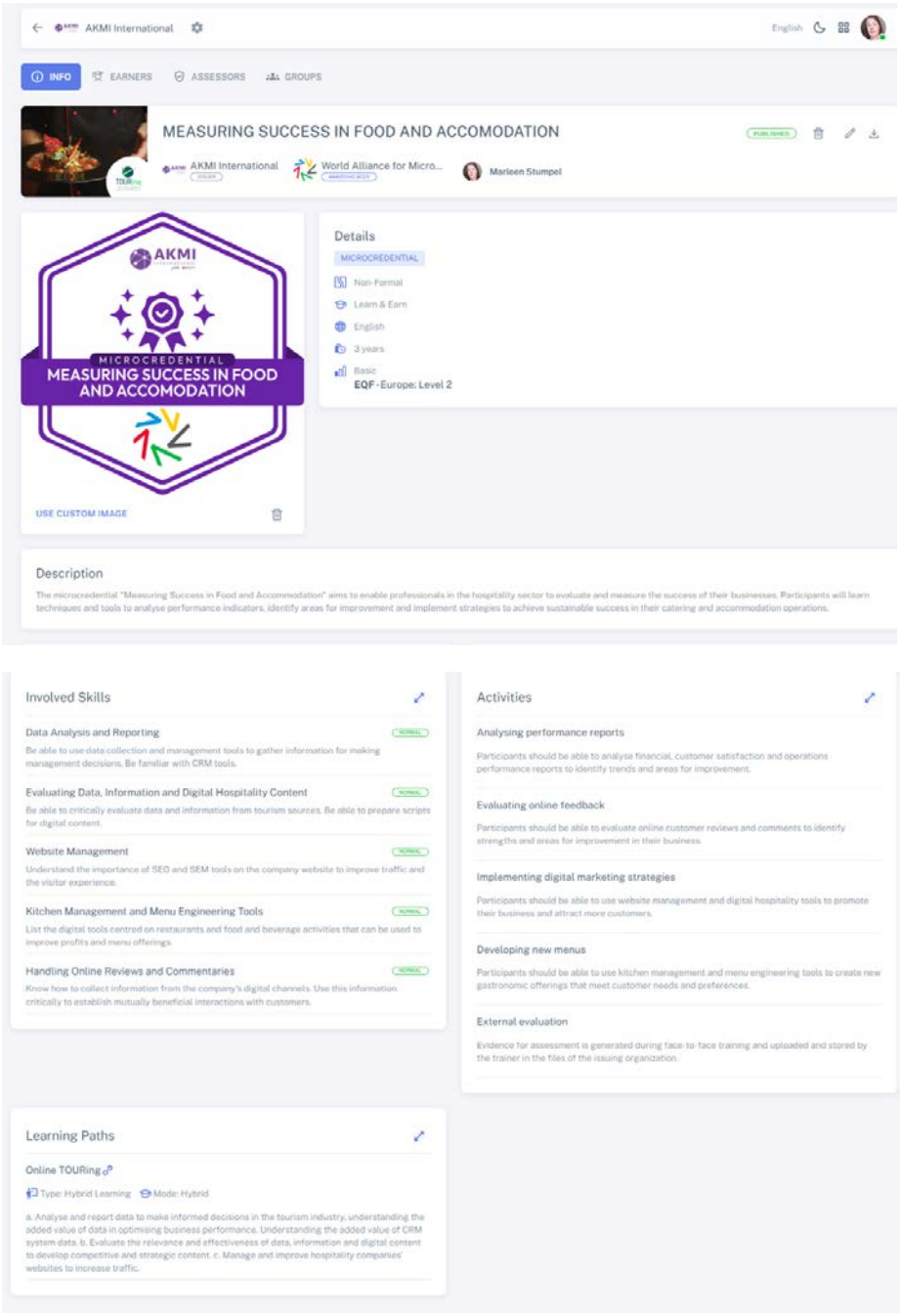
5.2 Visualisation Microcredentials

Example 1 [47]



[47] Source MICOO, Issuer AKMI international, Greece:

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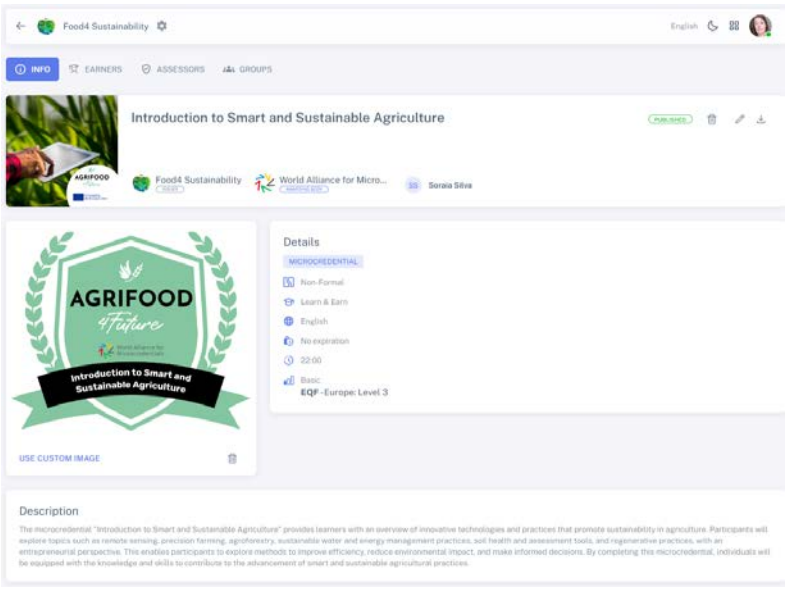
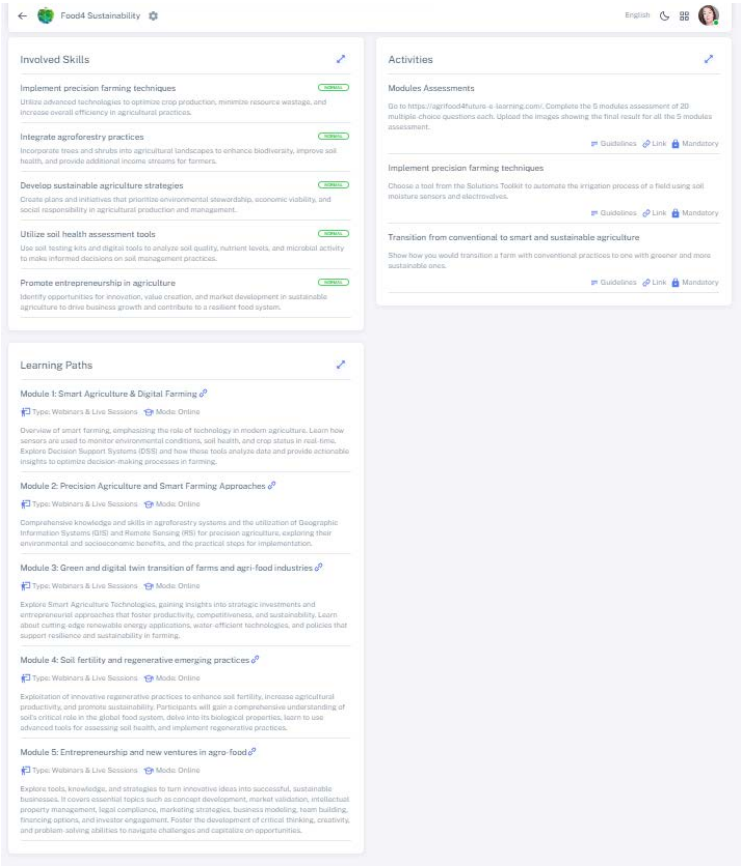
Example 2: [48]





[48] Source MICOO, Issuer Food4Sustainability, Portugal: https://micoo.app/credential/67ed4afb8890cc15678b27d6/

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6 TYPES OF BLOCKCHAIN USED IN EDUCATION

Ledgers

Before speaking about the types of Blockchain Technology first the term ledger needs to be clarified. The definition according to Cambridge dictionary is “a book in which things are regularly recorded, especially business activities and money received or paid”. [49] From a technical perspective, a ledger is simply a list of sequential, time-stamped transactions. Hence, there is agreed ownership who has the authority to copy and distribute the ledger to other stakeholders requiring access to the ledger. In effect, you can compare it to an excel sheet on a drive whereby you give either view or edit access to many, but you keep the ownership. In order to secure this environment and keep their transactions safe cryptography will be used to make all the transactions resilient and difficult to attack or unauthorized changes.[50] Distributed Ledger Technology (DTL) is a set of protocols that validate the transactions shifting the authority from one central authority to a network of users, meaning that the ownership sits with one organization or individual.

Blockchain Technology is a specific type of DTL whereby blocks are connected with each other through smart contracts linked by time stamped sequences (history of activities) and is therefore more associated with a decentralisation of control.

Blockchain Technology has various versions which each have some advantages and disadvantages, which need to be considered when implementing. Below you see a list with the current main types of Blockchain Technology.

Blockchain Technology	Advantages	Disadvantages
Bitcoin	The original cryptocurrency, so it's widely recognized. Lots of people use it, making it easy to buy and sell. Very resistant to censorship or control by governments.	Transactions are slow. Fees can be high. Uses a lot of energy (not very environmentally friendly). Can't handle many transactions at once.
Ethereum	Allows for complex programs called "smart contracts" and decentralized apps (dApps). Has a big and active	Can get overloaded, leading to high fees. Can't handle lots of transactions quickly. Building on it can be tricky. Smart

[49] https://dictionary.cambridge.org/us/dictionary/english/ledger

[50] https://oasis.col.org/server/api/core/bitstreams/2ff41b2d-3d0b-4f4f-acf5-49b46a203953/content , © UNESCO and COL, 2022 Revised version, ISBN 978-1-7772648-8-8

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	community of developers. Very flexible and can be used for many things.	contracts can have bugs that hackers can exploit.
Cardano	Designed with security as a top priority, and experts have checked its code. Uses less energy than Bitcoin (more sustainable). Has a good system for making decisions about its future? Built to handle more users.	Newer and smaller than Ethereum, so fewer people use it. Development is slower and more careful, which can be frustrating. Fewer dApps available compared to Ethereum.
Solana	Super-fast transactions and very low fees. Uses a clever combination of technologies to achieve speed and efficiency. Growing quickly, with lots of dApps and DeFi projects.	More centralized than some other blockchains, which is a concern for some. Has experienced network outages. Some security questions still exist.
Hyperledger Fabric	Designed for businesses, not cryptocurrencies. Can be customized to fit specific needs. Supports private and confidential transactions. Handles lots of transactions quickly and efficiently.	Not meant for public use like Bitcoin or Ethereum. Requires specialized knowledge to set up and manage. Less decentralized than public blockchains.

While several blockchain platforms are being explored in education, **Cardano** and **Ethereum** are emerging as prominent choices, each with its own strengths.[51]

Cardano is gaining traction due to its strong focus on sustainability. Its proof-of-stake consensus mechanism requires significantly less energy compared to Bitcoin's proof-of-work, making it a more environmentally friendly option. Additionally, Cardano's emphasis on peer-reviewed research and secure development practices makes it appealing for educational institutions that prioritize data integrity and reliability.

Ethereum remains a popular choice due to its versatility and large developer community. Its support for smart contracts enables the creation of complex applications for credentialing, student records, and even decentralized learning platforms. However, Ethereum's energy consumption and scalability issues are ongoing concerns, although efforts are being made to address these challenges.

[51] Various sources: https://www.alchemy.com/list-of/web3-education-resources-on-ethereum; https://www.bitpay.com/blog/ethereum-explained; https://www.cardanofoundation.org/blog/ccri-cardano-release-mica-sustainability-indicato

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Ultimately, the best blockchain platform for education depends on the specific needs and priorities of the institution. Factors to consider include:

- **Sustainability:** How important is it to minimize the environmental impact of the blockchain solution?
- **Complexity:** How complex are the desired applications and how much development expertise is available?
- **Usability:** How easy is it for students, faculty, and administrators to use the platform?
- **Scalability:** Can the platform handle the volume of data and transactions generated by the institution?

The European Union, Commonwealth of Learning (COL) and Unesco all work towards the “SDG 4, or Sustainable Development Goal 4, which is a commitment to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all” one of the important mission statements of the United Nations.

The blockchain landscape is constantly evolving, with new platforms and solutions emerging. It is of paramount importance that educational institutions should stay informed about these developments and carefully evaluate their options before making a decision.

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7 FURTHER READING AND WATCHING

[1.] Decentralised identity examples
[2.] A pilot at MIT, USA: http://news.mit.edu/2017/mit-debuts-secure-digital-diploma-using-bitcoin-blockchain-technology-1017
[3.] https://www.tcd.ie/teaching-learning/academic-affairs/course-development/course-proposals/new/assets/mc-pedagogic-considerations.pdf
[4.] https://digitalmedia.sheffield.ac.uk/media/EDU6147+4.+What+is+Blooms+Taxonomy/1_4lam0ovr
[5.] https://www.eursc.eu/BasicTexts/2018-09-D-69-en-2.pdf
[6.] Defining 'Skill' and 'Competence'

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8 APPENDIX A – GLOSSARY

Term	Definition
Add-on	microcredentials that supplement or complement existing qualifications or degrees.
Artificial Intelligence (AI)	The use of computer algorithms and technologies to simulate human intelligence, used in micro-credential platforms for personalized learning pathways and assessment.
Assessment	The process of gathering and evaluating evidence to determine a learner's level of achievement against specified learning outcomes.
Attitude	Attitudes describe the disposition and mind-sets to act or react to ideas, persons or situations.
Authenticity	Verification of the learner's identity and the legitimacy of their microcredential.
Awarding Body	Has the recognition to confer qualifications, including microcredentials. They set the standards, assessments, and issue the final certification.
Badge	A digital credential that represents a specific skill or accomplishment, often awarded through a microcredential program.
Behavioural competencies	Behavioural competencies are the bridge between the "who" (technical skills) and the "how" (behaviours) within your organization.
Blended Learning	A mix of online and face-to-face learning methods.
Blockchain Technology	A decentralized, distributed ledger technology that records transactions and data in a secure and transparent manner.
Bloom's Taxonomy	Bloom's Taxonomy is a framework for classifying learning objectives into six levels: Remember, Understand, Apply, Analyze, Evaluate, and Create, progressing from basic to complex thinking skills.
Centralized Ledger	A ledger maintained in a single location, typically by a central authority.

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Certification	The formal recognition of an individual's achievement of specific learning outcomes through a micro-credential.
Competency	A demonstrable combination of knowledge, skills, and behaviours required to perform a specific task or role.
Competency-Based Education	An approach focusing on the demonstration of skills and knowledge rather than time spent in education.
Continuous Improvement	The ongoing process of refining the assessment process and updating criteria based on feedback and industry trends.
Credential Transparency	Clear and accessible information on a microcredential's learning outcomes, assessment, and recognition.
Credential holder	A person holding any license, permit, certificate or registration granted by the department or any board; MC holder
Digital Badge	A digital representation of a microcredential that can be stored and shared electronically.
Digital Wallet	A secure digital platform for storing and managing digital credentials, including microcredentials.
Distributed Ledger	A ledger shared across multiple participants in a network, increasing transparency and security.
Earner	The earner is the student who by providing evidences can earn a microcredential
E-Learning	Learning conducted via electronic media, typically on the Internet.
Endorsing Body	Recommend or support individuals or organizations based on their expertise and potential. They don't necessarily issue the qualification themselves, but their endorsement adds credibility
ESCO (European Skills, Competences, Qualifications and Occupations)	A multilingual classification of European skills, competences, qualifications, and occupations.
European Qualifications Framework (EQF)	A framework that facilitates comparability and recognition of qualifications across European countries.

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Evidence	refers to the tangible proof that a learner has achieved the specific skills and knowledge outlined in the microcredential's learning outcomes. It's the material that learners submit to demonstrate their competency and mastery of the skills they've acquired.
Formal Learning	Structured learning that takes place in traditional educational institutions and leads to recognized qualifications.
Informal Learning	Unstructured learning that occurs through everyday experiences, such as self-directed learning or on-the-job training.
ISC (International Skills Catalogue)	A comprehensive database of skills and competencies, used to map and compare microcredentials.
ISO (International Organization for Standardization)	An international standard-setting body that develops standards for various industries and sectors.
Issuing Organisation	An issuing organisation is the entity responsible for formally granting or conferring the micro-credential
Knowledge	Knowledge is composed of the facts and figures, concepts, ideas and theories which are already established and support the understanding of a certain area or subject.
Labour market intelligence (LMI)	LMI is the information a person needs to make decisions about their future. It includes information about planning a career, work-related options and the types of training and education necessary for specific jobs.
Learning Outcome	A measurable statement of what a learner should know, understand, or be able to do as a result of completing a learning experience.
Learning Pathways	Flexible routes that allow learners to achieve recognized qualifications through different learning experiences.
Learning Experience Design (LXD)	a way of creating learning experiences that achieve the desired learning outcome in a way that is human-centered and goal-oriented.

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Lifelong Learning	The continuous acquisition of knowledge and skills throughout one's life.
Machine Learning	A type of AI that allows computers to learn from data without explicit programming, used for data analysis and predictive modeling in micro-credential systems.
Memorandum of Understanding	is a formal but not legally binding agreement between two or more parties outlining the terms of their collaboration. It serves as a mutual acknowledgment of shared goals and intentions for cooperation, often as a preliminary step towards a more formal agreement
Microcredential	A microcredential is the record of the learning outcomes that a learner has acquired following a small volume of learning
Modular Learning	A flexible learning approach where smaller learning units can be combined into a larger qualification.
National Qualification Framework (NQF)	A country-specific system for classifying and recognizing qualifications.
NFT (Non-Fungible Token)	A unique digital asset that represents ownership of a specific item, used to issue verifiable and tamper-proof microcredentials.
Non-formal Learning	Organized learning outside of the formal education system, such as workplace training or community courses.
Notional Workload	The estimated time required to complete a microcredential, often measured in ECTS credits.
O*NET (Occupational Information Network)	A free online database that provides comprehensive information on occupations.
Ontology	A system for classifying and defining concepts and relationships within a specific domain, used to structure micro-credential frameworks.
Open Badge	A type of digital badge that is freely available and can be earned by anyone who meets the specified criteria.
Prior Learning Assessment (PLA)	The process of recognizing and evaluating a learner's prior knowledge, skills, and experience for potential credit or recognition.
Proctoring	Supervised assessment to ensure the integrity and authenticity of the learner's work.

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Quality Assurance	The process of ensuring that a microcredential meets established quality standards.
Recognition	The acceptance of a microcredential by educational institutions, employers, or industry bodies as proof of skills and competencies.
Referencing	The process of aligning microcredentials with recognized standards, frameworks, or qualifications.
Reskilling	The process of learning new skills or adapting existing skills to transition to a different career or industry.
Self-Paced Learning	A learning method where the learner controls the speed and progression of their education.
Skills	Skills are defined as the ability and capacity to carry out processes and use the existing knowledge to achieve results.
Skills Databases	Centralized repositories of information on skills, competencies, and qualifications.
Skills Gap	The difference between the skills required by the labour market and those possessed by workers.
Stackability	The ability to combine multiple microcredentials into larger credentials or qualifications.
Stackable	Refers to the ability to combine multiple microcredentials to achieve a higher level of qualification or demonstrate broader expertise.
Transversal knowledge, skills and competences (ESCO)	Often referred to as *core skills, basic skills* or *soft skills*, the cornerstone for the personal development of a person. Transversal knowledge, skills and competences are the building blocks for the development of the "hard" skills and competences required to succeed on the labour market.
Unbundling	The process of breaking down traditional educational programs into smaller, more focused microcredentials.
Upskilling	The process of acquiring new skills or upgrading existing skills to remain competitive in the workplace.
UX Experience	The overall experience a user has when interacting with a product or service.
Validity and Reliability	Measures ensuring that assessments produce accurate and consistent results.

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Verification & Validation	Ensuring authenticity and reliability of submitted work, potentially involving experts.
Quality Assurance (of a MC)	The process of ensuring that a microcredential meets established quality standards.
WAM (World Accreditation Model)	A framework for quality assurance and accreditation of microcredentials.
WAM Foundation	Stichting World Alliance for Microcredentials foundation established on the 24th of May 2024 in the Netherlands
Work-Based Learning	Learning that occurs in a professional environment as part of a structured educational program.

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