Research Article

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Introducing a Reflective Framework for the Assessment and Recognition of Microcredentials

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Abstract
Assessment and recognition are key aspects of microcredentials, usually offered on massive open online course (MOOC) platforms. Microcredentials are designed to address the needs of employers and learners looking for units of study at a higher education level aligned with the requirements of labour markets. This paper reviews current methods for assessment and recognition proposing a framework with seven guidelines for use at the planning and design stages of microcredentials. The framework is based on a review of 27 documents and a synthesis process. It provides a tool for microcredential providers to check whether the best ID verification, assessment, recognition, and quality assurance approaches are in place, enabling them to reflect on, and possibly improve their choices.

Keywords: assessment, recognition, quality assurance, microcredentials, framework

Introduction and Background to the Study

Massive Open Online Courses (MOOCs) are courses designed for many participants, typically accessible by anyone, anywhere, open to everyone, without admission qualifications, and provide access to learning for free. The COVID-19 pandemic increased interest in online education, including MOOCs (AlQaidoom & Shah, 2020), which offer the public a vast supply of free-to-access courses. Over 900 universities have launched at least one MOOC, the total was 13,500 in 2020 (Shah, 2020), reaching 220 million learners in 2021 (Shah, 2021). MOOCs can support access to higher education, an area of growing focus for employers (Mee et al., 2018).

Accordingly, accredited short online courses – often framed as microcredentials – are growing in popularity. A microcredential is a small volume of certified learning (Lantero et al., 2021, p. 11):

> *Designed to provide the learner with specific knowledge, skills or competences that respond to societal, personal, cultural, or labour market needs […in a European context] Microcredentials have explicitly defined learning outcomes at The European Qualifications Framework (EQF)[1] level, an indication of associated workload in European Credit Transfer and Accumulation System (ECTS)[2] credits, assessment methods and criteria, and are subject to Quality Assurance in line with the Quality Assurance in Higher Education (ESG)[3].*

MOOC providers have launched over 500 microcredentials (Shah, 2021). Even when participation is smaller in scale, such courses offer focused training for the labour market and promote social inclusion through employability and opportunities for continuing professional development (CPD) (Farrow, 2020). Desmarchelier and Cary (2022) suggest that the potential of microcredentials lies in their capability to enhance lifelong learning producing learning experiences that should be positive and inclusive.

Microcredentials are delivered mostly online, over a shorter period than traditional courses and often to a different audience profile, with a more professional or vocational emphasis. These differences mean that many of the assumptions built into standard assessment and recognition practices are challenged (Antonaci et al., 2021). For instance, there is insufficient time and contact with an educator to establish a relationship which can be used as the basis for verification, whereas in conventional higher education settings the educator either knows the learner in a face-to-face setting or becomes familiar with their work through prolonged online interaction. However, identification (ID) verification, formal assessment and recognition of credit are essential to the value proposition of microcredentials (Healy, 2021). This is one aspect where they differ from MOOCs, which are often taken purely for interest, and thus less emphasis is placed on formal assessment and verification of the learner (Gamage et al., 2021).

[1] EQF, https://europa.eu/europass/en/european-qualifications-framework-eqf

[2] ECTS, https://ec.europa.eu/education/resources-and-tools/european-credit-transfer-and-accumulation-system-ects_en

[3] European Higher Education Area (ESG), https://www.enqa.eu/esg-standards-and-guidelines-for-quality-assurance-in-the-european-higher-education-area/

Online assessment in microcredentials raises issues because implementation of microcredentials requires consideration of how they will be assessed and how that assessment will be authenticated. Assessment can focus on individuals, groups, an institution, or a specific programme (Zlatović et al., 2015). In the context of this research, assessment is defined as the systematic process of documenting and using empirical data on knowledge, skills, and attitudes of learners. A second issue for microcredentials is recognition. To be attractive to learners and employers, the credits they confer must be mutually recognised and valued. This differentiates them from the largely informal study realised through MOOCs. Oliver (2019, p.1) sets out the challenge:

> *Microcredentials and other forms of non-formal learning are emerging as potential solutions to the rapid upskilling that will be required. The formal qualification system is unlikely to cope, burdened with the ever-increasing cost. The very people who could use microcredentials most – mature learners already in the labour force – are engaging less in certified learning just when certification of skills will be required more. But microcredentials alone will not meet any nation's future educational needs: the key opportunity is to enable formal qualification systems to evolve to include short-form credentials, some of which might be credit-bearing.*

The European Union has been looking for ways of standardising short credit-bearing courses developed by MOOC platforms, higher education institutions (HEIs), and employers (European Commission, 2020). Current terminology is confusing (including nano degrees, MicroMasters, MicroTracks, microcredentials, etc) and courses differ in length, level, and quality (Pickard, 2018). In 2017, the main European MOOC platforms (FutureLearn, FUN, Miríadax and EduOpen) and the OpenupEd partnership established the European MOOC Consortium (EMC) to represent MOOC and microcredential work in Europe. Members collaborated on the Common Microcredential Framework (CMF), designed to help unify terminology and criteria and respond to the demand for microcredentials in Europe (Antonaci et al, 2021; EADTU, 2019). The framework brings Europe into line with USA and Australian universities which offer formally acknowledged microcredentials (DESE, 2021), and addresses inconsistencies between microcredentials from different providers. To ensure quality, the CMF requires that microcredentials are associated with academic credit in line with national qualification frameworks. Courses should meet the following criteria (Antonaci et al., 2021): assessment enabling award of academic credit (either following successful completion of the course or recognition of prior learning); reliable method of ID verification at the point of assessment; and providing transcripts setting out course content, learning outcomes, total study hours, EQF level and credit points (ECTS) earned.

Furthermore, in the rapid move to online learning during the pandemic institutions developed very different offerings with challenging aspects such as changes in the curriculum, pedagogy, student services, and employment practices (Day et al., 2022). The pandemic has changed several aspects of online learning, and a preponderance of larger distance universities with many years of experience are making changes in their assessment and recognition processes. For example, The Open University (UK) expects to make digital exams the default option by Autumn 2025, deliver authentic assessments as much as possible and use a combination of forms for digital invigilation (including a lock-down browser tool so only permitted software and websites can be accessed, facial recognition, and voice recognition tools). On the other hand, The National Distance Education University (Spain), one of the institutions to launch an in-

house software for online exams during the pandemic (AvEx)[4] that was considered a better emergency solution than proctoring as indicated by students, decided to go back to face-to-face exams.

Recent contributions to the literature (McGreal & Olcott, 2022; Oliver, 2021) have yet to provide frameworks or guidelines to support good quality development in terms of assessment and recognition of microcredentials. This paper reviews current methods for assessment and recognition, introducing a framework with guidelines in the form of checklists to be used at the planning and design stages of microcredentials. The key stakeholders to use the framework are microcredential providers. To review current methods and in ID verification, assessment, and recognition the three research questions (RQs) addressed were:

- **RQ1**. Which processes exist where learners' identity (ID) is matched to verify identification?
- **RQ2**. Which different types of assessments are applied in existing practices?
- **RQ3**. Which different types of academic recognition are available?

This review production was undertaken as part of a large multi-stakeholder project that was set to support employment services, MOOC platforms and microcredential providers for the structural collaboration by building expertise in the delivery of microcredentials to job seekers as well as those employed in different sectors.

Methods

The literature review considers the impact of COVID-19 on the landscape of online education, with a particular focus on practices that apply to microcredentials. The method was based on rapid evidence assessment, an approach that achieves an agile approach to summarising and synthesising evidence while making some compromises on breadth, depth, and comprehensiveness (Barends et al., 2017). This approach uncovers broad evidence that could not normally be delivered within a single research cycle, in this case, a sensible choice to incorporate COVID-19 literature. We adapted the approach of Barends et al. (2017) as follows:

1. **Background and questions**. Specified in the background and in RQs.
2. **Inclusion criteria and search strategy**. Defines evidence to include by specifying searches, keywords, and publications.
3. **Results**. Describes the main findings from reviewed documents.
4. **Synthesis**. A coherent synthesis of evidence is created in the form of guidelines.
5. **Discussion and conclusions.** Concise statements of main findings are articulated alongside limitations and recommendations for future work.

[4] AvEx, http://www.open.ac.uk/blogs/opentel/are-digital-exams-here-to-stay/

Inclusion Criteria and Search Strategy

Our search began by identifying relevant keywords, using the following search string: *"(ID verification OR assessment OR recognition) AND (online learning OR MOOCs OR microcredentials)"* in the title and abstract. Inclusion criteria and search strategies prioritised recently published studies, year range was (2017 – 2021). Google Scholar was used due to its controlled search vocabulary, rich content across the domain of education, and inclusion of relevant peer-reviewed and grey literature. Literature sourced included book chapters, journal articles, and conference proceedings, published in English. Grey literature including thesis and research reports was also considered. The first author screened the title and abstract from the 542 potential documents derived from the search. The extracted studies were assessed for eligibility according to the following criteria: (1) description of research in educational settings and (2) the described research had a purpose to address "ID verification," "assessment," or "recognition" of current existing practices in higher ed contexts. The review resulted in 27 documents (see Table 1).

Table 1

Sources Used in the Review

Author(s)	Year	Description	Type of source	Theme
Antonaci et al.	2021	Definition of the common microcredential framework	Journal article	All themes
Baughan	2021	Assessment and feedback during pandemic	Research report	Assessment
Bergmans et al.	2021	Online proctoring	Journal article	ID verification
Bretag et al.	2019	Contract cheating	Journal article	Assessment
Dawson	2020	Preventing e-cheating	Book chapter	ID verification
Dunn	2021	Recognition of short learning programmes	Presentation	Recognition
Edwards et al.	2018	Student trust in e-authentication	Conference article	ID verification
Farrow et al.	2021	Assessment and recognition of massive open online courses (MOOCs)	Journal article	All themes
Gamage et al.	2021	Peer assessment in MOOCs	Journal article	Assessment
Habib & Sanzgiri	2020	Assessment and recognition of MOOCs	Research report	All themes
Hanafy	2020	Recognition in microcredentials	Master thesis	Recognition

Hussein et al.	2020	Evaluation of online proctoring tools	Journal article	ID verification
Iniesto et al.	2019	Evaluation of accessibility in MOOCs	Conference article	Assessment
Kharbat & Daabes	2021	Proctoring during the pandemic	Journal article	ID verification
Lancaster & Cotarlan	2021	Contract cheating	Journal article	Assessment
Mayer	2019	Assessment in online learning	Journal article	Assessment
Melai et al.	2020	Recognition of short learning programmes	Research report	Recognition
Mellati & Khademi	2018	Teachers' assessment literacy	Journal article	Assessment
Milian	2021	Recognition of microcredentials	Journal article	Recognition
Monsen et al.	2017	Negotiated assessment	Journal article	Assessment
Morris	2018	Contract cheating	Journal article	Assessment
Nguyen et al.	2017	Computer-based assessment	Journal article	Assessment
Okada et al.	2019	e-Authentication for online assessment	Journal article	ID verification
Read et al.	2018	Assessment and recognition of open learning	Research Report	Assessment and recognition
Sambell et al.	2019	Assessment design	Journal article	Assessment
Von Gruenigen et al.	2018	Cheating prevention	Conference article	Assessment
Xiong & Suen	2018	Summative assessment	Journal article	Assessment

The search was completed including current practices on MOOC and microcredential platforms based in Europe. Platforms included are FutureLearn[5], FUN[6], EduOpen[7], and Miríadax[8].

[5] Futurelearn, https://www.futurelearn.com/

[6] FUN, https://www.fun-mooc.fr/en/

[7] EduOpen, https://www.eduopen.org/

[8] Miriadax, https://miriadax.net/

Results: Identity Verification, Assessment, and Recognition in Place

The articles were divided for each of the main themes ("ID verification," "assessment," or "recognition," i.e., the three RQs) by the authors (see Table 1). The work then focused on synthesising the main findings from each of the 27 documents to identify the main types for each of the themes following a narrative approach as presented in the next subsections (Baumeister & Leary, 1997).

Existing Processes where Learners' ID is Matched to Verify Identification

Regarding the processes in place for ID verification, an ID verification service in education is used to ensure that students provide information that is associated with the identity of a real person. There exist four types of ID verification, (1) basic platform ID verification, (2) university registration, (3) proctoring exams, and (4) interviews (which can be on-site, online, or recorded) (Farrow et al., 2021). FutureLearn in its certification programmes requires learners to complete a registration process within the university as non-degree students. FutureLearn, Miríadax, and FUN optionally employ proctored exams. Miríadax uses random proctoring, with software taking pictures at random times during the exam, while FUN and FutureLearn use full proctoring, where the exam session is recorded, and then checked by a human. Some providers use interviews, such as EduOpen, make use of on-site interviews.

The EU-funded Adaptive Trust-based e-Assessment System for Learning (TeSLA)[9], provides identity verification for various forms of assignment at the point of the assessment, unlike proctoring which is only performed during exams. The use of technology for verification means it can be scaled more easily than human-based methods of verification. The TeSLA project designed a system to check student authentication and authorship through a combination of (Okada et al., 2019):

1. Facial recognition (analysing the face and facial expressions), voice recognition (analysing audio structures), and keystroke analysis (analysing how the user uses the keyboard).
2. Anti-plagiarism (using text matching to detect similarities between documents) and forensic (to verify authorship of written documents).
3. Digital signature (to authenticate) and timestamp (to identify when an event is recorded by the computer). A concern with this system relates to privacy of learner data (Edwards et al., 2018).

More broadly, use of online assessment has raised malpractice concerns, and use of e-authentication systems for detecting plagiarism and cheating remains an area of debate and innovation.

Hussein et al. (2020) evaluate online proctoring tools used for ID verification and provide recommendations relating to design of assessment and technological considerations for online proctoring. Unlike a live examination, online proctoring can only work reliably when students to have access to suitable technological infrastructure. This divides those with and without access.

[9] TESLA, http://tesla-project.eu

In addition, while taking online-proctored exams, students with accessibility needs may require more assistance than is available.

Rapid adoption of online proctoring during the pandemic showed this technology requires guidelines and training due to ethical issues (Kharbat & Daabes, 2021). Dawson (2020) argues that different disciplines or perspectives would frame proctoring issues differently. There are also tensions in approach: while criminology and cybersecurity would argue for the need to detect and deter cheating through remote proctoring, surveillance studies and critical pedagogy would be more concerned about socio-political implications. Bergmans et al. (2021) indicate the limitations of current proctoring companies, proposing live online proctoring as an alternative, with a human invigilator watching a limited group of students, and without recording.

The main challenges for those ID verification processes that can be used in the context of microcredentials include:

- Online elements of courses that are mostly online but partially not.
- Establishing that the person who gets the credit is the person who took the test, which can be challenging when microcredentials are not run by established education providers.
- ID documents vary across countries (although not all microcredentials are intended for an international audience).
- Possible discrimination against students, based on categories such as disability or race.

From the literature reviewed proctoring does not currently appear to be an ethically developed technology for use in microcredentials (Bergmans et al., 2021). Courses should operate a reliable method of ID verification at the point of assessment that complies with the provider's policies and is widely adopted across platforms. It is also feasible that combining methods like ID verification or university registration with interviews combines several advantages

Types of Assessments Applied in Existing Practices

Assessment is concerned with the scientific study of determining what students have learned. From the literature reviewed several types of assessment are used in existing practices, (1) formative, (2) summative, (3) peer-reviewed, (4) authentic, and (5) negotiated. Aspects to consider for assessment include cheating, ability to evaluate certain concepts and skills, tie and cost required, efficiency, scalability, and the confusion that multiple assessment types can provoke. While an initial focus of learning outcome assessment was on response execution, it later shifted to retention of presented information and then to constructivist approaches (Mayer, 2019). The current trend is to adapt assessment to the needs of individual learners by, for example, providing more time or different formats for those with accessibility needs (Iniesto et al., 2022).

Assignments can be (1) single-type, either computer-graded, peer-graded, or teacher-graded or (2) any combination of these (Farrow et al., 2021). FutureLearn professional certificates use computer-graded assessment as a single-type means of assessment. Other FutureLearn programmes have used teacher-graded assessment or a combination of the two.

Formative assessment includes processes intended to promote student attainment, may encourage reflection, and is designed to have a positive effect on student learning. Summative

assessments provide a quantitative grade and are often carried out at the end of a unit or lesson to determine whether learning objectives have been met (Xiong & Suen, 2018). While formative assessment is intended to promote student attainment, summative assessment represents a higher-stakes evaluation of learning at a given point in time and is used to assign grades to learners: “formative methods are an assessment for learning whereas summative ones are an assessment of learning” (bin Mubayrik, 2020).

Peer assessment is often used in MOOCs. Gamage et al. (2021) identify several issues:

1. **Multiple attempts.** Whether learners can submit multiple assignment iterations, integrating feedback received on an early draft to improve their results.

2. **Empty fields.** Peer-review interfaces contain rating rubrics and a text field for feedback. An option for numeric ratings makes feedback easier to complete, combatting the problem of feedback being submitted with empty review text fields.

3. **Variable quality.** Students demonstrate different abilities as reviewers, prompting sceptics to question the fairness of grades.

4. **Calibration.** Systems may use reviews from teaching assistants to calibrate students’ reviews.

5. **Algorithms.** Use of algorithms in peer reviews is common, either to calculate accurate grades and algorithms to assign reviewers (Baughan, 2021).

While designing assessment, Sambell et al. (2019) consider the benefits of providing authentic assessment which is embedded in real-life case studies and requires interpretation rather than the temptation to copy from textbooks. The pandemic has increased interest in authentic assessment, stressing the importance of making summative tasks meaningful to students. Fundamental aspects are the trust of the participants in the online assessment and the importance of designing assessment strategies that significantly influence student engagement (Nguyen et al., 2017).

Morris (2018) examines the issue of contract cheating in higher education. This has a complex nature with a relatively low proportion of students engaging in outsourcing behaviours involving a third party. Contract cheating has been shown to change with the use of file-sharing sites to breach academic integrity during the pandemic (Lancaster & Cotarlan, 2021). To reduce contract cheating, it is vital to train educators and students on academic integrity. Morris (2018) proposes institutions extend and establish strategies to do this. This involves determining academic integrity strategy; reviewing institutional policy; understanding students; re-visiting assessment practices, and implications for staff professional development. Messaging should provide clear, consistent advice of the benefits of academic integrity and the risks when it is breached (Lancaster & Cotarlan, 2021). Assessment literacy is also required to understand how assessment relates to learning and how the assessment process can build skills in self- and peer assessment (Mellati & Khademi, 2018).

Sambell et al. (2019) emphasise the importance of authentic assessment for learners’ learning and employability, and of reducing contract cheating and academic misconduct cases. Negotiated assessment is a technique which allows learners to negotiate how they will meet

learning outcomes. It engages remote learners and lowers the risk of cheating (Monsen et al., 2017). Other strategies include the adoption of a variety of assessment types to prevent cheating: reflective pieces, blogs, quizzes, essays related to applying learning to practice, projects (Von Gruenigen et al., 2018); and distributing assessment across various types rather than having one high-stakes assessment (Bretag et al., 2019). Iniesto et al. (2019) also underline the relevance of evaluating accessibility in educational settings, so that assessment is accessible to all learners.

Summative assessments are preferred in microcredentials because they provide a quantitative grade and they can be employed to determine whether learning objectives have been met (Xiong & Suen, 2018). Formative assessment is difficult to provide on a short course because it takes time for markers to provide useful feedback to all individuals in a large cohort, and there is additional expense involved in hiring markers, which raises the price of the course. Negotiated assessment is complicated in the context of microcredentials. Peer-reviewed assessment is a difficult type of assessment to use on courses that may have low numbers of participants (such as microcredentials).

Types of Academic Recognition Available

Recognition is understood as the approval of courses and qualifications from one HEI by another for the purpose of student admission to further studies. Recognition methods identified include (1) academic credit (non-transferable credit can only be applied to programmes offered by the same provider; transferable credit uses commonly recognised standards such as ECTS or named providers agree to accept the credits) and (2) professional credit (formal from professional accreditation bodies or informal awards such as certificates and badges) (Farrow et al., 2021). Transferable academic recognition is available on the EduOpen platform, which offers ECTS credits. In terms of professional recognition, European MOOC platforms offer formal recognition in the form of CPD hours or formally accredited programmes, while platforms in the United States tend to offer informal awards such as certificates and badges from the same platform where their programmes are endorsed by leading businesses. Several FutureLearn microcredentials offer industry partner accreditation (for example, Tableau, Amazon Web Services, Xero, and Salesforce) as well as academic credit. In that sense, Hanafy (2020) shows that few microcredential platforms include skill-related data. This might be due to providers prioritising technical features of their platforms over academic ones. Transparency of skill-related data is essential if learners want their skills recognised in different institutions. Skill-related data can include skill definition, skill type, level of mastery of skills, whether the skill is derived from a particular taxonomy, and skill reusability.

The authors of the review propose several key issues regarding recognition:

1. **Academic credit**. Milian (2021) highlights the difficulty of ensuring microcredentials are recognised by HEIs or employers. Such recognition can help maximise learner interest in microcredentials. It is important that studying microcredentials counts toward academic credit. Recognition of microcredentials also maximises their legitimacy for employers.
2. **Short learning programmes**. Short learning programmes (SLPs) are groups of courses (units, modules, or other learning building blocks) with a common subject, focusing on specific needs in society, which can be used as stackable elements of larger formal degrees targeting non-traditional and adult learners (Melai et al., 2020). SLPs' features

are coherent with the CMF, in terms of ECTS, learning outcomes, EQF and a system of quality assurance (Antonaci, et al., 2021).

3. **Lack of a framework**. Read et al. (2018) proposed a set of eight scenarios for recognition of credits based on open educational resources and MOOCs, simulating different situations learners face. However, as Dunn (2021) reports SLPs can vary greatly in scale, and there is still no single European-level framework for recognising credit which involves partners entering reciprocal recognition arrangements for their SLPs.

In terms of recognition, non-transferable, and informal options are not suitable for microcredentials because of their need for formality and transferability (Melai et al., 2020).

Synthesis: The Framework for Assessment and Recognition

Considering the review results and the existing CMF, a synthesis process was carried out to produce guidelines for the assessment and recognition of microcredentials. The ID verification methods, types of assessments, and methods for recognition recommended for microcredentials are summarised in Table 2.

Table 2

ID Verification, Types of Assessments, and Methods for Recognition

ID verification	Description
Platform ID verification	Match learner's photo via a selfie or a webcam with an ID
Provider registration	Learners complete a registration process within the provider
Interviews	● Interviewing the provider premises (On-site interviews) ● Conducting a short online interview to verify learner identity and work (Online interviews)
Recorded presentations	Recording a presentation as part of a capstone project (Recorded presentations)
Types of assessment	**Description**
Computer-graded assessment	Could be a final exam or quizzes based on case studies and projects
Teacher-graded assessment	Appropriate for essays and capstone projects
Multi-type assessment	A mixture of computer-graded assessment and teacher-graded assessment
Methods for recognition	**Description**
Academic credit	Transferable academic credit, flexible and convenient for learners, uses commonly recognised standards such as ECTS, or named providers agree to accept the credits

Professional credit	Professional credit hours or credits from formal professional accreditation bodies (Formal). The professional certificate is backed by a business leader to enhance its credibility and offer more work relevance (Endorsement)
Combined	Academic and professional credits in the same programme, offering more opportunities for learners

Brasher et al. (2022) performed a systemic comparison of current online education quality assurance tools and systems. Other researchers compared a variety of benchmarking and QA systems, highlighting the simplicity and structure of OpenUpEd (Mulder & Jansen, 2015). Several research projects have based their quality work on the OpenUpEd label, refining and adapting its checklists. These include ECO eLearning, Score2020, and BizMOOC (Jansen, Rosewell & Kear, 2017; Pitt, 2018). For that reason, an adaptation of the OpenupEd benchmark has been used here as the baseline framework for guidelines for assessment and recognition design. There are several aspects to consider when using the OpenUpEd label, the framework is not designed to be used by experts and it is oriented towards self-assessment. Providers are expected to reflect on their microcredential production to provide the first measure of strengths of performance and areas for improvement. The proposed framework has three structural levels: (1) checklists of main areas to evaluate; (2) guidelines relating to key aspects of each area; and (3) criteria covering different dimensions.

The framework maps elements of assessment and recognition, allowing platforms, universities, and employment services to place microcredentials and similar courses in context. The two checklists are designed to evaluate microcredential (is a course a microcredential, according to the CMF?) and best practices (is it following current best practices for assessment and recognition?). The framework includes 19 criteria within seven guidelines:

1. **Microcredential.** Microcredentials lay foundations for a new qualification to address the needs of employers and learners looking for small units of study that meet their career goals and/or develop higher education-level skills. Courses aligned with the CMF can be recognised as formal qualifications and follow recognised national qualification frameworks. They are stackable between different HEIs supporting the personalisation of learning.

2. **Course.** A plan of study including a summative assessment created and evaluated by a nationally recognised university under its national quality assurance framework. Course content is aimed at employees and combines theory and practice to ensure direct relevance to the workplace. A microcredential should award a transcript that sets out the course content, learning outcomes, total study hours, EQF level and number of credit points (ECTS) earned. It should be designed for those studying at university level – anywhere from first-year undergraduate (EQF Level 5) to doctoral standard (EQF Level 8).

3. **Study time and workload.** Total study time, including assessment, is 100 to 150 hours. The number of hours of study per week is suited to learners who will need to fit study around full-time work and familial responsibilities

4. **ID verification.** The course should deploy a reliable method of ID verification at the point of summative assessment. This should comply with the provider's policies and/or be a method that is widely adopted across platforms. Methods marked "basic" should be accompanied by another method marked "good" or "better" to grant verification. ID verification methods recommended for microcredentials: (1) platform ID verification, (2) provider registration, (3) interviews and (4) recorded presentations. It is important to consider accessibility and be compliant with W3C accessibility guidelines[10] according to the European Commission[11].

5. **Assessment.** A microcredential must employ a rigorous summative assessment method, allowing award of academic credit. This credit can be achieved either directly following successful completion of the course or via recognition of prior learning upon enrolment on the provider's course of study. Types of assessment include: (1) computer-graded assessment, (2) teacher-graded assessment, and (3) multi-type assessment. Accessibility should be a factor in selecting assessment type.

6. **Accreditation and recognition.** Course should provide a transcript (certificate supplement) setting out course content, learning outcomes, total study hours, EQF level and number of credit points (ECTS) earned. In addition, a credible industry backer for a microcredential might endorse its relevance for employment purposes. Endorsement is not always necessary, especially if the university's brand or the course subject would not benefit from a non-university endorsement. Identified methods for recognition include: (1) academic credit, (2) professional credit and (3) combined. Microcredentials should be awarded in a digital and signed format, for example, the identified Europass Digital Credentials (EDC)[12]. The transcript should be issued in a widely spoken language or an easy-to-read graphical format, in a standardised form, according to standardised processes.

7. **Quality assurance framework.** The European Association for Quality Assurance in Higher Education Guidelines (ESG) should be the reference framework used. Every microcredential must be associated with the award of credit, either directly or via recognition of prior learning. Quality is assured by providers confirming the microcredential passes the provider's standard quality assurance processes. Providers are responsible for ensuring their internal quality assurance mechanisms follow strict Internal quality criteria and procedures, in line with national quality standards, creating a guarantee for quality.

Table 3 summarises the framework including the two checklists, seven guidelines and all criteria.

[10] W3C, https://www.w3.org/WAI/fundamentals/accessibility-intro/

[11] Accessibility, https://wikis.ec.europa.eu/display/WEBGUIDE/12.+Accessibility

[12] Europass digital credentials, https://europa.eu/europass/en/europass-digital-credentials

Table 3

Guidelines for Assessment and Recognition Framework Structure

Checklist	Guidelines	Criteria
(1) Fulfils microcredential definition	(1) Microcredential	(1) Units of study
		(2) Formal qualifications
		(3) HEIs
	(2) Course	(4) Plan of study
		(5) Theory and practice
		(6) National qualification framework
	(3) Study-time and Workload	(7) Total study time
		(8) Number of hours
(2) Assessment and recognition	(4) ID verification	(9) Reliable method of ID verification
		(10) Accessible method
	(5) Assessment	(11) Recognition of prior learning
		(12) Summative assessment
		(13) Accessible assessment
		(14) Method for recognition
	(6) Accreditation and recognition	(15) Digital format
		(16) Strategy
		(17) Standardised
	(7) QA framework	(18) Quality assurance process
		(19) Internal quality assurance

The checklists are designed to be used at the planning and design stages of microcredentials, to check whether the best ID verification, assessment, and recognition approaches are in place and supporting reflection. Each of the criteria has information to help the evaluator to know what to evaluate and how to proceed with the test (see the appendices for the full framework).

Several scenarios are now provided to exemplify the use of the framework by a microcredential provider:

Scenario 1

> *Situation: The course operates a reliable method of ID verification which only includes provider registration. The method has not been evaluated as accessible.*
>
> *Framework: The use of the framework will suggest including another method for ID verification like online interviews or recorded presentations and to evaluate the accessibility of the methods included.*

Scenario 2

> *Situation: The course provides a summative assessment using computer-graded assessment to enable the award of academic credit without further specification.*
>
> *Framework: The use of the framework will indicate that the credit should include recognition of prior learning upon enrolment for specified qualifications offered by the course provider and suggest the inclusion of teacher-graded assessment.*

Scenario 3

> *Situation: The course provides academic credit only in a printed format.*
>
> *Framework: The use of the framework will indicate that a digital and signed format should be provided. The transcript needs to be issued in a widely spoken language and easy-to-read graphical format.*

Discussion and Conclusions

This paper has reviewed current methods for assessment and recognition, proposing a framework with seven guidelines for use at the planning and design stages of microcredentials. The framework is based on a review of 27 documents and a synthesis process with the complement of the CMF providing a tool for microcredential producers to check whether the best ID verification, assessment, recognition, and quality assurance approaches are in place, enabling them to reflect on, and possibly improve, their choices.

We acknowledge several limitations of this research. There exists a risk of selection bias in a desktop review compared with systematic literature reviews, because of the way the review process is streamlined (Barends et al., 2017). The process has not followed an inter-rater reliability process to add validity and reliability to the documents selected and only European platforms have been chosen to review the practices and processes in place. We understand pedagogical limitations for course production are included when suggesting the use of summative assessment which can influence the learning experience of participants. In the future, the framework could be adapted to facilitate other types of assessment and recognition, or even ID verification if the systems in place are aligned with ethical parameters (Bergmans et al., 2021). Future research needs to test the framework against existing microcredentials to trial the checklists for improvement and refinement. That will ensure the framework supports good practices for learning.

Pollard and Vincent (2022) indicate three principles to run away from the "uncertainty" in microcredentials: (1) being embedded in the curriculum, (2) alignment with the university mission, (3) is a critical and reflective pedagogy. Understanding the reasonable criticism of the current offer of microcredentials and their labour market focus (Oliver, 2019; Wheelahan & Moodie, 2021), if microcredentials are to be recognised for formal university credit, then they need to be subject to equivalent quality requirements regarding assessment as standard offerings (Lantero et al., 2021).

Microcredentials exist at the intersection of traditional higher education studies and more recent informal studies such as MOOCs. As such, they need to adopt elements of best practices from both, whilst still offering something of value to learners. This research sets out how European microcredential providers have sought to address some of these challenges. The first is to implement reliable verification methods, beyond the 'basic' level. Next, the assessment should be rigorous, involving a mix of computer-graded and teacher-graded methods. Recognition requires that a transcript is provided detailing course content, study hours, and the number of credit points (ECTS). It is also suggested that a credible industrial employer endorses the relevance of the microcredential to emphasise its vocational value. This research has detailed how existing practices are attempting to realise this, but it will remain an area that is likely to evolve and adapt as microcredentials are adapted for new purposes and audiences.

Author's Contributions

Each named author has substantially contributed to conducting the underlying review. All authors read and approved the final manuscript.

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Ethics Statement

Ethical approval was not applicable.

Conflict of Interest

The authors do not declare any conflict of interest.

Data Availability Statement

All data is provided within the manuscript and its appendices.

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Appendix

Review "Fulfils CMF microcredential definition"

Levels: NA (Not achieved); PA (Partially achieved); LA (Largely achieved); FA (Fully achieved)

Guidelines	Criteria	Fulfils microcredential definition			
		NA	PA	LA	FA
1.1 Microcredential	The course defines units of study which do one or more of the following: ● lay the foundations for learners to gain a new qualification that will enhance their employability ● are designed to meet the career goals of learners ● develop higher-education level skills				
	Comments:				
	The course defines units of study which enable the course to be counted towards formal qualifications issued in line with recognised national qualification frameworks				
	Comments:				
	The course defines units that can be combined with those at other higher education institutions				
	Comments:				
1.2 Course	The course includes a plan of study which includes a summative assessment created and evaluated by a nationally recognised provider under its national quality assurance framework				
	Comments:				
	The course combines theory and practice that are directly relevant to the workplace.				
	Comments:				
	The course is levelled at Level 5 - 8 in the EQF or the equivalent levels in the provider's national qualification framework considering a combination with ECTS (doctorate, bachelor, master, undergraduate level).				
	Comments:				

Guidelines	Criteria	Fulfils microcredential definition			
		NA	PA	LA	FA
1.3 Study-time & workload	The course has a total study time, including completion of the summative assessment of 100-150 hours				
	Comments:				
	The course is designed so that the number of hours of study per week is suited to learners who will need to fit study around full-time work and/or familial responsibilities				
	Comments:				

Review "Assessment and recognition"

Levels: NA (Not achieved); PA (Partially achieved); LA (Largely achieved); FA (Fully achieved)

Guidelines	Criteria	Assessment and recognition			
		NA	PA	LA	FA

2.1 ID verification	The course operates a reliable method of ID verification at the point of assessment that complies with the recognised University's policies or is widely adopted across platforms using (more than one could be used). Methods defined as "basic" should be accompanied by another method marked as "good" or "better" to grant verification for full achievement:
	● Platform ID verification. (Basic)
	● Provider registration. (Basic)
	● Interviews.
	  ○ On-site oral interviews (Basic)
	  ○ Online interviews (Good)
	● Recorded presentations (Better)				

	Comments:				
	The ID verification method has been checked as accessible for participants with accessibility needs.				
	Comments:				

Guidelines	Criteria	Assessment and recognition			
		NA	PA	LA	FA
2.2 Assessment	The course provides a summative assessment to enable the award of academic credit via recognition of prior learning upon enrolment for specified qualifications offered by the course provider				
	Comments:				
	The course provides a summative assessment that enables the award of academic credit via completion of the course using: ● Computer-graded assessment, ● Teacher-graded assessment, or ● A mixture of Computer-graded assessment and Teacher-graded assessment				
	Comments:				
	The summative assessment (s) has been checked as accessible for participants with accessibility needs.				
	Comments:				
2.3 Accreditation and recognition	The course provides at least a method for recognition: ● Academic Credit: Formal and transferable. ● Professional Credit: Formal and endorsement ● Combined: Academic and professional				
	Comments:				
	The course should be awarded in a digital and signed format, for example, the identified Europass Digital Credentials (EDC).				
	Comments:				
	The course provider has a strategy that addresses the recognition of microcredentials.				
	Comments:				
	The transcript is issued in a widely spoken language or an easy-to-read graphical format, in a standardised form, according to standardised processes.				
	Comments:				

Guidelines	**Criteria**	**Assessment and recognition**			
		NA	**PA**	**LA**	**FA**
2.4 QA framework	The quality is assured by passing the normal provider quality assurance processes: ● The course offers academic credit and is quality assured using the same procedures that are used for other courses for academic credit offered by the institution. ● The course offers professional credit and is quality assured using the same procedures that are used for other courses offering similar professional credit				
	Comments:				
	The provider of the course applies internal quality assurance mechanisms following internal quality criteria and procedures.				
	Comments:				