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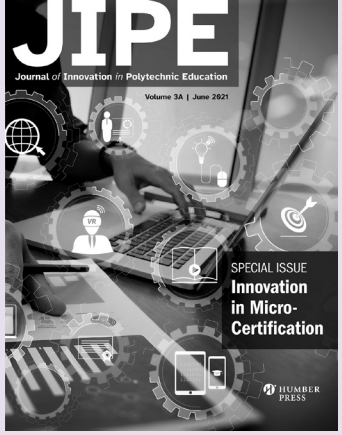

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Foreword

David Porter
Senior Adviser – Higher Education, Commonwealth of Learning

Micro-credentials and their use are hot topics in higher education in 2021. As the World Economic Forum Jobs 2020 report (World Economic Forum, 2020) noted, there is an increasing need to provide short-timeframe opportunities for re-skilling and upskilling that will not diminish as we move forward. Driven by this need to reskill or upskill learners, institutions are looking closely at new practice models that will allow them to offer training and certification in smaller units of learning directly tied to workplace needs. This opportunity to create customizable learning experiences for individuals has catalysed a movement to harness ideas originally designed for open badging (OpenBadges.org, 2020) with the developing requirement for institutions to offer digital credentials for all learners (AACRAO, 2020). The resulting fusion has led to the exploration and development of micro-credentials, inspired by the collective value proposition for learners, higher education institutions and employers.

Micro-credential definitions exist but there is no standard. Recently, the Higher Education Quality Council of Ontario offered a definition for consideration in the Canadian context, based on a synthesis of research it had carried out. HECQO's definition stated that, "a microcredential is a representation of learning, awarded for completion of a short program that is focused on a discrete set of competencies (i.e., skills, knowledge, attributes), and is sometimes related to other credentials." (Pichette et al., 2021)

The move to upskill and re-skill individuals for a dynamically changing economic environment has become integral to recovery and resilience strategies for a post-COVID world (Davidson, 2020). Consequently, the need to harness digital transformation in ways that better equip individuals and institutions to respond to opportunities for further learning and differentiated employment is imperative. Micro-credentials provide a viable and expedient pathway to explicitly certify competence and facilitate the match between individuals and employment opportunities. Higher education institutions are well-placed to develop and advance this space as providers; however, they will need to pivot away from conventional thinking on assessment and credentialing to more streamlined and authentic processes.

In a 2018 paper, Gary Matkin of the University of California (Irvine) presented a clear and cogent overview of the need to rethink the way in which higher education institutions provide credentials for their students.

Matkin noted:

> Alternative Digital Credentials (ADCs) will significantly transform the relationship between higher education institutions and society. By providing fully digital, workplace-relevant, and information-rich records of an individual's skills and competencies, ADCs will render traditional university transcripts increasingly irrelevant and obsolete. Universities and colleges that do not adopt in some measure the ADC movement will begin to experience a slow decline in market position and patron support. (Matkin, 2018, p.1)

He outlined the evolution of digital credential thinking from the early days of the open badge specification (2013) to the idea of alternative digital credentials, which he suggested, were a better match with current societal realities driven by the needs of learners and employers. Digital credentials can capture rich, dynamic and verifiable information about the skills and competencies that individuals possess and the shelf life of those skills. Matkin proposed that digital learning records would evolve and grow over time as the individual acquired additional knowledge and skills inside and outside classrooms. He noted that today's learners, many of whom already hold traditional higher education credentials, are looking for shorter, more targeted learning and skill development opportunities.

Digital micro-credentials, therefore, reflect the short- and long-term transformations occurring in the workplace and education sectors. Digital micro-credentials present a unique opportunity to acquire specific knowledge or skill captured in

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a credential that accurately verifies what its holder can do. And, while debates on standards for micro-credentials unfold, governments and their institutions of higher learning must recognise the opportunity presented by micro-credentialing to underpin new approaches to workforce development.

This special issue of the Journal of Innovation in Polytechnic Education (JIPE) explores a range of issues and practices associated with the development and use of micro-credentials from authors in a variety of education and workplace settings.

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The European Common Micro-credentials Framework for MOOCs and Short Learning Programmes

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European Association of Distance Teaching Universities (EADTU), European MOOC Consortium (EMC)

Abstract

In today's society, both employees and job seekers have to keep their knowledge and skills up to date, without investing too much time in doing so. The traditional offer of European higher education institutions does not meet this need, as continuing education programs are not flexibly organised, and most people cannot invest years in a bachelor's or master's degree. As a consequence, to meet these learners' needs, universities are required to provide more compact qualifications. Online micro-credentials and short learning programmes are formats that respond to this need.

After defining both the terms microcredentials and short learning programmes, this paper introduces a framework developed within the European MOOCs Consortium: the Common Microcredentials Framework- CMF, whose final aim is, from one side of facilitating the development of these types of programmes among traditional institutions and MOOC providers, and, from the other side, their recognition among European higher education institutions.

Keywords: Microcredentials; Short Learning Programmes; Lifelong Learning; Continuous Education; Continuous Professional Development; CMF

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INTRODUCTION AND BACKGROUND

Microcredentials[1] and short learning programmes (SLPs) represent a new format for the delivery of education. They provide an answer to the needs of learners in continuous education (CE) and continuous professional development (CPD). In order to remain competitive and updated in a constantly changing market, learners need to up-skill and re-skill their competencies, yet the majority of higher educational institutions (HEIs) usually only organize face-to-face continuing education and professional development in addition to regular degree programmes. Like never before, higher education institutions are being challenged to make education flexible and scalable by offering more compact, shorter, online programmes without, however, compromising on the quality provided.

The term "microcredentials" has been described by several authors (Kazin & Clerkin, 2018; Chakroun & Keevy, 2018; Oliver, 2019; ICDE, 2019; etc.) and European projects (MicroHE; ECIU; Microbol; etc.) adopting various names (nano degrees[2], MicroMasters[3], undergraduate or post-graduate certificates, expert or specialization certificate, focus diploma, etc.) and definitions (e.g., academic certificate, digital badges, open badges). In this paper we report the definition developed by the Microcredentials Higher Education Consultation group, in December 2020, and one elaborated within the project Microbol.

1 In this article the terms microcredentials and micro-credentials are used interchangeably.

2 Nanodegree is the term used by Udacity to indicate an online project and skills-based educational credential program.

3 As seen in the MicroMasters program

***Innovation Spotlights** are extremely brief contributions that highlight an innovative teaching practice, approach, or tool, and provide accompanying evidence that speaks to the effectiveness of the innovation.

EU Development

According to the Microcredentials Higher Education Consultation Group,[4] "a micro-credential is a proof of the learning outcomes that a learner has acquired following a short learning experience. These learning outcomes have been assessed against transparent standards. The proof is contained in a certified document that lists the name of the holder, the achieved learning outcomes, the assessment method, the awarding body and, where applicable, the qualifications framework level and the credits gained. Microcredentials are owned by the learner, can be shared, are portable and may be combined into larger credentials or qualifications. They are underpinned by quality assurance following agreed standards" (Shapiro Futures et al., 2020).

More focusing on the content and format of the microcredential program is the definition elaborated within the Microbol project: a micro-credential is a certified short learning experience, offered by a Higher Education Institution (HEI) or other providers (i.e. MOOCs- Massive Online Open Courses- platforms), designed to provide the learner with specific knowledge/ skills/competences that respond to societal, personal, cultural or employability needs. Micro-credentials are subjected to a quality assurance assessment in line with the Standards and Guidelines for Quality Assurance in the European Higher Education Area. As a consequence, they have an explicit reference to (1) EQF-EHEA/NQF (European or National Quality framework) levels; (2) the learning outcomes, that will be achieved; (3) a workload expressed in ECTS (European Credit Transfer and Accumulation System); and (4) the assessment methods and criteria adopted. Finally, each microcredential can be acknowledged by HEI as, and via, recognition of prior learning (RPL) (Cirlan & Loukkola, 2020).

Micro-credentials are high on the digitalization of the European agenda, already in 2018, the EU commission, with the Digital Education Action Plan,[5] "sets out how education and training systems can make better use of innovation and digital technology and support the development of relevant digital competences needed for life and work in an age of rapid digital change" (European Commission, 2018, p.1), also pointing out the importance of digitalized credentials. According to the European Commission (2018), digital technology should "facilitate the provision of flexible, accessible learning opportunities, including for adult learners and professionals, helping them to re-skill, upskill or change careers," which can be supported "through micro-credentials which capture the learning outcomes of short-term learning." The action plan announced that the Commission would "develop a European approach for micro-credentials." In 2020, with the new "Europass" platform, learners are enabled to create their own profile, register and display their digital credentials to be more attractive in the market. In the same year, 2020, the EU Commission launched its communication, Towards the European Education Area by 2025,[6] in which the development of a European approach to microcredentials in higher education is a key priority. It announced a proposal to the Ministers of Education Recommendation by 2021 and a plan at having all the necessary steps in place by 2025 for the wider use, portability and recognition of microcredentials. In 2021-2025, online micro-credentials are a top priority in the higher education policy of the European Union with the ambition to recognize microcredentials for lifelong learning in the qualifications framework of the European Higher Education Area.

The work done before and along recent EU policies by the European Association of Digital Teaching Universities (EADTU) and its members points in the same direction. EADTU and the European MOOC Consortium (EMC) have developed the Common Microcredentials Framework (CMF), a tool to describe, design and facilitate the recognition of microcredentials offered by European MOOCs providers as well as by HEIs that offer short learning programmes (SLPs). This framework allows higher education institutions to deliver a recognized formal qualification for micro-credentials as a specific award for continuing education.

Indeed, even if microcredentials can be awarded after formal, non-formal and informal learning, this paper deals with the formal recognition of a microcredential qualification within the European Higher Education Area. The next paragraphs present features of the Common Microcredentials Framework CMF and of SLPs. It ends with a short conclusion on the benefits of adopting the CMF and SLPs for both HEIs and students within the European context.

The Common Microcredentials Framework — CMF

The CMF has been developed within the European MOOC Consortium[7], coordinated by the European Association of Distance Teaching Universities (EADTU), and involving the main European MOOC platforms: FutureLearn, FUN (France Université Numérique), Miríadax, EduOpen and the MOOC portal

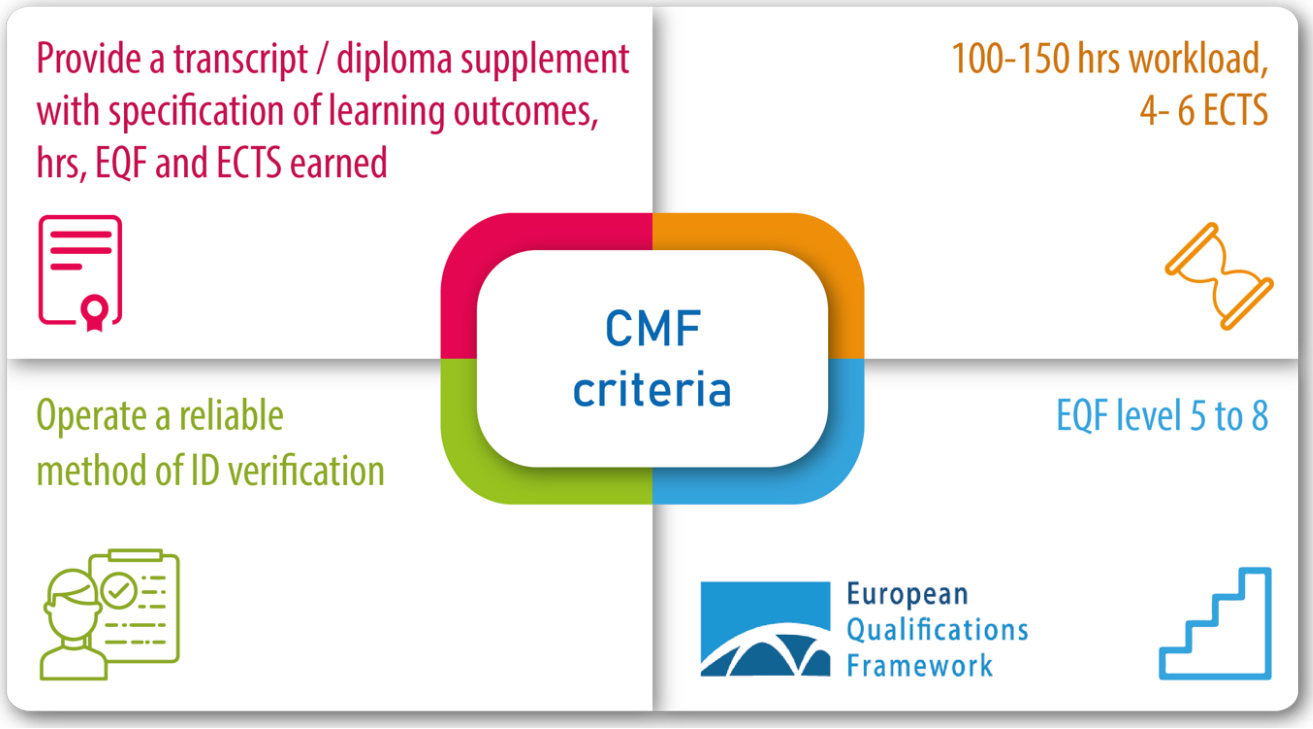
4 The European Commission has recently launched the 'Micro-credentials Higher Education Consultation Group' with two main purposes: (1) develop a common definition for microcredentials and its specifications (such as workload, learning outcomes and the ECTS range), and (2) explore how these credentials can be employed and recognized.

5 For more information, see the Digital Education Action Plan.

6 See the European Higher Education Area.

7 For more information, see the European MOOC Consortium.

Figure 1
THE CMF Criteria.



OpenupEd. It has been the result of bilateral consultation and cyclic stakeholders' needs for analysis and evaluation. The CMF responds to the question: how to harmonize the current wide variation of qualifications offered in high education, which lead to confusion on matters related to recognition of these credentials not only within institutions but also outside academia?

CMF uses the 'Bologna tools' such as the European Qualifications Framework (EQF), the European Credit Transfer and Accumulation System (ECTS) and the Diploma Supplement (DS) to provide a foundation for mutual trust and recognition through transparency. It promotes a common language between institutions and beyond.

Courses/MOOCs/short programmes described and designed in accordance with CMF meet the following criteria (see Figure 1):

- have a total workload of 100 - 150 hours (4-6 ECTS);
- are levelled at Level 6 (bachelor) to 7 (Master) of the EQF/NQF (European/National Qualification Framework), with options for level 5 (in combination with ECTS);
- provide assessment enabling the award of academic credit, either following successful completion of the course or recognition of prior learning (RPL);
- operate a reliable method of ID verification at the point of assessment; and
- provide a transcript (DS) setting out the learning outcomes for a course, hours of study required, EQF level, and number of credit points earned.

Within the EMC- LM (European MOOC consortium for the Labour Market)[8] project, the CMF has been validated by a consortium of MOOC platforms, universities, public employment services, sectoral organisations and companies. This validation included a conceptual analysis on recognition via involving experts. The CMF has to be seen as a new kind of international and portable credential for lifelong learning, which can be used to design a course or a programme that delivers a credential for each 4-6 ECTS, stackable as part of a bigger degree programme (e.g., Short Learning Programme- SLP or a degree programme).

SLPs: definition and characteristics

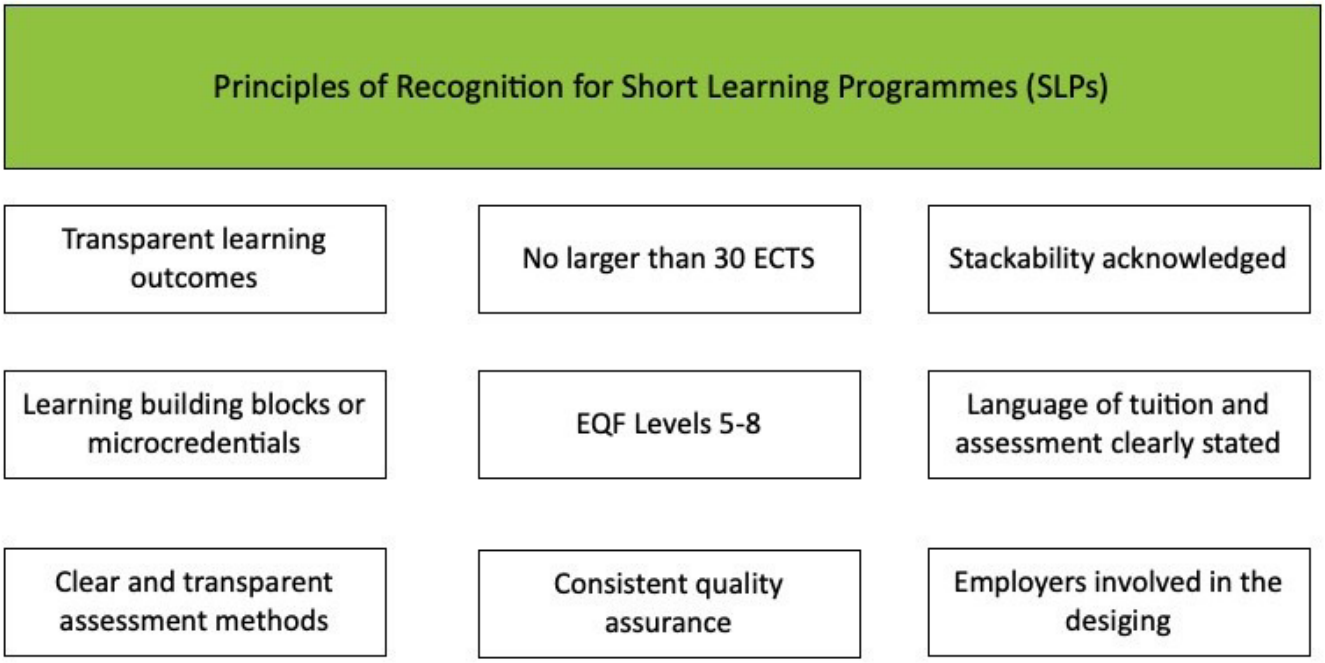
The European Short Learning Programmes project (E-SLP)[9], with a consortium consisting of 15 High Education Institutions (HEIs), belonging to 13 European countries (Belgium, Cyprus, Finland, Germany, Greece, Italy, Lithuania, Poland, Portugal, Spain, The Netherlands, Turkey and United Kingdom), represents one of the first European initiatives aimed at (1) defining the SLP concept;

8 For more information, see the European MOOC consortium for the Labour Market.

9 For more information, see the Short Learning Programmes project.

Figure 2

The criteria for the recognition of a SLP.



and (2) generating institutional strategies and guidelines for the design, development, delivery and recognition of SLPs.

According to the E-SLP consortium, a short learning programme can be described as a group of courses (units, modules or other learning building blocks) with a common subject, designed in response to a specific need, that targets higher education lifelong learners and delivers credit-based (ECTS) certification/credentials (Melai et al., 2020).

The main features of SLPs are:

- a coherent set of learning building blocks (or microcredentials) organised around steady learning outcomes, leading to an exam and ultimately to a credential/qualification;
- size variation, from 5 to 30 ECTS, and can reach 5 (foundation degree or diploma of higher education) to 8 (doctorate, PhD) EQF[10] level;
- only provided by a higher educational institution;
- delivered in online or in a blended mode;
- stackable to a larger programme, such as an academic degree (bachelor or master);
- accompanied by a document that details the main characteristics of the programme and the achievements of the student (such as the diploma supplement); and
- assessed by internal (institutional) quality assurance, and in some cases also by an external body (Melai et al., 2020).

These SLPs features are coherent with the CMF, with the reference to ECTS, DS, learning outcomes, EQF and a "system of quality assurance in line with the Standards and Guidelines for Quality Assurance in the European Higher Education Area," which has been made to foster a larger recognition[11] of SLPs adopting a common ground and language (European-Commission/EACEA/Eurydice, 2018).

DISCUSSION AND CONCLUSIONS

The development of micro-credentials has become a key priority of the European Commission's higher education policy. Between 2021 and 2025, Member States will take steps to adopt and recognize microcredentials in the European Higher Education Area to provide flexible and accessible learning opportunities for lifelong learning and professional development.

10 For more information, see the European Qualifications Framework.

11 Issues in relation to the accreditation and recognition of SLPs have been further examined by Dunn et al. (2020).

In this respect, two concepts have been developed within EADTU and the European MOOC Consortium, which are not completely independent of each other: the Common Micro-credential Framework and Short Learning Programs.

All developments fit into a common European approach to microcredentials, using the Bologna instruments related to volume (ECTS), European and national qualification levels (EQF/NQF), European quality guidelines and the description of certificates (Diploma Supplement). This makes CMF easy to be used and recognized for the valorisation of continuing education and professional development programmes within and outside the Bologna countries.

The purpose of this paper was to present the CMF within the European context and show its applicability in both credited MOOCs and SLPs. The simplicity of the framework has enabled its endorsement by the European MOOC Consortium (EMC), and the MOOCs platforms part of it, which link 400 European HEIs.

What's the advantage of referring to the CMF for students? By adopting CMF, students can receive a recognised microcredential after 4-6 ECTS from a university, giving them a sense of progress as they need less time to achieve a milestone, in this case a microcredential. Each microcredential award contains information related to the title of the qualification, the number of ECTS, the learning outcomes/competences, the level of the course achieved, assessment info and the grades earned. If the student wishes to continue learning in the same field in which they obtained the first microcredential, they can choose from related microcredentials, as they are stackable to a larger programme or degree, like in the case of SLPs.

What are the benefits for MOOC providers and higher education institutions? These providers join a movement that is revolutionizing continuing education and continuing professional development. Furthermore, by adopting the Bologna tools, CMF and SLPs enable a faster recognition of these credentials by academia and employers and guarantee their quality.

By the time this paper was written the CMF has been adopted by the following European MOOCs platforms: FutureLearn, Miriadex, FUN and EduOpen and it is going to be registered as a quality standard.

This framework has been developed and tested, keeping the European perspective and practice in mind. Future works may consider examining how other regions are developing and defining microcredentials to see if similar approaches could lead to a broader harmonization of qualifications for continuing education and professional development to the benefit of learners, institutions and employers.

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Making Sense of the Micro: Building an evidence base for Ontario's Micro-Credentials

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INTRODUCTION

Around the world, postsecondary institutions are experimenting with new credentials. "Micro-credentials"; "micro-certifications"; and other short, sometimes "stackable" programs that build toward traditional degrees, certificates or diplomas are emerging in response to calls for employability training and skills development (Bailey & Belfield, 2017; Fong, Janzow, & Peck, 2016; Presant, 2020; Resei et al., 2019). With so much experimentation and innovation, a range of new terminologies has also emerged, leaving students, institutions and employers to wonder: what do these terms *actually* mean? And what value do these credentials hold in the labour market?

According to the United Nations Educational, Scientific and Cultural Organisation (UNESCO) (2018), there is no efficient national or global system to collect, connect, search, and compare up-to-date information about alternative credentials, like micro-credentials, in a common language or format. This lack of shared understanding is contributing to "confusion, lack of trust and uninformed decision-making regarding the recognition of skills and qualifications "(UNESCO, 2018, p.1). In other words, the alternative credentialing space has become "confusing, and at times even chaotic" (Lumina Foundation, 2015).

This is the context in which the Higher Education Quality Council of Ontario (HEQCO) began gathering evidence and perspectives to facilitate a shared understanding of micro-credentials within Ontario's higher education sector. At the same time, HEQCO began building an evidence base to inform strategic approaches to the development and delivery of these new credentials. In addition to reviewing the literature, HEQCO engaged stakeholders—prospective students, employers, and institutional administrators—and examined the perceived and potential value of short, flexible credentials, using "micro-credentials" as an umbrella term to describe them. Below, we describe the impetus for our research and its outcomes, which include a definition, typology and evidence of stakeholder perceptions that governments, postsecondary institutions and employers can draw from to collaborate in the development and delivery of job-relevant micro-credentials.

WHY DOES ONTARIO NEED SHORT, FLEXIBLE CREDENTIALS?

Short, skill-focused courses and associated credentials are not new. Many employers and organizations have long offered in-house training and other informal learning opportunities for professional development and retention (Oliver, 2019). Powered, in part, by advancements in digital technology and evolving labour market demands, micro-credentials have emerged as a new form of focused learning with the potential to respond to both the modern hiring needs of employers and the training needs of adults looking to advance or pivot in the labour market.

HEQCO defines micro-credentials as being tied to short learning opportunities that are focused on a discrete set of skills, knowledge or attributes. They provide more targeted training than traditional degrees, certificates and diplomas (Pichette et al.,

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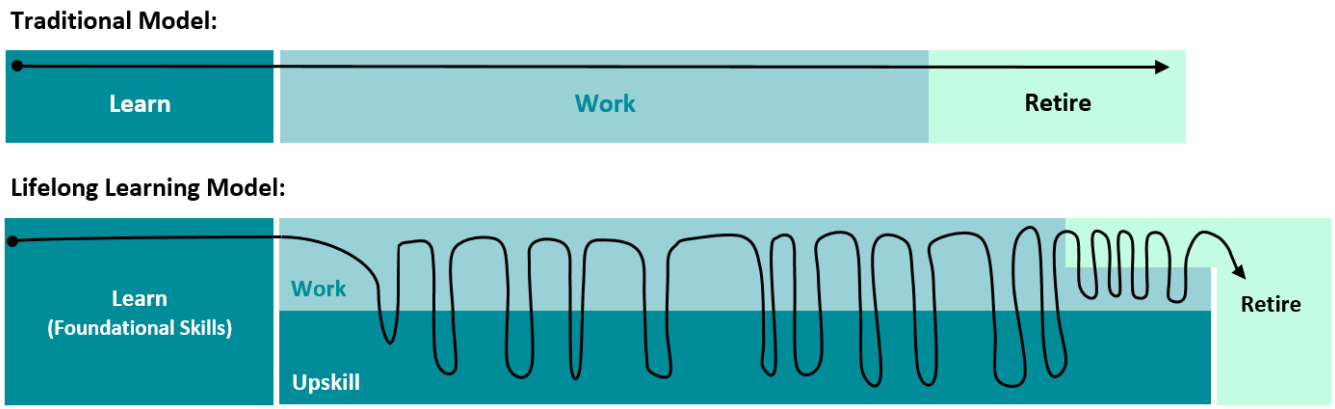
2021), which, at least in theory, makes them highly appealing to employers. Canada's Advisory Committee on Economic Growth notes that fewer Canadians are working for one employer over the course of their careers. This trend is discouraging employers from investing significant training dollars in their staff. Small and medium-sized enterprises in particular—which employ most private-sector workers in Canada—"often lack the resources to develop internal training programs" (Advisory Committee on Economic Growth, 2017). In the absence, or reduction, of traditional entry-level roles and staff development programs, micro-credentials could position employers to identify qualified applicants more easily and confidently by certifying a prospective hire's specific competencies. At the same time, micro-credentials could serve as a low-cost option for employers to invest in skill development, enabling affordable, on-the-job upskilling and in turn supporting employee retention.

Micro-credentials also stand to serve citizens and governments by acting as an essential feature of an effective lifelong learning system. In a 2019 publication, HEQCO researchers put forward the Lifelong Learning Model, adapted from McGowan and Shipley (2017) and depicted below. Rather than preparing students for a lifetime of work with one employer, the model illustrates the need to support longer careers, where job loss and job change are the norm. In this model, traditional postsecondary and K–12 sectors are relied on to build a foundation of transferable skills. Layered on top of that foundation, postsecondary institutions and employers are responsible for providing opportunities to "top up" transferable skills and foundational knowledge with job-specific training during adulthood. With the trend of declining long-term employment in mind, HEQCO authors argued,

> When adult learners require retraining or upskilling, they should have access to flexible programs that recognize prior learning and experience, are aligned with employer needs and are rigorously evaluated to ensure quality and market value. Such programs should lead to an employer-recognized credential that is portable between postsecondary institutions to allow for learning progression. (Pichette et al., 2019, p. 11)

The upskilling aspect of the Lifelong Learning Model is particularly important in times of displacement—something many Canadians are currently or have recently experienced in connection to the COVID-19 pandemic. According to Statistics Canada (2020), "From February to April, 5.5 million Canadian workers were affected by the COVID-19 economic shutdown. This included a drop in employment of 3.0 million and a COVID-related increase in absences from work of 2.5 million." Research suggests the Canadians whose jobs were affected by the pandemic will fare better if they have access to training opportunities. One study found that displaced workers who pursued postsecondary education within a year of losing their jobs earned almost $7,000 more in the long term than those who did not (Frenette, Upward & Wright, 2011). Another study of Canadians receiving employment insurance (EI) found that recipients who invested in skills development saw more pronounced positive effects on employment and earnings than other groups of EI recipients (Handouyahia, Roberge, Gringras, Haddad & Awad, 2016).

Figure 1
Lifelong Learning Model



NOTE. Adapted from McGowan & Shipley (2017).

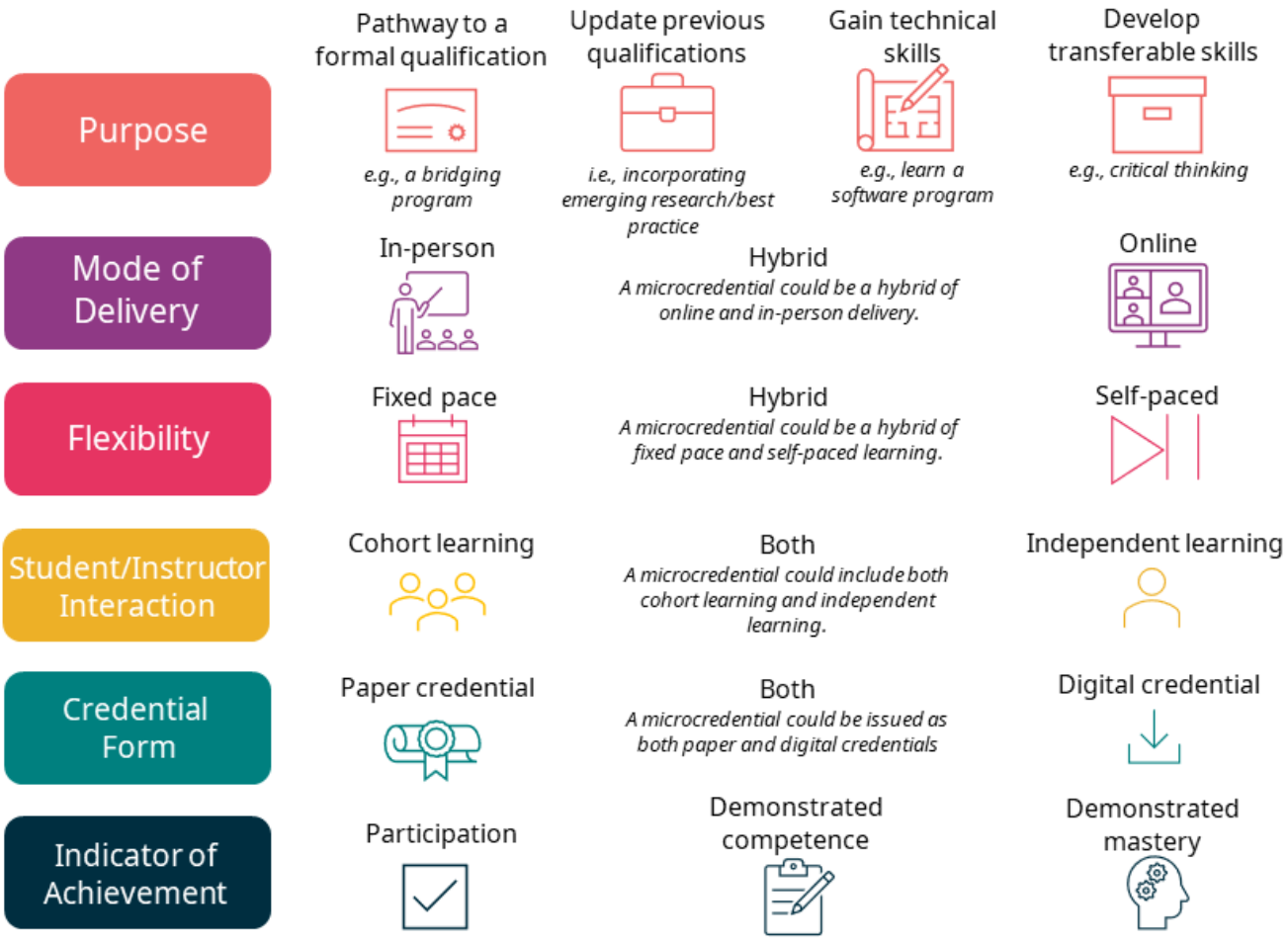
Meanwhile, the Organization for Economic Cooperation and Development (OECD) (2015) found that laid-off workers who seek new employment immediately after losing their jobs without pursuing upskilling opportunities experience lower earnings and a higher frequency of part-time work.

With job loss and job change becoming an increasingly common experience for adult workers and employers (Manyika et al., 2017), short, flexible and affordable learning opportunities focussed on teaching job-relevant skills will be key to adapting and thriving over the long-term. The Ontario government recognizes this; in its 2020 budget the government announced nearly $60 million for a micro-credential strategy. When speaking about a post-COVID-19 world, the Minister of Colleges and Universities touted micro-credentials as an opportunity for people who have been affected by the pandemic to retool and advance their careers, in a matter of weeks at a fraction of the cost of a typical degree or diploma (Taylor, 2020).

BEYOND BEING SHORT AND FOCUSSED, WHAT DO WE MEAN BY "MICRO-CREDENTIALS"?

As noted above, micro-credentials have lacked a clear, concise definition and standardized criteria. With an interest in developing an effective lifelong learning system and skilled labour force (in Ontario and nationally), HEQCO set out to facilitate a collective understanding of micro-credentials. To this end, HEQCO engaged

Figure 2
Micro-credential Typology



NOTE. Model found in Pichette et al. (2021).

stakeholders to assist in the development of a simple micro-credential definition and typology for Ontario, which we hope will be instructive nationally as well. We conducted 44 interviews between February 2020 and March 2021 with representatives from Canadian colleges and universities, employers and industry associations, as well as subject matter experts.

Looking at the Canadian context, Davidson and Ruparell (2020) argue that no jurisdiction has agreed upon a single definition of "micro-credential". Research out of Deakin University in Australia suggests the term "micro-credential" is used to describe all manner of short learning experiences with a variety of brands and modalities—adding to the confusion (Oliver, 2019).

Some specific examples of definitions include: one put forward by Oliver (2019), who defines micro-credentials as a "certification of assessed learning that is additional, alternate, complementary to or a formal component of a formal qualification (p. i)"; Davidson and Ruparell (2020) suggest micro-credentials be thought of as, "digitally administered and competency-based certifications that focus on specific knowledges, skills, or competencies (p. 29)"; and RMIT University in Australia defines micro-credentials as credentials which "certify an individual's achievements in specific skills and differ from traditional educational credentials in that they are shorter, can be personalised and provide distinctive value and relevance in the changing world of work" (eCampus, n.d.).

Pulling together elements of these definitions, and incorporating feedback from sector stakeholders, HEQCO developed the following definition:

A micro-credential is a representation of learning, awarded for completion of a short program that is focused on a discrete set of competencies (i.e., skills, knowledge, attributes), and is sometimes related to other credentials.

In Figure 2, we illustrate how our definition can lead to variation in practice, and indeed, how the micro-credentials currently being offered across the province do vary. Our goal with this graphic is to help address some conflation of terms (e.g., digital badges and micro-credentials) and misguided assumptions about micro-credentials (e.g., that they are all offered online). To some extent this same graphic could be applied to most other credentials offered by postsecondary institutions.

In addition to the points of variation above, like flexibility and the indicator of achievement, HEQCO notes many micro-credentials are designed to be relevant (tied to industry and/or community needs), stackable (part of a sequence of learning, leading to a larger credential) and/or accredited (recognized or issued by a professional accrediting body). While not defining of micro-credentials, HEQCO considers these features key "quality markers" that postsecondary institutions should be transparent about to facilitate transferability (Pichette et al., 2021).

WHAT DO STAKEHOLDERS THINK OF MICRO-CREDENTIALS?

In addition to developing a common language for thinking about and discussing micro-credentials, HEQCO set out to develop an evidence base to inform strategic approaches to micro-credential development and delivery. We conducted surveys of Canadian employers, prospective students (i.e., adults, aged 18–64 not currently enrolled in a postsecondary program) and representatives of Canadian postsecondary institutions. The surveys of employers and prospective students gauged awareness of, and interest in, micro-credentials as a means of upskilling. The survey of postsecondary institutions examined how stakeholder interests align with existing and planned micro-credential offerings at postsecondary institutions. In total, 201 Canadian employers, 2,000 prospective students, and 161 representatives from 105 postsecondary institutions responded to our surveys—all of which were administered online between September 2020 and January 2021. For a detailed description of our research methods and findings, readers should review our Making Sense of Micro-credentials report, available on HEQCO's website.

In summary, our research highlights an awareness gap, among Canadians and Canadian employers, about what micro-credentials are and who they serve. Even among postsecondary institutions, the term is used inconsistently. We hope our simple, inclusive definition helps to address this gap, especially given that once provided with a definition, the employers and prospective students who responded to our surveys showed interest in micro-credentials. Results from our prospective student survey suggested that Canadians care that micro-credentials are affordable and that employers see value in them. Employers favour micro-credentials that are competency-based and respond to industry or community needs.

Respondents from all surveyed groups showed mixed levels of interest in the concept of stackability, i.e., the ability to combine multiple micro-credentials into a larger credential. Based on this finding and the views expressed by interviewees, HEQCO advises postsecondary institutions to focus less on deconstructing existing curricula for stackability purposes and more on designing innovative, focused content that serves a new market of students. Stackability should be thought of as a bonus rather than an end in itself.

Reflecting on the perceptions of the stakeholders we engaged, HEQCO sees the primary functions of micro-credentials as responding quickly to evolving social and economic needs (like displacement stemming from the pandemic or new technology) and catering to underserved learners. Institutions and governments should focus their strategies on upskilling adult learners with specific training needs whose prior learning and experience have already provided a strong foundation of knowledge and transferable skills. Put differently, we see micro-credentials as being useful programs for upskilling and would consider more comprehensive learning opportunities as being better suited for reskilling.

WHAT'S NEXT FOR HEQCO?

HEQCO plans to continue research in this area, including by examining labour market outcomes associated with micro-credential programs and working to understand how micro-credentials offered by postsecondary institutions can, and should, differ from those offered by industry. Ultimately, we hope to continue assisting the sector in preparing students for success in a changing labour market.

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Original Research Article*

Assessment and Recognition of MOOCs: The State of the Art

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Abstract

This study presents a descriptive overview of assessment and verification techniques used and emergent in contemporary online learning platforms. The Covid-19 pandemic has encouraged many institutions to move to online examinations at scale. Verification of learner identity is thus increasingly important for online education in examination and proctoring. Here we review state of the art approaches to ID verification, recognition, and assessment in Massive Open Online Courses (MOOC). Desktop research included research publications, grey literature, and direct interactions with MOOC platforms to identify current practices. The main focus was on public data from course pages on MOOC platforms, and particularly courses that had been grouped to offer a single academic program. Four approaches to verification of identity are described: basic identity checks; checks made by the university; external proctoring; and various types of interview. Our review demonstrates the absence of any universal approach. However, the emergent picture indicates increasing co-ordination across relevant stakeholders (including higher education institutions, employment services and the private sector). There remain significant challenges for online proctoring, including overcoming learner preferences and meeting the increased resourcing needed for human-led processes of identity verification. There remain significant ethical challenges regarding the use of learner data (especially biometrics). As a result, MOOC platforms may benefit from adopting identity verification strategies that are well-established in higher education institutions, such as plagiarism checking software and pedagogies like e-portfolios..

Keywords: assessment, exams, ID verification, MOOC platforms, MOOCs, proctoring, recognition, micro-credentials

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INTRODUCTION

The rise of Massive Open Online Courses (MOOCs) has been a significant factor in the increase in online education over the last decade. MOOCs began as a Canadian experiment in teaching and learning (Cormier, 2008) and were scaled up through platformization over the last decade. There are now many thousands of MOOCs available at differing levels of complexity. MOOCs are often openly available in the sense that they can be accessed free of charge by unlimited numbers of learners (Ferguson, 2019) even if the course content itself is not openly licensed.

During 2020, this trend was significantly accelerated by Covid-19 (Bozkurt et al., 2020). ClassCentral (2020) reports that MOOC providers launched more than 2800 courses, 360 micro-credentials, and 19 online degrees during 2020. Similarly, one third of all MOOC learners ever to register for a course did so in 2020—approximately 60 million new learners from around 180 million who have taken a MOOC with a major platform (ClassCentral, 2020).

*Original Research Articles are papers that report on original empirical research with a focus on teaching and learning. Papers may be qualitative or quantitative and include an Abstract, Introduction, Method, Results, Discussion, and Reference section, as well as any tables and/or figures.

Although more than 60 MOOC based degrees are available (ClassCentral, 2020) the majority of MOOCs are not formally accredited. Learners have access to content, and often some access to educators, but rarely to academic or professional credit. There are two important blockers here. First, verification of identity (ID) is challenging—and costly—when learners are distributed across the world. Second, the processes of marking and quality assuring assessment are demanding—and costly—when any one course presentation may have tens of thousands of learners. Low-cost substitutes includes digital badges and Statements of Attainment, Completion or Participation (de Barba et al., 2016; Jansen et al., 2017).

For some learners, this state of affairs presents no problem; they have gained the skills and knowledge they need; their learning needs are met (Milligan & Littlejohn, 2017). For others – particularly those who have been unable to access traditional forms of Higher Education – this can present a significant gap in provision. Employers looking for evidence of professional training can also find such arrangements unsatisfactory as qualifications developed through online learning at scale may be perceived as lower quality or less rigorous in assessment.

There is thus a growing awareness of the need to rethink and reassess how learning is validated and recognized through collaboration between educational institutions, employers and labour markets. As MOOC platforms have shifted their business models towards revenue-producing courses which include micro-credentials and/or "nano" degrees (Lemoine & Richardson, 2015; Oliver, 2019; Rossiter & Tynan, 2019) there is an increasing need for accurate and authentic forms of assessment and identity verification which work at a distance.

THE EUROPEAN MOOC CONSORTIUM: LABOUR MARKETS KNOWLEDGE ALLIANCE

In this paper, we aim to describe the state of the art with respect to assessment and recognition in MOOCs. Our endeavor is grounded in the attempt to provide a practical knowledge base about MOOC assessment for a range of relevant stakeholders. We make no claims to statistical validity or efficacy per se in our account of the topography. Rather, we propose to capture and describe the range of implementations that presently exist and show what is considered effective practice at present.

This work is carried out as part of the European MOOC Consortium: Labour Markets (EMC-LM, n.d.) project, the first phase of which runs from 2019-2021. The EMC-LM Knowledge Alliance, funded under Erasmus+, is an outcome from the European MOOCs Consortium which comprises the major European MOOC platforms (Futurelearn, FUN, Miriadax and EduOpen) in collaboration with trade and industry associations (ANPAL: Agenzia Nazionale Politiche Attive Lavoro [Italy]; Ocapiat [France]; VDAB [Belgium]) and higher education institutions with an interest in online education (The Open University [UK]; Università di Foggia [Italy]).

The European context is characterized by a landscape of competing and contrasting qualifications which operate across different national, disciplinary, professional and linguistic borders (EU, 2020). A lack of common formats, standards and systems of recognition results in a patchwork approach which is not very coordinated. Furthermore, the changing nature of work and training means there is great demand for a successful, strategic approach to reskilling and upskilling. Alongside the growing influence of digitalization and the impact of Covid-19 there is a pressing need to build systems of assessment and recognition that are adequate to contemporary need.

EMC-LM foresees a convergence of interests around leveraging the digitization of education; developing sustainable MOOC business models; and developing a more responsive and flexible labour market at the European level. EMC-LM has facilitated the development of a European-wide approach to micro-credentialling, which aims to realise the potential of MOOCs to support both higher education and the needs of the labour market through shared recognition of learning.

This study was conducted to support the development and implementation of the framework by researching the state-of-the-art and effective practice for MOOC platforms in the key areas of identity verification, summative assessment, and methods of recognition. The Common Micro-credential Framework (CMF) (Bowden, 2020) is aligned with the European Qualifications Framework (EQF, n.d.) and requires the use of a reliable ID verification system, and a summative assessment so that academic credit can be reliably and accurately awarded. These micro-credentials are then mutually recognized by the relevant parties (educational institutions, employers, industry bodies, trade associations, etc.) and have an agreed workload and curriculum. To meet the requirements of the CMF, micro-credentials must include total workload (or study time) of 100-150 hours, including the summative assessment (which awards academic credit and produces a transcript) (para. 4).

METHOD

Both primary and secondary research was conducted. Through secondary research we systematically collected data from research publications and grey literature. This was used to

identify key criteria and points of comparison across the platforms examined in primary research. Time was spent auditing and reviewing MOOC courses and platforms to identify current standards and practices. The focus was on publicly available data from course pages on MOOC platforms: particularly courses that had been grouped to offer a single academic program, those that offered academic credit, and those that met the criteria of the CMF (FutureLearn, n.d.). Namely:

- having a total workload (or study time) of 100-150 hours, including revision for, and completion of, the summative assessment;
- being levelled at Levels 6-7 in the European Qualification Framework or the equivalent levels in the university's national qualification framework, or be levelled at Levels 4-5 and fulfil the criteria of the European Credit Transfer and Accumulation System;
- providing a summative assessment that awards academic credit, either directly following successful completion of the micro-credential or via recognition of prior learning upon enrolment as a student on a university's course of study;
- using a reliable method of ID verification at the point of assessment that complies with the recognised university's policies and/or is widely adopted across the platforms authorised to use the CMF; and
- providing a transcript that sets out the learning outcomes for a micro-credential, total study hours required, EQF level, and number of credit points earned.

As practice on MOOC platforms is a dynamic and transformative area of practice, and the move to widespread credentialing is relatively recent, examples from prior to 2019 are not included in this study. European platforms EduOpen (2018), France Université Numérique (FUN, n.d.), FutureLearn, and Miríadax (2019) were compared because these are the ones already most closely aligned with the CMF. USA-based platforms Coursera (45 million learners), edX (24 million learners) and Udacity (11.5 million learners) (Shah, 2019) were included both because of their scale and because they all offer micro-credentials or a similar qualification.

Another important part of identifying cases was to draw on the expertise across the EMC-LM consortium. All members of EMC-LM were asked to contribute examples, using a survey and online interviews to gather consistent responses in relation to platforms where the primary language is not English. This provided perspectives from universities and employment organisations, from countries across Europe, and in multiple languages. Desktop research also took into account relevant projects funded by the European Union, including MOOQ (n.d.), TeSLA (n.d.), MoonLite (Trager, 2015), BizMOOC (2018), E-SLP (n.d.), and OpenupEd (Rosewell & Jansen, 2014).

This approach identified 66 examples of potential good practice from MOOC platforms based in Europe and the US. These cases were examined for practices in ID verification, summative assessment, and methods of recognition. In some cases (particularly on the Udacity and edX platforms), assessment and identification methods were the same on multiple courses. In these cases, a representative sample was included in the study, capturing the breadth and variety of practice across courses and platforms.

Results are reported under the categories of ID verification systems, methods of recognition, quality assurance processes, academic credits, professional recognition, combined recognition, and a review of assessment methods.

RESULTS

Id Verification Systems

The Common Micro-credential Framework (CMF) specifies that courses, or sets of courses, should deploy a reliable method of ID verification at the point of the summative assessment. ID verification is the process by which a learner's ID is matched with an image of that learner, enabling platforms to issue verified certificates or to award credits. In the broader context of online assessment, it is also important to verify the authenticity and authorship of assessment (Mellar, 2016). "Authenticity" connotes that the learner is the person who completed the assessment, while "authorship" means that the learner has not cheated or plagiarized to produce that work under assessment conditions. Verification processes typically require time and resources to complete so have an associated cost that must be taken into account.

A reliable ID verification method in online assessment will verify authenticity and authorship. Good practice should verify authenticity and authorship at the point of taking the assessment. Better practice is a scalable verification method that is affordable in terms of cost and time.

Four categories of ID verification method currently in use for micro-credentials hosted on MOOC platforms were identified (see Table 1). These categories, arranged in order of rigour and scalability, are: basic ID verification system, university registration, proctoring an exam, and interviews. We also note the existence of a potential fifth category, specified but not yet used in practice, the TeSLA system.

Table 1: *Summary of identity verification systems*

Main Category	Sub-category	Brief Description	Level of practice	Advantages	Disadvantages
Basic Platform ID Verification	Basic Platform ID Verification	Learner's photo matched with ID.	Basic	Common across platforms – scalable	Not at the point of assessment – minimum level of verification
University Registration	University Registration	Learners complete a registration process within the university as non-degree students.	Basic	Second layer of authentication – scalable	Not at the point of assessment
Proctoring Exams	Random Proctoring	Software takes pictures at random times during the exam; sends similarity report to institution.	Good	Layer of authentication at the point of assessment – scalable	Coverage not continuous. Only deployed in exams
	Full Live Proctoring	Human proctors exam using software.	Good	More rigour at point of assessment	Not scalable for logistical reasons. Only deployed in exams
	Full Recorded Proctoring	Exam session recorded; checked by a human. Similarity report sent to the instructor	Better	More rigour at point of assessment –scalable	Only deployed in exams
Interviews	Interview: On Site	Interview conducted at university premises	Basic	Reliable in terms of authenticity and authorship	Not scalable due to geographical limitations
	Interview: Online	Short online interview to verify student identity and work	Good	Reliable in terms of authenticity and authorship at the point of assessment	Increase in time and cost per verification if scaled
	Interview: Recorded Presentation	Presentation recorded as part of capstone project	Better	At the point of assessment – scalable – flexibler	Increase in time and cost if scaled. No real-time guidance for learner to verify authenticity and authorship of work
TESLA System	TESLA System	Verification of authenticity and authorship across various e-assessment scenarios using different software	Better	At the point of assessment for different scenarios – scalable – flexible	Not implemented on MOOC platforms – still in pilot stage – some privacy concerns

Basic Platform ID Verification Systems

Basic Platform ID Verification Systems are commonly used on MOOC platforms. Learners match their own photo with an ID document such as a passport, national ID, or driving licence (Witthaus et al., 2016). FutureLearn, Coursera, and Udacity use NetVerify as a third party for verification.

This form of verification usually happens once, at the beginning of the registration process. One exception is edX, which verifies identity annually. EduOpen does not use online verification but uses ID checks at the university when qualifications are physically handed to learners. Udacity, by contrast activates, ID verification once learners submit an assessment and uses an exit interview as an extra step of ID verification.

This can be considered a basic practice because, although a minimum authentication level of ID verification is offered, it does not confirm identity at the point of assessment and is not tied to a specific assessment scenario. It is an authentication method which does not offer authorship verification.

Registration at a Higher Education Institution

Some study programs require learners to formally register with the university as non-degree students, providing another layer of ID verification. This example is used on FutureLearn, for example, on Business and Finance Fundamentals and The Digital Economy from The Open University and Causes of Human Disease: Understanding Causes of Disease and Discovering Science from the University of Leeds. This is also considered a basic practice because it provides a second layer of authentication but does not confirm authorship or confirm identity at the point of assessment.

Proctoring an Exam

The online proctored exam is a method of ID verification used by edX, FUN, FutureLearn, and Miríadax. Learners are required to set up proctoring software before sitting a final exam. This software monitors the computer screen and uses the webcam to monitor learners. Proctoring is typically used only for exams and not for assignments or other forms of work. It adds another layer of verification and helps to guarantee the authenticity of assessment. However, it cannot provide a guarantee that the student has not cheated or plagiarised work.

Random Proctoring

Random proctoring uses software to take pictures, with the learner's agreement, throughout the examination. Afterwards, the biometric system compares these images with a picture already submitted, and also checks for non-permitted activities such as talking, reading, or leaving the room. Images are sent to the instructor. Students may complete the exam successfully but fail on the basis of the biometric result. Miríadax used Smowltech software to apply this approach on the Expert in PPP Contract Management final exam. While this example is scalable and provides another layer of verification, it is not foolproof and Miríadax is currently reviewing alternative tools.

Full Proctoring (Live)

Full live proctoring uses software to observe learners taking an exam. This approach is used on the FUN platform, with the aim of replicating the exam experience on traditional university courses. An online reviewer monitors the assessment. At the start, students show their surrounding environment to demonstrate the absence of materials that would help them to answer questions. Their activity is then streamed via webcam and computer audio. This method involves matching an online reviewer with a learner and securing a stable internet connection; the learner could be disqualified if the connection is lost. Some MOOC platforms that were interviewed in the course of the study said that they were discontinuing their use because learners felt uncomfortable about being watched and this potentially affected their performance.

Full Proctoring (Recorded)

Recorded exam sessions are currently proctored after the event on edX, FUN and FutureLearn. The monitor notes whether an instructor needs to examine the recording at certain points. This approach allows learners to take their exams at times convenient for them and offers a reliable and scalable alternative to live proctored exams. This flexibility is undoubtedly appreciated by learners and educators, though there exists a gap in the research literature regarding the comparison of synchronous and asynchronous proctoring in terms of learner performance.

Interviews

The authenticity and authorship of learners' work can be validated in an onsite or online interview. Alternatively, learners may be asked to record a video to demonstrate knowledge in relation to certain learning outcomes. This approach adds a layer of verification, with a focus on authenticity, at the point of the assessment. However, it is arguably the most demanding in terms of cost and time and relies to some extent on the personal judgement of the interviewer.

Interview: On Site

At EduOpen, once learners finish a course, they are interviewed on university premises and their identity verified. This method is considered reliable in terms of authenticity and authorship. EduOpen is required to take this as it falls within the wider Italian national system, but it would be difficult to scale due to cost, time, and geographical limitations. In the age of the Covid-19 pandemic, face-to-face interviews are especially problematic.

Interview: Online

Online validation interviews are used on Udacity's Nanodegrees and on some edX Micromasters. A short interaction with an educator is used to validate a student's identity and work. On Udacity, learners verify their identity after passing an exam and are often prompted to schedule an exit interview, which takes less than five minutes. One example is The Associate Android Developer Fast Track Scholarship Program, where learners are asked about the exam project (Hidayat, 2017).

edX Micromasters courses that use interviews to verify identity include Instructional Design and Technology from University System of Maryland. Learners complete a capstone project, which includes designing and developing an online course. They then schedule a 10-minute interview using videoconferencing software in which they are asked about the decisions they made and also discuss course content.

Interview: Recorded Presentation

Assessment on the Corporate Innovation Micromasters developed by the University of Queensland includes an oral presentation, used to verify authenticity and authorship of work. Like the interview method, this method combines ID verification with assessment. Asking learners to record a presentation goes some way towards establishing authentication and authorship. However, in live interviews, students can be asked questions that directly verify authenticity and authorship; in a pre-recorded submission, it is possible that a candidate could be reading a script written by someone else.

Nevertheless, recorded presentations are often considered better practice than live interviews as they give learners more

space for trial, error, and creativity. They provide a better medium for learning and a relatively trustworthy layer of verification. In addition, they increase flexibility for learner and assessor, removing time limitations and the pressure of the moment.

Potential Good Practice: TeSLA System

TeSLA is a project funded by the European Commission to develop a system for trust-based authentication and assessment of authorship. Using this system, authenticity and authorship can be verified across different e-assessment scenarios (Mellar, 2016). This is achieved through different software capabilities (Knuth, 2016), including:

1. Face Recognition: analyzing visual data such as images and videos and recognizing a face within the data.
2. Voice Recognition: analyzing and verifying the learner's identity by comparing characteristics of the voice within the data.
3. Plagiarism Checks and Authorship Validation: detecting word-for-word copies in sets of documents.
4. Key-stroke Patterns: recognizing patterns based on the times of press and release on keys when typing on a keyboard.

In the TeSLA system, an instructor sets an activity and selects a verification instrument from the set above. The learner agrees to the use of this instrument and provides input to the system. This is used to build a model that will be used for verification. The learner completes the activity and submits it via TeSLA, which produces a report the instructor can use to verify authenticity and authorship.

TeSLA provides identity verification for various forms of assignment at the point of assessment (unlike proctoring, which is only used for exams). The use of technology means it can be scaled more easily than human-based methods of verification. Concerns about this system relates to the privacy of learner data once it has been collected, and the TeSLA project devoted considerable effort to the legal and ethical aspects of this (Mellar, 2016). The TeSLA project is currently running pilots with three universities, but the system has not yet been implemented on any MOOC platform. However, it is potentially a better practice than many currently in use.

Methods of recognition

Recognition refers to the award that students receive on successful completion of a study program. Programs aligned with the CMF provides a transcript that specifies course content, learning outcomes, total study hours, level on the European Qualification Framework (EQF) and the number of academic credit points (ECTS) earned. Table 2 provides a summary of the recognition methods currently in use.

Table 2: *Summary of recognition methods*

Main Category	Sub-category	Brief Description
Academic Credit	Non-transferable	Academic credit an only be applied to a program offered by the same university.
	Transferable	Academic credits can be transferred, either because ECTS are awarded or because specified universities have agreed to accept the credits.
Professional Credit	Formal	Awards credit hours or credits from formal professional accreditation bodies.
	Informal	Informal awards such as a certificate from the MOOC platform or badge from content provider
	Endorsement	Professional certificate backed by business leader, enhancing credibility and increasing work relevance.
Combined	Combined	Academic and professional credits awarded. Increases utility for learners.

Quality Assurance Processes and Awarding Credit

It is crucial for trust in qualifications that providers demonstrate to accrediting bodies that they are following appropriate quality assurance (QA) processes. In addition to internal QA processes, they must demonstrate they are adhering to the quality standards set by accrediting bodies. The different standards directly impact practice when awarding academic or professional credit. For instance, UK universities must meet the national qualification standards set by the Quality Assurance Authority (QAA). The QAA code includes: expectations, core practices, and common practices, all supported by advice and guidance. Expectations are objectives that providers should reach after setting the standards and managing the quality of their awards. Core practices are effective ways of working. Scottish providers also adhere to SCQF (n.d.) quality standards in order to award academic and professional qualifications. So, even within the UK, there are manifold pressures. There is some convergence of approach evident in Europe, but this does not travel to other contexts in obvious ways. Micro-credentials in New Zealand, for instance, follow NZQA quality standards, which integrate initial QA with ongoing self-assessment. The NZQA (n.d.) adapts the Te Hono o

Te Kahurangi QA approach, which includes six policies that help educators undertake evaluative conversations.

Academic Credit

Academic recognition is given when a learner is awarded academic credit, which varies according to the length and level of the program. (The CMF specifies the award of 4-6 ECTS per micro-credential.)

Non-transferable Academic Credit

Some universities offer academic credit that can only be applied to a program offered at that university. These credits cannot be transferred without appropriate work on credit transfer. This practice is applied across all FutureLearn's academic programs, on Coursera's MasterTrack certificates, and is often the case on edX.

FutureLearn offers several programs that offer academic credit. For example, The Open University's Business and Finance Fundamentals is accredited using the Online Course Certification System (EOCCS). Those who complete it successfully are awarded 30 UK credits (300 study hours) towards the university's Business Management BA degree. The Digital Economy awards 15 UK credits (150 study hours) towards the university's MBA.

Coursera also offers non-transferable academic credit. Successful completion of the Machine Learning for Analytics MasterTrack from the University of Chicago enables learners to fulfil 18% of the requirements of the University's Analytics MSc. Successful completion of the Supply Chain Excellence MasterTrack from Rutgers University earns students three credits on the Supply Chain program at that University.

This approach is also used on edX. Successful completion of the Business Fundamentals Micromasters program from the University of British Columbia earns learners six of the 31.5 credits needed for the Master of Management degree at that University. Non-transferable academic credit arguably has value for students, but failure to offer flexibility could be a barrier for some.

Transferable Academic Credit

Transferable academic credit is more flexible and is used on the edX and EduOpen platforms. An edX example is the Supply Chain Micromasters program from MIT. Successful completion of this program can help students apply to 18 universities worldwide, where they can use the academic credits they have earned. Also, at edX, successful completion of Managing Technology and Innovation from RWTH Aachen University gains a student 15 ECTS that can be transferred and recognized across Europe.

EduOpen offers Unità di Credito Formativo (CFU), the Italian equivalent of European ECTS credits, on its academic pathways. The Content and Language Integrated Learning pathway offers 16 CFUs that can count towards a master's degree from Universita Di Foggia and other universities that accept the transfer of these credits.

Transferable credits give learners freedom of choice if they want to study at another university or in another region. However, awarding and guaranteeing these credits involves administrative work which is likely to result in higher costs.

Professional Recognition

Professional certification is another form of recognition. European MOOC platforms, especially FutureLearn, usually offer formal recognition in the form of continuing professional development (CPD) hours or formally accredited programs. US platforms Coursera, edX, and Udacity offer more informal awards such as certificates and badges. At present, platforms in the USA are more likely to have their programs endorsed by leading businesses than their European counterparts. This is perhaps intended to balance the lack of formal accreditation awarded by professional societies and accreditation bodies.

Formal Recognition and Accreditation

Some courses offer formal recognition in the form of professional credit hours or accreditation awards. This practice is most common on the FutureLearn platform and is occasionally observed on Coursera and edX.

The University of California Irvine (UCI) offers a Professional Certificate for Project Management on Coursera. Successful completion of the program earns learners 120 contact hours that can be used to meet The Project Management Institute's educational hours requirement. The TESOL professional certificate provided by Arizona State University offers a 150-hour TESOL certificate on successful completion. The University System of Maryland professional course on Spiritual Competency Training in Mental Health awards six Continuing Education (CE) credits for successful completion on edX. FutureLearn offers formal professional accreditation across all its professional programs.

Informal Recognition

Other professional-development courses offer informal awards such as certificates from the MOOC platform or badges from the content provider. A badge is an image that can be displayed online, containing a hyperlink to evidence that award criteria has been met (Cross, Whitelock, & Galley, 2014). Informal recognition is common on Miríadax and the US-based platforms Coursera, edX, and Udacity.

On Coursera, professional certificates are usually awarded by programs offered by business leaders. The majority are provided by IBM, Google Cloud, and SAS. A certificate is offered following successful completion of the program. IBM professional

certificates offer an IBM Digital badge. After completing the IBM z/OS Mainframe Practitioner Learning Path, for example, learners are awarded a digital badge for each course. Similarly, edX offers informal recognition at the end of its professional certificate program, and Udacity learners receive a certificate of achievement after completing a nanodegree program.

On successful completion of the Miríadax's program, Expert in PPP Contract Management learners receive are certified as 'Expert in Contract Management of Public-Private Associations' by the Development Bank of Latin America. Informal recognition is common across MOOC platforms, yet it is not established as credible for learners or employers compared with a formal accredited award.

Endorsement

Informal awards can be complemented by endorsements from leading businesses. Endorsement gives awards more weight and enhances their reputation. There are several examples of endorsements on edX and Coursera.

On edX, many professional certificates are endorsed by a senior professional from a business leader, or the programs are offered by a business leader. The Professional Certificate in Corporate Finance from Columbia University is endorsed by a senior product manager for LinkedIn; the Professional Certificate in the Science of Happiness is endorsed by the Manager of Corporate Social Responsibility and Community Relations at LG; and the Professional Certificate in Python Data Science is offered by IBM and endorsed by the CTO and Director Emerging Technologies at IBM.

Coursera offers programs from leading businesses, including SAS, IBM, Google Cloud, and (ISC)². An example is the Google IT Professional Certificate by Google Cloud, recognised by a large hiring consortium that includes the Bank of America, GE Digital, Intel, The Home Depot, Walmart, and Google. Endorsement from a leading business can enhance the credibility of informal professional credits.

Combinations of Academic & Professional Recognition

Some programs offer both academic and professional credit. Examples on FutureLearn include Causes of Human Disease and Environmental Challenges from the University of Leeds. These programs offer 14 CPD credits in addition to the academic credit awarded on successful completion. Also, on FutureLearn, successful completion of Genomics in Healthcare from St. George University gains learners 35 CPD credits from RCPath and 10 RCGP learning hours as well as academic credit.

On Coursera, the Google IT Professional Certificate by Google Cloud mentioned above can earn learners academic credit and a professional certificate. They earn a credit recommendation from the American Council on Education (ACE) ACE CREDIT®, which transforms professional learning into college credit. On successful completion, learners earn a recommendation of 12 college credits, equivalent to four college courses at associate degree level. This approach offers value for learners as it is flexible and relevant for both employers and employees.

Assessment

Assessment is traditionally the documentation of metrics that determine the success of educational interventions.

Summative Assessment

Summative assessment evaluates what a learner has achieved after a period of study. It typically relates to a program's learning aims and may be carried out in accordance with a national or international qualification framework. MOOC platforms have two broad approaches to summative assessment; they use a single type or combine multiple types. The different approaches are summarised in Table 3.

Computer-graded assessment

Computer-graded assessments are commonly used, particularly on programs offering professional recognition. This is a scalable and efficient approach to summative assessment that reduces the costs of marking, and provides opportunities for instant feedback (Laurillard, 2015). Multiple-choice tests allow teachers to evaluate the performance of groups and individuals. However, computer grading is currently not capable of evaluating certain concepts and skills (Laurillard, 2015).

Final proctored exams, discussed above as an ID verification practice, are commonly used. Final timed and proctored exams are used by NYIF across its seven programs on edX and FutureLearn. Each examination includes up to 70 MCQs and lasts up to two hours. MCQs are also used for summative assessment by EduOpen, for example on their program Enabling and Rehabilitating Approach to Sensory Disabilities – Introduction to Sensory Disabilities. Computer-marked exams are scalable because the cost per student goes down as the number of scripts marked goes up. Although MCQ tests can give students instant results, depending on them for summative assessments reduces opportunities for students to receive in-depth feedback.

Another approach is to use MCQ quizzes based on projects or case studies. This method is commonly used on Coursera's technical professional certificates, such as the SAS Programmer Professional Certificate and the Data Engineering with GCP Professional Certificate. Combining computer-graded assessments with the use of artificial intelligence to detect code

Table 3: *Approaches to summative assessment*

Main Category	Sub-category	Examples	Advantages	Disadvantages
Single-type assessment	Computer-graded	Final proctored exams, multiple-choice quizzes, computer-graded assignments	Scalable and efficient. Reduces cost per student. Opportunities for instant feedback. Supports evaluation of group and individual performance	Cannot currently test certain concepts and skills
	Peer-graded	Peer-reviewed project plan or presentation	Pedagogic benefit for learners.	Low rate of student approval. Difficult to apply on self-paced courses.
	Teacher-graded	Written assignments, tasks, portfolios	Offers value through constructive feedback.	Feedback delayed. Not scalable due to time and cost.
Multi-type assessment	Peer-graded assessment and teacher-graded assessment	Essay self assessed against criteria, then peer-reviewed, then tutor marked	Time and cost reduced ; chances for feedback increased	Complex to set up
	Peer-graded assessment and computer-graded assessment	Report on project evaluated by peers, plus MCQs	Use of AI could allow this to scale. Peer evaluation can provide useful feedback.	Peer evaluation difficult on self-paced courses
	Computer-graded assessment and teacher-graded assessment	Literature review, recorded video, and final exam. Final exam and online interview. Online test, oral presentation, essay, and live questions.	Robust summative assessment. More chances for students to obtain feedback	Poorly planned combinations of assessment can cause confusion.

bugs allows the program to scale easily, decreasing marking costs. This is an efficient form of assessment. However, reliance on automated grading of MCQs once again reduces opportunities for feedback. Unless MCQs are drawn from a very large question bank, students may cheat by sharing correct answers.

Another approach combines regular assignments with a final proctored exam. This method is used on edX on the Corporate Finance Professional Certificate from the University of Columbia. MCQ quizzes are used with a final, computer-marked exam. Also, on edX, the Introduction to Python Program Professional Certificate from Georgia Tech University combines problem sets with a final proctored exam.

Combining forms of computer-graded assessment increases opportunities for instant feedback. However, complete reliance on computer-based assessment limits the skills and concepts that can be assessed.

Peer-graded Assessment

Peer-graded assessment involves students receiving marks from their peers and marking their peers in return. This approach is commonly used to scale marking at low cost. Good practice is for learners to be trained to grade assignments until the grade that they give matches the grade given by the tutor; tutors randomly review the grading to ensure quality; and several students grade each assignment to give an average grade. Laurillard (2015) notes a significant pedagogical benefit to peer assessment, however, it is often not highly approved by students (Laurillard, 2014). Moreover, peer assessment is more valid with learners who are trusted to have some knowledge.

The Project Management Specialization developed by University of California, Irvine, on Coursera uses peer-graded assessment. Learners submit a project plan as a capstone project. They receive a mark based on peer assessment by five peers. The Strategic Management Professional Certificate offered by Wharton Business School on edX requires learners to create a presentation, which is then reviewed by peers.

Peer-graded assessment gives students an opportunity to produce authentic and meaningful work and receive feedback. In the process, they critically evaluate other learners' work, reinforcing and reflecting on their own learning. However, this approach is necessarily not trusted as a reliable assessment method. Perceived reliability increases when combined with other types of assessment.

Teacher-graded assessment

Teacher-graded assessment does not always scale well because of the time and cost involved in marking but is often applied to essays and capstone projects. There are several examples on FutureLearn. Management and Leadership Essentials – Management and Leadership, Personal Development from The Open University (UK) includes an assignment made up of six writing tasks. Tutors grade these and provide constructive feedback. The Managing People program ends with a 1,500-word assignment and students receive feedback on this from Henley Business School at the University of Reading.

On Coursera, the TESOL Professional Certificate on Coursera offered by Arizona State University includes two capstone projects, building a portfolio of artefacts. This portfolio is submitted for expert review in order to be awarded the 150-hour TESOL certificate. Udacity's nanodegrees include project-based summative assessments. A portfolio showcases technical skills acquired by learners. Experts assess these and provide personalised feedback.

Teacher-graded assessment offers value to learners by providing constructive and developmental feedback. However, learners have to wait for this, and the time and cost involved makes this approach difficult to scale.

Hybrid Approaches: Peer-graded Assessment and Teacher-graded Assessment

Peer-graded and teacher-graded assessment are combined by the University of Leeds for three programs hosted on FutureLearn. In week one of a summative assessment, students self-assess their work against an example answer using marking criteria. The next week, they refine their work and undertake a peer-review process using the same grading criteria. In the final week, they refine their work again and submit it for final tutor grading. This approach uses self-assessment and peer-assessment to familiarize students with grading criteria and provide feedback before final submission. Learners have opportunities to improve their work and refine their final submission, raising their chances of success and making final marking easier. There are multiple opportunities for feedback, and the time and cost per student are lower than if all assessment were done by an academic.

Hybrid Approaches: Peer-graded Assessment and Computer-graded Assessment

IBM combined peer-graded and computer-graded assessment on its professional certificate offerings on Coursera and edX IBM Applied AI, IBM Data Science and Python Data Science. During capstone projects, learners worked through MCQ quizzes and submitted a project report.

Hybrid Approaches: Computer-graded Assessment and Teacher-graded Assessment

Computer and teacher grading are combined in several ways. For the Introduction to Psychology program offered by Monash University on FutureLearn, learners record a video and submit a literature review for teacher grading, then complete a computer-marked exam that covers the concepts of the program.

On Sustainable Energy, offered by Queensland University on edX, learners sit two online proctored exams and participate in an online Zoom meeting. On the university's Corporate Innovation program, learners take a computer-graded online test, prepare an oral presentation and a written essay, and present a live oral pitch followed by questions and answers with faculty members.

CONCLUSION

This paper reviewed state of the art approaches to ID verification, recognition, and assessment in MOOC. There does not appear to be a universal approach or solution to the challenges of verifying student identity or ensuring examinations or assessment have been completed by the enrolled student.

There is, however, emerging coordination of recognition (e.g., endorsement or formal accreditation) of participation/completion of online courses but for this to meaningful at scale, it is dependent on engaging with and coordinating efforts across a range of stakeholders including businesses, universities and employment services at the national and international level. Projects such as BizMOOC and the CMF launched by the EMC are being recognized more universally, but many others remain siloed.

There is a tension here which goes back to the original conceptual and practical dichotomy between xMOOC and cMOOC, and their respective understandings of "open" in online education. The competitive and commercial nature of many xMOOC platforms prohibits the kind of transparency and data sharing that expedite a "joined-up" approach.

A diverse range of assessment techniques are currently being deployed by the MOOC platforms reviewed, ranging from human (peer, teacher) to automated assessment and combinations thereof. However, significant challenges remain including being unable to test certain skills via online means and student preference for specific feedback mechanisms (e.g., peer review). Moreover, student preference for individual teacher feedback despite delivery at scale is difficult to reproduce. In addition to that reported in the state of the art, some online courses have deployed assessment models which provide individual feedback from others, e.g., past participants or a group of educators who support students in smaller cohorts, alongside the main course facilitators. The time and resource required to evaluate work and support

learners is therefore spread over a larger number of persons. However, this remains a resource intensive option and reliant on sufficient uptake of facilitators—and potentially volunteers.

Four methods of ID verification were highlighted in the above review: basic ID checks, checks made by the university, proctoring and various types of interview. There is no systematic or standardized approach to how or when ID verification takes place or in what context (e.g., during examination). Projects such as TeSLA are aiming to test these approaches more consistently across a course's lifecycle and will perhaps generate a template that could be applied to other types of online learning. The norm currently remains replication of face-to-face methods of ID verification and there remains a significant tension between learner expectation and prior experience and the limits of current technology. Considerable ethical concerns, particularly around privacy and data protection remain and the use of third-party software could also be of concern, particularly in relation to proctoring. Proctoring remains controversial and there remains a need to robustly survey ID and assessment approaches prior to implementation whilst working with students to better understand the viability of different approaches.

In relation to recognition, few examples showcased in this paper draw on existing research in these areas. For example, research on the use of multiple-choice questions, computer-aided assessment and e-portfolios have not yet influenced the practice reviewed in this state of the art despite being long established in e-learning. Similarly, plagiarism checking software such as TurnItIn or Copycatch is routinely used by higher education institutions around the world to verify that students have not copied the work of others, yet hardly used at all on MOOC platforms.

The pedagogical approach(es) employed by platforms should also be reviewed, particularly to encourage more innovative and sustainable ways of assessing student work and participation in a course. This could result in more robust frameworks for ethical and sustainable approaches to online ID verification and assessment. Other challenges for current ID verification methods (and also modes of assessment) include scalability, support for students and scoping.

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Original Research Article*

Digital Badge Metadata: A Case Study in Quality Assurance

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Abstract

Digital badges are competency-based credentials that provide specific information within their metadata. However, there appears to be no research investigating the quality of the information conveyed in the metadata. To better understand how to convey the value of digital badges, this study investigated the metadata quality using mixed-method content analysis on the digital badges developed in a micro-certification pilot project. The results revealed similarities in metadata location but differences between curriculum expectations. This study found that metadata information's type and location may affect the perceived value of digital badges. Building on the research on assurance, this study suggests reimagining the learning experience to support digital badges as a new credential.

Keywords: competency, digital badge, digital credential, metadata, micro-certification, micro-credential, Ontario Quality Framework, quality standards

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INTRODUCTION

Digital badges are a new form of digital credentialing gaining popularity in higher education institutions. Like businesses awarding points to their customers, educators designed digital badges to reward students for their learning (Coronado, 2020; Mozilla Foundation, 2011). They differ from conventional credentials in that they contain verifiable evidence describing the skills or competencies achieved, embedded within the digital badge in the form of links. Furthermore, since they are a digital credential, the badges are in the control of the earner and can be easily shared online via social media. (Hickey, 2015; IMG Global, 2020; Open Badges, 2020).

Developed originally in the United States, higher education institutions in Ontario have recently begun to adopt digital badges. In 2013, the Mozilla Foundation created the open badge standard, which outlined the first set of guidelines for developing digital badges. By 2015, major companies such as IBM, Pearson, and Microsoft created their industry-specific learning pathways (Open Badges, 2020). And shortly after, education organizations like eCampusOntario and higher education institutions in Ontario started to develop digital badges to meet short-term, industry-specific learning needs within the province.

eCampusOntario started an Educational Technology Sandbox with new digital badging technology, testing the use of digital badges with eight Ontario post-secondary institutions to develop a framework for other institutions (eCampusOntario, 2019). The number of institutions using digital badges has doubled with the help of two additional pilot projects by eCampusOntario (2020).

One reason for the adoption of digital badges is their ability to credential skills. For example, in a 30 funded pilot projects study, Hickey and Chartrand (2020) investigated how institutions were using badges to credential skills. They found four different methods of credentialing. Participants could earn a badge by demonstrating a skill, participating in an experience, completing a project, or a hybrid of the previous three. Like how Boy and Girl Scouts receive badges for developing a new skill, higher education institutions now have a tool to recognize skills gained to workplace needs and present this evidence in a public and open way.

Digital badges have a unique feature that recognizes the skills achieved called metadata. Since these badges are digital, developers can embed information such as the standards achieved, tasks, artifacts created, and the quality of experience (Gibson et al., 2015). This information is known as metadata, which represents data about the credential. Therefore, digital badges provide unique value because of their ability to display the skill developed by the earner in detail.

Even though the metadata provides valuable information about the skill developed, the value of digital badges is still in question. There have been several studies investigating the perceived value of digital badges. But without a framework describing the value of digital badges, stakeholders such as earners, employers, and institutions question their value (Devedžić & Jovanović, 2015; Dyjur and Lindstrom, 2017; eCampusOntario, 2019; Hickey et al., 2015). Grant et al. (2016) suggests that the lack of a central authority governing the quality of digital badges has contributed to this uncertainty. Part of this issue is the definition of quality, but this paper takes Weingarten's (2018) simplified approach in describing "whether these desired qualifications and learning outcomes are actually achieved." Moreover, with no central authority assuring the quality of digital badges in Ontario, it is essential to understand how to convey their value as adoption increases.

Decentralizing the authority of badges may be an asset to digital badges. Different stakeholders with different values may require alternative expectations for them. But, to better understand how to convey the value of digital badges, this paper investigates how badges convey the relationship between learning and skills.

One crucial area to investigate is the metadata's quality. All badges provide specific information for the metadata issued for them. However, there appears to be limited research investigating the quality value of the information conveyed in the metadata, and none within the context of Ontario.

This study investigates the quality of the metadata by exploring two questions:

1. What are the similarities and differences between the metadata of digital badges?
2. Is the information provided in the metadata relevant to stakeholder's understanding of value?

By exploring the quality of information conveyed by digital badge metadata, this study hopes to add to the body of research on digital badge metadata design.

LITERATURE REVIEW

The perceived value of digital badges tends to vary between stakeholders. For example, some stakeholders are optimistic about digital badges' ability to track and visualize different learning pathways (Pitt et al., 2019). In some cases, stakeholders are divided on their perception, where some see them as innovative, whereas others see them as less prestigious than certificates of completion (Dyjur & Lindstrom, 2017). Although in other cases, earners, faculty, and employers do not understand the value of digital badges (eCampusOntario, 2019).

This difference in perception may be due to the varying usage of digital badges. For example, Hickey and Chartrand (2020) defined four types of digital badges. A competency badge for demonstrating specific competencies; a participation badge for engaging in social learning; a completion badge for individuals completing projects or investigations; a hybrid badge for multiple types of learning.

Across each of the four types of digital badges, there is the potential for further variance. West and Randall (2016) described the badges as lightweight or heavyweight, depending on the criteria' rigor and assessment. Also, the scope badges can support at a local level or upwards to a global level. With so much variability, the varying perception of digital badges may be due to the inconsistency of digital badge expectations.

Applying quality assurance frameworks to digital badges may help with their varying perception and usage. Generally, quality assurance refers to measuring whether desired learning outcomes have been achieved (Weingarten, 2018). Research in quality assurance happens at nearly every level and credential in the field of education: secondary school (Spruit & Adriana, 2015), higher education (Skolnik, 2016), professional schools (Ingvarson & Rowley, 2017). However, since digital badges are a reasonably new credential, there appears to be less research investigating how to ensure quality.

Providing a framework for design and implementation has been shown to improve the quality of digital badges. For example, Derryberry et al. (2016) investigated how badges can be recognized and accepted within education ecosystems. They found that several elements are needed. There needs to be a process for verification, authentication, and validation. Also, there needs to be a respected endorser supporting this process. Their work suggests that badges developed in this process are likely to be perceived as credible.

Design and implementation frameworks support the development of well-constructed digital badges but adding standards may help with the credibility of digital badges. Pitt et al.

(2019) investigated the credibility of digital badges from college admission officers' perspectives. First, they were concerned with the credibility of the endorsers. If the endorsers who authorized the badge was not credible, then the badge was perceived as of lower quality. Second, they were concerned with the standard of badge completion. Since the standard for achieving a badge is unregulated, then its value is put into question. Their argument suggests that the credibility of digital badges may improve with credible standards due to their novelty.

In Ontario, the Ontario Qualification Framework (OQF) sets the standards for post-secondary credentials. The OQF provides the specifications for knowledge and skills for every credential in Ontario. Created by the Postsecondary Education Quality Assessment Board in 2002, the OQF specifies the qualifications offered by post-secondary institutions and other authorized providers. Also, the OQF describes in detail the full range of post-secondary credentials in Ontario (Ministry of Colleges and Universities, 2018a).

Institutions use the standards set by the OQF to quality assure their programs. Every new post-secondary credential in Ontario must follow the standards set out by the OQF. By starting from the same base standard, every credential should meet the same learning outcomes.

These same learning outcomes set the baseline for quality assurance of current credentials. This relationship between standards and quality assurance ensures that a credential earned in Ontario is the same quality regardless of the institution.

These standards also apply to the transfer of domestic and international credentials. For example, if a student is changing schools, the standards of the OQF are used to identify which credits are transferable. This process also applies to internationally trained professionals trying to work in Ontario. If their credential meets the OQF standards, they will be allowed to practice in their field (Canadian Information Centre for International Credentials, 2020).

Since digital badges are not a part of the OQF, it is currently not possible to quality assure them against a standard in Ontario. Digital badges have a section that identifies an industry partner/external body that endorses the competency (eCampusOntario, 2021), but this validation is industry-specific and only applies to that badge. The OQF includes certificates, diplomas, advanced diplomas, post-graduate diplomas, bachelor's degrees, master's degrees, and doctoral degrees (Ministry of College and Universities, 2018b). Each of these credentials have different standards and expectations for quality assurance. Digital badges are currently not included, but they may be in the future.

For digital badges to be a part of the OQF, they require standards. If digital badges had their own set of standards, their value would be consistent across all Ontario institutions. Some standards do exist for different aspects of digital badges, which we will explore.

IMG Global Learning Consortium, and formerly Mozilla, leads the development of the open badge standard. These standards set the specifications for developing a badge and are available for anybody to use. Its second iteration, Open Badges 2.0, describes the standard method to package and embed information into digital badges (IMG Global Learning Consortium, 2020). The specifications ensure that all badges that follow this method have the same digital structure, allowing for universal integration into existing learning management systems and social media platforms.

By specifying the underlying code of digital badges, organizations now have a base to develop frameworks. For example, eCampusOntario has undertaken the task of expanding the use of digital badges in Ontario. In partnership with a working group, they created the Micro-certification Principles and Framework, which provides a common provincial framework for developing micro-certifications. Using the Open Badge standard for their digital badges, they were able to test and modify their framework.

Standards and frameworks support the construction of digital badges, but they do not assure their quality. For example, every qualification in the OQF states the typical duration for the credential (e.g., a certificate 1 is at least 40 hours of instruction). Neither Open Badges 2.0 nor the Micro-certification Principles and Framework sets guidelines for the duration of a digital badge. Even though the administration uses program duration for other needs (e.g., student number estimates), they provide both students and employers an idea of the amount of work completed. Without these guidelines, future earners can participate in vastly different instructional hours and yet earn the same digital badge.

To ensure digital badge quality, standards for content are necessary. Currently, the International Association of Continuing Education and Training (IACET) is developing digital badge standards. The IACET is presently working on a set of guidelines for metadata detail. These guidelines are not yet complete, but they believe their standards will support the quality assurance process in the future.

Also, credential standards are not new to post-secondary institutions. For example, the Credential Validation Service (2021) ensures that credentials issued by Ontario colleges meet sufficient rigor and credibility by comparing the program outcomes against specific standards.

Even though standards are important, there are other issues with digital badges.

Over time, the credibility of digital badges may improve with the addition of more content-related standards. However, experts argue that credibility does not have to do with the content but with the usage of digital badges.

The current job market is rapidly changing, pushing higher education institutions to adapt their delivery methods. The StrategyCorp Institution of Public Policy and Economy released a white paper with recommendations to promote economic recovery (Davidson & Ruparell, 2020). Their research suggests that automation will take over large parts of the economy, so Ontario's future workforce must develop their skills for the work of tomorrow. Ontario's institutions need to be able to adapt quickly to address market demand.

In a rapidly changing job market, small and quick credentials like micro-credentials may be the solution. Students earn micro-credentials by learning specific competencies. Also, by combining them, they can achieve a full qualification (Pichette & Rizk, 2020). Since competencies are often synonymous with skills, digital badges are the credentialing tool of choice because of their ability to display this information in the metadata. In combination, experts believe that micro-credentials and digital badges present a potential solution to the changing job market.

Even though smaller credentials may fill this gap, some experts believe they may create another problem. For example, unions have criticized Davidson and Ruparell's paper and believe that their vision promotes the gig economy, offering precarious, impermanent work (Ontario Public Service Employee Union, 2020). They think by promoting micro-credentials, institutions will be creating a continuous loop of training for precarious jobs. Instead of focusing on building a foundation of knowledge, the fear is that workers are trained only for short-term work instead of stable, full-time employment.

Besides influencing problems such as the gig economy, digital badges also influence student motivation. Research has shown that digital badges may positively affect student motivation to learn (Abramovich et al., 2013). Critics believe that badges motivate students for the wrong reasons (Resnick, 2012). Motivation to earn badges may undermine the content being learned by shifting the focus from learning the information to accumulating badges.

Even though digital badges have their shortcomings, many still believe in their potential. In their 2019-2020 annual report, the Ministry of Colleges and Universities set out their plans and priorities for the upcoming year. In 2019, the government changed its skills training programs to help job seekers reskill for new jobs. One solution proposed is micro-credentials and digital badges.

Micro-credentials are "a certification of assessed learning associated with a specific and relevant skill or competency" (eCampusOntario, 2021). When an earner completes a micro-credential, they receive a digital badge. Currently, eCampusOntario is developing a framework to help institutions align to a common provincial framework. As more institutions build micro-credentials, digital badges will likely increase. Hence, it is essential to perform further research on the quality assurance of digital badges.

The OQF sets the value of every post-secondary credential in Ontario using descriptions and standards. The descriptions section of the framework outlines the purpose, length, admission requirements, providers, and the qualifications awarded for each credential. The standards section the depth and breadth of knowledge; conceptual and methodological awareness/research; communication skills; application of knowledge; professional capacity/autonomy; awareness of limits of knowledge. Combining the descriptions and standards identifies each qualification's primary purpose and represents a benchmark along the continuum of credentials (Ministry of Colleges and Universities, 2018).

This study uses these benchmarks as a conceptual framework. Since the OQF descriptions and standards define every post-secondary credential, this study uses the same. By investigating the metadata using these categories, this study hopes to understand if the metadata provides adequate information to meet the criteria of the OQF.

This study will use a digital badge pilot project as a case study. In 2019, eCampusOntario ran a pilot project developing micro-certifications using digital badges. Each project constructed a digital badge using the framework created by eCampusOntario. This study hopes to add to the research on digital badge quality assurance by investigating if developers in this pilot project are providing sufficient information to meet the criteria of the OQF. This study also hopes to add to the research by exploring the similarities and differences between the metadata to find patterns of good practice.

METHODOLOGY

To better understand how to convey the value of digital badges, it is crucial to investigate the quality of the metadata.

All digital badges provide program-specific information within their metadata. However, there appears to be no research investigating the quality and value of the metadata information conveyed.

This research aims to fill this gap by performing a case study on a digital badge pilot project, using a mixed-methods content analysis design, to answer the following questions:

- What are the similarities and differences between the metadata of digital badges?
- Is the information provided in the metadata relevant to stakeholder's understanding of value?

Research Design

This case study used mixed-method content analysis to investigate metadata quality. Since digital badges are text-based, other methods such as discourse analysis and textual analysis are possible. But the content analysis method determines the presence of words, themes, or concepts from qualitative data; this method allows researchers to quantify and analyze the presence of meaning and relationships (Columbia Public Health, 2019).

This study used the OQF description and standards for its content analysis scoring. Also, to understand the digital development process, developers participated in an open-ended survey or interview.

Data Collection & Analysis

For the content analysis, this study will use the criteria set by the OQF. The OQF consists of five descriptions and another five standards:

- OQF descriptions
  - Purpose
  - Length
  - Admission Requirements
  - Provider
  - Qualification Awarded
- OQF standards:
  - Depth and breadth of knowledge
  - Conceptual and methodological awareness/ research
  - Communication skills
  - Application of knowledge
  - Professional capacity/autonomy

The content analysis scoring method used a range from **0** to **2**.

- **0**: If there was no evidence of the criteria in the metadata.
- **1**: if there was evidence to infer the criteria in the metadata.
- **2**: if the metadata explicitly explained the criteria.

In addition to the content analysis, this study will use open-ended surveys or interviews.

The survey and interview consisted of the same eight questions:

1. What was your experience explaining digital badges to your stakeholders (i.e., faculty, employers, earners)? Did they understand the value, or did they require some convincing?
2. Besides the headings provided by the BC Diploma for the metadata, did you use any frameworks to decide which information to provide?
3. For the pilot project, did you create one badge, or did you create a set of digital badges?
4. Can you describe your assessment?
5. Can you explain how your assessment demonstrates the skills/competencies in your course?
6. Did you use the evidence feature of the digital badge?
   - If yes, what type of evidence did you provide? Where was the information saved?
   - If no, why did you not include any evidence?
7. Do you believe your stakeholders (i.e., faculty, employers, earners) were very interested in digital badges?
8. Did you have any other issues with your digital badge?

The goal of these open-ended questions was to understand the decisions behind the metadata presented.

Participants

Participants in this case study were a part of a micro-certification pilot project by eCampusOntario (2019). The investigator contacted each of the 14 institutions to participate in this case study. Five institutions were removed from this study because they could not complete the project and create digital badges. Another three institutions decided not to participate in the case study.

For the analysis, the digital badges were publicly available through the badge issuing company. Four institutions participated in the open-ended interview, and the remaining two participated in the open-ended survey.

Limitations

The main limitation of this case study was the small sample size. Only nine of the fourteen institutions developed digital badges. Of those nine, only six participated in this study. Therefore, due to the limited number of participants, there is low generalizability from this study's findings.

In addition, the method in this study had its limitations. For example, having multiple digital badge assessors would improve the reliability of the analysis and minimize bias.

RESULTS

Ontario Qualification Framework Descriptions

This investigation analyzed the content within digital badge metadata to find similarities and differences in quality. The first

phase of the content analysis focused on the OQF descriptions (Table 1). Each badge represents a different institution, teaching other skills.

Table 1: *Content analysis using the OQF qualification description*

Scoring:

- **0**: If there was no evidence of the criteria in the metadata.
- **1**: if there was evidence to infer the criteria in the metadata.
- **2**: if the metadata explicitly explained the criteria.

QUALIFICATION DESCRIPTION	Institution 1	Institution 2	Institution 3	Institution 4	Institution 5	Institution 6
Overall program design and outcome emphasis	2	2	2	2	2	2
Preparation for employment and further study	2	1	1	2	2	1
Typical duration	0	0	1	1	0	1
Admission requirement	0	0	0	0	0	0
Qualification	2	2	2	2	2	2

The content analysis of digital badges using the OQF descriptions found two categories clearly explained. All six badges clearly explained the Overall Program Design and Outcome Emphasis and Qualification.

This study found three OQF description categories unclear. Three badges clearly explained the Preparation for Employment and Further Study, but the other three were incomplete. Only one badge clearly explained the Typical Duration, but two badges needed inference, and three provided no evidence. Also, no digital badges provided any evidence of Admission Requirements.

Ontario Qualification Framework Standards

The second phase of the content analysis focused on OQF standards (table 2).

Table 2: *Content analysis using the OQF qualification standards*

QUALIFICATION DESCRIPTION	Institution 1	Institution 2	Institution 3	Institution 4	Institution 5	Institution 6
Depth and breadth of knowledge	2	2	2	2	2	2
Conceptual and methodological awareness / Research and scholarship	1	2	1	1	1	2
Communication skills	1	2	1	1	1	0
Application of knowledge	1	1	1	1	2	1
Awareness of limit of knowledge	1	1	0	1	0	0

The content analysis of digital badges using the OQF standards found only one category clearly explained. All six badges clearly explained the Depth and Breadth of Knowledge.

This study found five OQF standard categories unclear. Conceptual and Methodological Awareness/Research and Scholarship and Professional Capacity/Autonomy had two badges clearly explaining these categories. Only one badge clearly explained Communication Skills and Application of Knowledge. Also, no badges clearly explained Awareness of Limit of Knowledge.

Location Of Evidence Within The Metadata

This study also identified the location of category evidence within the metadata.

This study found that the location of evidence was similar between the digital badges. All six digital badges provided evidence in the same location for five categories (Preparation for Employment and Further Study; Typical Duration; Application of Knowledge; Qualification; Application of Knowledge; and Awareness of Limit of Knowledge). Four categories (Overall Program Design and Outcome Emphasis; Depth and Breadth of Knowledge; Conceptual and Methodological Awareness/ Research and Scholarship; Communication Skills) had five of six badges providing evidence in the same location. Moreover, only one category provided evidence in three different locations (Professional Capacity/Autonomy).

Also, none of the badges used the evidence feature of the metadata. The evidence feature provides a link for developers to embed examples of the assessment completed by earners. Most developers did not use the evidence feature because they did not have the resources. First, there was no service available to upload evidence. Second, most badges used a quiz or a test to evaluate the students. These developers wanted additional training on creating different assessments that could provide better visibility of the skills achieved, rather than posting the tests' scores.

DISCUSSION

This study found that institutions are interested in increasing their use of digital badges. In the interviews and surveys, developers

Table 3: *Content location within the metadata using the OQF qualification description*

QUALIFICATION STANDARD	Institution 1	Institution 2	Institution 3	Institution 4	Institution 5	Institution 6
Overall program design and outcome emphasis	Title	Outcomes	Title	Title	Title	Title
Preparation for employment and further study	Outcomes	Outcomes	Outcomes	Outcomes	Outcomes	Outcomes
Typical duration	Assessment	None	Assessment	Assessment	Assessment	Assessment
Admission requirement	none	none	none	none	none	none
Qualification	Title	Title	Title	Title	Title	Title

Table 4: *Content location using the OQF qualification description*

QUALIFICATION STANDARD	Institution 1	Institution 2	Institution 3	Institution 4	Institution 5	Institution 6
Depth and breadth of knowledge	Title	Outcomes	Outcome	Outcomes	Outcomes	Outcomes
Conceptual and methodological awareness / Research and scholarship	Competency / skill	Competency / skill	Competency / skill	Outcomes	Competency / skill	Competency / skill
Communication skills	Competency / skill	Competency / skill	Competency / skill	Competency / skill	Outcomes	None
Application of knowledge	Assessment	Assessment	Assessment	Assessment	Assessment	Assessment
Professional capacity/ autonomy	Component of	Component of	Outcomes	Component of	Competency / skill	None
Awareness of limit of knowledge	Component of	Component of	none	Component of	None	None

expressed that their institutions were supporting them in this pilot project. Most projects decided to start with only one digital badge. So, they focused on the quality of the badge rather than the quantity.

Even though there is interest, institutions are still learning about digital badges. For institutions and industry partners who were new, developers mentioned that they had to teach them about digital badges. Although, once they understood the concept, they were interested in participating.

As more institutions adopt digital badges, this study maintains the importance of industry partner endorsement. For example, one institution worked with industry partners who could not provide sufficient professional development for their employees. Because of this need, they were willing to join the project and further promote their employees' badges. Therefore, this paper reiterates the importance of industry support for digital badge development.

Relevancy Of Metadata Information

This study found that the metadata lacked sufficient information to convey their value. All the digital badges clearly explained only three of the eleven OQF categories. For the other eight categories, stakeholders must infer the evidence, or there was no evidence at all. Since most categories were not clear, this study argues that the digital badges in this pilot project did not have sufficient information to convey their value.

Although more research is needed because of the small sample size, only nine of the fourteen institutions completed the project. Furthermore, of those nine, only six participated in this study. Therefore, readers must note that this was a small sample size, and there is limited generalizability in Ontario from these findings.

Even though the sample size is small, the evidence suggests that the missing information may contribute to stakeholders' misunderstanding of digital badge value. The OQF categories distinguish between different credentials and their value. Since digital badges do not clearly explain all of these categories, it is not easy to determine the value between different digital badges and other credentials.

Metadata Similarities

The location of evidence within the metadata was similar between digital badges. For 10 of 11 categories, the evidence location was in the same location for at least five out of the six badges.

Even though the location was consistent, there was one category missing. The category of admission requirements was not in the metadata. Even though significant, it was not an expectation for developers to include this information.

The evidence from this study suggests that digital badges can hold all of the information in the OQF. In the future, the OQF can be applied to the metadata sections to provide information that conveys the digital badge's value.

Metadata Differences

One significant difference between the metadata was the amount of content taught. For example, one digital badge requires an earner to complete five self-paced modules, whereas another had to complete an entire course with a co-op work term. In another example, one digital badge requires earners to complete three assignments and two quizzes, whereas another requires only one summative assessment.

The variability in the curriculum may be due to the lack of standards for digital badges. Even though each digital badge in this pilot project followed the framework set by eCampusOntario, there were no guidelines for the course structure. Therefore, the lack of curriculum standards for digital badges may influence the variability in expectations.

This study suggests that the difference in expectations may contribute to the lack of understanding of digital badge value. For each credential in the OQF, the expectations in workload are the same. For example, every certificate has no more than 700 instructional hours. In the case of the badges in this study, the number of hours varied. Since the workload is not the same for each digital badge, their perceived value may differ according to their expectations.

Future Outlook Of Digital Badges In Ontario

Currently, digital badges are recreating the traditional classroom experience. Some digital badges were indistinguishable from a traditional in-person class format with the same assessment requirements (i.e., quiz and assignments). In other cases, part of the badge expectation was to complete an actual credit post-secondary course.

To take full advantage of digital badges, developers may benefit from reimagining the classroom experience. For example, no digital badges used the evidence feature. This feature is one of the unique features of digital badges, allowing earners to show their accomplishments. Since the standard credential does not require posting evidence, most developers were unsure how to do this.

The evidence suggests that developers need to reimagine the learning experience to support digital badges as a new credential. From the interviews and surveys, developers expressed help in reimagining their courses to better use the badges' abilities. If developers transport the typical course from a paper credential to a digital badge, there is no additional value other than its portability. Therefore, having well-defined metadata following OQF criteria may increase the credibility of the digital badges.

Future Research

Building on the digital badge quality assurance research, this study suggests developing standards for the metadata. Since 10 of the 11 categories were consistently within the metadata, this study suggests that digital badges can hold all OQF categories.

The results of this study recommend placing the OQF categories in the sections outlined in table 5.

In addition to standardizing the location of evidence, this study also suggests standardizing the metadata's content. Only three of the eleven categories were well described. If there was guidance on how to write each section so that the information meets the OQF categories' expectations, then the metadata will better convey its value to stakeholders.

TABLE 5: *OQF category and location of evidence best suited for metadata*

OQF CATEGORY	METADATA LOCATION
Overall program design and outcome emphasis	Title
Preparation for employment and further study	Outcomes
Typical duration	Assessment
Admission requirement	none
Qualification	Title
Depth and breadth of knowledge	Title
Conceptual and methodological awareness / Research and scholarship	Competency / skill
Communication skills	Competency / skill
Application of knowledge	Assessment
Professional capacity/autonomy	Component of
Awareness of limit of knowledge	Component of

CONCLUSION

This study sought to investigate the quality of digital metadata, using the OQF as a conceptual framework. The evidence suggests that stakeholders may be misunderstanding the value of digital badges because of missing information and inconsistent workload. Also, this study found that the metadata can hold all of the evidence related to the OQF. For these reasons, this study suggests developing standards for digital badges in line with the OQF categories and placing them within the metadata.

One limitation, though, was the small sample size for this case study. Only six of the fourteen institutions of the pilot project participated in this case study. Therefore, another investigation with a larger sample size will further the research.

In addition to quality assurance, the results from this study suggest that developers should reimagine their course content and assessments for digital badges. The institutions in this study were unable to use all of the digital badge features. Institutions relied on traditional classroom formats, which did not translate to the evidence feature. If developers start to design new forms of learning and assessments, digital badges may carve a unique credentialing niche.

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Original Research Article*

Back to Basics? Facilitating the Recognition of Micro-Credentials in Ontario PSEs

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Abstract

Support for micro-credentials has grown significantly over the past year within Ontario post-secondary education (PSE). However, significant barriers remain to their widespread recognition both within and outside of PSE. This piece focuses on the indirect benefits associated with maximizing the recognition of micro-credentials within Ontario PSE, including the maximization of student interest, promotion of employer recognition, as well as mitigation of equity-related concerns. It outlines a set of tactics to facilitate the recognition of micro-credentials within the specific context of Ontario PSE, including amendments to the Ontario Qualifications Framework, the establishment of a fully transferable "common core" of micro-credentials, and the need for systematic empirical tracking. These topics are approached from the vantage point of transfer research and policy in Ontario.

Keywords: micro-credentials; Ontario; transferability

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INTRODUCTION

Interest in micro-credentialling has skyrocketed in Ontario PSE (post-secondary education). The blistering pace of developments in this space make it difficult for even the keenest of specialists to keep up. Over the past few years, not only have we have seen eCampusOntario (2020) develop a framework to guide micro-certification initiatives in the province, but also several other distinct visions for micro-credentialling. These include Colleges Ontario (Davidson & Ruparell, 2020), College and Institutes Canada (2021), the Higher Education Quality Council of Ontario (Deakin et al., 2021) and the Ryerson-based Future Skills Centre (Chaktsiris et al., 2021). Perhaps most importantly, we observed the Ontario government fully embrace micro-credentials as a training solution by:

i. rendering micros eligible for funding via the Ontario Student Loans Program (OSAP); and,
ii. investing vast sums to improve micro-credential offerings (Government of Ontario, 2020).

These peak levels of interest in micro-credentialling should inspire much excitement in the PSE community, but also deep reflection on the challenges that lay ahead. It is important to remember that PSE is an incredibly obdurate field (Pizarro Milian et al., 2016), one that resists change and innovation despite positive affirmations we hear from college and university presidents, or politicians. Indeed, the widespread adoption and recognition of micro-credentials across Ontario PSE remains far from guaranteed (Pizarro Milian & Davies, 2020).

This piece addresses one critical problem that is frequently sidestepped by supporters of micro-credentialling or addressed only at a highly conceptual level (for an exception, see Gooch, 2020): the within-system recognition or "transferability" of micro-credentials. Here, the term transferability refers broadly to the recognition of micro-credentials awarded by one PSE organization by the rest of its peers within the system. This problem, solutions to it, and the broader arguments presented herein are approached from the vantage point of transfer credit research and policy in Ontario. In this adjacent sphere, policymakers and other stakeholders in Ontario continue to struggle to promote the recognition of courses across colleges

and universities, despite years of effort and strategic financial investments by the provincial government. Given this experience, and the relative novelty of micro-credentials in Ontario PSE, it is argued—as done elsewhere (Peppler-Beechey & Weingarten, 2021)—that micros will similarly struggle to achieve within-system recognition. This challenge is far from unique to Ontario. Indeed, Lockley et al. (2016) have noted within the Australian context that "most institutions do not currently provide credit for the sub-elements of a full subject/unit," and that changing this "would require major policy, system and cultural change" (p. 62). To help mitigate this situation in Ontario PSE, a set of plausible tactics to promote the system-wide recognition of micro-credentials in Ontario PSE are outlined.

The perspective presented in this piece contrasts the focus of contemporary discourse on micro-credentials, which concentrates on their "disruptive" potential and on ensuring maximum alignment with employer demands. Analysts at the Higher Education Quality Council of Ontario (HEQCO), for example, have argued for the primacy of maximizing the independent value of micro-credentials, painting efforts to promote within-system recognition or "stackability" as being of only secondary importance (Deakin et al., 2021; Pichette et al., 2021). Indeed, even one of the anonymous reviewers of this manuscript cautioned that its focus on transferability was out of step with current discourse, and reflective of the authors being in the "wrong ballpark!" However, as outlined through this manuscript, considering these goals as mutually exclusive is short-sighted given that maximizing within-system recognition can enhance the legitimacy of micro-credentials among employers, and facilitate the success of the broader micro-credentialling enterprise in Ontario.

ANALYTICAL APPROACH

There has been sustained interest in how the study of policy frameworks across other jurisdictions—such as Australia, the European Union, and New Zealand—could inform the development of micro-credentials in Ontario, and Canada more broadly (e.g., Chaktsiris et al., 2021, p. 14; Duklas, 2020; Presant, 2020). Policy innovations proven effective elsewhere could be emulated or transplanted to our province. However, there has been limited effort to draw on the experiences of adjacent policy spheres within Ontario itself, and in particular, the field of transfer, as a source of insight. It would be naïve to expect that policy borrowing—either across jurisdictions or policy spheres—could be straightforward or seamless. When policies are transplanted, they often mutate into forms that reflect their new environments (Cummings, 2003), and produce unexpected results. Despite such complexities, Burdett & O'Donnell (2016) suggest that drawing on "lessons learnt from other contexts can, and should, be a powerful tool in the field of comparative education and policy-making" (p. 113). There is much to be gained from studying foreign policies, as long as one carefully considers how local cultures, histories and other factors influence their success in particular scenarios (Lingard, 2010, p. 132).

The piece thus approaches the within-system recognition of micro-credentials from the vantage point of credit transfer in Ontario, with the underlying assumption that the latter's longer history promoting the recognition of formal learning can inform strategies in the micro-credentialling space. Again, the operating assumption is not that a perfect blueprint can be drawn from the Ontario credit transfer experience—as existing structures in this sphere are far from perfect—but rather, that some degree of fruitful cross-pollination can occur between these fields.

A BRIEF OVERVIEW OF MICRO-CREDENTIALS

It is useful at this point to define what we mean by "micro-credentials." As colleagues at HEQCO (Pichette & Rizk, 2020) have recently observed, despite the furor with micro-credentialling, there is considerable ambiguity around the term (also see Academica Group, 2021, p. 11-12; Contact North, 2020). Based on a reading of definitions used across recent academic articles (e.g., Wheelahan & Moodie, 2021) and the "gray" literature, there appears to be an understanding that micro-credentials are signals representing smaller than normal units of learning. As Milligan & Kennedy (2017) outline, "micro-credentials focus on modules of learning much smaller than those covered in conventional academic awards, often allowing learners to complete requisite work in a matter of weeks" (p. 4, emphasis added). Algonquin College (2020) similarly defines micro-credentials as a "granular certification that an individual has mastered certain skills or competencies, earned through the completion of short and purposeful skills-based learning experiences" (emphasis added). The acquisition of the abovementioned knowledge can occur online, in-person, or via blended formats (Kato, Galán-Muros & Weko, 2020). The learning validated by micros can be evaluated through either formal, standardized testing or via the completion of course assignments or projects, and certified either via paper or digital credentials (Kato, Galán-Muros & Weko, 2020). In practice, many configurations exist, and more are likely to emerge as experimentation with micro-credentials continues.

Since their conception, micro-credentials have been heralded as a tool to "unbundle" traditional degrees, rendering the human capital contained within them more accessible to the masses

(Olneck, 2018). The broader vision is one of a shopping mall college or university, where individuals are granted "just-in-time" access (Kohler et al., 2021; Resei et al., 2019) to skills or knowledge without being subject to rigid admissions standards, faculty mandated course requirements, and other bureaucratic hurdles that must be endured in the pursuit of traditional "macro" credentials (e.g., diplomas, degrees). One of the great promises of micro-credentials is that students will be able to "stack" them into something bigger. At Humber College (2020), for example, it is proposed that students "may have the opportunity to combine individual micro-credentials to earn full credentials such as certificates and diplomas." To the south of Ontario, the State University of New York (2018) also accepts as one of its guiding principles that micro-credentials should "stack toward a registered certificate or degree" (p. 5). By serving as a gateway credential to higher learning, it is normally expected that micros could augment access to traditionally exclusionary PSE systems.

A system of more granular signals of skills is depicted by many as facilitating the efficient matching of jobseekers and employers (Hope, 2017). The broader context is that markets are now saturated with PSE graduates, but growing homogeneity in their credentials makes it difficult for employers to screen based on workplace competencies. As Peck et al. (2016) argue, within this scenario, rather than "relying on the sparse information of college transcripts and perhaps inaccurate information from references, a set of digital badges could give an employer a clear idea of what skills and employee brings to the table" (p. 90). Others similarly argue that micro-credentials can paint a "well-rounded picture of knowledge and competencies that resumes and degrees do not reflect" (Alliance for Excellent Education, 2013, p. 8; also see Lockley et al., 2016, p. 59). Barabas & Schmidt (2016) perhaps put it best when they suggested that:

The more fine-grained these signals get, the less they look like "credentials," per se, and the more they look like a corpus of data that can be processed in novel ways to yield insights into workers' abilities and potential. (p. 6)

Some within PSE (e.g., McCowan, 2017; Lewis & Shore, 2019), of course, opine that the "neo-liberal" unbundling of traditional credentials in this manner may be dangerous or problematic for an array of reasons. Two contrasting and prominent arguments have been raised thus far about their impact on social inequality. On the one hand, some fear that already disadvantaged learners may be disproportionately encouraged to forego traditional certifications, and streamed into "untested" micro-credentials (Kift, 2021, p. iii). In this account, micro-credentials may become the new "basement" of PSE and training:

The poor, unemployed, older, disenfranchised, racialized and other marginalized students will get a micro-skill that comes with a built-in glass ceiling, while privileged students get a more thorough, transferable education. (OPSEU, 2020)

At the other end of the spectrum, others worry that, should micro-credentials become a "reliable path" to broader credentials: "they might become 'weaponized,' with a specialized support industry growing to advise well-resourced students about the 'best' badges for college admission" (Fishman, Teasley, & Cederquist, 2018, p. 15). Irrespective of whether micro-credentials become highly valuable symbols or not, alarms have been raised about their ability to feed into social stratification processes.

Though debate ensues about the benefits and drawbacks of micro-credentials, their recent endorsement by the Ontario government as a vehicle through which to provide expedited re-training means that efforts to streamline their development and adoption across the province will be "turbocharged." Nevertheless, there are basic questions about their within-system recognition that remain unsatisfactorily addressed in either policy discourse and, given the recency of these developments, the academic literature.

THE PROBLEM OF RECOGNITION

The way that micro-credentials could interface with, and come to mirror, employer needs has attracted extensive attention within academic and policy documents. Recent micro-credential pilot projects funded by both eCampusOntario and the Future Skills Centre have also been guided by a strong ethos of cross-sector collaboration, including intriguing collaborations between PSE organizations and employers from various industry and community sectors. As such, there is little question about the potential for micros to be synchronized with, or tailored to meet, employers' evolving training needs.

Far less attention has been directed at the mechanisms that could ensure that micro-credentials—and the learning they represent—will be recognized across PSE systems. This remains true even though manufacturing "collective belief" in micro-credentials among consequential stakeholders, including administrative staff, faculty, and students, has been described as a "wicked problem" by experts in the field (Grant, 2016, p. 91-92). At the time of writing, the non-recognition of traditional courses is a well-known problem across many provinces in Canada (Pizarro Milian & Munro, 2020), and a large collection of American states (Giani, 2019; Jenkins & Fink, 2015; Simone, 2014; United States Government Accountability Office, 2017). Research on this topic is quite clear: most students that transfer during their PSE journeys experience some degree of credit loss. Given these priors, there is

no reason to believe that micro-credentials will fare any better in the absence of adequate policy efforts to ensure their recognition. Indeed, scholars have repeatedly observed that more applied, skills-oriented training—such as that typically signaled by micro-credentialling systems—is given "short shrift" during transfer credit assessments, "counting as electives at best or not at all at worst" (Book, 2015, p. 201-202).

Why is this a problem? There are several reasons why the recognition of micro-credentials across PSE should be of import to those spearheading their development. First, full recognition can help to maximize student interest in micros. If the goal of the micro-credentialling movement is to go "mainstream"—attracting the average college and university student, and not just a segment of mature students needing to quickly up- or re-skill—then work done towards acquiring micro-credentials needs to count towards the total number of credits required for a macro credential. This ensures that micros are perceived not as a detour from the pursuit of macro credentials that currently dominate the market—requiring additional time and tuition—but rather, as a built-in component of existing pathways. This design decision renders micro acquisition as a pathway that produces no additional resistance.

Some have argued that one solution to achieve this outcome would be to build groups of domain-specific micro-credentials into degrees, such as an assortment of "badges" for programming languages (e.g., Java, Python) into computer science programs (LaMagna, 2017). This is something that colleges and universities have experimented with (Zanville, Porter, & Ganzglass, 2017; Prebil & McCarty, 2018). However, such strategy will not be maximally effective if students know that the work done towards acquiring those credentials will not be recognized at other organizations. To have "currency", micros "must be recognised and accepted beyond the issuing institution" (Lockley et al., 2016, p. 62). Data from the U.S. tells us that roughly a third of students transfer to a second organization within six years of enrolled in PSE (Shapiro & Dundar, 2015). In Ontario, recent reports suggest that roughly 8% of students transfer within the first two years of study alone (Zarifa et al., 2020). If students who intend to transfer—be it from college to university, or in another direction—fear that credits earned through micro-credentials will not carry over, this will serve as a very strong disincentive to their uptake. The same is true if micro-credentials will not be formally recognized by graduate, law, and other professional schools during admission decisions.

Second, ensuring the recognition of micro-credentials across PSE also serves to maximize their legitimacy in the eyes of prospective employers. An intriguing feature of credentials as labor market signaling devices is that their value is determined not just by the utility of the human capital they represent, but by the institutions that endorse them (Craig, 2015; Willis III et al., 2016). Even then, establishing trust in a new credential category is a difficult exercise (Barabas & Schmidt, 2016). Increasing the number of educational organizations that formally recognize a micro serves as useful strategy to signal to employers that it is indeed trustworthy. Indeed, if there is no mutual recognition of micro-credentials among colleges and universities within the same province, what does this implicitly signal to employers about their quality? As an example of the strength of mutual recognition, consider this hypothetical: a small northern Ontario college could certainly develop a micro-credential in an area of expertise (e.g., mining, forestry) that becomes widely recognized by regional employers. With some time, if they excel in such training, the recognition of this hypothetical micro-credential could spread even further. Now, consider an alternative scenario, where a network of colleges across northern and rural Canada collaborated to develop a state-of-the-art micro-credential in the same area, developing a consistent and expedient training program that is fully transferable, and carrying the endorsement of each of their institutional brands. Which of the abovementioned micro-credentials is most likely to carry greater currency among employers?

Equity is the third reason why the within-system recognition of micro-credentials across PSE should be pursued vigorously. It is unlikely that, if micro-credentials become widely offered across our PSE system, they will be perceived as equivalent to traditional credentials by either students or employers. History shows us that whenever a new organizational type, credential or other innovation has been introduced to PSE, as a rule, it has been subordinating to pre-existing alternatives. This was true for American community colleges (Brint & Karabel, 1991), for-profit colleges (McMillan-Cottom, 2017), online universities (Davies & Zarifa, 2012), and other notable upstarts. In each of the abovementioned cases, we saw that it was primarily students from traditionally marginalized groups that flocked to the new seats created by these less lucrative options, at times with less than desirable academic and labor market outcomes. Obviously micro-credentials in Ontario are a qualitatively distinct case, as they will be offered by reputable actors. But, at the same time, there is no evidence even mature students will pursue untested micros as opposed to enrolling part-time in a post-graduate certificate or master's degree offered by the same organization.

In the event that micros eventually become a second-tier track within our system, it is of the utmost importance that students who take them have the ability to apply the learning

and academic credit accumulated through them to conventional macro-credentials. This will ensure that these students do not face unnecessary barriers to advancing their education. Such rationale has long been used within the field of transfer research and policy to justify the construction of pathways between the community college and university sector.

SOME STRATEGIES TO PROMOTE RECOGNITION

If the within-system recognition of micros can maximize student interest, legitimacy, and equity, then it is incumbent on developers of micro-credentialling programs within PSE organizations and other stakeholders to do the work required to render micros as widely recognizable as possible. To this end, the next sections of this manuscript outline a series of tactics constituting part of a broader policy strategy to maximize the recognition of micro-credentials in Ontario PSE. This strategy is grounded in part in knowledge of policy innovations and practices that have worked (and failed) in achieving the transferability of course-based credits and programs in Ontario and other jurisdictions (Missaghian, 2020). We hope that raising these strategies kick-starts more inclusive discussions of this topic within the Ontario PSE community.

RECONFIGURING THE OQF

Qualification frameworks typically outline the knowledge or competencies that PSE programs at various credential tiers are designed to provide learners. The Ontario Qualifications Framework outlines this information for a range of credentials offered across all sectors of the provincial system, including public colleges and universities, private career colleges and Indigenous institutes. A key function of the OQF is that it provides the foundation for quality assurance, ensuring that credentials adhere to the same standards regardless of where they are offered (Ontario Ministry of Colleges & Universities, 2020). Inclusion in the OQF facilitates an objective comparison and mapping of credentials, and thus, the fair evaluation of equivalencies between units of learning during transfer credit decisions.

At the time of writing, micro-credentials are not included in the OQF (Gooch, 2020), nor does there appear to be a concerted effort to push for their inclusion (Usher, 2021). This produces considerable ambiguity as to what type or amount of learning they actually represent and will arguably serve as a significant barrier to their formal recognition across PSE organizations. This could lead to unpredictable results during routine processes, such as transfer credit assessments and other evaluations of transcripts for various organizational purposes (e.g., graduate admissions). Inclusion in the OQF would clear up a lot of this haziness about what micros are, as it would provide evaluators with a basic understanding of how they relate to existing and recognized credential categories.

Using the most basic and objective criteria available—instructional hours—it is possible to assess whether any existing categories in the OQF could incorporate micro-credentials. Let us first recall that micros are intended to be completed expeditiously, in a matter of a few weeks (see Milligan & Kennedy, 2017). While the Commonwealth of Learning suggests micro-credentials can be anywhere from one to 100 hours in length (COL, 2019), other sources highlight that they tend to be much shorter. McMaster University's (2020) Faculty of Engineering recently defined micros as encompassing nine to 12 hours of learning. This was rationalized as the equivalent of taking 3 hours of learning every week, over a three-to-four-week period. Looking at the OQF, there is only one credential category below the 100 instructional hours mark: The Certificate 1, which requires at least 40 instructional hours. The next longest credential, Certificate 2, requires at 240-500 instructional hours, and would exceed the definition of what most would deem as "micro". The province could move to formally designate Certificate 1 as the category that micro-credentials fit under within the OQF. Further amendment would also be required to allow all institutional types in Ontario to offer the credential, as it is currently set aside for private career colleges and Indigenous institutes. That, or there could be an introduction of a shorter micro-credential category into the OQF, consisting of less than 40 instructional hours. Either move would facilitate the comparison and recognition of micro-credentials, via the standardization of the credential.

This focus on formal categorization may appear superficial, bureaucracy-driven, or even pedantic to some. However, decades of sociological and organizational theorizing demonstrate that social categories are essential to how individuals make sense of their surroundings (Lamont & Molnar, 2002). And, in particular, how they make status distinctions (Delmestri & Greenwood, 2016). The latter are particularly important within PSE, where meaning and value are often attributed to credentials based on their associated organizational brand, and quite independent of any objective criteria (Brankovic, 2018; Pizarro Milian, 2017). Such status distinctions also eventually bleed into the labor market, with perceptions of credentials and their cultural significance fundamentally shaping employer recruitment and hiring practices (Rivera, 2015). All this to say: micro-credentials cannot be left in the ether and should be formally included in the OQF if they are to achieve wide recognition within the PSE system.

Ontario would not be innovating in following this course of action. Indeed, New Zealand has already introduced micro-credentials into their qualification framework, and similar discussions have taken place in other jurisdictions (Selvaratnam & Sankey, 2020; Wheelahan & Moodie, 2021).

ESTABLISHING A "COMMON CORE"

Having established general parameters around what micros should look like, via formal inclusion in OQF, groups of system stakeholders could then work towards the development of a "common core," meaning an agreed-upon batch of micro-credentials that transfer seamlessly across segments of the PSE system. This is a strategy that has worked in numerous American state systems to ensure full recognition of course-based credits (Logue, 2017), and typically relies on strong government leadership, endorsement, and enforcement. However, in the absence of a central entity that could legally mandate a common core in Ontario, this work would require an extensive amount of collaboration and consensus-building across our system. There is no precedent for this level of collaboration in the Ontario transfer system, where articulation agreements are typically bilateral, and when multi-lateral, tend to include only a subset of the system's colleges or universities.

One potential avenue through which to push this work forward would be for the provincial government tap existing hubs, such as the Council of Ontario Universities (COU) or Colleges Ontario (CO), to facilitate discussions for the development of an initial set of university or college sector specific micros. Breaking discussions down further, and starting even "smaller", could entail focusing on specific program areas within sectors, such as business or nursing. Within the college system, the Heads of Business group has been successful in establishing one of Ontario's most wide-reaching articulation agreements, ensuring the transferability of business courses across the province's colleges (see ONCAT, 2020). This agreement could provide a template for the development of a set of fully transferable, business-related micro-credentials in the college sector. Another avenue at the discipline level could entail using professional bodies or accreditors, such as the Chartered Professional Accountants (CPA) or other groups, to design and endorse the adoption of a particular set of professionally oriented micro-credentials.

An important consideration, given the collaborative and labor-intensive nature of the approach proposed above, is how to prioritize the development of micros across areas. Rather than letting all interested stakeholders run off to develop their own set of micro-credentials, it may be prudent for the provincial government to prioritize areas with demonstrated industry demand. Research on the demand for industry certifications—arguably the closest conventional certification to micro-credentials—suggests that their demand is far from even. As a Burning Glass (2017) analysis of 700 million job advertisements found, the top 50 industry certifications accounted for roughly two-thirds of all those requested on job advertisements. Moreover, the demand for certifications varied significantly across job categories, from 2% of job ads related to sales positions to 18% in business and financial operations. The same could be true for the distribution of demand for micro-certifications, though more research is needed in this space. Once high demand is identified, government support for micro-certification development, including both financial support and formal endorsement, should be highly targeted.

EMPIRICAL TRACKING

In a scenario where micro-credentialling enjoys the sustained support of the provincial government and other system stakeholders, and where they eventually proliferate across our system, empirically tracking their evolution would afford multiple benefits—which we highlight below. These benefits would be amplified if micro-credential development remains a decentralized process—spearheaded by colleges and universities—rather than centrally orchestrated effort, by either the provincial government or one of its agencies.

From a purely administrative standpoint, formalizing the within-system recognition of a micro-credential requires an articulation agreement identifying its equivalency with another micro, or between the focal micro and other units of learning (e.g., course credits). Establishing this equivalency requires a formal evaluation of curriculum documents (e.g., course outlines) by faculty members at each of the institutions covered by the agreement (Missaghian, 2021). At the moment, a key barrier to articulation involving micros is there is limited public information about them. Indeed, the recently created database of Ontario micro-credentials setup by the provincial government offers no details beyond a short title and duration. Nor does it link to any website containing said details or provide contact information for individuals associated with these micros. Given this paucity of information, it would prove very difficult for faculty member tasked with evaluating a micro for transfer credit to make an informed decision. This sets the table for significant credit loss, with work done towards the achievement of micro-credentials likely not counted towards the completion of macro-credentials. One way to overcome this information problem would be for all micro-credentials (and associated information) to be included in the

provincial government's database. This is a solution which should have been implemented long ago in Ontario for course outlines, to support transfer credit assessment.

Beyond a central database for administrative purposes, it would also be important to develop the adequate data infrastructure to track what students are completing micro-credentials. This information would be useful for two primary reasons. First, to track student demand for, and satisfaction with, micro-credentials, intelligence which could in turn inform augmented offerings across topic areas. Second, data identifying completion of micros could be incorporated by colleges and universities into cyclical reporting for Statistics Canada's Postsecondary Student Information System (PSIS), which is tied to tax records and an assortment of other administrative datasets. At this point, there is no solid research which ties micro-credentials to improved labor market performance (Boud & St Jorre, 2021). And the little research that does exist suggests that their perceived value is lacking (Grant, 2016, p. 99). As such, it is unclear what labor market value they provide. Systematically tracking and quantifying the returns to micro-credentials could go a long way towards legitimizing micro-credentials as an essential component of the credential ecosystem (Gander, 2016, p. 81-82).

A NOTE ON INDUSTRY-BASED MICRO-CREDENTIALS

Up to this point, we have focused on the recognition of micro-credentials across colleges and university. This discussion has generally excluded the large swath of micro-credentials that have been developed and offered for some time by corporations, such as Microsoft, LinkedIn, and IBM. There are many challenges to the full-scale recognition of industry-based micro-credentials in PSE, given the sheer diversity that exists across the former (Kato & Weko, 2020). Existing models for establishing equivalencies between industry-based micro-credentials and the course content offered by PSE organizations require extremely labor intensive, bi-lateral articulation. For example, Leaser et al. (2020) discuss a collaboration between Northeastern University and IBM, whereby these two entities established an articulation agreement between a set IBM's digital badges and a Northeastern professional M.A. program. This arrangement allowed individuals with IBM digital badges to receive credit if they enrolled in the Northeastern program. There have also been suggestions that institutions like Elon University are developing the registrarial architecture to establish equivalencies between micro-credentials and conventional courses (see Parks, 2019). As these efforts move forward, one expedient way to proceed in establishing more equivalencies between industry-based micro-credentials and PSE programming may be for colleges and universities to rely heavily on plausible or indirect equivalencies. For example, peers of Northeastern could work backwards from the courses that institution determined were equivalent with IBM's badges, and assess whether they currently recognize such courses as equivalent to their own. This could expedite their own articulation efforts with IBM, as it would eliminate ambiguity about the prospective equivalencies. The approach would ensure that the energy expended by first-movers like Northeastern can inform future articulation between its interested peers and entities like IBM. However, even such efficiency-minded efforts to establish equivalencies between PSE and industry training may prove too slow and cumbersome over the long term. It is questionable whether articulation could keep pace with rapid micro-credential development within industry. At a system level, it may prove most efficient for colleges and universities to simply embed popular industry-based micro-credentials into their programs, rather than attempting to articulate existing courses to micro-credentials.

CONCLUSION

Micro-credentials offer an exciting solution to many pressing societal problems, expanding access to PSE training, providing signals for more efficient labor markets, and expedited training in high-demand areas. Given the momentum that micro-credentials have built over the last year, it appears that they may be well-positioned to disrupt Ontario PSE in the coming decade. In doing so, they may succeed where other technologies like online learning, MOOCs and others have failed. Nevertheless, there are many challenges on the path to their widespread adoption. This piece has emphasized that their recognition and transferability across PSE is not guaranteed, and that a lack of within-system recognition threatens the emergence of micro-credentials as a legitimate option in the eyes of students, employers at large, and has strong equity implications. In turn, a set of innovative tactics and policy reforms that could be employed to facilitate their recognition across Ontario PSE have been outlined. This includes the amendment of the OQF, and the development of a fully transferable "common core" of micro-credentials. Alone, such developments will not entirely solve the recognition problem for micro-credentials. However, they constitute initial steps that could dismantle key barriers as the province attempts to introduce micro-credentialling into the PSE system.

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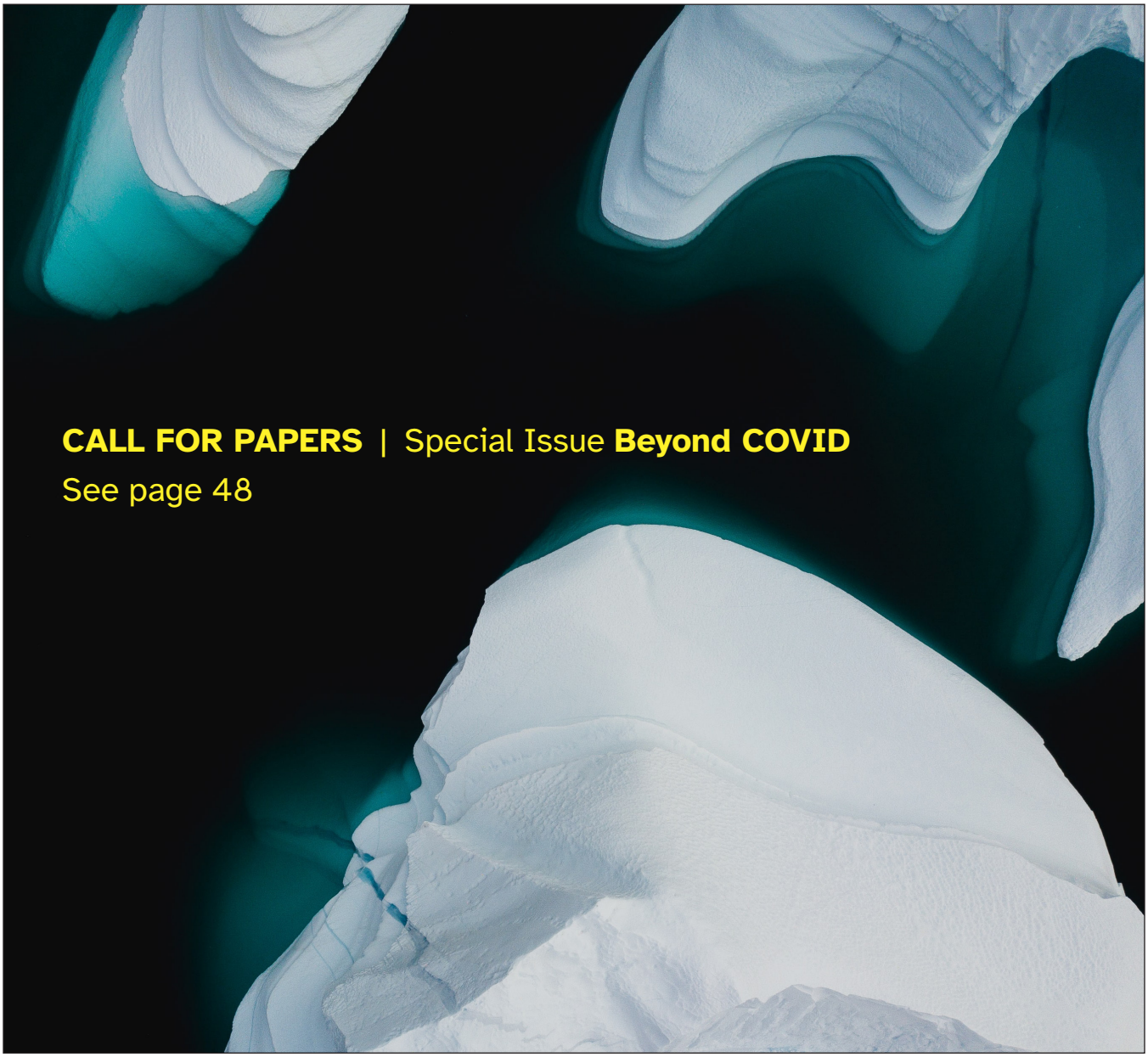

Submissions

Please note: For **any type of research paper** (Original Research Article, Brief Report, or Innovation Spotlight), the expectation is that evidence has been systematically gathered, using the appropriate scientific rigour. Accordingly, whether a quantitative or qualitative approach is taken, all manuscripts submitted as **Original Research Articles**, **Brief Reports**, or **Innovation Spotlights must** include a "Method" section that describes the empirical approach, and a "Results" section that summarizes the findings. *JIPE* especially encourages submissions that include **multiple forms of evidence** (e.g., collected at multiple points in time, using multiple data collection instruments, and/or from multiple sources).

Original Research Articles

Papers that report on original empirical research with a focus on teaching and learning. Papers may take a qualitative or quantitative approach, but must include an Abstract, Introduction, Method, Results, Discussion, and Reference section, as well as any tables and/or figures. **Research articles should be approximately 5000 words in length.**

Brief Reports

These are papers that report on empirical research, but are shorter and more limited in scope. Examples of research that might be presented in this format include results from a pilot study, findings from a study with a small sample size that show promise of a large effect size, research using a simple design and answering a single, specific question, or reports from an early phase of a project that is still ongoing. These papers still include Abstract, Introduction, Method, Results, Discussion, and Reference sections, **but are no longer than 2,500 words in length**.

Innovation Spotlight

These are extremely brief contributions that highlight an innovative teaching practice, approach, or tool, and provide accompanying evidence that speaks to the effectiveness of the innovation. Papers should include a very brief review of the most relevant literature to situate the approach, a brief method section, a results section, and a discussion/conclusion section. An Abstract is not required. Papers should be approximately 1,500 words.

Review Papers

These are papers that provide a balanced synopsis of the current literature within a specific area of inquiry. These papers should not only summarize the literature comprehensively, but should also identify outstanding questions and areas for future inquiry. **Review Papers should be no more than 5,000 words in length.**

Book Reviews

Scholarly reviews of books are occasionally considered for publication, depending on the relevance of the book for the journal readership. These papers should present a brief summary of the book as well as a critical reflection on the book's strengths and weaknesses. Of critical importance is that the review situates the book within a teaching and learning framework. These papers are **no more than 1,500 words in length**.

Invited Commentary

Invited commentaries will occasionally be included in the journal, particularly as part of a special issue.

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JIPE requests the following considerations to ensure your submission meets AODA guidelines and is accessible to all readers:

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Figures in submissions must have meaningful alt-text associated with it. In addition to providing JIPE with a figure title and additional notes (such as the source of the image), also provide a descriptor of the image. This description will be read by screen readers, and should provide sufficient information for the reader to understand the purpose of the figure. Alt-text should be no longer than 125 characters.

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Complex images (i.e., tables, graphs and charts) should be accompanied by a long description. This description includes all of the information in the complex image. For example, a long description of a graph should describe trends and key data points so that the reader using a screen reader can understand the purpose of the graph.

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All submissions are expected to be formatted using word processing Styles. Please ensure that your submission title uses the "Title" style. Primary headings should be formatted to use Heading 1, sub-headings should use Heading 2, and so on.

JIPE

Journal *of* Innovation *in* Polytechnic Education

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Expressions of interest are invited for a Special Issue of the Journal of Innovation in Polytechnic Education exploring the topic of "Beyond COVID." Authors are invited to submit a 250 to 500 word expression of interest, describing a paper they would like to contribute to the Special Issue. Proposed contributions could take the form of empirical papers, review papers, brief reports, or case studies. Papers will be peer-reviewed. JIPE is an open access journal that uses Creative Commons licenses.

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