

From Classrooms to Career Pathways: Universities Rewired Through Micro-Credentials

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Abstract

Higher education institutions are facing increasing demands to keep up with technological innovation, changing job market needs, and an increased focus on graduate employability. Micro-credentials are becoming a clear institutional response in this context, viewed as flexible and career-relevant alternatives or complements to traditional degrees. In this paper, a comprehensive and critical analysis of the literature in higher education is presented to identify how the concept of micro-credentials is transforming the universities from degree-oriented learning environments to career-oriented learning ecosystems. The review draws from a range of peer-reviewed research and influential policy documents from the period 2018-2024, and presents a synthesis of evidence in four key areas: conceptual foundations of micro-credentials; redesigning curriculum and assessment; career pathways and workforce alignment; and challenges and risks. The analysis shows that micro-credentials are more than just miniature versions of qualifications; they drive more profound structural changes that affect curriculum modularisation, industry partnerships, and credential architecture. However, the review highlights ongoing issues with quality assurance, recognition, equity, academic legitimacy, and regulatory coherence. This paper provides a nuanced understanding of the conditions under which the adoption of micro-credentials could support the adaptability of institutions and improve employability outcomes, without sacrificing the larger educational goal of the university. The results will help inform future research activities and serve as policy and leadership recommendations in credential reform.

Introduction

New demands, such as rapid technological development, shifting occupational configurations, and heightened attention to graduate employability, are increasingly driving the context in which universities function. The notion that one degree is enough to prepare students for the certainty and stability of careers has become increasingly problematic. The digitalization, automation, and increasing knowledge-intensive work have hastened the pace of change in skills, sometimes faster than the traditional curriculum revision cycles (Brown et al., 2020; Marginson, 2019). This has put higher education institutions under increasing pressure from students, employers, and policymakers to provide increased and more evident relevance to the labor market, while maintaining academic quality and social missions. In response to these pressures, universities are rethinking their role in human capital formation. Institutions are no longer just expected to offer "full qualifications" at specific points in time but are expected to foster ongoing learning, reskilling, and career reinvention (OECD, 2021). These changes align with the changing nature of the work in terms of a shift from linear to non-linear career trajectories, including mobility and mid-career transitions, as well as hybrid professional identities (Futures for Work Institute, 2023). In this changing landscape, micro-credentials

have become an important option that universities can use to fill new skills needs without replacing traditional degree programs.

Micro-credentials are viewed as recognition of very brief, focused learning that corresponds to a specific competency or professional practice (Oliver, 2019). However, their impact goes beyond their size and form of delivery. Micro-credentials are thus a substantive reconfiguration of the logic of credentialing, assessment, and curriculum architecture when embedded in institutional strategies. They disrupt the status quo of the time-centric approach to measuring learning, and emphasise actual outcomes that are meaningful to both learners and employers (Wheelahan & Moodie, 2021). This transformation raises basic questions about the organization, evaluation, and validation of knowledge in the university. Micro-credentials are increasingly becoming part of policy and institutional new agendas, with a strong association to employability discourses that emphasize skills signaling and workforce preparation. Employers are increasingly looking for applied capability, adaptability, and industry-specific skills and knowledge, and these are often presented as verifiable competencies that are broad but not necessarily based on academic qualifications (Rothwell & Hemingway, 2020). In terms of signaling theory, micro-credentials provide more specific signals of the workers' capabilities in labor markets with information asymmetry (Spence, 1973). However, they are only valuable if they are credible within the institution, recognized by employers and shared standards, and valued across sectors and national contexts.

Although the number of micro-credentials is growing, the literature on micro-credentials is variegated and even conflicting. Some argue that they can facilitate lifelong learning, expand student participation and increase sensitivity to the labour market, but they may also lead to fragmentation, credentials becoming more and more specialised and a loss of the broader objective of education (Biesta, 2022; Wheelahan et al., 2022). While much of the current literature remains descriptive or limited to policy statements, it fails to provide a critical synthesis of the nature of micro-credentials and how they are transforming universities as institutions rather than as individual programs. In this context, this paper reviews the literature critically with a special emphasis on how micro-credentials can enable universities to shift their focus from degree-oriented education to a learning ecosystem for careers. This review examines the impact of micro-credentials on curriculum change, career pathways, and university–industry liaison, and challenges the governance, equity, and legitimacy issues of implementing micro-credentials. The paper seeks to bring together conceptual, empirical and policy-based approaches to the topic in an effort to shed a more complex light on the circumstances in which micro-credentials could be a means to increase institutional adaptability without compromising the core values of higher education.

This review contrasts with many of the descriptive/policy or short-term employability focus publications on micro-credentials in that it sought to explore what is being learned about micro-credentials and their implications for the wider field of learning. This paper does not assess micro-credentials as an innovation or the effectiveness on its own, but as a tool for institutional transformation in higher education. In particular, it examines the implications for changes in universities' curriculum architectures, governance and connections to the labor market. The micro-credentials review combines findings from a literature review on curriculum theory, credential governance and labor market signaling theory, providing a unified analytical framework that reflects the structural and systemic aspects of micro-credentials. In doing so, it transcends the program-level assessment. It uncovers the impact that micro-credentials are

having on a reconfiguration of the university in career development, lifelong learning, and workforce alignment.

2. Review Methodology and Scope

This study is a critical systematic review with an integrative synthesis orientation and a mixed-method approach of structured literature search and theory-informed qualitative analysis. It is not intended to assess the effectiveness of micro-credentials as standalone interventions, but rather to explore the role of micro-credentials in the process of institutional change within HE. The literature search was carried out in Scopus, Web of Science, ERIC and Google Scholar. The databases that were focused on were Scopus and Web of Science because they provide wide coverage of the peer-reviewed higher education and policy research literature, and ERIC was used to narrow down the literature to studies relevant to education. Selected papers of great influence, including conceptual papers and policy reports, were retrieved from Google Scholar. The search terms included micro-credentials, digital credentials, short-form credentials, employability, skills-based education, and higher education. About 320 records were found in the search. Following the deletion of duplicate publications, approximately 230 publications were left. About 80 articles were selected for full-text review after title and abstract screening. After careful selection and screening according to the inclusion criteria, 34 studies were included for final synthesis. Research was selected if it explored the conceptualisation of micro-credentials or similar modular approaches to credentialing in university settings and made a critical investigation of curriculum design, matching with the labour market, governance, or institutional transformation. All articles that were solely about corporate training, informal learning, or technical platform descriptions were omitted. The conceptual framing, methodology, and main arguments related to curriculum restructuring, credential governance, and signaling to the labor market were the data extracted for this study. Thematic analysis guided by the theories of lifelong learning, human capital, and signaling was used for the synthesis, allowing for a balance between a more empirical and a more conceptual and policy-oriented approach. The review focuses on micro-credentials, which are available in universities, to enable a more detailed examination of institutional change in higher education. The geographic distribution of studies is concentrated in Europe, North America, and Australia, which is indicative of the patterns of research. The focus of the review is not to uncover causal connections or calculate the impact of the introduction of micro-credentials on employment outcomes but rather to offer a critical examination of how micro-credentials are transforming curriculum structures, governance and university–labor market relations.

3. Universities and Curriculum Rewiring

The introduction of micro-credentials in higher education has led to a reconfiguration of the curriculum, which Kift et al. (2020) and Wheelahan & Moodie (2021) describe as curriculum rewiring, rather than simply the addition of micro-credentials to existing portfolios of degrees. This rewiring is a shift from rigid, linear degree designs towards more flexible and dynamic curricular designs that can accommodate iterative learning throughout the life span. In this respect, the purposes of micro-credentials do not seem to be intended as a peripheral service, but as a way of re-thinking the organisation, recognition and linking between work and learning in universities. Micro-credentials are at the curricular level, contributing to the modularisation of academic programmes, where academic programmes are being broken down into smaller and more coherent units of learning that can stand alone and be aligned with wider, more robust qualification frameworks (OECD, 2021; Wheelahan et al., 2022). Modular design allows

learners to engage with focused learning without needing to take on full programs and offers opportunities for building on credentials to larger awards. However, the literature is clear that modularization is not neutral and does not simply occur. If not managed carefully, modular curricula can fragment the curriculum, compromise the coherence of the concepts and the development of cumulative knowledge (Kift et al., 2020; Marginson, 2019). Careful planning to ensure flexibility is achieved without compromising academic integrity is thus essential to effective curriculum rewiring.

Assessment practices have also been transformed in parallel as Universities strive to match the micro-credential to identifiable learning outcomes and learning outcomes that are relevant to the workplace. Traditional assessment methods (such as examinations and extended theoretical essays) are increasingly being complemented and/or replaced by authentic and applied assessment, such as project-based tasks, simulations, case analyses and digital portfolios (Fawns et al., 2020; Boud & Solomon, 2001). These are strategies that will ensure that learning outcomes are 'legible' both for the employer and the learner, thereby continuing to strengthen the signaling role of micro-credentials in the labor market. Meanwhile, researchers question the comparability, rigour and academic oversight—especially when assessment is co-designed with industry or offered in accelerated formats (Wheelahan & Moodie, 2021). A consistent approach to micro-credential offerings is an ongoing institutional challenge. Another key area of curriculum rewiring is credit and qualifications frameworks. Typical credit-hour systems, where learning is defined as the amount of time spent in formal instruction, do not tend to align well with short-term credentials with defined learning outcomes. In response, universities have begun to explore new models of credit recognition based on outcomes and new credential architectures that emphasize competence rather than contact hours (OECD, 2021; Wheelahan et al., 2022). Empirical research indicates unevenness between flexibility and lifelong learning; these innovations support flexibility and lifelong learning. While policy talk is of seamless accumulation, many micro-credentials do not explicitly reflect the pathways that lead to degree programs (Wheelahan & Moodie, 2021). The policy–institutional disconnect poses issues on transparency and learner protection.

Micro-credentials involve engaging with industry in the curriculum rewiring. More universities are co-developing learning outcomes, curriculum, and assessment for the current workforce needs, with employers and professional groups (Rothwell & Hemingway, 2020; OECD, 2021). These connections are often mentioned as a way of maximising relevance and employability of graduates. There are, however, arguments in the literature that an overly strong influence of the industry can increase the focus on the short-term skills requirements, which may lead to less emphasis on theory, critical thinking, and developing general intellectual skills (Marginson, 2021; Biesta, 2022). There is therefore a key tension developing about the nature of the curriculum in micro-credentials, between responsiveness and academic autonomy. In terms of pedagogy, the proliferation of micro-credentials has supported the implementation of flexible delivery models such as intensive, blended and online. These modalities are well suited for working adults and adult learners and further emphasize the connection of micro-credentials with lifelong learning goals (OECD, 2021). In the case of the academic staff, however, the concept of curriculum rewiring involves increased job assignments that involve the ability to develop the curriculum in short cycles, to interact with outside parties throughout the process, and to revise the curriculum constantly. Researchers point to the fact that this is not being met by our existing academic workload models and reward systems, which continue to have a strong focus on teaching and research for degrees (Fawns et al., 2020; Kift et al., 2020). In sum, the literature suggests that micro-credentials are not simply curricular innovations but agents

of institutional transformation. Their integration transforms the university curricula, assessment frameworks, credit systems and governance structures. Micro-credentials can add flexibility to the curriculum, provided there are coherent frameworks for curriculum rewiring and strong quality assurance to ensure academic standards are maintained. When not aligned, however, micro-credentials may further fragment curricula or drift from their intended goals and purposes, rather than reform them.

4. Universities and Curriculum Rewiring

The embedding of micro-credentials in higher education has challenged universities to make fundamental changes to the curriculum architecture, pedagogical approaches and institutional governance. Some institutions are not just adding a short course to a program, but rather are taking an active approach to reinstalling the curriculum in ways that differ from the traditional approach to its delivery, assessment, and credentialing within individual programs (Kift et al., 2020). This change comes with a departure from the traditional monolithic degrees to modular structures that accommodate flexible and iterative learning processes. Micro-credentials have taken a step toward modularizing academic programs at the curricular level. Modular design involves breaking down the degrees into smaller and coherent learning units which can be taught independently but also linked to other qualification frameworks. By enabling targeted learning without requiring a full degree program and also allowing for the stacking of micro-credentials toward larger awards, this approach could provide opportunities for learners (Wheelahan et al., 2022). However, with modularization, there is a need to be mindful about the curriculum mapping to ensure that there is coherence, progression, and alignment with the discipline standards. If not, curricula may turn into a collection of skills and not a coherent learning experience.

There has been an equivalent transformation of the assessment practice. Traditional assessment modes, which tend to be theoretical and answer to exams, are being supplemented and/or replaced in increasing numbers by applied and authentic assessment modes. Competencies linked to micro-credentials are typically assessed through a variety of methods, such as project-based learning, simulations, case analyses, and digital portfolios (Fawns et al., 2020). These methods are used to measure applied knowledge and workplace-relevant capabilities, reflecting employers' expectations for demonstrating skills. Meanwhile, the literature reflects the issues of comparability and academic rigor, especially when assessments are co-created with industry partners. Another important area of institutional transformation is the credit systems. The traditional credit hour system—where learning is assumed to occur in the classroom—may not align well with the delivery of micro-credentials. In response to this, universities have been exploring ways to recognise credits based on outcomes rather than contact hours, and alternative models of credentialing that focus on the evidence of learning rather than time or place (OECD, 2021). These innovations promote flexibility, but also pose challenges regarding consistency, transferability and regulatory compliance. Although it is written into the policy, empirical research indicates that stackability is not always realised, as many micro-credentials do not have clearly identified pathways to degree programmes (Wheelahan & Moodie, 2021).

Industry involvement is at the heart of micro-credentials-related curriculum rewiring. Co-Design of learning outcomes, assessment criteria and content areas with employers in universities is growing in importance. These partnerships can be seen as ways of improving relevance and employability of graduates (Boud & Solomon, 2001). However, it is suggested that the power of the industry could lead to curricula focused on the present needs of industry

rather than on theory and critical thinking (Marginson, 2021). Responsiveness and academic autonomy are something of a contradiction in the design of micro-credentials. From a pedagogical perspective, the introduction of micro-credentials has fostered experimentation with new formats of teaching and learning, such as blended learning, intensive and fully online courses. These modes will enable working adults and other adults to be involved, supporting objectives for lifelong learning. The change means more roles for faculty, such as designing curriculum in shorter learning cycles, interacting with external parties, and updating content continually. These include the implications for academic workload, professional identity and reward systems, not necessarily congruent with modular and industry-oriented teaching (Fawns et al., 2020). In general, the literature suggests that micro-credentials are more catalysts for deeper institutional transformation than they are for curricular innovations. They must be integrated into a coherent curriculum, supported by strong assessment and credit systems, and governed by a well-balanced system that allows for flexibility and integrity. With these conditions absent, the use of micro-credentials could result in peripheral usage and/or fragmentation instead of effecting meaningful change.

5. Micro-Credentials, Career Pathways, and Workforce Alignment (Revised)

One of the core arguments for embedding the concept of micro-credentials in higher education is its ability to enhance the labor market relevance of education in the context of high-speed technological development and fluidity of occupations. Career pathways that involve micro-credentials are situated in a framework of career mobility, reskilling and ongoing career adaption, rather than a linear path from education to employment (OCD, 2021; Futures for Work Institute, 2023). The micro-credentials in this context are seen as ways for the universities to contribute to the more fluid career pathways without the learner having to leave the work or undertake long-duration study. From the learner side, micro-credentials allow for the development of the selective and individual learning trajectory towards a specific occupational role, a tool, or a regulation. Empirical research indicates that this modular model is appealing to adult learners and mid-career professionals who are looking for specific upskilling and/or transition to a new career path, not a full requalification (Brown et al., 2020; Wheelahan & Moodie, 2021). Micro-credentials are therefore considered a way to navigate the ever-changing job market and help individuals adjust to new job openings and skill requirements.

It is broadly recognized that a key characteristic of workforce-aligned micro-credential ecosystems is employer involvement. Employer engagement is widely recognized as a key characteristic of workforce-aligned micro-credential ecosystems. Empirical evidence demonstrates that a clear articulation of learning outcomes, rigorous assessment and learning outcomes that are aligned to occupational standards or professional frameworks are the most important factors employers value more about micro-credentials (Rothwell & Hemingway, 2020; OECD, 2021). Micro-credentials can therefore minimize information asymmetry in recruitment by communicating clearly about specific competencies that are relevant to the job, but may not be communicated by a broad degree classification. This signaling function is similar to the signaling theory of the labor market, which focuses on the utility of credentials in the signaling of ability in an imperfect-information setting (Spence, 1973). The value of micro-credentials as indicators, however, is not consistent and greatly dependent on the context. There is mixed evidence of employers' recognition of consistency in the different sectors. Although there are growing number of employers that accept micro-credentials as their initial screening tools, especially for entry-level positions, many employers continue to use

traditional degrees as their first line of screening, particularly in professional services and healthcare fields (Brown et al., 2020; Rothwell & Hemingway, 2020). A lack of uniformity in recognition reduces the portability and stacking of micro-credentials, which further underscores the need for institutional reputation, standards, and transparency of credentials. If these conditions are not met, micro-credentials can be understood in a variety of ways and become ineffective as labour market signals.

Institutional level, micro-credentials allow universities to deal faster with new demands from the labour market; they can reduce curriculum development cycles and integrate labour market intelligence in the development of micro-credentials. Micro-credential offerings are more and more being informed by industry advisory boards, skills forecasting instruments and professional accreditation requirements, enabling universities to be more agile regional and national contributors to the workforce strategy (OECD 2021; Marginson 2021). But there is a concern that there is a risk of relying too heavily on the short-term signals from the labor market, which can lead to curricular responses that are short-term and focused on employment rather than conceptual understanding or long-term adaptability (Marginson, 2019; Biesta, 2022). The literature thus shows that there is a conflict between responsiveness and sustainability when designing a course for work. The issue of micro-credentials leading to greater employability over the longer term is also raised by critical scholarship, which challenges whether the micro-credentials truly create added value in this regard or just shift accountability for employability to the individual. This means that learners may need to 'sculpt' their credentials, interpret and explain their credentials to employers, and this may provide an advantage to those with greater social, cultural and digital capital (Wheelahan & Moodie, 2021; Wheelahan et al., 2022). This is a concern that the micro-credential ecosystem can exacerbate inequalities not reduce them, and can be a harbinger of career inequality. Furthermore, it is not well documented long-term effects of micro-credentials on learners' careers and claims for the enduring effect on occupational mobility are lacking. Combined, the literature indicates that micro-credentials can only be part of more flexible, and responsive, career pathways as part of coherent institutional and labor market settings. They have the ability to assist in aligning workers, which relies on clear signaling, employer recognition, and guidance for learners, as well as their links to other qualification systems. Without these factors, micro-credentials may end up being short-term employability devices that offer little or no cumulative or transformative benefits.

6. Challenges, Risks, and Critical Debates (Revised with Expanded Citations)

As micro-credentials begin to emerge as a feature of the higher education reform efforts, they present a variety of issues that make their incorporation difficult in university environments. The literature is clear that micro-credentials should not be seen as an innovation per se and that they are not necessarily good. Rather, attention must be paid to the implications these have for quality assurance, recognition, equity, academic legitimacy, and governance in the increasingly marketised spaces of HE (OECD, 2021; Marginson, 2021; Wheelahan et al., 2022). These are part of the larger contrast of flexibility and coherence that's been part of the contemporary reform of credentials. One of the more constant and prevalent issues that comes up is quality assurance. There has been a lack of alignment between quality frameworks, which are not strong and widely shared, and the quality, academic rigor and curriculum design of the rapidly expanding number of micro-credential offerings (OECD, 2021; Wheelahan & Moodie, 2021). The traditional accreditation and quality assurance processes are mostly geared toward full degree programs and may not be able to address short, modular programs delivered in a variety

of formats. Consequently, queries about comparability, credibility and levels of learning arise, especially when micro-credentials are offered on a large-scale and/or in collaboration with external partners. If not designed with clear benchmarks and oversight, micro-credentials could become an avenue for credential inflation instead of recognition of skills (Brown et al., 2020).

Issues of recognition, portability and stackability are closely related to the quality concerns. Micro-credentials are often cited as a means to a bigger qualification, and empirical research indicates that pathways can be less than explicit or are not implemented consistently or have institutional restrictions on their use (Wheelahan et al., 2022; OECD, 2021). Learners can earn several micro-credentials that they think could be applicable toward the progression to a degree, but face challenges with credit limits, disciplinary issues or regulatory restrictions. This lack of transparency puts the responsibility for risk on the learner and makes it difficult to argue that micro-credentials are a solution to flexibility and choice in higher education systems in themselves. Optimistic narratives of micro-credentials are further complicated by equity issues. They are often touted as an alternative to college education, but there are indications that not everyone benefits equally and that there may be a low participation rate. Individuals who have previously achieved higher education qualifications, good digital literacy and professional networks are better able to understand and apply the value of credentials and utilise the potential of micro-credentials in the labor market (Wheelahan & Moodie, 2021; Brown et al., 2020). At the same time, there are barriers for people from disadvantaged backgrounds to using the very patchwork credential system, getting employer recognition, and paying for several short credentials. Micro-credentials may thus reinforce and/or consolidate inequalities, unless extra support and guidance are provided and structures put in place.

The academic legitimacy and mission drift criticism is more complex and is not as fully accepted. An increased focus on job-specific, market-driven skills is likely to fail to capture the educational role of the university in a wider sense, leading to a focus on instrumental learning, and a de-emphasis on critical thinking, intellectual growth and civic engagement (Biesta, 2022; Marginson, 2021). In this light, micro-credentials could enable a shift in the university's focus towards rapid reaction to the needs of the workforce and undermine its function as a place of critical inquiry and the dissemination of knowledge. Supporters argue that micro-credentials can complement and supplement the prevailing values of academia, but literature suggests a danger that the demand of the job market and employability metrics could be more influential in determining curricular focus. Fragmentation of regulations and policies also hampers the effective implementation. This means that in many countries there is a mismatch between funding systems, qualification structures and reporting systems and those of modular systems (OECD, 2021). Lack of national or international standards makes it difficult to use the micro-credential across institutions and geographies, thereby diminishing the ability of micro-credentials to facilitate lifelong learning beyond institutional and geographic boundaries. This disintegration also makes it difficult to make institutional decisions regarding policy, as universities have to deal with conflicting signals and conform to the existing policy frameworks (Marginson, 2019). These problems, when seen in a combined perspective, highlight the need to approach micro-credentials as institutional challenges in overcoming skills gaps, not as a technical measure. The literature highlights the need for governance arrangements that promote flexibility and academic integrity, are transparent in their approach to recognition and credit, do not expose learners to undue risk and maintain the overall educational goals of higher education (Wheelahan et al., 2022; Biesta, 2022). If not implemented with relevant protections, micro-credentials can worsen fragmentation and inequality, and mitigate the transformative power that can be attributed to them.

7. Future Implications for Higher Education

As micro-credentials gain in popularity, the implications for the future of higher education in terms of structure, purpose, and governance will be long-lasting. Instead of replacing traditional degrees, the literature says that the micro-credentials will be able to complement and co-exist with them and thus change the structure of university learning and the perception of the value of the knowledge acquired through various degrees. The coexistence of these positions reflects the beginnings of redefining degrees as singular indicators of preparedness for work to a more integrative approach that situates and makes sense of modular and lifelong learning experiences (Wheelahan & Moodie, 2021). The one most important implication relates to the changing role of universities in a wider learning environments. Universities are increasingly seen as a place to build capabilities continually, rather than for early career learners, as micro-credentials become more accepted. This transition is in keeping with policy discourses about higher education as a public good to re-skill and make workers resilient to technological change (OECD, 2021). But it also demands new expectations of universities to keep it relevant in widely different contexts of learners' needs, time and career goals.

This will also likely impact faculty roles and academic work. Micro-credentials will need more involvement from industry partners, regular curriculum revisions, and new forms of applied competence-based assessments. These demands are at odds with the traditional academic workload models and rewards, which tend to focus on research output and teaching based on degrees (Fawns et al., 2020). The addition of micro-credentials to faculty work without institutional support and recognition could continue to be an uneven or tangential experience. Micro-credentials at the architecture of credentials level pose questions regarding coherence and hierarchy in the architecture of qualifications. However, if modular credentials begin to emerge and are not well connected to degree programs, there is a danger of producing a fragmented landscape of learning, which can be challenging for students and employers. On the other hand, good practice around incorporating micro-credentials into degrees can have a positive effect on flexibility without compromising depth and progression (Wheelahan et al., 2022). Degrees' significance for the future might then be based on their ability to be used as frameworks for multiple learning modalities rather than as end in themselves.

These trajectories are likely to be determined by policy and regulation. National credential systems, funding systems and quality assurance structures need to change to work with modular credentials and not undermine academic quality or equity. It is important to note the emphasis on policy coherence in the literature, which argues for the need to support, rather than detract from, public trust in HE, through the provision of micro-credentials (Marginson, 2021). As learners and employers expand their international horizons, there is likely to be a growing need for alignment on international qualifications. Lastly, the advent of micro-credentials calls for a re-thinking of the objectives of higher education. Along with being responsive to change in the labor market, it is important to keep in mind that the university is not just a tool for labour market adaptation, but also a place of longer-term, more long-term learning (Biesta, 2022). The future challenge is to embed the micro-credentials in a way that enables increased adaptability and employability and maintains the role of the universities in knowledge production, critical inquiry and social development. Whether micro-credentials are meaningful or contribute to further fragmentation in higher education systems will depend on how they are managed in institutions.

8. Conclusion and Directions for Future Research

This review has explored micro-credentials as a catalyst to structural and conceptual changes in higher education, and not as isolated, or supplementary, learning products. The literature suggests that micro-credentials have helped universities to slowly shift from a degree-based approach to a more flexible learning approach that is focused on a career. Micro-credentials are transforming the nature of learning by changing the way learning is designed, valued and linked to work, through curriculum modularization, outcome-based assessments, and increased industry engagement. Meanwhile, the review identifies that micro-credentials' transformative impact is not consistent and is uncertain. They need to be coherent across institutions, to have quality assurance processes, and to be integrated with other credentialing systems. If micro-credentials are not clearly articulated, linked pathway, have clear standards, and governance, they can be a risk to meaningful reform and contribute to fragmentation (Wheelahan et al., 2022). Likewise, the notion that micro-credentials are better for employability needs to be approached with a certain degree of circumspection, as employers vary in recognising them and the value of micro-credentials in different sectors (Rothwell & Hemingway, 2020).

One common thread to the literature is the issue of responsiveness to labour market change and the universities' wider educational role. Although micro-credentials can be useful for workforce readiness and lifelong learning, a focus only on short-term skills can potentially lead to a reduction in and restriction of curricular content, which can lessen the integrative and critical nature of higher education (Biesta, 2022). The issue for universities is how to integrate micro-credentials into structures that maintain the depth, coherence and academic legitimacy of the courses that are available, and also increase access and flexibility. Equity issues are also highlighted in the review. While micro-credentials are typically said to provide opportunities for everyone, emerging evidence indicates that they can benefit some learners more than others, with a disproportionate advantage for learners who already have educational and social capital (Wheelahan & Moodie, 2021). If not explicitly designed and institutionalized to chip away at inequalities in education and employment, micro-credentials may shift the burden of employability from education to the individual.

The synthesis sparks several questions for the future research. It is important to note that there is a need for longitudinal research that tracks learners' long-term career pathways who are using micro-credentials and compares these pathways with those who do not use micro-credentials, especially in terms of their career edge. It is also important to note that there is a need for longitudinal research that tracks the career pathway of learners who are using micro-credentials on an extensive basis and compares these pathways with those who are not using micro-credentials, especially with regard to their career edge. Second, there is a need to pay more attention to the implementation and application of micro-credentials in the workplace in various industries and employment environments. Third, comparative analyses of national systems would help to inform understanding of the role of policy in supporting the recognition, portability and legitimacy of micro-credentials. The results highlight the need for the qualification systems and recognition processes to be coherent and transparent, thus protecting the rights of the students and ensuring the continuity of the public trust in higher education from a policy perspective. The challenge for institutional leaders is to rather see the micro-credentials as an integrated approach to education and not as innovations responding to short-term demand. Overall, micro-credentials are an important advancement in the dynamic between universities, learners and labour markets. What makes them successful in the long term will be their ability to be considered and woven into the academic, social, and policy fabric of higher education.

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