



Educational Innovation with Alternative Credentials as a Driver of the Digital Transformation of the University: A Case Study in Latin America

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COLLECTION:
MICROCREDENTIALS

ARTICLE

 ubiquity press

ABSTRACT

The dynamics of change in the work environment are becoming more dizzying, given that adopting new technologies generates new knowledge and jobs. This research analyzed a case study of a Mexican university implementing alternative credentials. The method was instrumental case study research, with exploratory and descriptive categories, applying three instruments: documentary analysis of alternative credential programs, a questionnaire, and interviews with the experts involved in designing and delivering alternative credentials. In this case, the implementation of alternative credentials coincided with the reference frameworks of the European Union and the province of Ontario, Canada. Their frameworks mention the vision and institutional mission of alternative credentialing for the value offered, its definition, operation, award processes, accreditation, and quality. The case provides data for interested higher education institutions, such as why to do it, the strategy to follow, the added value offered, the elements that define it and its design, the assessment process and assignment, the timing of accreditation, and where it is recognized. This research contributes recommendations for defining and managing alternative credentials to serve as a reference for other universities interested in incorporating technology-supported educational innovations.

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KEYWORDS:

Digital transformation;
Alternative credentials;
Higher Education; Educational
Innovation; Organizational
model; Case study

TO CITE THIS ARTICLE:

Farias-Gaytan, S, Ramirez-Montoya, M-S and Aguaded, I.
2023. Educational Innovation
with Alternative Credentials
as a Driver of the Digital
Transformation of the University:
A Case Study in Latin America.
*Journal of Interactive Media in
Education*, 2023(1): 6, pp. 1–18.
DOI: [https://doi.org/10.5334/
jime.793](https://doi.org/10.5334/jime.793)

Information technologies and the evolution of the work environment have opened the way for the educational field to explore how to incorporate technologies in the learning process. Technology has challenged all industries because its functions enable processes rather than an end. Its adoption leads to organizational changes (Steiber et al. 2020). The pairing of education and technology drives the future of learning and talent development (HolonIQ 2021). At this time in humanity, the limits in the use of technology by industries are becoming more tenuous, and the education sector is included through the digital transformation of its processes and practices of educational innovation.

This research first presents the literature review, case study context and the research method. Next, the literature review results are described and discussed. Finally, conclusions are presented with recommendations for those institutions interested in exploring the implementation of alternative credentials. The article is of value to educational and innovative communities interested in new training options, such as alternative credentials.

CONCEPTUAL FRAMEWORK

Educational innovation and digital transformation

Digital transformation in the work environment has caused jobs to evolve faster. Organizations have seen the need for a workforce capable of developing and implementing new technologies in the short term (Kane et al. 2017). Consequently, universities must incorporate new technologies into their programs to prepare their graduates (Guillén-Gámez, Mayorga-Fernández & Álvarez-García 2020). Likewise, they must consider, assess, and incorporate trends such as augmented and virtual reality, technology platforms, and artificial intelligence, which have been present in the panorama of higher education in the last five years (Table 1).

STUDENT EXPERIENCE	SUSTAINABILITY	SCALING THE CHANGE	NEW NORMAL
• Alternative credentials	• Enigmas of enrollment	• The changing role of the CIO	• Online productification
• Corporate collaboration	• Tuition tensions	• Online everywhere	• COVID-19 campus
• E-Sports	• International students	• Cloud now	• Hybrid everything
• Virtual experiences	• Low-Code applications	• Chatbots	• Remote proctoring
• Cross-Life-Cycle CRM	• Cyberthreats	• Hybrid classrooms	• Faculty Info. Systems

Table 1 Top higher education technology and business trends for 2021.

Note: Taken from Morgan et al. (2021).

Training throughout life has become a constant in the professional development of people. As of 2013, Gartner included open credentials as an educational trend with the emergence of the *Massive Open Online Course* (MOOC) (Lowendahl 2013), and in 2018 it renamed them digital credentials (Calhoun Williams 2018). MOOCs have been an option for developing knowledge and skills in less time than traditional formal education programs for undergraduate or graduate degrees. In this regard, the Coursera and edX impact reports highlight that 87% of MOOC learners progress in their career path (Coursera 2020; edX 2020). Due to the above, universities and organizations with training programs displayed these credentials, highlighting areas of opportunity in terms of implementation and clarity of purpose for the end user.

Alternative credentials overview

The addition of credentials as a new educational product resulted in rapid adoption by people looking for a solution to their training needs. However, it also triggered a global market that has made it challenging to establish equivalencies, quality standards, and official recognition that is useful for both users and employers (Erasmus+ Programme 2019). For example, in the United States, 738,428 different credentials were identified (Credential Engine 2019). Another aspect to consider is the lack of consensus on the meaning and scope of this product (Table 2). These situations revealed areas of opportunity to achieve harmonic and systemic incorporation of this educational trend.

Table 2 identifies the terms “micro” and “macro” used to distinguish between credentials based on their duration. This way, the term micro is assigned to courses such as MOOCs, certificates,

Scientific production with alternative credentials predominates in the United States, Australia, and European countries (Figure 2). Below are examples of alternative credential implementation in Europe and the Americas.

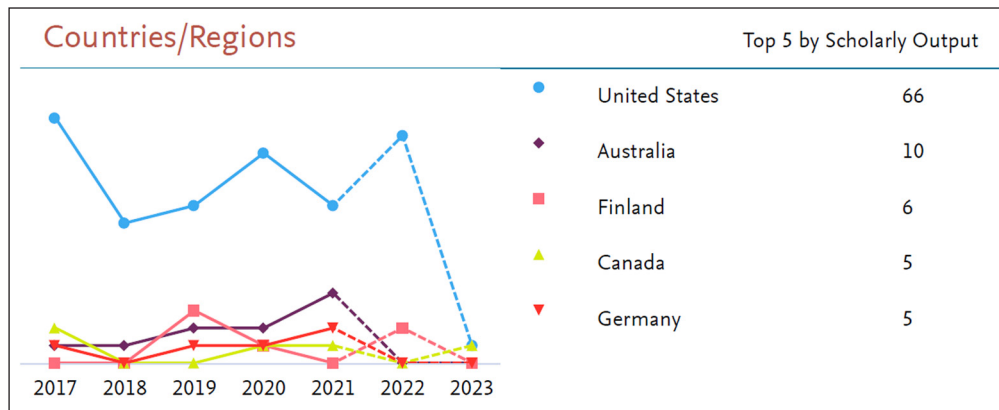


Figure 2 Main countries/regions with scientific production.

Note. Entity: Credentialing; Education; Instructional Design T.60840·Year range: 2017 to 2023 ·Data source: Scopus up to 25 Jan 2023.

The need for reskilling and upskilling is advancing at the same speed as the development of new technologies, and alternative credentials are seen as an option to fulfill this demand. The main drivers of change in alternative credentials have derived from the fourth industrial revolution, changes due to the digital transformation of education, and the globalization of labour markets (Cedefop 2022). As a result, in 2020, the European Union published the Bologna Digital Agenda and the “Digital Education Action Plan”, with which it put its hands to work in its interest in advancing the digitization of credentials (Hudak & Camilleri 2018). As part of this strategy, in July 2020, it launched an initiative focused on implementing micro-credentials to be developed over four years. The framework includes defining micro-credentials, quality standards, accreditation processes, and the means of portability and dissemination (European Commission 2020). To accomplish the above, they formed working groups with the participation of the member states and parallel projects that contributed with recommendations on implementing micro-credentials (Cirlan & Loukkola 2020). Achieving consensus helps to advance adoption and transparency for those participating.

Decision making processes and frameworks must keep pace with changes in the labour and technological environment. The Council of the European Union published in May 2022 a set of recommendations which “aimed to support the building of trust in micro-credentials across Europe among all those involved, whether providers or beneficiaries” (Council of the European Union 2022: 4). These recommendations include definitions, descriptive elements of the credential, deployment of a design and implementation ecosystem among member states (Council of the European Union 2022; van der Hijden & Martin 2023). This strategy is also taking place in other parts of the world, such as Australia and America, although examples are found only at the national level.

Australia is an example of alternative credentials implementation at the country level. Their interest in having an alternative credentials framework is to facilitate the learner’s experience in selecting the right offer for their needs, as well as to be recognized by employers (Australian Government Department of Education, Skills and Employment 2021). As a follow-up to this strategy, the government intends to develop an alternative credentialing platform to connect providers and users (van der Hijden & Martin 2023). Universities such as Griffith, Deakin and RMIT lead the credential offering with short-courses at graduate and undergraduate level (McGreal & Olcott 2022). Establishing agreements facilitates the deployment of large-scale programs.

Alternative credentials have impacted educational institutions and government initiatives in the United States and Canada. The interest in credentials in Canada is recorded in Google searches before 2004 as digital badges and, as of 2013, as micro-credentials (Brown et al. 2021). The Ontario government recognized the importance of this trend and allocated part of the 2020 budget to define a micro-credentials strategy to improve job skills (Pichette et al. 2021). Other advances in this direction have been alliances of higher education institutions with platforms for the delivery, management, and verification of digital credentials (Brown et al. 2021). In 2019

eCampusOntario published the Micro-credential Principles and Framework “which provides a common standard on which to collaborate and create micro-credential programming” (Gooch et al. 2022: 26). This effort has a local level outreach to develop a credential ecosystem.

In the case of the United States, the number of credentials was estimated at more than 330,000 in 2018, and a study published in 2019 found more than 730,000 unique credentials available (Credential Engine 2019). Higher education institutions, such as the State University of New York, formed work teams to develop a micro-credentials implementation strategy to establish a definition that provides clarity to students and those who develop the content, as well as an approval process that ensures quality, flexibility, and delivery (SUNY 2018). In addition, North American universities integrated the “Digital Credentials Consortium” in 2019 with universities from Europe and Latin America to create a trusted, distributed, and shared infrastructure that can be the standard for issuing, storing, displaying, and verifying digital academic credentials. (DCC 2019). Both in Europe and America, it is clear that its implementation involves more than just adapting content; it is necessary to adjust management models, evaluation, dissemination, and recognition of alternative credentials in organizations.

This research is valuable because, although ten years have passed in which MOOC courses have boosted alternative credentialing, it continues to be a little-explored topic. For example, from 2017 to 2023, 127 articles on this topic were published in Scopus journals worldwide (Scopus 2023). These included studies on the need to scale access to education and develop skills and knowledge for adults, and the challenges faced by consumers and providers (Cumberland et al. 2023; Delello & McWhorter 2017; Selvaratnam & Sankey 2021), higher education teachers (Dyjur & Lindstrom 2017) and undergraduate students (Graham et al. 2023; Ward et al. 2022). Alternative credentials motivate learners and provide new paths to learning and recognition (Carey & Stefaniak 2018; Mah 2016). Thus, this paper aims to present the experience of a Mexican higher education institution in implementing alternative credentials and identifying best practices as a reference for those universities and organizations interested in venturing into this trend.

CONTEXT

Tecnológico de Monterrey is a private Mexican institution founded in 1943. It offers high school, undergraduate, and graduate academic programs to more than 90,000 students on 26 campuses in the Mexican Republic and has more than 10,000 teachers (Tecnologico de Monterrey 2021). The institution has been a pioneer in the implementation of distance education programs for more than 30 years, both in academic programs and continuing education: 227,396 high school and undergraduate students have taken digital education courses, along with 35,000 graduates from online programs, 1.5 million online diploma professionals, and more than 1.5 million people in MOOCs (Tecnologico de Monterrey 2022: 9). In addition, the university has stood out for incorporating educational technology in the learning process with innovations such as immersive learning, personalized learning, and hologram telepresence effect, impacting more than 30,000 students since 2018 (Tecnologico de Monterrey 2022).

Likewise, Tecnológico de Monterrey was the first private Mexican university to associate with the Coursera platform in 2013, attaining more than 137,000 students from 142 countries enrolled in seven courses (Tecnologico de Monterrey 2019). Based on this experience, it also associated with the edX and MéxicoX platforms, reaching more than 1.7 million subscribers (Tecnologico de Monterrey 2019). These associations made it possible to explore new trends and venture into products beside MOOCs, such as the specialized programs of Coursera and Micro-Masters in edX (Tecnologico de Monterrey 2019). In this way, Tecnológico de Monterrey introduced alternative credentials for students to earn recognition for specific skills and knowledge, and as a flexible pathway towards a graduate degree (Jackson 2019; Tecnologico de Monterrey 2019, 2023; Treviño 2020).

METHODOLOGY

This research applied the qualitative instrumental case study method. The case study presents the detailed analysis of an event within a group or community where the researcher has little control over the phenomenon, which takes place in real life (Merriam 2002; Yin 2009). The case

study focuses on a unit of analysis, a delimited system with particular characteristics (Merriam 2002). In this research, the unit of analysis of a higher education institution was an instrument to know the configuration and application characteristics of alternative credentials.

SAMPLE

The study sample consists of two professors, subject matter experts, and the lead for the design team (Table 3) involved in the development of a specialized program in Coursera for which students who pass and obtain the certificate have the possibility of requesting the accreditation of a subject from the Master's Degree in Educational Technology (MTE) or the Master's Degree in Education (MEE) of the Tecnológico de Monterrey.

PARTICIPANT ID	ROLE
PA	Subject matter expert
PB	Subject matter expert
PC	Design team leader

Table 3 Participants' role.

INSTRUMENTS

Before data collection, planning was carried out to select the most appropriate strategies and instruments for this research. The qualitative method has three primary sources of information, interviews, observation, and documentary analysis (Creswell 2014; Merriam 2002). For this work, we chose interviews and questionnaires with subject matter experts responsible for designing and delivering the credentials, and documentary analysis of the implemented programs. In a qualitative case study, the questions may refer to a description of the case and the issues that arise when studying it (Creswell 2014). In this study, the exploratory analysis elements were delimited to describe the characteristics of the alternative credentials; three instruments were applied: interviews, questionnaires, and document analysis. The confidentiality and anonymity of the participants' opinions was guaranteed, and data was analyzed for academic and research purposes. The participants voluntarily agreed to participate in the study.

The questionnaires included open questions to inquire about the participants' experience implementing alternative credentials. The questions were grouped into five sections to answer the questions *why* (elements that guide the institution's strategy and business model), *what* (definition and aspects to consider in its design), *how* (assessment process and allocation), *when* (they are accredited), and *where* (portability and recognition by third parties). The 50-item questionnaires were sent to the experts by email, who answered them individually (Annex 1).

The semi-structured interviews were applied individually to the same university experts, with open questions to deepen information about the five sections mentioned above. Interviews were conducted through the Zoom tool.

The institutional public documents (educational innovation documents and web pages) and alternative credential programs were analyzed, and the publication strategy of offering alternative credentials on commercial platforms, such as Coursera and edX, was reviewed. The characteristics considered to define the credentials and who would participate in their design, the evaluation elements, the accreditation process, and the publication and portability of the credentials offered to students were also reviewed.

CATEGORIES AND DATA ANALYSIS

The data analysis was carried out by categorizing the responses from the questionnaire and the interviews based on the models of Pichette et al. (2021) and Hudak and Camilleri (2018) (Table 4). The thematic analysis allowed the researchers to take as a base the categories of the selected frameworks and identify new categories from the responses. The reason for selecting these frameworks was that they were aimed at higher education institutions, and the intention was to relate the case under discussion to the experiences of other universities.

MICRO-CREDENTIALS QUALITY MARKERS FOR POSTSECONDARY INSTITUTIONS (PICHETTE ET AL. 2021)	THE MICRO-CREDENTIAL (MCS) USERS' GUIDE (HUDAK & CAMILLERI 2018)
*Definition	Definitions and Classification.
Relevant: Consulted or involved in industry/community.	Vision, Mission, and Strategy for MCs at the institutional level.
Flexible: The pace and/or structure of learning can be personalized.	
Accredited: Recognized or issued by a professional accrediting body.	Accreditation & Quality Assurance.
Standardized: Meets a government-set quality standard.	Awarding Micro-Credentials.
Assessed: The learner must demonstrate skills/knowledge to earn the credential.	
Stackable: Can be "stacked" or combined toward a higher credential, e.g., a diploma or degree.	Academic recognition and portability of micro-credentials.

Table 4 Information analysis categories.

The questionnaire analysis was carried out considering the categories of two frameworks, Pichette et al. (2021) of the province of Ontario, Canada, and Hudak and Camilleri (2018), concerning the European Union strategy. The instrument's questions were assigned to these two frameworks (not exclusively), with 94% being identified in Hudak and Camilleri (2018) and 71% in Pichette et al. (2021) (Figure 3).

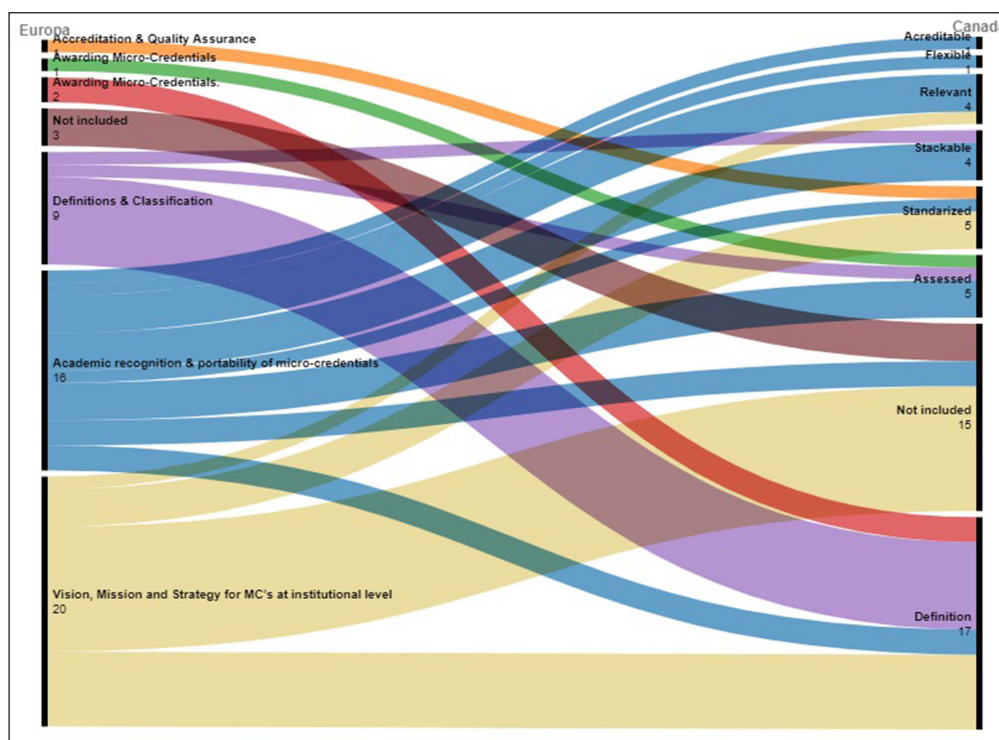


Figure 3 Categorization of the battery of questions based on Hudak and Camilleri (2018) and Pichette et al. (2021).

The analysis characteristics of the reference frameworks were imposed upon the instrument items. It was found that more than 70% were related to these categories (Figure 3), which denotes the common interests and concerns among higher education institutions regarding the implementation of alternative credentials, such as having a definition, establishing evaluation and assignment processes, and ensuring that third parties recognize them as evidence of student development.

It is important to note that the issue of the intellectual property of the content developed by the teacher was not found in the reference frameworks; however, it is an aspect to consider in the content design and understanding between the institution and the participating teachers.

Based on these results, the case study analysis categories were delimited to answer the questions described above (Table 5):

QUESTIONS	CATEGORIES
Why	Value added Institutional Strategy
What	Definition Flexibility Intellectual property
When	Accreditation
How	Evaluation and assignment process
Where	Recognition and portability

Table 5 Categories identified for case analysis.

ETHICAL STATEMENT

The ethical processes in the study addressed various ethical dilemmas (Creswell 2007; Lincoln & Guba 1985), such as the participants, data management, and dissemination of the generated knowledge. Before starting the fieldwork, we presented extensive and detailed information to the voluntary participants. The data handling was handled objectively, similar to the evidence collected in important public documents; as stated above the confidentiality and anonymity of the participants' opinions was guaranteed, and data was analyzed for academic and research purposes. The researchers analyzed the data of interest following the recommendations of Traxler (2012). The dissemination of knowledge must respect the participants' confidentiality and adhere to what is indicated in the investigation of the case study.

RESULTS: A CASE OF ALTERNATIVE CREDENTIALS AT TECNOLÓGICO DE MONTERREY

Next, the results obtained from applying the instruments were presented and grouped to answer the five questions: *why* implement digital credentials, *what* is considered a digital credential, *how* are they evaluated, *when* are they accredited, and *where* are they recognized (Figure 4).

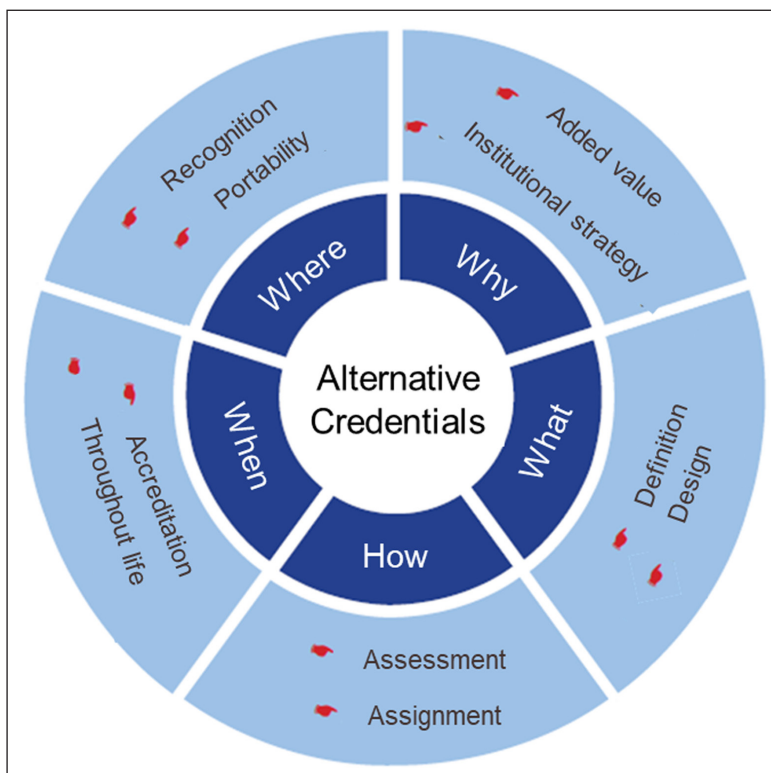


Figure 4 Alternative credentialing components.

WHY? ADDED VALUE, INSTITUTIONAL STRATEGY

Clarity in digital credentialing implementation is crucial for the educational institution. The participants declared that it is necessary to consider the value of the labor market, the value it brings to the students and graduates, and the hallmark it brings to the institution. Regarding

the value it brings to the student, the credentials were used to review specific content or develop certain skills in undergraduate students and to incorporate new topics in graduate studies. Comments from participant A support these ideas.

PA: It is necessary to highlight the value it [the alternative credential] gives to the person, why the institution offers it, and what is the impact it has on the person who decides to seek and achieve it.

The value brought to the graduate must be perceived in the labor market. In this way, the courses were designed to provide flexibility as they are optional graduate courses with a flexible schedule and reduced cost. Likewise, it was essential to document the business model for decision-making, which included the cost of content design, payments to designer teachers and tutors, and the publication strategy and management of the offering for which alliances were established with MOOC course platforms to reach a wider audience.

WHAT? DEFINITION, DESIGN

In the experience of the participants, in this case, the institution did have a process for the design and delivery of alternative credentials, where the interested department first documented a proposal aligned with institutional policies, as well as the added value of implementing credentials, such as opportunities for positioning and attracting students to graduate programs.

PB: The strategy decided was to offer a flexible program of the School of Humanities and Education, that is, elective courses, with a flexible calendar, and reduced cost.

Once the Dean of the School had authorized the proposal and business case, several areas were involved, including one that manages the MOOC provider platforms and the area that designs the centrally taught digital education programs. In this case, three teachers participated in the content design. The moral rights to the developed content belong to the teachers and the patrimonial rights to the institution.

To design the credentials, a group of specialists in digital education was assigned to the teaching team. This group of specialists comprised specialists such as pedagogical architects and instructional designers, technologists such as programmers and Web developers, and creative personnel such as multimedia designers, graphic designers, and video producers and editors.

Before designing the credentials, the group defined the delivery modality, didactic structure, duration, methodology, evaluation, and educational resources to present the content and promote learning.

PC: The online courses were designed with various educational resources such as video, readings, presentations, and immersive resources, to promote active learning, and to help the student develop the required competence.

The participants stated that their didactic approach was determined by defining the credentials, the competencies to be covered, and the disciplinary area of the content. This was done by the department interested in implementing credentials aligned with institutional policies. In this case, the purpose of the credentials was to find opportunities to position and attract students to a graduate program. The development time took between eight and twelve months for the teaching team and the team of specialists.

Likewise, they established the characteristics to consider within the digital credentials, which included learning objectives, the instructional methodology implemented, the evaluation model, and the duration of the credential, that is, the time that the student must dedicate to complete the content and activities, which are the guiding axes for any course teaching modality.

Also, the development team highlighted that, when designing credentialing for an online learning environment, these components need to be adapted to the environment, incorporating the functionalities of the platform and the technological resources used.

An issue that arose among the participants, which was not specified in the reference frameworks, regarded the intellectual property of the credentialed contents. They specified that the moral rights belonged to the teacher in charge of their development, and the patrimonial rights corresponded to the institution. Intellectual property was managed in the institution with

agreements in which teachers signed a copyright transfer for the work and projects entrusted during the employment relationship to the institution.

PB: Regarding the rights to use the material, a transfer of rights is signed by the subject matter experts with the university for an indefinite period, and an image consent is also signed according to the country's legislation.

HOW? ASSESSMENT, ASSIGNMENT

The credential awarding describes the protocols to integrate a credential and the metadata that allows recognition of the scope of what it grants and recognizes. The experts indicated the elements that are considered for the recognition of credentials. In the case of evaluations, automated evaluations were designed with self-assessments, peer evaluations, and others with review by a teacher, which was integrated into the cost of the business model.

PA: For example, several evaluation instruments were considered, some were automated using the platform functionalities, and others were evaluated by professors as they were part of the accreditation.

On the other hand, the protocols were formalized based on institutional regulations for the credential assignment to the student. For example, it was specified to cover the credits or units required to be validated later. This involved formalizing an institutional statement on the definition and scope of credentials that could be comparable to the courses of an academic program.

WHEN? ACCREDITATION THROUGHOUT LIFE

The credential accreditation must be clear for the student, educational institutions, and the labor market to recognize and facilitate the beneficiary's mobility. In this case, the student applying for the credential had to deliver activities (products) that were evaluated and served as evidence of their having developed their skills and abilities. There were several competency evaluation models, such as e-portfolios and summative evaluations, in addition to the development of projects (Figure 5). A specific level of qualification was established for the evaluation instruments from the course design based on the academic program's requirements.

PB: Accreditation goes beyond just completing the course; the student must demonstrate the competence acquired.

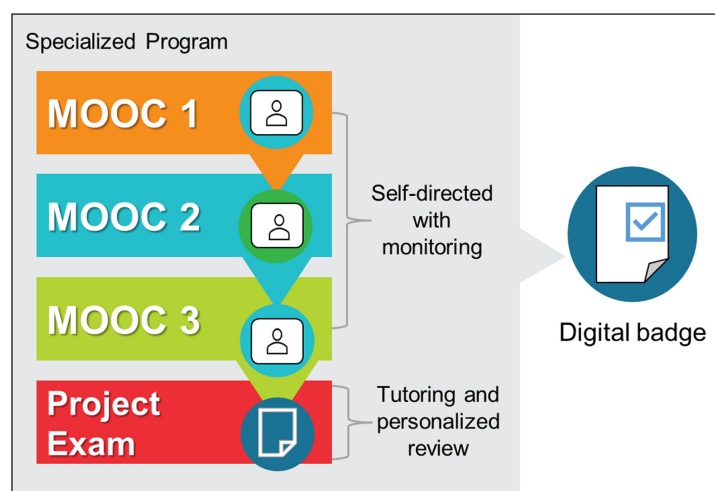


Figure 5 Accreditation scheme for the Specialized Education Program.

WHERE? RECOGNITION, PORTABILITY

Recognition and portability consider aspects of evaluation, flexibility, relevance, and standardization and provide transparency and certainty to students and other organizations about alternative credentials. The participants described these aspects based on the projects they carried out.

In this case, the implementation of alternative credentials fulfilled the purpose of the specialized program of the Department of Humanities and Education since it achieved international projection and visibility and attracted new students to the academic program. Participants explained that before the COVID-19 health contingency, adults in graduate and continuing education had been interested in alternative credentials. Now, they found interest emerging from young adults as well.

PA: Before COVID-19 we might have claimed it worked best for “middle-aged and older adults” in graduate and continuing education, but now we are seeing “young adults” searching and inquiring for these courses.

Students who meet the requirements receive a digital certificate with the name of the credential, which they can share on their social networks and include in their portfolios. The participants’ experience in the graduate program indicated that the certification accreditation could be validated with a Master’s degree course in Education.

In summary, the elements and strategies of the case presented coincided with the two reference frameworks consulted in implementing alternative credentials. Furthermore, the reviewed case added a feature regarding the intellectual property of the content of the alternative credentials, which was not found in the reference frameworks (Table 6).

MICRO-CREDENTIAL QUALITY MARKERS FOR POSTSECONDARY INSTITUTIONS (PICHETTE ET AL. 2021)	THE MICRO-CREDENTIAL (MCS) USERS’ GUIDE (HUDAK & CAMILLERI 2018)	TECNOLOGICO DE MONTERREY
*Definition	Definitions & Classification	What: Definition
Flexible		Flexibility
Not included	Not included	Intellectual property
Relevant	Vision, Mission, and Strategy for MCs at the institutional level	Why: Institutional Strategy
Accredited	Accreditation & Quality Assurance	When: Accreditation
Standardized	Awarding Micro-Credentials	How: Assessment and Assignment Process
Assessed		
Stackable	Academic recognition & portability of micro-credentials	Where: Recognition and portability

Table 6 Elements considered in the implementation of digital credentials (own elaboration).

*Note: Pichette et al. (2021) refer to the need to have a definition of micro-credentials, although they do not include it in the quality elements but treat it separately.

Based on the results, a trajectory was identified for the design of the alternative credentials, where the key elements considered for their management and implementation stood out (Figure 6). In this process, the questionnaire items on using alternative credentials (Annex 1) were linked, which are of value to institutions and organizations interested in scaling these training possibilities upward with educational innovations.

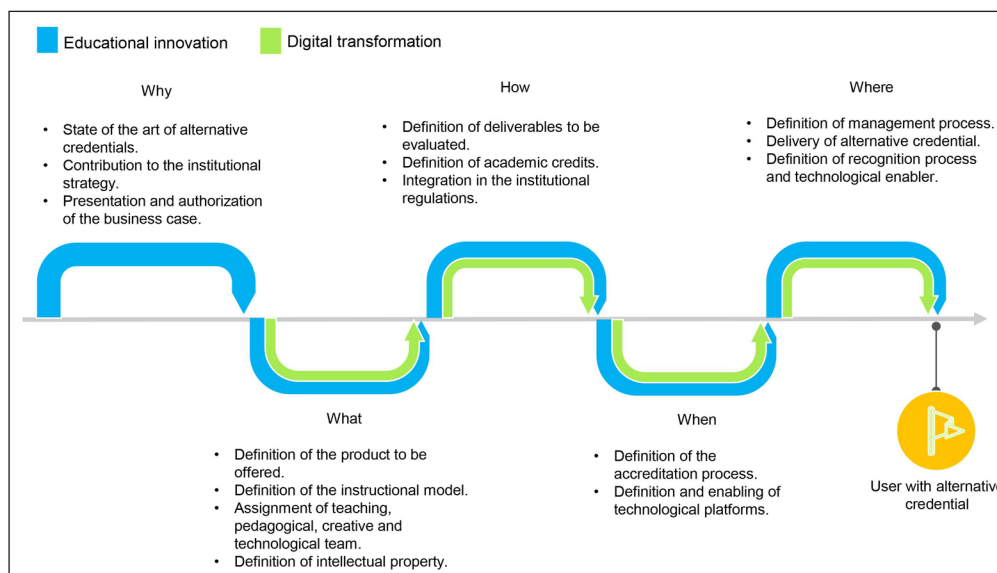


Figure 6 Alternative credentials management.

This management process can be a reference for institutions or organizations interested in alternative credentials, where educational innovation is a transversal axis and the engine of digital transformations. The implications for practice identify the need to analyze the context, the motivation to offer new training possibilities and the support of human resources and infrastructure that accompany this action. It is also of substantial importance to consider the implications of educational research as a critical element in generating knowledge about educational innovation.

DISCUSSION

Although alternative credentials have been present in the last two decades, there is still no internationally approved concept. The reference frameworks used, and the case study presented here agree on more than 70% of the elements required in the implementation of an alternative credentials strategy (Figure 3); they also raise the importance of having a common definition and, given the lack of international consensus, each interested party proposes its own (Table 2). The International Labor Organization uses “digital credential” and “micro-credential” interchangeably (International Labor Organization 2021). However, Pichette et al. (2021) and Hudak & Camilleri (2018) refer to them as micro-credentials and Tecnológico de Monterrey (2019) as alternative credentials. This lack of consensus continues to be an opportunity for this educational trend; it is necessary to move from the state of novelty to seek practicality that provides transparency to the users and parties involved.

Educational institutions must define a strategy that includes their vision, mission, and operating framework for alternative credentials in their value offering. The reference frameworks are a guide for the institutions, but no details were found for their operation; however, in the case study, we emphasized and propose a framework that includes aspects of design, management, and even intellectual property (Figure 6). For Canadians, institutions and governments must establish the target audience for credentials (Pichette et al. 2021). Technology facilitates portability, security features, and alternative credential programs’ storage, verification, and scalability (Brown et al. 2021; DCC 2019). Once clear on the significance of alternative credentials for the institution, the next step is to establish the “how” of their implementation.

Alternative credentials must be explicitly detailed with user and credential information so that other organizations can recognize them. The awarding of credentials must align with the established evaluation model that is transparent to the student and easy for third parties to interpret so that they can incorporate them into their processes and programs. Aspects such as duration, evaluation process, stacking, and providers, among others, are helpful metadata for awarding credentials and disseminating student achievements (Cirlan & Loukkola 2020; Erasmus+ Programme 2019; Kato, Galán-Muros & Weko 2020). The body responsible for granting the alternative credentials must be readily identifiable to strengthen and validate the process.

The alternative credential must add value to the labor market. Credential quality is considered in the reference frameworks and the case study as a critical element of the implementation process to ensure the useful life of the conferred credential. Since the alternative credentials granted by higher education institutions are part of their value offerings, they must be subject to the same quality assurance processes as their other programs (Hudak & Camilleri 2018). Likewise, institutions must verify the applicable regulations of the corresponding educational authority for their accreditation (European Commission 2020), making it possible for granted alternative credentials to be recognized by other organizations.

The flexibility and versatility offered by alternative credentials allow the users to take different paths in their professional development. This has led organizations to consider credential stackability as part of their undergraduate or graduate programs and to use technologies to manage them. This integration into programs must be thought of in terms of the needs of the labor market instead of trying to adapt or partition the current curriculum (Pichette et al. 2021). Blockchain technology has become an enabler of the portability of alternative credentials, and educational institutions in various parts of the world have implemented it (International Labor Organization 2021; Longino Torres 2019). The adoption of technologies demands that institutions continuously update and make consequent adjustments to their processes to leverage the benefits they provide to users.

LIMITATIONS

A limitation of this study is its small scope because it only considers one program from a higher education institution. However, the analysis results can serve as a reference for other institutions to explore the implementation of alternative credentials in their offerings. Future studies may consider, on the one hand a longitudinal study of the results of the implementation of alternative credentials in the institution, and, on the other, the study could expand the sample of universities by compiling other experiences, either in the same country or at the regional level, documenting users' experience and satisfaction.

CONCLUSIONS

The purpose of this research was to present a case study of implementing alternative credentials in a higher education institution in Mexico to identify best practices that serve as a reference for those universities and organizations interested in venturing into this trend. Change has become a constant due to the implementation of new technologies, which has led to the digital transformation of organizations. The COVID-19 pandemic intensely challenged educational institutions (Aguaded & Contreras-Pulido 2020; Ramirez-Montoya & Lugo-Ocando 2020). Based on the results of this study, it was possible to verify the international interest in the use of alternative credentials in Europe, Australia and North America, national and regional experiences, among which it was found that there is a lack of a consensus on the definition and scope of these credentials.

Another conclusion that can guide communities interested in educational innovation and alternative credentials is that consensus was found on a series of elements, the approach and processes universities have considered in their management process of alternative credentials: why they are going to venture into this trend, the strategy to follow, the added value of their offering, the elements that define it and its design, how to conduct the evaluation and assignment process, when the accreditation is carried out, and where it is recognized. This article presents an alternative credential management process as a guide for higher education institutions, not without considering that there continue to be opportunities at a global level around its definition, interest in ensuring quality, as well as clarity for students and companies and organizations on the recognition and validity of the knowledge and skills acquired.

Finally, alliances between countries, organizations, and higher education institutions could allow the advancement of this educational innovation, which is now highly relevant for talent training (upskilling, reskilling, outskilling). With this, students, workers and companies can understand and have confidence in the knowledge and skills they certify and the quality of the supplier entities. This trend opens the opportunity for universities to diversify their offer, for students and workers to broaden their knowledge and skills, and for organizations and companies to diversify their recruitment processes and have access to more people with the required profile.

ANNEX 1

Questionnaire on the use of alternative credentials

Why? Added value, institutional strategy

- What are the essential elements to consider when defining a micro-credential?
- What is the purpose of its use in undergraduate studies? Level content, update and/or complement current curricula with elective courses?
- Were they used to open non-existent offerings at the university in specific topics leading to a qualification or professional updating (graduates and/or external)?
- How do you define the content?
- What is the flexibility model that you have defined for micro-credentials?
- Do you have the same courses on Coursera and edX? How do they define which course they offer on one platform or another if they are different?

- How is it organized? Are they separate units, or are they included in each degree/unit?
- How are the protocols formalized to generate a credential? Are there requirements to declare it, forms to fill out, and minimum course hours?
- How are teachers who participate in the production rewarded when it is made and when the micro-credential is executed? Are teachers paid for the construction of asynchronous material? If they are paid, do they do it for the hours of dedication or the resulting hours for the students?
- Is an hourly rate paid or a percentage of the revenue if the courses are sold?
- Do teachers get paid each time the program is taught even though there is no interaction?
- Do you have a calculation of hours worked per teacher for each “asynchronous teaching” hour?
- How are tutors who support implementation rewarded?
- What are the costs involved in creating a micro-credential? What are the most critical points to keep in mind?
- What is the operational and cost structure to produce micro-credentials?
- Do you charge undergraduate students? Are they offered to collaborators and teachers under special conditions?
- What business models have you explored? Which ones are the most effective?

What? Definition, design

- What are the defined segments? Are they subjects whose structure better allows delivering specific content or developing skills/competencies? Can they be practical subjects, or is it fundamentally oriented toward theoretical classes? Are they rather instrumental, or can they be exploratory?
- When defining a micro-credential, do you have a defined process to formalize the course?
- When is a development considered to be new compared to an earlier one?
- How do you transition when using parts of another micro-credential? Is it done by modules or by credentials?
- How short can a course/program be under the Tec model so that a micro-credential can be awarded?
- What are the formats used? Are micro-credentials only offered online?
- What methodologies and/or tools are used for the design?
- What are the forms that deliver the content? (Videos, readings, external materials).
- Is your design different from a regular degree course? Do you have particular specifications in your planning and/or implementation? (Duration, academic hours, learning objectives, methodologies, evaluation, etc.)
- Are the assessments all self-correcting? Do you have evaluations that require someone to review, correct, and apply criteria?
- How do you calculate asynchronous student work hours?
- What is the role of teachers in implementation? Do they answer questions? Do you proofread jobs?
- Is there an academic tutor and a service tutor?
- How much time is required to develop a micro-credential course and offer it?
- What types of tools are used to ensure levels of learning?
- What factors do you consider in quality control?

- By whom and how is the course designed and produced? Is there a department in charge of this?
- Who owns the Intellectual Property? How is it managed?
- Do they have different treatments for external teachers versus contracted ones?
- What protection do you take if a teacher leaves the institution? Do you sign any transfer of rights? Indefinite or for a fixed term?

How? The evaluation process, assignment

- How are content evaluations carried out? (Partial evaluations, final evaluation, types of assessment).
- How are competencies assessed in asynchronous courses? What kind of instruments are used?
- How do you ensure standardization in students' experience of taking a micro-credential course?

When? Accreditation, throughout life

- How do you see the option of delivering the certification without taking the course, that is, accrediting the competency or knowledge?
- Do they have experience of integrating a micro-credential course into the undergraduate or graduate curriculum? If so, could an evaluation be defined that certifies the competence and/or ability?
- If the student does not pass, will they be able to take the course in micro-credential format and then obtain certification if they meet the defined evaluation?

Where? Recognition and portability

- What has been Tec's experience with micro-credentials offered through interdisciplinary courses/programs? What possible benefits can be seen in applying this model to this type of program vs. disciplinary programs?
- What things work best? Which market is more receptive?
- How does dissemination occur? Internally, through the platform used (edX, Coursera), or mixed?
- Have you explored third-party certification for your students?
- How is the certification curriculum sheet reflected? Diploma? LinkedIn?
- What are the characteristics of the components of a learning path and its criteria?
- Where can we see all the micro-credentials offered to the different segments?

ACKNOWLEDGEMENTS

The authors acknowledge the technical and financial support of Writing Lab, Institute for the Future of Education, Tecnológico de Monterrey, Mexico, in the production of this work.

COMPETING INTERESTS

The authors have no competing interests to declare.

AUTHOR CONTRIBUTIONS

Three authors contributed to the content of the article, conceptualizing the approach (Aguaded, Ramirez-Montoya), supporting the study theoretically and methodologically (Farias-Gaytan, Ramirez-Montoya), and discussing the data (Farias-Gaytan, Aguaded).

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TO CITE THIS ARTICLE:

Farias-Gaytan, S, Ramirez-Montoya, M-S and Aguaded, I. 2023. Educational Innovation with Alternative Credentials as a Driver of the Digital Transformation of the University: A Case Study in Latin America. *Journal of Interactive Media in Education*, 2023(1): 6, pp. 1–18. DOI: <https://doi.org/10.5334/jime.793>

Submitted: 31 October 2022

Accepted: 17 February 2023

Published: 24 May 2023

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Journal of Interactive Media in Education is a peer-reviewed open access journal published by Ubiquity Press.