

**CRITICAL FACTORS IN THE DEVELOPMENT OF INSTITUTIONAL MODELS  
OF DISTANCE MICRO-CREDENTIALS ORIENTED TOWARDS THE  
DEVELOPMENT OF TEACHING COMPETENCES**

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**ABSTRACT**

This article analyses critical factors shaping institutional models of distance micro-credentials for developing teaching competences in higher education. Drawing on European policy frameworks, DigCompEdu, and literature on distance education and governance, the study adopts an exploratory approach combining documentary analysis, institutional data, evaluation questionnaires and comments from four editions of a teacher training programme. Findings identify regulatory, pedagogical, organisational and technological factors influencing implementation. Results suggest that flexibility and modularity increase pedagogical complexity, reinforcing the need for instructional design, pedagogical support and institutional coordination. An analytical matrix is proposed to support the design and improvement of institutional micro-credential models.

**KEY WORDS**

micro-credentials; distance education; institutional model; higher education; teaching competences.



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**FATORES CRÍTICOS NA CONSTRUÇÃO DE MODELOS INSTITUCIONAIS DE  
MICROCREDENCIAIS A DISTÂNCIA ORIENTADOS PARA O  
DESENVOLVIMENTO DE COMPETÊNCIAS DOCENTES**

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**RESUMO**

Este artigo analisa fatores críticos que influenciam modelos institucionais de microcredenciais a distância para o desenvolvimento de competências docentes no ensino superior. Com base em enquadramentos políticos europeus, no DigCompEdu e na literatura sobre educação a distância e governação, o estudo adota uma abordagem exploratória que combina análise documental, dados institucionais, questionários de avaliação e comentários de quatro edições de um programa de formação docente. Os resultados identificam fatores regulatórios, pedagógicos, organizacionais e tecnológicos que influenciam a implementação. Os resultados sugerem ainda que a flexibilidade e modularidade aumentam a complexidade pedagógica, reforçando a necessidade de desenho instrucional explícito, apoio pedagógico e coordenação institucional. É proposta uma matriz analítica para apoiar o desenho e a melhoria de modelos institucionais de microcredenciais.

**PALAVRAS-CHAVE**

microcredenciais; educação a distância (EaD); modelo institucional; ensino superior; competências docentes.



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**RESUMEN**

Este artículo analiza factores críticos que influyen en los modelos institucionales de microcredenciales a distancia orientados al desarrollo de competencias docentes en la educación superior. Basado en marcos políticos europeos, en DigCompEdu y en la literatura sobre educación a distancia y gobernanza, el estudio adopta un enfoque exploratorio que combina análisis documental, datos institucionales, cuestionarios de evaluación y comentarios procedentes de cuatro ediciones de un programa de formación docente. Los resultados identifican factores regulatorios, pedagógicos, organizativos y tecnológicos que influyen en la implementación. Los hallazgos sugieren además que la flexibilidad y el modularidad aumentan la complejidad pedagógica, lo que refuerza la necesidad de un diseño instruccional explícito, apoyo pedagógico y coordinación institucional. Se propone una matriz analítica para apoyar el diseño y la mejora de modelos institucionales de microcredenciales.

**PALABRAS CLAVE**

microcredenciales; educación a distancia; modelo institucional; educación superior; competencias docentes.



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# Critical Factors in the Development of Institutional Models of Distance Micro-credentials Oriented Towards the Development of Teaching Competences

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## INTRODUCTION

Micro-credentials have increasingly asserted themselves as a strategic instrument in European higher education, linked to the need for more flexible, modular learning pathways oriented towards the continuous updating of skills throughout life. Their expansion is frequently framed within lifelong learning and employability agendas, yet both the literature and international reports converge in arguing that their impact depends on institutional conditions capable of ensuring quality, recognition, and trust, preventing the proliferation of formats from resulting in fragmentation and asymmetry of value (Brown & Nic Giolla Mhichíl, 2022; OECD, 2023).

The rapid expansion of micro-credentials in European higher education has intensified debates concerning quality assurance, recognition, interoperability and institutional governance. European initiatives such as the work of the Micro-Credentials Higher Education Consultation Group and the MICROBOL project highlighted the need to align micro-credentials with the principles of the Bologna Process, particularly regarding transparency, recognition and coherence with existing qualifications systems (Cirlan & Loukkola, 2020; EHEA, 2020). This concern was reinforced by the 2022 Council Recommendation on a European Approach to Micro-credentials, which established common principles and standardised descriptive elements intended to support portability, comparability and trust across systems (Council of the European Union, 2022). Research further suggests that the long-term value and sustainability of micro-credentials depend not only on their format, but on their integration into coherent institutional and quality assurance frameworks capable of articulating pedagogical design, recognition mechanisms and organisational support (European Commission, 2021; McGreal & Olcott, 2022; Oliver, 2021; Varadarajan et al., 2023).

In the Portuguese higher education context, the expansion of micro-credentials has been closely associated with institutional digital transformation strategies and with public investment programmes linked to the Recovery and Resilience Plan (PRR). Higher education institutions have increasingly been encouraged to develop short, flexible and digitally mediated learning pathways capable of supporting lifelong learning, professional upskilling and pedagogical innovation. This process has reinforced the need for institutional models capable of ensuring pedagogical consistency, technological sustainability and quality assurance in digitally mediated environments, particularly in distance education contexts where issues of instructional design, teaching support and pedagogical interaction become especially relevant.

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Despite this regulatory progress, recent research highlights a persistent gap between the policy-regulatory landscape and the concrete implementation within higher education institutions. Systematic reviews show that micro-credentials offer relevant opportunities for different stakeholders, yet they also reveal ongoing challenges related to quality assurance, pedagogical coherence, recognition mechanisms, and organisational sustainability, particularly when provision occurs in digital environments (Tamoliune et al., 2023; Varadarajan et al., 2023). Within this context, there is a need to deepen empirical evidence that clarifies how European principles translate into institutional decisions regarding design, assessment, credit recognition, support, and continuous improvement.

A particularly underexplored area concerns the development of teaching competences as an enabling infrastructure for institutional models of distance micro-credentials. The design and implementation of short, modular learning pathways in digital environments require teaching staff to have the capacity to plan by learning outcomes, design transparent tasks and assessments, select and produce digital resources, and manage interaction and tutoring processes on online platforms. The DigCompEdu framework provides a robust basis for situating these demands, as it defines competence areas associated with digital resources, teaching and learning, assessment, and learner empowerment (Redecker, 2017). In parallel, international discussion underscores the importance of clear and verifiable credentials and support ecosystems that reinforce trust and recognition, including in digital formats (UNESCO, 2022).

The interpretation of the findings is informed by three complementary perspectives: (i) European policy and governance framework for micro-credentials; (ii) literature on quality and pedagogical interaction in distance education; and (iii) The DigCompEdu framework as a reference for understanding teaching competence in digitally mediated learning environments. This articulation makes it possible to analyse micro-credentials not only as regulatory or organisational instruments, but also as pedagogical processes requiring specific forms of instructional design, teaching presence and institutional support.

It is within this context that the present study positions itself, seeking to contribute to understanding how institutional models of distance micro-credentials are built when deliberately oriented towards teacher capacity building. This article analyses critical factors in the construction of institutional models of distance micro-credentials aimed at developing the teaching competences necessary for their implementation, drawing on a methodological triangulation approach that integrates documentary analysis of the European framework (DigCompEdu) and of the institutional regulation and model, institutional data, and empirical evidence from four editions of a teacher training programme dedicated to the design and implementation of micro-credentials in distance education.

By systematising critical regulatory, pedagogical, and organisational factors, the study culminates in the proposal of an analytical matrix that articulates theory and empirical evidence. This matrix aims to contribute to the design, governance, and continuous improvement of institutional models of micro-credentials in digital contexts, offering a transferable framework for higher education institutions seeking to consolidate sustainable strategies for distance micro-credentials.

The article is structured as follows. Section 2 presents the theoretical framework, focusing on micro-credentials, institutional governance, distance education and teaching competence. Section 3 describes the methodological design, data sources and analytical procedures. Section 4 presents the results of the empirical analysis. Section 5 discusses the findings in dialogue with the literature. Section 6 concludes with the main implications, contributions and recommendations for future research, and Section 7 points some of the limitations we faced in the present study.



## THEORETICAL FRAMEWORK

### QUALITY, TRUST, AND INSTITUTIONAL GOVERNANCE OF MICRO-CREDENTIALS

The issue of quality is central across the literature on micro-credentials. Systematic reviews indicate that perceived value is strongly associated with the clarity of learning outcomes, the appropriateness of workload, the transparency of assessment criteria, and the existence of explicit quality assurance systems (Selvaratnam & Sankey, 2021; Tamoliune et al., 2023; Varadarajan et al., 2023).

European and international reports emphasise that trust in micro-credentials does not stem solely from their policy framing, but from the coherence between pedagogical design, implementation, and external communication of the credential (ENQA, 2023; McGreal & Olcott, 2022). In this context, institutional governance takes on a central role, requiring clear decision-making models, defined responsibilities, and the integration of micro-credentials into internal quality systems.

Critical studies further highlight the need to avoid ad hoc approaches, advocating structured institutional models that ensure consistency across editions, courses, and academic units (McGreal & Olcott, 2022; Wheelahan & Moodie, 2021). This body of literature reinforces the importance of empirically analysing how institutions operationalise European principles in concrete contexts, moving beyond a merely normative view of micro-credentials.

### MICRO-CREDENTIALS IN DISTANCE EDUCATION AND THE DEVELOPMENT OF TEACHING COMPETENCES

Distance education is frequently identified as a privileged modality for the implementation of micro-credentials, due to its temporal and spatial flexibility, scalability, and capacity to reach diverse audiences (OECD, 2023). However, several studies emphasise that the quality of micro-credentials in distance education depends strongly on instructional design, the modular organisation of learning pathways, and the effectiveness of mechanisms for interaction and pedagogical support (Kumar et al., 2022; Maina et al., 2022).

The growing adoption of verifiable digital credentials introduces an additional dimension to the debate. Recent research indicates that the transparency and verifiability of digital credentials positively influence students' perceived value, while also requiring clear technical and descriptive standards (Kiiskilä et al., 2023). This evidence reinforces the need for institutional models that integrate pedagogical, technological, and organisational considerations coherently.

Although the literature on micro-credentials is extensive, several authors note that the role of teacher training remains underexplored. The design and implementation of micro-credentials, particularly in digital environments, demand specific teaching competences related to planning by learning outcomes, transparent assessment, the production and selection of digital resources, and the management of pedagogical interaction (Kumar et al., 2022; Maina et al., 2022).

The DigCompEdu provides a robust structure for articulating these requirements, since it defines areas of competence associated with digital pedagogical practice (Redecker, 2017). However, systematic reviews indicate that few studies empirically examine how teacher training contributes to the operationalisation of European principles of quality and trust in micro-credentials (Selvaratnam & Sankey, 2021; Varadarajan et al., 2023).

Authors such as Martin and van der Hijden (2024) argue that the sustainability of micro-credentials depends on their integration into institutional strategies for teachers' professional development, reinforcing the idea that training is not an accessory element but rather a critical infrastructure of institutional micro-credential models. This perspective supports the need for empirical studies that connect the European framework (DigCompEdu), institutional governance, and evidence on teacher capacity-building — a gap that the present study seeks to address.

However, teaching competence in digitally mediated environments should not be reduced to technical proficiency in digital tools or platforms. Critical perspectives on online and distance education emphasise that digital teaching competence involves forms of pedagogical mediation, instructional judgement, interaction management and assessment design that are deeply contextual and relational (Garrison et al., 2000; Salmon, 2013; Selwyn, 2016). From this perspective, teaching in distance micro-credentials requires lecturers not only to mobilise digital resources, but also to sustain teaching presence, scaffold learning processes, manage asynchronous interaction and support learner engagement within flexible and modular learning environments.

This perspective also challenges instrumental interpretations of flexibility frequently associated with micro-credentials and digital education. While micro-credentials are often presented as lightweight and easily scalable learning solutions, research on online pedagogy suggests that flexibility frequently redistributes pedagogical complexity towards course design, feedback processes and the invisible labour associated with supporting learners in digitally mediated environments (Koehler & Mishra, 2009; Selwyn, 2016). Consequently, the development of teaching competence for distance micro-credentials should be understood not only as a matter of digital skills acquisition, but as part of broader institutional and pedagogical processes involving instructional design, pedagogical support and organisational coordination.

## METHODOLOGY

### STUDY DESIGN AND METHODOLOGICAL APPROACH

The present study adopts a repeated cross-sectional design, appropriate when different editions of the same intervention involve distinct participants, making it impossible to follow the intervention over time. This type of design is widely used in educational research of an institutional and evaluative nature, as it allows the identification of patterns and variations across successive cohorts without assuming individual progression (Levin, 2006; Menard, 2002).

Likewise, triangulation is particularly recommended in studies seeking to understand complex phenomena in real contexts, such as the implementation of institutional



models, as it enables the articulation of different levels of analysis and strengthens the interpretative credibility of results (Creswell and Plano Clark, 2018; Denzin, 2012).

In this context, the research follows an exploratory methodological approach guided by a logic of methodological triangulation, combining documentary, quantitative and qualitative evidence in order to analyse the implementation of an institutional model of distance micro-credentials from complementary analytical perspectives.

Documentary analysis focused on three categories of documents: (i) European and national policy and regulatory documents related to micro-credentials and qualifications frameworks; (ii) institutional regulations for distance education and for micro-credentials, pedagogical guidelines, course plans and learning design documentation associated with the institutional micro-credential model; and (iii) institutional reports produced after each programme edition. The analysis aimed to identify recurring principles, organisational procedures, pedagogical assumptions and quality dimensions associated with the implementation of distance micro-credentials and with the development of teaching competences in digitally mediated environments.

## CONTEXT, PARTICIPANTS AND DATA SOURCES

The study was conducted at a Portuguese public higher education institution (Instituto Politécnico de Leiria) that implemented an institutional model of micro-credentials aligned with the European Union's 2022 Council Recommendation (Council of the European Union, 2022). This model establishes quality principles, mandatory descriptive elements, assessment criteria and crediting procedures, ensuring coherence with the European framework in terms of transparency, recognition and portability.

The institutional model was operationalised through a teacher training programme delivered in a distance education format, designed and facilitated by the institution's Centre for Pedagogical Innovation and Distance Learning, within the scope of the Skills4Digital<sup>2</sup> and EPIC<sup>3</sup> projects funded by the Recovery and Resilience Plan (PRR). This funding enabled the acquisition of a limited number of software licences for multimedia content creation (e.g., Veed.io, Articulate, Genially), which, in turn, constrained the number of participants per edition. Between 2024 and 2025, four consecutive editions of the programme were delivered, each corresponding to approximately 41 hours of work (1,5 ECTS) and structured into three sequential challenges addressing the key stages of designing and implementing distance micro-credentials.

The training programme was delivered fully online in an eLearning mode, with a predominance of asynchronous interaction. The pedagogical design followed a modular, sequential and time-structured approach, with staged release of contents and activities according to a predefined schedule. In the first three editions, the programme included four synchronous sessions (5.5 hours), complemented by 35.5 hours of asynchronous work. In the fourth edition, synchronous interaction was reduced to 2.5 hours, maintaining 38.5 hours of asynchronous activities. This organisation allowed the combination of real-time guidance with flexible asynchronous learning, while preserving the consistency of the institutional micro-credential model across editions.

The programme had a strongly practice-oriented focus and was organised around three progressive challenges integrating multiple assessment activities. Through these challenges, participants planned and operationalised a distance micro-credential course

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<sup>2</sup> <https://skills4digital.ipleiria.pt/>

<sup>3</sup> <https://excelenciapedagogica.pt/pt-pt/epic>

and developed the corresponding pedagogical and didactic materials, adopting an active role in the learning process.

Across all four editions, the programme maintained a stable structure and a consistent graphical and organisational design within the learning management system (LMS). Each challenge included: (i) a course roadmap outlining relevance, methodology, schedule and development stages; (ii) an introductory forum (“Who is Who”) aimed at supporting social presence; (iii) a task page specifying the activities to be completed; (iv) supporting resources; (v) a satisfaction questionnaire; and (vi) an automatically issued participation certificate upon completion of the mandatory activities. Table 1 summarises the main activity types organised by challenge.

Table 1  
*Main activity types by challenge*

Challenge	Core task(s)
Challenge 1: Planning the micro-credential course	Develop the micro-credential course plan
Challenge 2: Organising the virtual learning environment	Design the virtual environment in the LMS
Challenge 3: Creating learning resources	Create multimedia resources for the first module

Across the four editions, the programme involved lecturers from different schools within the institution, representing a range of disciplinary fields, including Technology and Management (n = 22), Education and Social Sciences (n = 10), Health (n = 10), and Marine Technology (n = 3). In total, 45 enrolments were registered, of which 31 participants completed the programme and 14 did not complete all required activities. Completion of the evaluation questionnaires was voluntary, resulting in 30 valid responses distributed across the four editions (1st edition: n = 8; 2nd edition: n = 7; 3rd edition: n = 5; 4th edition: n = 10).

Participation and completion varied across editions, while completion rates were proportionally similar across schools. Overall, the repeated implementation of the programme across four consecutive editions demonstrates the consistency of the institutional micro-credential model and its applicability to teaching staff from diverse disciplinary backgrounds. Table 2 details enrolments and completion by edition.

Table 2  
*Participation and completion across the four editions*

Edition	Enrolled	Completed	Not completed	Schools represented
1st	9	7	2	Education and Social Sciences; Technology and Management
2nd	10	7	3	Technology and Management
3rd	11	6	5	Education; Technology and Management; Health
4th	15	11	4	Health; Tourism and Marine Technology; Education and Social Sciences; Technology and Management
<b>Total</b>	<b>45</b>	<b>31</b>	<b>14</b>	—



The data sources comprise documentary analysis of the European framework, the institutional regulation on micro-credentials and the pedagogical model adopted by the institution, institutional reports produced after each edition of the training programme, and evaluation questionnaires completed by participating lecturers. The combined use of institutional documentation and empirical data is consistent with recommended approaches for analysing implementation processes in higher education (Yin, 2018).

## DATA ANALYSIS PROCEDURES AND ETHICAL CONSIDERATIONS

The evaluation questionnaires included Likert-scale items (1–5) addressing course organisation, adequacy of resources, pedagogical interaction, completion of activities, and perceived development of competences for implementing distance or blended learning courses, as well as an open-ended comments field. Participation was voluntary for enrolled participants and took place after each programme edition.

Although the questionnaires do not constitute a formal instrument for assessing teachers' digital competence, several items align with core areas of the DigCompEdu framework and were used as indirect indicators of perceived competence development in the context of distance micro-credentials, a common approach in exploratory pedagogical evaluation research (Cohen et al., 2018; Redecker, 2017).

The instrument corresponds to the programme's standard institutional course-evaluation questionnaire, administered after each edition as part of routine quality monitoring. For the purposes of this study, the analysis focused exclusively on the subset of items that remained unchanged across all four editions, ensuring content stability and comparability between cohorts. Given the exploratory nature of the study and the small and heterogeneous sample, the questionnaire was used as an evaluative tool and as an indirect indicator of perceived competence development rather than as a formal measure of digital teaching competence.

Data preparation involved harmonising the common items across editions, checking internal consistency and excluding invalid responses, namely values outside the defined scale. Only items present in all four editions were retained for analysis. Quantitative data were analysed using descriptive statistics, including means, standard deviations and the proportion of responses equal to or above 4. This analytical strategy is considered methodologically appropriate given the sample sizes and the exploratory focus of the study (Field, 2018).

Open-ended comments were analysed using thematic analysis, enabling the identification of recurrent categories related to time and workload management, pedagogical interaction, digital tools, technical pedagogical support and course structure. Thematic analysis followed iterative coding and contextual interpretation procedures commonly used in educational research to examine participants' perceptions and experiences (Braun & Clarke, 2006).

All analysed data were collected in accordance with ethical principles governing institutional evaluation processes, with anonymisation of responses and full respect for confidentiality. The questionnaires did not collect sensitive personal data and the institutional documents used were authorised for internal circulation.

## RESULTS

### SATISFACTION QUESTIONNAIRES

The descriptive analysis of the evaluation questionnaires common to the four editions of the teacher-training programme consistently shows very positive evaluations of the structure and organisation of the course, as well as the adequacy of the digital resources used. These results suggest an overall positive perception of the pedagogical and organisational conditions associated with the institutional model of training for micro-credentials in distance education.

Although the programme presented relatively high non-completion rates across some editions, a pattern also reflected in the number of responses to the evaluation questionnaires, this should be interpreted in light of the voluntary nature of participation, the coexistence of the programme with regular teaching responsibilities, and the intensive practical workload associated with the development of pedagogical artefacts for distance micro-credentials. Variability in completion is frequently reported in short-format online professional development initiatives and does not necessarily correspond to negative perceptions among participants who completed the programme.

Three questionnaire items related to activity completion, perceived pedagogical adequacy and perceived development of competences for implementing distance or blended learning courses were analysed as indicators of participants' perceptions regarding competence development in the context of distance micro-credentials. The results show high levels of agreement across the four editions, although there is some variation between cohorts, particularly regarding perceived pedagogical adequacy.

Table 3 presents the means, Standard Deviation (SD) and number of valid responses per edition (n), considering only items that reflect competency indicators. The overall pattern indicates consistency across editions, with generally high and convergent values in the three indicators analysed.

Table 3  
*Perceived competence indicators by edition (Likert 1–5; M±SD; n)*

<b>Edition</b>	<b>I was able to complete the activities successfully Means</b>	<b>The activities enabled me to develop the proposed competences Means</b>	<b>I feel that I developed more competences to implement distance learning or b-learning courses/modules Means</b>
1st (2024)	4.67 (SD 0.52) (n=8)	4.83 (SD 0.41) (n=8)	4.83 (SD 0.41) (n=8)
2nd (2025)	4.00 (SD 1.49) (n=7)	3.00 (SD 1.70) (n=7)	4.50 (SD 0.71) (n=7)
3rd (2025)	5.00 (SD 0.00) (n=5)	4.80 (SD 0.45) (n=5)	5.00 (SD 0.00) (n=5)
4th (2025)	4.80 (SD 0.40) (n=10)	4.70 (SD 0.45) (n=10)	4.85 (SD 0.35) (n=10)



The evaluation questionnaires also included an open-ended comments field, whose analysis complemented and further contextualised the quantitative findings. The thematic analysis identified recurring categories across the four editions related to time and workload management, pedagogical interaction in synchronous and asynchronous modalities, technical pedagogical support, availability of digital tools and licences, and the sequence and structure of the course.

Table 4 summarises the main emerging themes, presenting anonymised representative excerpts, the approximate number of occurrences per edition and the implications for the institutional model. Comments related to time and workload management highlight the importance of realistic schedules and of making explicit the relationship between estimated workload and the proposed tasks, particularly in multimedia production activities. Pedagogical interaction was valued when it was perceived as facilitating understanding of the tasks and progression throughout the course, although some participants reported difficulty attending synchronous sessions regularly, reinforcing the importance of structured asynchronous alternatives.

Technical and pedagogical support was consistently mentioned as a facilitating factor in completing activities and overcoming difficulties, while references to tools and licences appeared less frequently, mainly associated with the predictability of access and a preference for open-source alternatives. Finally, the sequence and structure of the course were frequently perceived positively, with the progressive organisation of challenges and the scaffolding between tasks highlighted as central elements of the learning experience.

Table 4  
*Thematic analysis of open comments: categories, representative excerpts, occurrences by edition and implications*

Category (theme)	Representative excerpt (comment)	Occurrences (1st/2nd/3rd/4th)	Implication for the model
Time and workload	“It was difficult to manage the time needed to complete the tasks... perhaps extend the deadlines.”	0 / 0 / 2 / 0	Adjust schedules and time buffers for multimedia production; make workload explicit (ECTS ↔ hours).
Pedagogical interaction (synchronous/asynchronous)	“Synchronous sessions helped to streamline and contextualise learning.”	1 / 0 / 0 / 0	Define minimum interaction and tutoring requirements; ensure asynchronous alternatives when participation is low.
Technical-pedagogical support	“The support provided by the trainers was exemplary.”	1 / 0 / 2 / 1	Consolidate helpdesk and office-hours channels; strengthen formative feedback at key moments.
Tools and licences	“I would prefer open/free tools, though I understand the cost/quality issue.”	0 / 1 / 0 / 0	Plan licences in advance and offer pathways using open software where feasible.
Sequence and structure	“Well-structured course, a solid basis for other courses.”	1 / 0 / 1 / 1	Preserve the sequence of challenges and make the scaffolding between tasks and artefacts explicit.

The patterns observed in Table 3 with the thematic categories presented in Table 4, point to five programmatic conditions affecting the training experience in distance education micro-credentials: management of time and workload, availability and stability of tools and licences, quality of pedagogical interaction, instructional sequencing with scaffolding between challenges, and technical pedagogical support. The comparative analysis across editions further suggests that the stronger emphasis on asynchronous flexibility introduced in the fourth edition may have contributed to reducing constraints previously reported by participants, while maintaining high levels of perceived pedagogical adequacy and successful completion of activities. Recommendations nevertheless persist regarding the need to clarify workload expectations, ensure tutoring and feedback at critical stages of the programme, and anticipate software licensing needs while offering open-source alternatives whenever possible.

#### INTEGRATION: THEORETICAL AND CASE EMERGING FACTORS

The integration of quantitative results, thematic analysis of open comments and institutional documentation (models and regulations), and the literature (Council of the European Union, 2022; ENQA, 2023; Maina et al., 2022; Martin & van der Hijden, 2024; McGreal & Olcott, 2022; Redecker, 2017; Tamoliune et al., 2023; Varadarajan et al., 2023) enable the identification of a coherent set of critical factors for constructing and implementing institutional models of distance micro-credentials, based on empirical evidence from the four editions.

Table 5 reflects this synthesis, showing that factors widely discussed in the literature correspond to the observed institutional practices. At the same time, pedagogical and organisational factors emerge that directly shape the training experience and the perceived development of teaching competences, including time and workload management, stability of digital tools, pedagogical interaction, instructional sequencing and institutional support.

Table 5

*Critical factors for institutional models of distance micro-credentials: theoretical synthesis and evidence from the case study*

Critical factor	Theoretical basis (examples)	Evidence from the case study (4 editions)	Implications for the institutional model
Quality and transparency	Common definition, standard elements and principles of quality and portability.	Structure of challenges, consistent criteria and feedback across all editions.	Maintain clear rubrics, formative feedback and aligned learning outcomes.
Interoperability / description	ELM/EDCI and standardised elements for digital credentials.	Local regulation with ECTS and standard elements operationalised in course plans.	Standardise descriptors and ensure portability and verifiability.
Workload and time	Alignment of workload with objectives and realistic schedules.	Requests for more time in the third edition and comments about time management in earlier editions; greater homogeneity of perceptions in the fourth edition following scheduling adjustments.	Adjust deadlines and buffers and make time estimates explicit for each task.



Critical factor	Theoretical basis (examples)	Evidence from the case study (4 editions)	Implications for the institutional model
Tools and licences	Technological reliability and quality of resources.	Occasional licence constraints in the second edition; lower incidence in the fourth edition due to prior planning and alternatives.	Ensure availability, contingency plans and pathways using open-source software.
Pedagogical interaction	Engagement and tutoring in distance education.	Low attendance in synchronous sessions in the second and third editions; greater emphasis on asynchronous alternatives in the fourth edition with high levels of perceived adequacy.	Define minimum interaction requirements and reinforce asynchronous support and feedback at critical moments.
Sequence and scaffolding	Modular and progressive design.	Recurrent appreciation of the sequencing of challenges across all editions.	Stabilise the structure and reinforce scaffolding between tasks and artefacts.
Teachers' digital competence	DigCompEdu framework.	Indirect measures with high levels across all editions, with greater homogeneity following institutional adjustments.	Anchor training in DigCompEdu and monitor progress.
Assessment and crediting	Transparency in assessment and validation.	Challenge-based assessment tasks and consistent local certification.	Consolidate instruments and make the crediting process more visible.
Institutional support	Quality ecosystems and governance.	Role of the pedagogical innovation centre in support, documentation and helpdesk reported by participants.	Formalise operational plans and ensure consistency across editions.

## SYNTHESIS OF RESULTS AND IMMEDIATE IMPLICATIONS

The triangulation of quantitative indicators, qualitative data and the consolidated theoretical-regulatory framework confirms that quality and transparency, interoperability and standardised description, time and workload management, stability of tools and licences, pedagogical interaction, instructional sequencing and institutional support constitute critical factors for defining and implementing institutional models of distance micro-credentials.

In practical terms, the results suggest that fine-tuned adjustments to scheduling and support mechanisms throughout the programme, with an emphasis on asynchronous alternatives and contingency plans for licences, may mitigate variations between cohorts and maintain high levels of perceived competence for implementing distance learning or blended-learning courses. Building on this synthesis, it becomes necessary to examine how each factor aligns with the European framework and internal evidence, and which operational decisions are priorities for refining the model and sustaining quality in the next edition.

## DISCUSSION

The results of this study contribute to a deeper understanding of how institutional models of distance micro-credentials can be constructed and consolidated when deliberately oriented towards developing teaching competences. The cross-edition analysis of the four iterations of the teacher training programme shows that perceived quality and model consistency do not result solely from formal alignment with European regulatory frameworks for micro-credentials and digital teaching competence (Council of the European Union, 2022; Redecker, 2017), but from their effective translation into coherent pedagogical, organisational and technological practices at institutional level.

First, the findings confirm the centrality of quality and transparency as structuring factors of institutional micro-credential models. As argued in the literature, the clarity of learning outcomes, explicit definitions of workload, and transparent assessment criteria are decisive for participants' trust and the credibility of micro-credentials (ENQA, 2023; McGreal & Olcott, 2022; Wheelahan & Moodie, 2021). In this study, the sustained high evaluations of course structure and organisation across all four editions suggest that a stable instructional design with sequential challenges, clear rubrics and consistent feedback contributes to materialising European principles of quality and portability in institutional practice.

Second, the discussion also reinforces the importance of articulating micro-credentials with formal qualifications systems and institutional regulations. Previous studies highlight that alignment with National Qualifications Frameworks and the use of standardised descriptors are critical conditions for recognition and trust (Cedefop, 2024; Kato et al., 2020; Varadarajan et al., 2023). The empirical evidence presented here suggests that the existence of a clear institutional regulatory framework contributes to a perception of legitimacy and stability, even when operational conditions vary across editions. This finding supports the view that micro-credentials should be embedded within existing governance and quality assurance structures rather than developed as parallel or ad hoc initiatives.

A third axis of interpretation concerns time and workload management, which emerges consistently from both quantitative indicators and qualitative feedback. This finding aligns with international literature identifying workload calibration as one of the main design challenges in micro-credential provision, particularly in digitally intensive and short-format programmes (OECD, 2023; Varadarajan et al., 2023). The variations observed between editions in this study indicate that workload alignment is not a minor operational adjustment but a structural dimension of micro-credential quality. From an interpretative perspective, the results suggest that realistic scheduling, explicit articulation between ECTS and learning activities, and the inclusion of time buffers are essential for sustaining engagement and completion in distance micro-credentials, echoing findings from research on online and flexible learning design (Kumar et al., 2022; Maina et al., 2022).

Pedagogical interaction constitutes another critical dimension, in line with perspectives emphasising teaching presence and pedagogical mediation in digitally mediated education (Garrison et al., 2000). While micro-credentials and distance education are often associated with flexibility and learner autonomy, the findings indicate that the absence of clearly defined tutoring and feedback mechanisms can negatively affect the learning experience, supporting critical perspectives that associate flexibility with increased pedagogical and organisational complexity rather than simplification (Selwyn, 2016). Although synchronous participation varied across



editions, participants consistently valued pedagogical presence, guidance and timely feedback. These findings reinforce the literature (Garrison et al., 2000; Salmon, 2013) on distance education, suggesting that teaching presence does not disappear in asynchronous environments but is instead reconfigured through structured interaction, feedback, and support mechanisms. In this sense, the results refine existing assumptions by showing that autonomy in micro-credentials depends on clearly articulated pedagogical support structures that sustain engagement and progression throughout the learning process.

Beyond confirming patterns reported in the literature (Maina et al., 2022; Tamoliune et al., 2023; Varadarajan et al., 2023), the findings also raise critical questions about implicit assumptions surrounding micro-credentials in distance education. In particular, the results suggest that increased flexibility and modularity do not reduce the need for pedagogical structure, teaching presence or institutional support. On the contrary, the implementation of micro-credentials appears to redistribute pedagogical complexity towards course design, assessment transparency and teaching competences. This challenges narratives that frame micro-credentials as inherently lightweight, low-effort or easily scalable solutions, and highlights the often-underexplored demands placed on teaching staff and institutional infrastructures.

This critical reading is further reinforced by evidence related to technological and organisational conditions. Occasional constraints related to software licences and tool availability influenced participants' experiences and perceptions, while prior planning, access to alternatives, and the presence of technical-pedagogical support were consistently valued. These findings resonate with research emphasising the importance of institutional quality ecosystems, in which technological governance, support structures and resource planning are integral to the credibility and sustainability of micro-credential models (ENQA, 2023; McGreal & Olcott, 2022).

Finally, the study contributes to ongoing debates on the role of teaching competences as an enabling infrastructure for micro-credential implementation. Although much of the literature focuses on regulatory frameworks and credential formats, fewer studies empirically examine how teacher training supports the operationalisation of micro-credentials in practice (Selvaratnam & Sankey, 2021; Varadarajan et al., 2023). Interpreted through the lens of the DigCompEdu framework, the consistently high levels of perceived competence development across editions suggest that structured training programmes anchored in outcome-based design, scaffolding and formative feedback can effectively support lecturers in implementing distance micro-credentials. This finding reinforces arguments that the sustainability of micro-credentials depends on their integration into institutional professional development strategies rather than on isolated or experimental initiatives (Martin & van der Hijden, 2024).

## CONCLUSIONS

This study analysed critical factors in the construction of institutional models of distance micro-credentials oriented towards the development of teaching competences, articulating the European framework, institutional governance and empirical evidence drawn from four editions of a teacher training programme delivered in a distance education format. Through a methodological triangulation approach, the study integrated documentary analysis, institutional data and

participants' perceptions, providing a coherent account of the elements that shape the quality, credibility and sustainability of institutional micro-credential models in digital contexts.

The findings confirm that the principles defined in the European Approach to Micro-credentials, namely quality, transparency, comparability and portability, only become effective when translated into concrete institutional practices. In this sense, the results also demonstrate that increased flexibility and modularity do not reduce pedagogical complexity. On the contrary, the implementation of distance micro-credentials requires explicit instructional design, clearly articulated learning outcomes, transparent assessment criteria, sustained teaching presence and robust institutional support structures. These conditions emerge as structural rather than merely operational components of credible micro-credential models.

The analysis of the four editions also highlights the centrality of time and workload management, technological stability and pedagogical interaction as transversal critical factors. These results reinforce the literature by demonstrating that realistic scheduling, the introduction of time buffers and predictability in access to tools and licences are not merely operational details but structural components of institutional micro-credential models, with direct impact on the training experience and perceived pedagogical adequacy.

Regarding pedagogical interaction, the study suggests that the flexibility typically associated with distance micro-credentials must be balanced with clear tutoring protocols and structured asynchronous alternatives capable of ensuring equity and consistency across cohorts. Even when synchronous participation is limited, participants value timely feedback, guidance and pedagogical presence, highlighting the need for institutional models that define minimum interaction standards aligned with quality assurance principles in distance education.

Based on this evidence, and in alignment with the European framework and international literature, the study makes it possible to formulate a set of recommendations for the construction and consolidation of institutional models of distance micro-credentials. These include ensuring explicit assessment rubrics, formative feedback throughout the programme and descriptions aligned with standardised elements; clarifying the relationship between estimated workload and tasks through realistic planning; anticipating access to tools and licences along with contingency plans; defining minimum standards for pedagogical interaction supported by structured asynchronous alternatives; integrating micro-credential training into institutional professional-development strategies anchored in frameworks such as DigCompEdu; and implementing mechanisms of continuous monitoring and improvement to foster organisational learning and ensure consistency across editions.

The main contribution of this work lies in the proposed matrix of critical factors, which articulates regulatory, pedagogical and organisational dimensions with empirical evidence from a concrete institutional context. Beyond offering a descriptive framework, this matrix highlights the often underestimated pedagogical, organisational and infrastructural demands associated with the sustainable implementation of distance micro-credentials. As such, it constitutes a transferable analytical instrument for higher education institutions seeking to design, audit or refine institutional micro-credential models in alignment with the European framework and recognised quality practices.

For future research, it is recommended that this line of work be further developed through the application of formal instruments for assessing digital teaching competence within pre-post designs, the analysis of artefacts produced by lecturers and the collection of objective participation data in digital environments. Comparative and



multi-institutional studies may also contribute to testing the transferability and robustness of the proposed matrix across different governance regimes, disciplinary cultures and levels of digital maturity.

## LIMITATIONS OF THE STUDY

The results of this study should be interpreted in light of the limitations arising from the methodological design adopted and the empirical context in which the research was conducted. The choice of a repeated cross-sectional design, in which each of the four editions of the teacher-training programme involved different participants, made it possible to identify patterns and variations between successive cohorts, but does not allow for the monitoring of individual progression nor for the inference of causal relationships between the conditions under which the model was implemented and competence development. This type of design is, however, widely recognised as appropriate for institutional and evaluative studies in higher education, particularly when the focus lies on implementation processes rather than individual change over time (Levin, 2006; Menard, 2002).

The quantitative evidence collected is based on self-perception measures, used as indirect indicators of digital teaching competence in the context of distance-education micro-credentials. Although these indicators align with central areas of the DigCompEdu framework, they do not correspond to formal instruments for competence assessment and may reflect biases associated with subjective perception and social desirability. Methodological literature acknowledges these limitations, emphasising that self-reported data should be interpreted with caution, especially in the absence of pre-post measures or objective evaluations of the artefacts produced (Cohen et al., 2018; Redecker, 2017; Varadarajan et al., 2023).

The sample sizes for each edition are relatively small due to the voluntary nature of questionnaire participation, and they show variation in the number of valid responses across items, which constrains the statistical robustness of the analyses and justifies the use of descriptive statistics. This approach prioritises the identification of aggregate trends and patterns rather than inferential testing and is methodologically consistent with the exploratory nature of the study and with research conducted in specific institutional contexts (Field, 2018).

It is also important to mention that no systematic collection of objective data on the use of digital platforms was carried out, such as logs and authentications or interaction metrics, which could have complemented the participants' perceptions with behavioural evidence. Recent studies highlight that integrating digital learning data can deepen understanding of pedagogical dynamics in distance education and support more robust analyses of engagement and competence development (Tamoliune et al., 2023).

Finally, the study focuses on a single institutional context, although analysed across four consecutive editions of the training programme. This approach enables an in-depth analysis of implementation processes and the identification of recurring critical factors, but it recommends caution when directly transferring the findings to other contexts. European literature has shown that accreditation regimes, governance models and levels of digital maturity differ significantly across institutions and higher-education systems, influencing how micro-credentials are designed and operationalised (Cedefop, 2024).

These limitations delineate the scope of the results presented but do not compromise the validity of the study. On the contrary, they help clarify its analytical positioning and reinforce the relevance of future research exploring longitudinal designs, multi-institutional contexts and more diversified assessment instruments, deepening the articulation between teacher training, pedagogical quality and the credibility of micro-credentials in distance education.

## DISCLOSURE ON THE USE OF ARTIFICIAL INTELLIGENCE TOOLS

Generative artificial intelligence (ChatGPT 5.2) was used to support the translation of the original manuscript from Portuguese into English and to assist with language revision, including improvements in coherence and stylistic consistency across sections authored by multiple contributors. All substantive intellectual contributions, including the study design, data collection, data analysis, interpretation of results, and the development of arguments and conclusions, were carried out by the authors. All AI-assisted outputs were critically reviewed, edited and validated by the authors to ensure accuracy, consistency with the empirical data, and compliance with academic and ethical standards.

## AUTHORS CONTRIBUTION

Conceptualization: Manuela Francisco and Carina Rodrigues; Methodology: Manuela Francisco, Carina Rodrigues and Susana Reis; Formal Analysis: Carina Rodrigues; Investigation: Manuela Francisco, Carina Rodrigues, Susana Reis, Joana Mineiro e Tatiana Nogueira; Writing – Original Draft Preparation: Manuela Francisco; Writing – Review & Editing: Manuela Francisco, Carina Rodrigues, Susana Reis, Joana Mineiro e Tatiana Nogueira.

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