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ORIGINAL ARTICLE

Theoretical framework of educational and digital skills for the digital transformation of the teaching and learning process

Marco teórico de competencias digitales docentes para la transformación digital del proceso enseñanza aprendizaje

Nancy Andreu Gómez[1*] https://orcid.org/0000-0002-2577-1114
Maida Librada Bilbao Consuegra[1] https://orcid.org/0000-0001-6137-3810
José Antonio Marimón Carrazana[2] https://orcid.org/0000-0002-1096-5127
Ignacio Morales Martínez[3] https://orcid.org/0000-0002-2016-2088

[1] "Marta Abreu" Central University of Las Villas. Department of Educational Technology. Villa Clara. Cuba.
[2] "Marta Abreu" Central University of Las Villas. Center for Educational Studies. Villa Clara. Cuba.
[3] University of Medical Sciences of Villa Clara. "Celestino Hernández Robau". University Cancer Hospital. Santa Clara. Villa Clara. Cuba.

Corresponding author. Email: nancya@uclv.cu

ABSTRACT

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Context: to achieve a true digital transformation of higher education, developing the digital skills of faculty members is a challenge. Cuban universities are participating in this process to ensure inclusive, equitable, and quality education in the 21st century.
Objective: to present the development of a theoretical framework for the digital skills of Cuban higher education faculty in order to support the digital transformation of the teaching and learning process.
Methods: the research was conducted at the Central University "Marta Abreu" in Las Villas during the 2024-2025 academic year. A qualitative research methodology was employed, with a predominance of theoretical systematization and other theoretical methods: analysis-synthesis, induction-deduction, a systemic-structural approach, and modeling; empirical methods: online collaborative work in virtual environments, triangulation of documentary sources, and prospective structural analysis.
Results: within the framework of a sectoral project of the Ministry of Higher Education entitled “Strengthening the Digital Skills of Faculty for the Digital Transformation of the Teaching and Learning Process,” a theoretical framework for digital skills was developed to support the digital transformation of this process, with the participation of five universities in the country. This framework is structured around four main areas of competence (didactics, technology, professional attitude, and management and innovation), each with specific variables and indicators.
Conclusions: this framework provided the necessary theoretical basis for integrating policies and implementing assessments of the digital skills of faculty at the five participating universities, based on the identified areas, sub-areas, and indicators.
MeSH: information technologies and comunication projects; competency-based education; computer literacy; educational technology; education, higher

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RESUMEN

Fundamento: para lograr una verdadera transformación digital en educación superior, el desarrollo de competencias digitales en docentes representa un reto. Las universidades cubanas se insertan en este proceso para garantizar una educación inclusiva, equitativa y de calidad en el siglo XXI.

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Objetivo: exponer la construcción de un marco teórico sobre las competencias digitales docentes en la educación superior cubana para la transformación digital del proceso enseñanza aprendizaje.
Métodos: se realizó una investigación en la Universidad Central “Marta Abreu” de Las Villas, durante 2024-2025. Se empleó una metodología de investigación cualitativa con predominio de la sistematización teórica y otros métodos teóricos: análisis-síntesis, inducción-deducción, sistémico estructural y modelación; empíricos: el trabajo colaborativo en línea en ambientes virtuales, la triangulación de fuentes documentales y el análisis estructural prospectivo.
Resultados: como resultado de proyecto sectorial adscrito al Ministerio de Educación Superior titulado “Fortalecimiento de las competencias digitales de los docentes de la educación superior para la transformación digital del proceso de enseñanza-aprendizaje”, se conformó un marco teórico de competencias digitales docentes para la transformación digital del PEA con la participación cinco universidades del país. Estructuralmente se compone de cuatro grandes áreas de competencia (Didáctica, Tecnológica, Actitud Profesional y Gestión e Innovación) cada una de ellas con sus respectivas variables e indicadores.
Conclusiones: este marco ha constituido la base teórica para la integración de políticas y la realización de diagnósticos de competencias digitales docentes en las cinco universidades participantes, sobre la base de las áreas, subáreas e indicadores obtenidos.
DesC: proyectos de tecnologías de información y comunicación; educación basada en competencias; alfabetización digital; tecnología educacional; educación superior.

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INTRODUCTION

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The digital transformation of Cuban higher education represents a revolution in traditional paradigms, where the development of digital teaching skills appears as a crucial element for a successful transition to more effective educational models. This innovation transcends the simple adoption of technologies and implies a profound revolution in teaching methodologies and knowledge construction, enabling the creation of personalized learning environments adapted to the challenges of the 21st century.

In this context, training in digital teaching skills appears as a strategic imperative for faculty, as it is essential for maintaining academic relevance and meeting the needs of a connected student population. These skills enable the development of innovative teaching practices, the creation of high-quality educational resources, the strengthening of collaboration and the promotion of active methodologies, in order to improve the quality of higher education. This challenge also aligns with the objectives of the 2030 Agenda for Sustainable Development.(1)

For Cuban higher education, the digital transformation of teaching and learning processes is a priority. This objective is supported by national reference documents: the “Digital Transformation Policy,” the “Cuban Digital Agenda,” and the “Artificial Intelligence Strategy,” which envision this process as a comprehensive cultural shift placing the citizen at the center.(2)

Based on this observation, the sectoral project “Strengthening the Digital Skills of Higher Education Faculty for the Digital Transformation of the Teaching and Learning Process” (code PS223LH001-072) aims to create a contextualized framework of digital skills for faculty. Its distinctive feature lies in its specific approach to the transformation of the teaching and learning process, adapted to the Cuban context and drawing upon the regulatory framework of the Ministry of Higher Education (MHE) and Cuban pedagogical traditions.

This article aims to present the development of a theoretical framework for digital skills in higher education in Cuba, with a view to the digital transformation of the teaching and learning process.

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MÉTODOS

A study was conducted at the Central University "Marta Abreu" in Las Villas during the 2024-2025 academic year. To develop a digital skills framework for teaching, a qualitative research methodology was employed, emphasizing theoretical systematization, supplemented by quantitative methods. The study focused on a sample of 16 specialists in educational technologies and digital skills from the five universities participating in the project. The inclusion criteria were as follows: training and experience in the field of educational technology, a master's or doctoral degree, and a willingness to participate as evaluators.

The following theoretical methods were used:

- Theoretical systematization: This allowed for the organization, reconstruction, and coherent integration of existing knowledge on the research problem, thus providing a renewed and well-supported understanding of the theoretical positions adopted.
- Analysis and synthesis: This enabled the decomposition of the constituent elements of the competency frameworks studied and the results of previous research (domains, competencies, indicators).
- Induction and deduction: This enabled the identification of regularities and general trends from the examination of specific theoretical studies, thereby establishing the common patterns that support the proposition.
- Systemic-structural approach: This allowed for the analysis of the research problem by addressing it as a complex system, emphasizing relationships, interdependencies, and the emergent structure of these interactions.
- Modeling: Creation of a simplified graphical representation visualizing the essential relationships and components of the proposed theoretical framework.

Empirical methods:

Online collaborative work: through the use of a Moodle virtual classroom integrating interactive activities such as wikis and discussion forums, sharing and consensus were

facilitated on the following points: a) the definition of the concept of "Digital Transformation of the Teaching and Learning Process," and b) the preliminary determination of competency areas, sub-domains (variables), and indicators.

Triangulation of documentary sources: internationally recognized digital competence frameworks for teaching, recent research (national and international) and Cuban regulatory documentation were analyzed and compared in order to establish regularities and justify the proposed variables and indicators.

Prospective structural analysis: This technique, supported by MICMAC software, enabled the identification and classification of variables according to their relationships of influence and mutual dependence. The objective was to determine the key variables (the most influential and least dependent) and the linking variables (both influential and dependent).

Procedure

1. Initial orientation and organization (January 24, 2024): an inaugural videoconference was held via Google Meet with the participants. The project was presented, the objectives of this phase were explained, and the official communication channels were established: a virtual classroom on Moodle (serving as a central repository for information and formal work) and a WhatsApp group (for agile communication and logistics).
2. Collaborative conceptual definition: two working teams (producers and reviewers) were formed using a collaborative wiki on Moodle. After studying the specialized literature, the production team developed a definition of the "Digital Transformation of the Teaching and Learning Process", which was then reviewed and refined by the review team. The following operational definition was thus adopted:

"The digital transformation of the teaching and learning process encompasses all changes related to the design, implementation, and evaluation of this process. The introduction of information and communication technologies (ICTs) fosters a renewal of didactic and curricular design through the introduction of new methodologies, new media, and new technological tools, as well as new ways of assessing and organizing teaching. This renewal induces a cultural shift among the stakeholders involved and generates a forward-looking

vision for the development of organizational and management policies and strategies aimed at academic effectiveness".

Systematic review and variable proposal: four teams were formed with specific tasks:

1. Analysis of international digital skills frameworks (DigCompEdu, UNESCO, ISTEE, etc.).
2. Review of the international literature on teachers' digital skills.
3. Review of the literature on teachers' digital skills in the Cuban context.
4. Analysis of regulatory documentation from the Ministry of Higher Education (MHE) and the Ministry of Communications (MICOM) to identify guidelines related to digital skills and digital transformation.

The dissemination of results and the proposal of an initial list of variables and indicators were carried out via Moodle discussion forums and a summary videoconference. A prospective structural analysis was used to identify consensus variables, which were then used to construct a matrix of direct relationships. Each specialist assessed the relationship between each pair of variables. The assessment method for each pair was used to construct a final consensus matrix, which was processed using MICMAC software. This analysis made it possible to classify the variables, identify their power of influence and dependence, and validate the hierarchical structure of skills.

The MICMAC process enabled the identification of a coherent final structure for the competency framework. The main result of this methodological phase was the definition of four fundamental competency areas, subdivided into 16 sub-domains (strategic variables), and operationalized through 72 indicators specifying the digital pedagogical skills required for the digital transformation of Cuban higher education.

RESULTS AND DISCUSSION

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The first question requiring in depth analysis was the feasibility of adopting the dimensions of existing digital competency frameworks, adapting them to the context of Cuban higher education, without considering them as mutually exclusive options. It was agreed that existing digital competence frameworks such as the EU's DigComp, the ISTE standards or the Spanish reference framework for digital competences in education are extremely valuable for the following reasons:[3,4,5,6,7]

- They provide a common and structured language through internationally recognized taxonomy and terminology, ensuring that no essential area is omitted.
- They facilitate assessment and certification, and their standardization allows for the design of comparable and recognized instruments in various contexts.
- They represent a saving of time and resources, making the use of a validated framework an effective strategy.

However, the indiscriminate application of a universal framework carries several risks:

- A European or North American framework might not reflect the technological, infrastructural, pedagogical, cultural, or socio-economic realities of the Cuban education system.
- General frameworks do not incorporate the foundations of Cuban pedagogy, particularly the learning theories that underpin it. Regulatory frameworks for the design, implementation, and evaluation of technology-mediated teaching and learning are based on these foundations.
- Rigidity and inability to adapt: Given that technology and its social uses are evolving rapidly, a contextualization process allows for more agile, continuous updating, integrating tools and practices relevant to the specific context.

It was therefore decided to select relevant variables from international frameworks applicable to the Cuban context and to construct a contextualized theoretical framework for the development of digital skills in teaching. This framework is structured around a fundamental triad: established ministerial policy, the regulatory framework in force, and the theoretical foundations of Cuban pedagogy.

These patterns emerged through comparative analysis of widely recognized frameworks, such as the European Digital Competence Framework for Educators (DigCompEdu),[3] the Common European Framework of Reference for Languages (CEFR),[4] the UNESCO Digital Competence Framework for Teachers,[5] the TPACK Framework (Technological, Pedagogical and Disciplinary Knowledge),[6] and the ISTE standards for educators.[7]

Patterns were also identified in studies by recognized international[8,9,10,11] and national experts[12,13,14,15]. Among the Cuban researchers, we can cite: Coloma Rodríguez *et al*.[13], Estrada-Molina *et al*.,[14] and Valdés *et al*.[15]

The definition of digital competence in teaching proposed by INTEF was well received:

"... the set knowledge, skills and attitudes that allow the efficient, responsible and creative use of digital technologies in educational, professional or personal contexts,[4] servesd as a guide to operate three of the dimensions of the frameword under construction: didactic, technological and professional attitude".

The study by Coloma *et al*.[13] proved invaluable in establishing the foundations and revealing the relationship between the dimensions of different reference frameworks, and in proposing areas of competence adapted to the Cuban context. Building on these solid foundations, this study focuses more specifically on the area of pedagogical competences, thus addressing the need for a reference framework centered on the digital transformation of the teaching and learning process.

It was observed that, while all the analyzed frameworks recognize the importance of the didactic, technological, behavioral, organizational, and managerial dimensions -albeit with different terminology- none explores the didactic sequence or the skills required for the different phases of the teaching and learning process (planning, implementation, and assessment).

The analysis conducted by Verdú-Pina *et al*.[11] on 31 publications from the last ten years proved interesting. Its objective was to identify the similarities and differences in the concepts of digital competence in teaching in order to establish their relationship with its dimensions. It confirmed that the structuring of the competency framework was heading in the right direction.

Furthermore, the definition by Cabero-Almenara *et al*.,[8] which conceives of digital competence in teaching (DCT) as: "…the set of knowledge, skills, and strategies specific to the teaching profession that enable Teachers to solve the educational problems and challenges posed by the knowledge society…" reinforced the importance of integrating the management and innovation dimension into the framework under development, emphasizing the need to use strategies to address these problems and challenges.

The work of George Reyes[12] and Estrada Molina[14] provided essential references; their dimensions of digital competence in teaching are fully consistent with the findings presented here. The main finding is the consensus that emerged regarding the fundamental role attributed to the didactic dimension in the development of digital competence in teaching, given that digital transformation is the objective toward which the competency framework under development is striving.

Didactics reminds us that technology is a means, not an end in itself. Without a solid didactic foundation, there is a great risk of using technology in a technocratic, decontextualized, and ineffective way. These principles align with the TPACK model,[6] which argues that technology should serve the learning of content, and not be a mere supplement or an end in itself.

Thus, although technology is a determining factor in digital transformation -the most studied area in the literature- it is the didactic dimension that gives pedagogical meaning to these skills, adapting them to the specific needs of each educational context.

The methodological triangulation was complemented by an analysis of the regulatory framework of the Ministry of Higher Education, designed to specify the institutional

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requirements for developing teachers' digital skills. The review of documentation included strategic guidance tools, among them:

- Digital Transformation Policy, Cuban Digital Agenda, and Artificial Intelligence Strategy (2024)
- Regulations for the Organization of the Teaching Process and the Management of Pedagogical and Methodological Work in University Programs. Resolution 47/22 (2022)
- Curriculum E Core Document (2018)
- Distance Learning Model for Cuban Higher Education. CENED (2016)
- Draft Strategy and Policy for Open Science and Education (2019)
- Regulations on Postgraduate Higher Education in the Republic of Cuba. Resolution No. 2/2018 (2018)
- Distance Professional Development for Postgraduate Students. Resolution 110/2020 (2020)

Digital Competency Framework for Faculty for the Digital Transformation of the Teaching and Learning Process in Cuban Higher Education

The structure and content of this competency framework are presented below. Figure 1 illustrates the four domains.

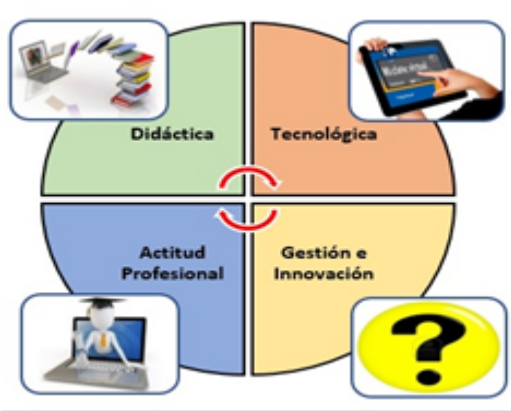

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Fig. 1. Competency Domains of the Digital Competency Framework for Faculty for the Digital Transformation of the Teaching and Learning Process in Cuban Higher Education
Source: author's elaboration

The didactic domain constitutes the very heart of the proposal, giving it its unique character. This dimension is operationalized through the indicators presented in Table 1, distributed according to the different stages of the teaching and learning process.

The didactic domain constitutes the distinctive core of the proposal, as it is what gives it its unique character. This dimension is operationalized by the indicators presented in Table 1, distributed according to the different stages of the teaching and learning process.

Table 1. Competency Area 1: Didactics

1.1 Planning the Teaching and Learning Process
Design an online learning guide that provides a solid foundation for the activity, sufficient support to help students understand the approach, and a coherent and logical content structure.
Identify and select study materials, digital resources, reference documents and other sources of information, in any format suitable for the assimilation and management of different content by students.
Create and/or select appropriate digital learning resources, taking into account the context, learning objectives, students' diagnostic assessments and their potential for engagement with content and learning situations.
Design educational activities that motivate and stimulate reflection and introspection, favoring an interdisciplinary and problem-based approach, making the student an active participant in their learning, and fostering decision-making and creativity.
Select digital resources adapted to the existing technological context.
Design educational activities and select digital resources that take diversity into account and promote personalized learning.
Design learning activities using digital resources based on the specific needs, context,

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and professional profile, in coordination with other professionals.
Develop a didactic approach that unifies independent and collaborative learning.
Select active learning methodologies to guide the instructional design of the virtual learning environment, enabling the effective achievement of learning objectives within a stimulating and creative framework.
Adapt curricula to new conditions and contexts.
1.2 Implementation of the teaching and learning process
Develop a continuous interaction and communication process that considers the unity of cognitive and affective dimensions, provides learners with feedback not only on their errors but also on their potential, and encourages their progress in a climate of trust.
Implement innovative teaching and learning methodologies mediated by ICT (flipped classroom, gamification, project-based learning, challenge-based learning, etc.).
Implement teaching organization methods and learning strategies using digital resources that promote collaborative and independent learning.
Offer different learning pathways, levels, and paces.
Combine various communication, interaction, and information management applications (LMS, virtual labs, websites, communication platforms, repositories, etc.).
Evaluate the effectiveness of the implemented actions and adjust them accordingly.
1.3 Implementation of the teaching and learning process
Provide personalized feedback and differentiated support to students based on data generated by the digital technologies used.
Use digital assessment tools to track and monitor the learning process and obtain information on student progress.
Leverage the potential of digital resources to assess activities that progress through different levels of content assimilation.
Implement assessment functions (diagnostic, formative, and summative) based on the potential of the assessment resources.
Critically analyze and interpret digital statistics on student activity, performance, and

progress to adjust teaching and learning.
Critically analyze and interpret digital statistics on student activity, performance, and progress to adjust teaching and learning.
Empower students to evaluate and interpret their results so they can self-assess, identify areas for improvement, and self-regulate.
Diversify and combine digital resources so that assessment takes place in a creative environment where students feel motivated and confident.
Use digital technologies to inform students individually of their assessment results.

Source: author's development.

The technological domain emphasizes the mastery and effective application of digital tools to enrich the teaching and learning process. It encompasses everything from information management and software manipulation to content creation and digital security, thus ensuring critical, creative, and secure use. It includes the following indicators, presented in Table 2.

Table 2. Competency Domain 2: Technologies

2. 1 Information technology skills
Navigate, search, and filter information, data, and digital content for integration into the PLE.
Organize and analyze digital information, evaluating its purpose and relevance.
Store and retrieve information, data, and digital content.
Evaluate information, data, and digital content on the Web.
Identify effective search strategies for processing digital information
2. 2 Software and hardware skills
Develop IT skills for using the LMS, specialized software, and other applications that complement the professional learning environment (PLE).
Develop IT skills for integrating various devices and technological resources (mobile phones, interactive whiteboards, etc.).

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Incorporate emerging technologies such as AI, virtual reality, augmented reality into the PLE, among others.
Use digital technologies to record, compare, and synthesize data on student progress
2. 3 Evaluation and selection of programs, applications or platforms
Critically evaluate the credibility and reliability of the computer sources and resources to be used.
Consider and resolve potential accessibility issues when selecting, modifying, or creating digital resources and provide alternative or compensatory tools or approaches for students with special needs.
Select the appropriate digital technologies to promote active learning in a given learning context or for a specific learning objective.
2. 4 Creation of digital content
Create new digital educational resources (MOOCs, OER, educational videos, online courses, infographics, among others).
Integration and reworking of digital content
2.5 Adaptability and personalization
Develop skills to readjust to updates of existing applications, new programs, alternatives, or emerging technologies such as artificial intelligence, augmented reality, among others.
Develop skills to customize computer applications.
2. 6 Security
Protection of information and personal data in the PLE.
Implementation of measures to protect data and confidential information related to the PLE.

Source: author's development.

Professional Attitude area transcends mere technical mastery to address the dispositions, values, and ethical principles that guide the integration of ICTs. This dimension assesses the teacher's commitment to innovation, their critical and reflective stance toward technology, their collaboration, and their adherence to an ethical and legal code. It constitutes the

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foundation upon which all digital competencies are responsibly and effectively built. It includes the following indicators, grouped in Table 3.

Table 3. Competency Area 3: Professional Attitude

3. 1 Willingness and commitment to integrating ict into the teaching and learning process
Active participation in ICT integration, positive attitude towards pedagogical change.
Professional commitment to undertaking tasks related to integrating ICT into the teaching and learning process.
3.2 Ethical and legal conduct
Respect the various licenses assigned to digital resources and the implications of their reuse.
Properly cite sources when sharing or publishing copyrighted resources.
Assign (open) licenses to user-created resources.
Modify and edit existing digital resources when permitted.
3.3 Critical and reflective thinking
Critically analyze one's own teaching practice using ICT to inform decision-making and continuously improve the process. Understand the role of ICT in educational policies and contemporary society.
Identify gaps in the development of one's digital skills.
3.4 Collaborative attitude
Use digital technologies to collaborate with other teachers to improve the teaching and learning process through inquiry.
Use digital technologies to collaboratively develop teaching resources.
Share digital content using links or attachments, online platforms, or personal or institutional websites/blogs.
Create, participate in, and promote disciplinary, interdisciplinary, and transdisciplinary networks.
3. 5 Continuous professional development and research

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Continuously improve the integration of ICT into the teaching and learning process through various means: postgraduate studies, online courses, methodological activities, academic training programs, and/or personal development.
Use ICT to support research activities.
Explore the use of programs, applications, and methodologies that integrate ICT to improve the teaching and learning process.

Source: author's elaboration.

The "Management and Innovation" domain represents the most significant impact of digital teaching competence, as it extends beyond the classroom to influence the entire educational institution. This dimension assesses the ability to guide, manage, and transform teaching and learning processes through ICT. It emphasizes the willingness to design institutional strategies, energize technological ecosystems, and, fundamentally, the capacity to generate pedagogical innovation through the design of advanced learning experiences, the creation of new resources, and creative problem-solving.

This project aims to improve teaching practices and the educational community as a whole. It is structured around the indicators presented in Table 4.

Table 4. Competency Area 4: Management and Innovation

4. 1 Willingness and commitment to integrate ICT into the teaching and learning process
Active participation in the design of policies and strategies to improve the teaching and learning process through ICT.
Active participation in the institution's academic and organizational dynamics for the development of the teaching and learning process.
Use of ICT to organize and energize processes related to improving the teaching and learning process, with an emphasis on the functioning of a technological and management ecosystem.
4.2 Innovation
Design and implementation of advanced experiments integrating ICT into the teaching

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and learning process.
Creation of innovative digital content and teaching resources.
Implementation of new practices and creative problem-solving through ICT, drawing on the teaching and learning process and the teaching community.

Source: author's elaboration.

This digital skills framework for teaching has proven its validity by serving as the theoretical basis for a diagnostic assessment conducted between October and November 2024 in the five universities participating in the project. This assessment identified gaps, strengths, patterns, and trends in faculty digital skills.

The digital transformation of higher education is a complex process that goes beyond the simple integration of technological tools. It requires a profound renewal of didactic and curricular approaches, the adoption of active and innovative methodologies, and, fundamentally, a change in attitude and a proactive, forward-looking vision on the part of teachers and administrators. In this context, the development of digital skills for teaching... is considered an essential condition for promoting management policies and strategies that lead to greater academic effectiveness.

Scientific contribution

The framework's structure, organized into domains, subdomains, and indicators with their respective rating scales, has demonstrated its practical utility by enabling the design and implementation of a robust diagnostic tool. Its application in five universities across the country generated significant data revealing trends, potential, limitations, and developments in the current digital skills of faculty, thus providing a crucial benchmark for action.

CONCLUSIONS

The results of implementing this framework provide a solid basis for decision-making, enabling the development of integrated policies and effective teacher training strategies at the institutional level. Furthermore, this framework represents a valuable tool for

establishing evaluation and self-evaluation guidelines, facilitating a process of diagnosis and continuous improvement of the digital skills of Cuban higher education faculty.

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Declaration of interests

The authors declare no conflict of interest.

Author contributions

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Conceptualization: Nancy Andreu Gómez, Maida L. Bilbao Consuegra, José A. Marimón Carrazana, Ignacio Morales Martínez

Data curation: Nancy Andreu Gómez, Maida L. Bilbao Consuegra, José A. Marimón Carrazana, Ignacio Morales Martínez

Formal analysis: Nancy Andreu Gómez, Maida L. Bilbao Consuegra, José A. Marimón Carrazana, Ignacio Morales Martínez

Project management: Nancy Andreu Gómez

Research: Nancy Andreu Gómez, Maida L. Bilbao Consuegra, José A. Marimón Carrazana, Ignacio Morales Martínez

Methodology: Nancy Andreu Gómez

Supervision: Nancy Andreu Gómez

Validation: Nancy Andreu Gómez, Maida L. Bilbao Consuegra, José A. Marimón Carrazana, Ignacio Morales Martínez

Visualization: José A. Marimón Carrazana, Ignacio Morales Martínez

Original version: Nancy Andreu Gómez

Editing: José A. Marimón Carrazana, Ignacio Morales Martínez