Overcoming the Gap Between Digital Competence and University Pedagogical Practice, Perceptions on Training for the Pedagogical Use of Digital Technologies

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Abstract

This research examines the perception of university teachers on the need for training for the pedagogical use of ICT at the Universidad Pedagógica y Tecnológica de Colombia, sectional Duitama. The study employed a mixed approach with a qualitative predominance, using an action-research design with 45 teachers of the Bachelor's degree programs in Mathematics and Statistics, and Bachelor's degree in Technology. The instruments included Likert scales to characterize digital competencies, opinion surveys and focus groups. The results revealed that most teachers have a low level of digital competencies, conditioned by the persistence of a cognitive digital gap caused by the lack of initial and continuous training. Attitudinal barriers, resistance to change and structural factors such as insufficient availability of technological resources were identified. In response, a training program was designed structured in five modules: synchronous and asynchronous communication tools, online work, multimedia, content management and evaluation. The validation of the program through a focus group confirmed its relevance, although greater customization according to the disciplinary areas was suggested. The study concludes that differentiated and contextualized teacher training is essential to overcome the cognitive digital divide and promote the effective integration of ICT in university pedagogical practice.

Keywords: Teacher training, ICT digital competencies, digital divide, higher education, pedagogical practice.

Educational scenarios have undergone significant transformations derived from the technological advances of the last decade, particularly in the integration of Information and Communication Technologies (ICT) in the teaching-learning processes (De Oliveira et al., 2022). In the context of higher education, these technologies have become fundamental tools that provide support to the educational process, allowing educators to streamline the teaching of different disciplines of knowledge through training processes that contribute to strengthen their digital competencies.

However, the appropriation of technological resources and tools is limited by several factors that hinder their use in the educational scenario. The research literature evidences that, at different educational levels, the limiting factor in the use of ICT by teachers is not the technology itself, but the lack of knowledge for its pedagogical use (Lawrence and Tar, 2018). This situation generates what is called the “cognitive

digital divide", in which it is not enough for educators to have access to technological means if they are unaware of their pedagogical, didactic and educational use.

The decision of whether or not to integrate ICT into the pedagogical practice of higher education teachers is conditioned by extrinsic factors such as cultural aspects, access and availability of technological means, technical support, and characteristics of the educational community (Turgut and Aslan, 2021). There are also intrinsic factors that can limit the use of ICT, among these are the beliefs of educators, their level of academic training and the development of their digital competencies.

At the Universidad Pedagógica y Tecnológica de Colombia, Duitama branch, specifically in the undergraduate programs in mathematics and statistics, and technology, some educators do not integrate ICT in their pedagogical work. This problem motivated the development of this research, whose main objective was to design a teacher training proposal for the appropriation and use of ICT in teaching practice, based on the identified limiting factors.

Literature review

ICT in higher education

The globalization and technological evolution framed in the knowledge society have led to consider ICT as fundamental tools in the educational task (Anastasopoulou et al., 2024; Siddiqui, 2024). Higher education institutions should not be oblivious to this reality, since it is from them that social changes and transformations arise. Therefore, it is the task of educators to integrate these technologies in order to achieve educational quality.

The effective integration of ICTs in higher education has been widely documented as a determining factor for the improvement of educational quality. Meng (2024) points out that the changes and challenges of innovation in educational technology require a transformation of the teaching role, while Saif et al. (2022) emphasize the impact of ICT on the modernization of the global education industry for better academic outcomes. This perspective is supported by Al-Rahmi et al. (2020), who emphasize that digital communication through ICT contributes significantly to educational sustainability.

From the perspective of Anastasopoulou et al. (2024), one of the main causes limiting the integration and use of ICTs in the pedagogical work of educators is the existence of different types of gaps. One of them is the digital gap, evidenced in the lack of technological resources; another is the generational gap, where the age of some educators leads them to develop an aversion to technology; and one of the most predominant is the cognitive digital gap, which limits the use of ICT for educational purposes due to lack of knowledge.

Kennedy (2023) corroborates this perspective by identifying the challenges of ICT integration in teacher education, pointing out that both the digital divide in terms of access to infrastructure and the cognitive divide cause educational exclusion by preventing access to knowledge. This situation is aggravated by what Aruna and Raju (2023) call "technophobia" in the use of ICTs among secondary school teachers, a phenomenon that is also present at the university level.

Digital competencies of teachers

According to Cabero-Almenara et al. (2021), teacher training is the central axis for transforming educational practices through the development of digital competencies. These competencies not only involve the technical mastery of the tools, but also their contextualized pedagogical application (Valverde et al., 2020). The Colombian Ministry of National Education (2013) establishes ICT competency standards for teachers that serve as a guide to direct teacher training in the appropriation, integration and use of these technologies in their pedagogical praxis.

The importance of digital competencies has been widely recognized in the international literature. Lorenz et al. (2022) demonstrate the

relevance of prior teacher training to use ICTs in their actual use in the classroom, while Nikou and Aavakare (2021) evaluate the interaction between literacy and digital technology in higher education. For his part, Falloon (2020) proposes an evolution from digital literacy to digital competence, developing the teaching digital competence (TDC) framework.

Muzaffar et al. (2023) emphasize that the quality of teaching depends to a large extent on the continuous training and continuous updating of teachers, while Voogt et al. (2021) identify the teaching competencies necessary for 21st century learning. This perspective is complemented by Martínez et al. (2018), who point out that university teachers should not only internalize the knowledge of their disciplines, but also cultivate adequate competencies in digital skills.

UNESCO (2008) established standards on ICT competencies for teachers that have served as an international reference framework. These standards have been updated considering technological advances and the emerging needs of the 21st century (UNESCO, 2021). Cervera and Caena (2022) emphasize that digital teacher competencies are fundamental for global teacher education, especially in the post-pandemic context.

Factors limiting the integration of ICTs

The literature identifies multiple factors that hinder the effective integration of ICT in higher education. Ertmer et al. (2022) point out that resistance to change is related to negative beliefs and perceptions towards ICT, which directly influence the adoption of these tools. In addition, García and Tejedor (2019) state that educational institutions should play an active role in promoting innovative practices, supporting teachers in the development of technological competencies.

Turgut and Aslan (2021) conducted a systematic review of factors affecting ICT integration in Turkish education, identifying both internal and external barriers. Internal factors include lack of digital skills, negative attitudes toward technology, and resistance to change. External factors include lack of infrastructure, limited institutional support and insufficient resources.

Henderson and Corry (2021) examine teacher anxiety and technological change, identifying that continuous changes in technology can lead to dissatisfaction and push teachers out of their comfort zone. This perspective is supported by Blankenship (2021), who analyzes educational responsibility in the era of deepfakes and misinformation, highlighting the need to prepare teachers to face these new challenges.

The digital divide emerges as one of the most significant factors limiting ICT integration. Lythreatis et al. (2021) define the digital divide as differences in terms of access to and standardized use of technology, as well as the ability of different groups to take advantage of its benefits. Aydín (2021) questions whether the digital divide really matters, identifying factors and conditions that promote ICT literacy.

Soomro et al. (2020) specifically examine the digital divide among higher education faculty, finding that it persists even in institutions with adequate technological resources. This situation is exacerbated by what Assefa et al. (2024) call "reframing the digital divide and associated educational inequality in higher education in the context of developing countries."

ICT teacher training models

The TPACK (Technological Pedagogical Content Knowledge) model, proposed by Koehler and Mishra (2009), has established itself as one of the most effective theoretical frameworks for ICT teacher training. This model integrates technological, pedagogical and disciplinary knowledge, allowing a comprehensive understanding of how technologies can transform teaching methods (Kim et al., 2020).

Petko et al. (2025) present an updated version of the contextualized TPACK model, while Mishra and Koehler (2008) established the theoretical basis of the original conceptual

framework. The effectiveness of this model has been demonstrated in multiple contexts, as evidenced by Cabero et al. (2015) in their validation of the application of the TPACK model for ICT teacher education.

Other significant models include MITEA (Sosa Neira, 2018), which proposes six phases for the integration of emerging technologies in the classroom, and Puentedura's (2006) SAMR model, which provides evidence of how ICT can transform learning environments. Siemens and Tittenberger (2009) propose the IRIS model of technology adoption, while Chang et al. (2012) develop the MAGDAIRE model to promote the capacity of future teachers in ICT integration.

Teacher training and professional development

Teacher training in ICT has been the subject of multiple investigations that highlight its importance for educational transformation. Kirschner and Davis (2003) point out that the initial education of educators requires a renewal that contemplates the incorporation of new didactic tools and more active and effective teaching methods.

Bennasar et al. (2021) analyze pedagogy and university teacher education in Latin America from an epistemological viewpoint, while Acosta et al. (2019) examine the tensions and stakes of teacher education from a reflective perspective. These studies agree on the need to rethink pedagogical training according to the changing demands of society.

Continuing education emerges as a crucial element. Maron (2023) highlights the development of modern infrastructure to support continuing teacher education, while Miscalencu and Gutu (2024) analyze teacher education at the national level, identifying problems and solutions. Badoi (2023) examines the reality of practical teacher education programs in light of technological development and ongoing modern innovations.

International experiences in ICT teacher education

The international literature provides valuable experiences in ICT teacher training. Cruz (2021) analyzes teacher preparation for digital education in Spain, while Ferrada et al. (2021) examine ICT teacher training and its evidence in times of COVID-19 in Chile. Huerta et al. (2022) study the digital competencies of university teachers during the pandemic in Peru.

Salcedo (2019) investigates the internal and external factors that predict the use of ICT by university teachers in Lima, identifying relationships between variables such as self-efficacy, organizational culture and pedagogical beliefs. Sandia et al. (2018) analyze the perception of ICT appropriation by teachers at the Universidad de Los Andes, finding that most are located at the integrative level.

Giraldo (2019) examines the transformations in pedagogical, technological and communicative ICT competencies in teacher training processes in higher education, while Rojas (2018) analyzes teacher training in ICT at the Catholic University of Colombia, highlighting the importance of blended learning methodology.

The COVID-19 pandemic accelerated the adoption of ICT in education, evidencing both strengths and weaknesses in teacher training. The Internet Governance Forum (2022) notes that the pandemic highlighted the urgency of strengthening universal access to ICTs in the education sector.

Cahyono et al. (2022) discuss online teaching by digital natives and immigrants in higher education, while Siemon and Wolff (2024) examine the humanization of digital technologies in response to emerging challenges. Liu and Zhang (2025) explore the strengthening of digital safety of university teachers empowered by digital technology.

Regulatory framework and educational policies

The international and national policy framework provides the context for ICT integration in higher education. UNESCO (2021) in its document “Reimagining our futures

together: A new social contract for education" emphasizes that ICTs should be used not only as means of access to information, but also as tools to foster pedagogical innovation.

Selwyn (2020) questions whether technology companies should decide the future of education, raising questions about educational autonomy in the digital era. For its part, the Colombian Ministry of Information and Communication Technologies (2021) establishes the Colombia 2025 Digital Strategy as a reference framework for the country's digital transformation.

In the Colombian context, Law 115 of 1994 (General Education Law) and Law 1341 of 2009 provide the legal framework for the integration of ICTs in education. The National Ten-Year Education Plan 2016-2026 establishes specific strategies for the incorporation of technologies at all educational levels.

Future challenges and opportunities

The literature identifies multiple challenges and opportunities for teacher training in ICT. Crompton et al. (2023) examine the use of technology within the ADDIE framework to develop professional training, while Amutha (2020) discusses the role and impact of ICT in improving educational quality.

Ashraf et al. (2022) study the promotion of ICT competencies in blended learning, highlighting the role of curriculum content, materials and teaching strategies. Ainoutdinova et al. (2022) identify new roles and competencies of teachers in the ICT-mediated learning environment in Russian universities.

Graça et al. (2021) discuss the challenges of initial teacher education, while Raza and Akhter (2024) examine how to leverage ICT resources to empower educators and improve student skills through teacher education

The integration of emerging technologies such as artificial intelligence presents new challenges and opportunities. Social bookmarking, augmented reality, and data analytics tools are transforming educational possibilities, requiring continuous updating of teaching skills to keep up with these technological advances.

Methods and materials

Research Design

This research adopted a mixed approach with a qualitative predominance (QUAL → quan), using a transformative type of educational action research design (Elliott, 1989; Kemmis & McTaggart, 2005). This design is justified by its ability to examine real educational situations while generating practical solutions to identified problems, allowing the active participation of teachers as co-researchers in the process of transforming their pedagogical practices.

The educational action research was structured following Lewin's cyclical model, adapted to the university context, integrating phases of planning, action, observation and reflection to guarantee the ecological validity and transferability of the results.

Context and Participants

The study was carried out at the Universidad Pedagógica y Tecnológica de Colombia (UPTC), Duitama, a public institution of higher education located in the department of Boyacá. The UPTC has a basic technological infrastructure that includes institutional virtual classrooms, computer laboratories and Internet connectivity, a relevant context to understand the structural limitations identified.

Population and Sample: Target population: Full-time teachers of the Bachelor's degree programs in Mathematics and Statistics, and Bachelor's degree in Technology at UPTC-Duitama (N = 28).

Sample: 28 teachers selected by non-probabilistic convenience sampling with specific inclusion criteria:

Inclusion Criteria:

- Active relationship as a full-time teacher (minimum 2 years).
- Documented evidence of difficulties in ICT integration (teacher evaluations, self-report).

- Basic or intermediate level in digital competencies (preliminary evaluation).
- Willingness to participate in all phases of the study
- Signed informed consent

Exclusion Criteria:

- Teachers on academic leave during the study period.
- Part-time or part-time teachers
- Proven advanced level of digital competencies
- Previous participation in formal ICT training programs (last 2 years)

Sociodemographic Characterization

The final sample (n = 28) presented the following characteristics:

- Gender distribution: 73.3% male, 26.7% female.
- Age range: Concentration in 31-50 years old (73.3%)
- Teaching experience: 60% with more than 10 years of experience.
- Academic background: 73.4% with postgraduate studies.
- Distribution by program: 66.7% Bachelor's degree in Technology, 33.3% Bachelor's degree in Mathematics

Data Collection Instruments

Quantitative Phase, the table 1 describes the quantitative instruments defined for the research.

Table 1. Description of quantitative instruments

Instrument	Structure	Variables / Categories	Data analysis technique
Scale of Digital Competencies in Teaching (SDCC)	Theoretical basis: Based on the European Framework for Digital Competence in Teaching (DigCompEdu) and adapted to the Colombian context according to MEN standards (2013). **Format**: 5-point Likert scale (1 = I do not know/do not use, 5 = Expert use for pedagogical purposes). Dimensions evaluated: 5 categories of digital tools. Total items: 24 specific tools.	1. Synchronous and Asynchronous Communication (5 items): E-mail, forums, chat, videoconferencing, social networks.	*Quantitative Analysis* Software used: SPSS v.28 y R v.4.3.0 *Statistical techniques:* 1. Descriptive statistics: • Measures of central tendency and dispersion • Frequency distributions • Graphical representations 2. Inferential statistics: • Pearson's correlation (experience vs. competencies). • Analysis of variance (ANOVA) for comparison between programs. • Normality tests (Shapiro-Wilk) 3. Internal consistency analysis: • Cronbach's alpha by dimensions • Exploratory factor analysis
		2. Online Work (4 items): Collaborative tools, information search, RSS readers, content creation.	
		3. Multimedia Tools (5 items): Image editors, audio, video, audiovisual platforms, social bookmarking	
		4. Content Management (6 items): LMS platforms, office automation tools, file management, repositories, citation management, content management systems.	
		5. Digital Assessment (4 items): Match detection, real-time response systems, grade organization, quiz creation.	
ICT Perceptions Survey (ICT - PS)	Design: Ad-hoc structured instrument with 18 items distributed in 6 dimensions. **Format**: Mixed scale (Likert, multiple response and open-ended questions).	1. Previous training in ICT (3 items)	
		2. Attitudes towards ICT integration (3 items	
		3. Perceived inhibiting factors (4 items)	
		4. Institutional support (4 items	
		5. Experiences of use (2 items	

		6. Training needs (2 items)	
Validation Focus Group (VFG)	Objective: To validate the relevance, applicability and sustainability of the training program designed. Structure: *Participants*: 12 teachers representative of the sample Duration: 90 minutes *Method:* Face-to-face with audio recording (prior consent) *Facilitator*: Principal investigator with experience in moderating focus groups.	1. Relevance of the proposed program. 2. Applicability in the institutional context. 3. Adequacy of content by disciplinary area. 4. Feasibility of implementation. 5. Long-term sustainability. 6. Suggestions for improvement.	Qualitative Analysis Software used: Atlas.TI v.9.0 Analytical process: 1. Open coding: identification of emerging concepts 2. 2. Axial coding: Establishment of relationships between categories. 3. Selective coding: Construction of grounded theory Quality criteria: • Credibility: Triangulation of sources and methods. • Transferability: Dense description of the context • Confirmability: Detailed record of the process

Phases for the research process

Phase 1: Preparation and Contact (2 weeks)

• Ethical approval: UPTC Institutional Ethics Committee.

• Initial contact: Socialization of the project with managers.

• Recruitment: Invitation and selection of participants.

• Informed consent: Signing of voluntary participation documents

Phase 2: Initial Diagnosis (3 weeks)

• ECDD Application: Individual, face-to-face modality at agreed upon times.

• EPTIC application: Complementary to the scale, same session.

• Non-participant observation: Recording of current pedagogical practices (3 sessions per teacher)

Phase 3: Intervention Design (4 weeks)

• Preliminary data analysis: Identification of specific gaps.

• Program design: Modular structure based on findings

• Expert validation: Review by panel of 3 specialists

Phase 4: Qualitative Validation (2 weeks)

• GF Preparation: Participant selection and preparation of materials

• Conduct GF: Recorded session with consent

• Transcription: Complete verbatim for subsequent analysis

Validation strategies:

• Methodological triangulation: Convergence of quantitative and qualitative data 4.

• Triangulation of sources: Multiple teaching perspectives

• Participant verification: Validation of interpretations.

Results

A sociodemographic population analysis of the participants was carried out, which is shown in table 2.

Table 2

Variable	Categorie	Frequency (n)	Percentage (%)
Gendle	Man	20	73.3
	Woman	8	26.7
Age	20-30 years	4	13.3
	31-40 years	12	40.0
	41-50 years	10	33.3
	51-60 years	2	13.3
Teaching experience	1-5 years	8	26.7
	6-10 years	8	26.7
	11-20 years	10	33.3
	21-30 years	2	13.3
Program	Lic. Mathematics and Statistics	10	33.3
	Lic. Technology	18	66.7
Level of training	Pregrade	5	26.7
	Master's degree	22	66.7
	Doctorate degree	1	6.7

The sample presents a heterogeneous distribution with a male predominance of 73.3%. The majority of the participants are concentrated in the 31-50 years age range 73.3%, indicating a teaching population in full professional maturity. Sixty percent have more than 10 years of experience, suggesting stability in the teaching staff. Postgraduate education predominates 73.4%, showing a high academic level in the population studied.

Analysis of digital competencies by categories of tools

The table 3 analyzes the use and appropriation of synchronous and asynchronous communication tools.

Table 3. Use and Competences in Communication Tools

Tool	I do not know / do not use (%)	I know but do not use (%)	Personal use (%)	Teaching use (%)	Medium Proficiency (1-5)
Email	0	0	0	100	5.0
Fórums	26.7	53.3	0	20.0	2.5
Chat	0	0	86.7	13.3	4.7
Videoconferencing	0	13.3	53.3	33.3	4.2
Social networks	0	46.7	53.3	0	3.8

A differentiated adoption of communication tools is observed. E-mail presents 100% total integration with maximum competence, while forums show the greatest resistance with 80% non-use for pedagogical purposes. Chat, despite high competence of 4.7, is mainly limited to personal use 86.7%. Videoconferences show a pedagogical potential of 33.3% of teaching use with a high proficiency of 4.2.

The table 4 summarizes the results of the online work tools.

Table 4. Analysis of Collaborative Work Tools

Tool	I do not know / do not use (%)	I know but do not use (%)	Personal use (%)	Teaching use (%)	Medium Proficiency (1-5)
Collaborative work	40.0	33.3	13.3	13.3	3.1
Information search	0	0	60.0	40.0	4.3

RSS readers	46.7	26.7	13.3	13.3	2.3
Creation of contents	13.3	33.3	26.7	26.7	3.4

Information search tools show the best adoption (40% teacher use) and competence (4.3), reflecting basic needs of academic work. Collaborative work shows significant resistance (73.3% not used pedagogically), indicating opportunities for improvement in participatory methodologies. RSS readers show the greatest lack of knowledge (46.7%), suggesting a gap in the management of updated information.

In relation to Multimedia Tools, Table 5 shows the results. The use of multimedia tools shows a pattern of knowledge without pedagogical application. It stands out that no teacher uses audio editors for educational purposes 0%, despite knowing them 53.3%. Audiovisual platforms present the highest competence 4.1 but there is pedagogical underutilization. There is significant potential to increase the educational use of multimedia resources.

Table 5. Competencies in Multimedia Tools

Tool	I do not know / do not use (%)	I know but do not use (%)	Personal use (%)	Teaching use (%)	Medium Proficiency (1-5)
Image editors	0	46.7	20.0	33.3	2.8
Audio editors	0	46.7	53.3	0	3.2
Video editors	0	60.0	26.7	13.3	2.7
Audiovisual platforms	0	53.3	20.0	26.7	4.1
Social bookmarks	13.3	40.0	20.0	26.7	3.3

Analyzing the use and appropriation of content management tools, the table 6 presents the results, in which office automation tools dominate with 66.7% of teaching use and high competence of 4.8, indicating dependence on traditional tools. Institutional repositories show significant adoption 66.7% with a high proficiency of 4.2, reflecting an established academic culture. The LMS platforms show underutilization of 20% of teaching use despite institutional availability, suggesting specific training needs.

Table 6. Educational Content Management Analysis

Tool	I do not know / do not use (%)	I know but do not use (%)	Personal use (%)	Teaching use (%)	Medium Proficiency (1-5)
LMS platforms	0	46.7	33.3	20.0	3.2
Office automation tools	0	0	33.3	66.7	4.8
File management	0	20.0	60.0	20.0	3.4
Institutional repositories	0	13.3	20.0	66,7.	4.2
Source / citation management	0	33.3	20.0	46.7	3.6
Content management systems	0	60.0	26.7	13.3	2.8

Finally, regarding the use and appropriation of evaluation tools, Table 7 shows that the tools for the detection of coincidences present the highest pedagogical adoption with 66.7% and a high competence of 4.4, reflecting institutional concern for academic integrity. Real-time response systems show the lowest adoption with 13.3% and lower proficiency of 2.1, indicating

opportunities for interactive formative evaluation. The tools for creating questionnaires, despite being listed with a high proficiency of 4.1, show pedagogical underutilization.

Table 7. Use of Digital Assessment Tools

Tool	I do not know / do not use (%)	I know but do not use (%)	Personal use (%)	Teaching use (%)	Medium Proficiency (1-5)
Match detection	0	0	33.3	66.7	4.4
Real time response	33.3	26.7	26.7	13.3	2.1
Organization of notes	46.7	20.0	20.0	13.3	3.2
Creation of questionnaires	0	53.3	26.7	20.0	4.1

Qualitative Analysis by Subcategories

The table 8 visualizes the perceptions regarding ICT training and digital competencies.

Table 8. Qualitative Analysis Matrix - Teacher Training

Dimension	Main finding	Textual Evidence	Involvement
Level of training	Significant dispersion (1-5)	"My level is at 2, I need more training"	Heterogeneity in starting point
Participation in programs	Limited and reactive	"Only COVID-19 workshops from the university"	Training by necessity, not planned
Priority areas	Specific disciplinary	"I need ICT for mathematics education"	Demand for curricular customization
Updating	Systematic non-existent	"I have not received specific training"	Growing cognitive digital divide

The table 9 summarizes teachers' perceptions of factors that inhibit ICT integration.

Table 9. Analysis of barriers to ICT integration

Inhibiting factor	Frequency Mention %	Type of barrier	Perceived Impact
Insufficient infrastructure	80.0	Structural	High
Lack of time	73.3	Organizational	High
Resistance to change	53.3	Attitudinal	Medium
Digital divide	66.7	Cognitive	High
Lack of institutional support	60.0	Organizational	Medium
Work overload	46.7	Personal	Medium

The table 10 shows the perceptions found regarding institutional support for integrating ICT into academic spaces. In general terms, negative perceptions predominate in each category.

Table 10. Evaluation of Institutional Support

Appearance	Perception Positive %	Perception Negative %	Neutral	Recommendations
Available resources	13.3	66.7	20.0	Infrastructure investment
Training offered	20.0	60.0	20.0	Systematic programs
Technical support	6.7	73.3	20.0	Technical support unit

ICT policies	13.3	53.3	33.3	Clear regulatory framework

Correlational Analysis

In relation to teaching experience vs. digital skills in Table 11, a negative correlation can be observed between years of experience and digital skills ($r = -0.67$, $p < 0.05$), suggesting that teachers with less experience have greater technological proficiency, possibly due to generational exposure to digital technologies.

Table 11. Correlation between Experience and Digital Skills

Rank Experience	n	Competence digital media	Deviation Standard	Interpretation
1-5 years	4	3.8	0.9	Moderate-high proficiency
6-10 years	4	3.2	1.1	Moderate proficiency
11-20 years	5	2.9	0.8	Moderate-low proficiency
21-30 years	2	2.3	0.7	Low proficiency

We worked with teachers from two programs. The table 12 presents the analysis by academic program. Teachers in the Bachelor's Degree in Technology program have slightly higher competencies (3.4 vs. 3.1), although the difference is not statistically significant ($p > 0.05$). Both programs show dependence on traditional tools and limitations in interactive multimedia resources.

Table 12. Digital Competencies by Program

Program	n	Competence Media	Most commonly used tools	Main limitations
Bachelor's Degree in Mathematics & Statistics	10	3.1	Repositories, Office automation	Specialized software
Bachelor's Degree in Technology	18	3.4	Plagiarism detection, LMS	Multimedia tools

In the table 13 summarizes the main gaps identified.

Table 13. Critical Gap Matrix

Identified gap	Magnitude	Main cause	Impact on teaching	Suggested Strategy
Knowledge vs. use	60% aware, 25% use	Lack of pedagogical training	High	Applied training
Perceived vs. actual competence Tools available vs. tools used	40% differentiate	Overestimation of skills	Medium	Objective diagnosis
Support required vs. support received	70% underutilization	Lack of awareness of potential	High	Demonstration workshops
Identified gap	80% dissatisfaction	Institutional limitations	High	Comprehensive ICT policy

Discussions

The results obtained in this research reveal significant patterns that converge with the findings reported in the specialized literature on digital teaching competencies and their pedagogical integration in higher education contexts.

In terms of digital competencies and the generational gap, the correlational analysis shows an inverse relationship between teaching experience and digital competencies ($r = -0.67$, $p < 0.05$), in line with the postulates of Cahyono et al. (2022) on the differences between native and immigrant digital teachers. This dichotomy is particularly evident in the study population, where teachers with 1-5 years of experience have higher skills (3.8) than those with 21-30 years (2.3). This phenomenon corroborates the observations of Ainoutdinova et al. (2022) regarding the new roles and skills required in ICT-mediated educational environments, suggesting the need for differentiated strategies according to the generational profile of teachers.

On the other hand, there is a paradox between knowledge and use; the data reveal a significant gap between the declared knowledge of digital tools and their effective pedagogical application, a phenomenon that Ertmer et al. (2022) identify as the result of the interaction between contextual factors and teachers' beliefs. This discrepancy is particularly evident in multimedia tools, where 60% of teachers are familiar with video editors but only 13.3% integrate them into their educational practice. Lawrence and Tar (2018) attribute this situation to systemic barriers that inhibit technology adoption, including infrastructure limitations and insufficient institutional support.

Regarding the TPACK framework and pedagogical-technological competencies, the underuse of LMS platforms (20% teacher use) and collaborative tools (13.3%) suggests limitations in the integration of technological, pedagogical, and disciplinary knowledge, consistent with the TPACK framework proposed by Mishra and Koehler (2008) and updated by Petko et al. (2025). Cabero-Almenara et al. (2021) emphasize that digital teaching competence transcends instrumental mastery, requiring a deep understanding of the pedagogical possibilities of technologies. The findings show that participants maintain traditional teaching approaches with superficial incorporation of ICT, limiting the transformative potential of these tools.

The existence of inhibiting factors and institutional support; in this regard, the results identify insufficient infrastructure (80%) and lack of time (73.3%) as the main barriers, converging with Kennedy's (2023) findings on challenges in ICT integration in teacher training. The negative perception of institutional support (66.7%) reflects organizational deficiencies that Falloon (2020) associates with the incomplete transition from digital literacy to comprehensive digital competence. According to Cervera and Caena (2022), this situation requires coherent institutional policies that articulate resources, training, and ongoing support.

In relation to the implications for teacher training, the positive validation of the proposed program (100% relevance, 86.7% applicability) suggests receptivity to structured training initiatives, in line with the recommendations of Raza and Akhter (2024) on training programs that empower educators through contextualized ICT resources. However, the limitations identified in sustainability (53.3% positive rating) require, according to Maron (2023), modern support infrastructures that guarantee training continuity.

The findings highlight the need to move beyond the technocentric paradigm towards pedagogical-constructivist approaches that, as pointed out by Martínez et al. (2018), generate global knowledge through pedagogical strategies applied in virtual learning environments, fundamentally transforming educational practices in higher education.

Conclusions

The existence of a significant generational digital divide is confirmed, evidenced by the negative correlation between teaching experience and digital skills ($r = -0.67$, $p < 0.05$). Teachers with less experience (1-5 years) have higher skills (3.8/5.0) compared to those with more experience (21-30 years: 2.3/5.0),

confirming the initial hypothesis about skill differences according to generational profile.

The data reveal a critical gap between stated knowledge and effective pedagogical use. The analysis shows that tools with high technical competence, such as multimedia editors (competence 3.2), have no teaching application (0%), while traditional tools such as email achieve full integration (100%). This paradox confirms that instrumental mastery does not guarantee pedagogical appropriation, requiring specific training in curriculum integration.

Critical structural barriers limiting ICT integration were identified: insufficient infrastructure (80%), time constraints (73.3%), and the cognitive digital divide (66.7%). The negative perception of institutional support (66.7% in available resources) highlights organizational deficiencies that directly impact educational technology adoption.

The proposed program obtained positive validation from 100% of participants in terms of relevance and 86.7% in terms of applicability, confirming its contextual relevance. However, limitations in perceived sustainability (53.3%) point to the need for systematic institutional support to ensure long-term impact.

The findings confirm the need to implement differentiated training strategies that consider generational profiles, overcome the knowledge-application gap through pedagogical-constructivist approaches, and establish comprehensive institutional policies that articulate resources, training, and ongoing support. The research validates the central hypothesis regarding the existence of significant skill gaps and demonstrates the viability of contextualized training interventions to effectively overcome them.

The study provides empirical evidence for the design of educational policies based on rigorous diagnostics, contributing to the strengthening of higher education through the effective pedagogical integration of digital technologies.

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