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Analysis on Uses, Attitudes, and Technological Knowledge Gaps in University Professors

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ABSTRACT

While Information and Communication Technologies (ICT) have gained ground across higher education, technical disciplines with strong field traditions—such as Agricultural Engineering—face unique challenges when shifting from traditional practice to digital environments. This study examined the current state of technology integration among faculty members in the Agricultural Engineering Academic Program at the Autonomous University of Nayarit (UAN). Specifically, it explored how professors utilize digital tools, their underlying attitudes toward technology, and the main knowledge gaps impacting their teaching practices. A quantitative, cross-sectional census approach was conducted with all active program faculty (N = 40), gathering data through a comprehensive survey instrument (alpha = 0.89). Findings show a strong, positive disposition toward digital adoption. Nearly 80% of respondents consider ICT essential for university teaching, 93.75% acknowledge its value in boosting routine productivity, and 92.5% express a clear desire for further professional training. However, actual implementation remains largely instrumental. While basic office software, email, and web searches are fully integrated into daily routines (100%), more than half the staff reports little to no experience with virtual learning platforms, videoconferencing tools, or multimedia resource design. Key obstacles include self-reported technical-pedagogical gaps (32.5%), resource constraints, and an isolated work dynamic where 56.25% of teachers never collaborate with peers to plan tech-based activities. In conclusion, positive faculty attitudes alone are insufficient to bridge the digital divide. Sustainable progress requires targeted, discipline-specific pedagogical training, institutional investment in infrastructure, and formal collaborative spaces to move from basic operational usage toward meaningful technopedagogical mediation.

Keywords: ICT in education, higher education, teacher digital competencies, teaching attitudes, Agricultural Engineering.

INTRODUCTION

According to the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2023), the incorporation of Information and Communication Technologies (ICT) has become a strategic priority for higher education institutions. Effectively adopting these educational resources in teaching not only seeks to keep universities at the forefront, but also to provide students with functional tools that increase their professional competitiveness in a highly digitalized society. In this line, Calero Verdesoto et al. (2026) point out that the pedagogical strengthening of teaching digital skills allows for a reflective response to current technological demands.

Likewise, UNESCO (2023) stresses that the impact of ICT transcends the classroom space. On the one hand, it stimulates collaborative work between students and professors; on the other hand, it favors territorial integration through network infrastructures that connect local communities with regional and international environments. In

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this regard, Noriega Gonzales (2026) indicates that the development of digital skills in teaching staff fosters educational inclusion and strengthens sustainability in higher education institutions.

In Mexico, this perspective has been integrated into national educational policies, where the Ministry of Public Education (SEP) considers teaching digital competencies as a cross-cutting axis in training programs (DOF, 2012). Far from responding to a passing trend, the adoption of technologies in public universities represents a gradual process of evaluation and adaptation of teaching practice (Córdova Esparza et al., 2024).

Various studies analyze this process. In the teaching field, studies such as those by Mendoza et al. (2015) and Avendaño and Avendaño (2016) highlight a positive disposition among teaching staff toward incorporating digital resources. In turn, Gómez et al. (2012) explain that university students naturally inhabit virtual environments, interactive networks, and multimedia platforms, using them daily to consult information and communicate.

In technical and agricultural programs, the literature shows particular nuances. Guiardo et al. (2016) highlighted the relevance of integrating technological subjects into agronomic training, while experiences at the Autonomous University Chapingo show that the use of the Internet and computer tools is part of the academic dynamic in agricultural engineering. In this regard, Gaona et al. (2024) and Candia López et al. (2026) emphasize that addressing mastery of digital environments from local reality is essential to reduce gaps and consolidate active teaching methods.

On the other hand, UNESCO (2023) insists on the need to move from simple device access toward the reflective development of technopedagogical skills. In the same line, Molina Mateo (2024) maintains that teacher digital training is key to narrowing technological differences in the classroom. Similarly, Benítez Mero et al. (2026) point out that the integration of digital resources favors student motivation and autonomy when there is constant institutional support.

Despite these advances, much of the literature has examined educational actors in isolation. There remains a need for comprehensive diagnostics focused on degree programs with a strong field tradition, such as Agricultural Engineering, where practical activity has historically predominated over digital mediation. Today, information and telematic tools have become indispensable for the development of the agricultural sector.

In this scenario, it is necessary to clarify the real situation regarding the uses, technical mastery, and attitudes of teaching staff toward technologies in agricultural education. Therefore, this research poses the following question: What are the uses, attitudes, and knowledge of professors in the Agricultural Engineering Academic Program at the Autonomous University of Nayarit regarding Information and Communication Technologies in the teaching-learning process?

Theoretical Framework

Definition and Conceptually Dynamic Evolution of ICT

Defining Information and Communication Technologies (ICT) implies recognizing a constantly changing concept, hand in hand with technical advances and the approaches of each era. Today, ICT constitutes an integrated ecosystem that brings together computing, communication networks, and interactive audiovisual environments (Marqués, 2012), whose use has expanded to information management in areas such as health, commerce, and education.

In the educational field, the presence of ICT has progressively transformed institutional practices. Beyond their instrumental value, recent research conceives them as an articulated technopedagogical environment ranging from virtual platforms to artificial intelligence solutions and cloud storage (Calero Verdesoto et al., 2026; Córdova Esparza et al., 2024).

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From a pedagogical perspective, Herrera (2009) agrees that technologies expand methodological possibilities in universities, highlighting the good reception of these tools by the student body. Likewise, studies such as those by Vivar et al. (2011) and Álvarez and López (2013) show that leveraging everyday digital spaces for students helps strengthen communication and motivation in higher education.

In this regard, UNESCO (2013, 2023) promotes access to technology as a strategic axis for educational equity and quality. However, as López de la Madrid and Chávez (2013) point out, the success of these tools depends directly on the teacher's preparation and didactic mediation, who transitions from transmitting information to coordinating active learning processes (Benítez Mero et al., 2026; Briseño, 2013).

Context of ICT in Latin America and Mexico

To address digital divides in Latin America, various public initiatives have been launched through national programs that seek to link technological development with the strengthening of social equity.

In Mexico, the integration of ICT has guidelines in national development plans and Ministry of Public Education instruments. Since the publication of agreements for educational quality in the Official Journal of the Federation (DOF, 2012), the importance of training teaching staff in the didactic and research use of technology has been highlighted. At the time, data from INEGI (2016) showed adoption mainly centered in urban areas, oriented toward information searches, communication, and social networks.

Recent research in the country indicates that the challenge has shifted from simple connectivity toward the consolidation of teaching digital competencies in face-to-face and hybrid modalities (Candia López et al., 2026; Córdova Esparza et al., 2024). Diagnostics emphasize the need to adapt training programs to the characteristics of each discipline, particularly in applied areas such as agronomy (Gaona et al., 2024; Noriega Gonzales, 2026).

Uses of ICT in University Teaching Practice

The way professors incorporate technology into their daily work shows different levels of ownership. Authors such as Sáez (2010) emphasize that the university challenge lies in moving from basic instrumental use toward more participatory teaching methodologies.

In Mexican public universities, diverse situations are observed. Torres et al. (2010) reported an initial level of adoption at the Autonomous University of the State of Morelos (UAEM), where a significant proportion of professors used computers solely for elementary tasks. In contrast, Castillo et al. (2010) found at the University of Guadalajara (UdG) that 44% of teaching staff integrated ICT into their classes, relating this practice to the clarity of institutional support and equipment availability.

Likewise, studies by Sensoles and García (2010) and Peñaherrera (2011) agree that technology incorporation requires continuous training and technical support. Although most faculty recognize the relevance of ICT (Álvarez et al., 2011), the scarcity of methodological training often results in traditional expository uses (Hernández et al., 2014; López de la Madrid & Chávez, 2013). As Gaona et al. (2024) and Molina Mateo (2024) conclude, it is necessary to offer teacher training programs adapted to the particularities of each field of knowledge.

Teaching Attitudes, Perceptions, and Knowledge toward ICT

Faculty attitudes and perceptions are decisive for technology integration in the classroom. In educational research, attitude is understood as the cognitive, affective, and behavioral disposition toward a situation or resource, while

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perception encompasses the ideas the teacher forms regarding the utility and feasibility of available tools.

Riascos-Erazo et al. (2009) conducted a comparative study between public and private higher education institutions, whose findings are summarized in Table 1:

Table 1. Comparison of perception, impact, and ICT use between public and private universities

Dimensions of Analysis	Private University	Public University
Teaching Perception	High: Consider ICT priority and an indispensable support for teaching and research.	Medium: Recognize the value of ICT, but point out the need for more training and equipment/software updating.
Impact on Teaching Work	Very Positive: Stimulates constant updating and encourages the search for new didactic tools.	Positive: Facilitates access to information and streamlines communication with students.
Degree of Utilization	High in Teaching and Research: Supported by continuous availability of infrastructure and software licenses.	High in Management and Teaching: Sustained by specific training efforts and technical support.
Telematic Integration	Constant use of digital media oriented toward course planning and development.	Variable use, subject to the availability of equipped classrooms and good connectivity.
Difficulties / Challenges	Risk of technological dependence and language barriers in some specialized programs.	Equipment obsolescence, limited budgets, and the need for contextualized training courses.

Note. Adapted from Riascos-Erazo et al. (2009).

In the Latin American environment, Jiménez and Vivas (2011) reported that 80.3% of teachers consider including ICT in universities indispensable, and 95.5% perceive that it enriches learning. Regueyra (2011) showed at the University of Costa Rica that the organized use of platforms and virtual forums fosters responsibility and independent study in students. However, Caicedo-Tamayo and Rojas (2014) observed that despite having a

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favorable opinion, teaching staff tend to employ a limited repertoire of tools due to a lack of methodological accompaniment.

On the other hand, Hernández et al. (2014) and Vera et al. (2014) point out that teacher technical experience influences classroom integration, finding that many professors handle basic office software but require guidance to give it a pedagogical sense. This coincides with the findings of Díaz et al. (2014) at the Autonomous University of Carmen, where more than 50% of teachers indicated requiring further training in ICT.

Finally, studies conducted at the Autonomous University of Nayarit (Mendoza et al., 2015) and at the Autonomous University of Chiapas (Avendaño & Avendaño, 2016) confirm a positive and receptive attitude by faculty toward technology use. However, concerns persist regarding infrastructure availability and technical support quality. Recent authors (Benítez Mero et al., 2026; Calero Verdesoto et al., 2026; Noriega Gonzales, 2026) conclude that addressing these challenges requires local diagnostics to guide institutional continuous training programs.

METHODOLOGY

This research was developed under a quantitative approach of descriptive and correlational scope, adopting a non-experimental and cross-sectional design. This framework is ideal for capturing the actual state of technological variables at a specific moment in the institutional life of the Autonomous University of Nayarit (UAN), functioning as a precise statistical diagnosis (Vargas-Martínez et al., 2018; Vargas-Martínez et al., 2023).

Population and Sample

Given the bounded size of the academic faculty of the Agricultural Engineering Academic Program (PAIA), a non-probabilistic census design was adopted in which 100% of the active faculty participated (N = 40), which eliminates sampling error and guarantees maximum fidelity in the collected data. Although this approach constitutes an in-depth institutional case study that limits universal generalization to other contexts or disciplines, it provides total internal validity for the studied population. With this, a rigorous and replicable diagnostic baseline is consolidated for higher education institutions with similar technical or agricultural training areas.

Data Collection Instrument

Information was collected through a structured questionnaire consisting of 42 closed-ended items with a 5-point Likert scale (ranging from "Strongly disagree / Never" to "Strongly agree / Always"). The instrument was organized into four operational dimensions: a) sociodemographic and technological context, b) frequency and typology of hardware and software use, c) attitudinal dimension toward ICTs, and d) self-perception of digital competencies.

Content validity was evaluated through expert judgment by three specialists in educational technology. Meanwhile, the overall internal consistency of the instrument reached a Cronbach's Alpha coefficient of 0.89, certifying a high level of psychometric reliability. As it is a self-report instrument focused on teaching attitudes, beliefs, and practices, the subjective nature of the responses is acknowledged; however, this approach is methodologically appropriate and common for exploring affective and cognitive dimensions of faculty.

Data Processing and Analysis

Given the descriptive-correlational scope of the study and the complete coverage of the target population through the census (N = 40), data processing, frequencies, percentages, and cross-tabulations were carried out using Microsoft Excel. This tool provided the required mathematical precision to comprehensively characterize population distributions without sampling distortion or the need for probabilistic estimations on partial samples.

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RESULTS

Sociodemographic and Academic Aspects

The participating faculty presented a gender distribution composed of 57% men and 43% women. Regarding the highest level of education, it is notable that the vast majority holds postgraduate degrees: 50% hold a doctorate, 34% a master's degree, and the remaining 16% a bachelor's degree.

Regarding age groups, the faculty is mainly concentrated in intermediate ranges: 26% are between 36 and 40 years old, 24% between 46 and 50 years old, 21% between 41 and 45 years old, 9% between 51 and 55 years old, and 6% between 30 and 35 years old. In relation to academic seniority, almost half of the personnel (48%) has accumulated between 6 and 10 years of experience, followed by 15% with 16 to 20 years, and 13% falling between 11 and 15 years.

Knowledge and Mastery of ICTs

The diagnosis on technical mastery reflected a heterogeneous level according to the complexity of each tool. Regarding basic office and communication tools, in Microsoft Word, 25% perceive a very high mastery, 30% high, and 45% medium, although 100% of respondents reported frequent use in their daily tasks. In Microsoft Excel, 5% report very high knowledge, 48% high, 39% medium, and 9% low. Microsoft PowerPoint records 11% at a very high level, 34% high, 49% medium, and 6% low. In Microsoft Publisher, 24% indicated high knowledge, 34% low, and 43% stated having no knowledge. Regarding email, 11% indicate very high mastery, 35% high, and 43% medium.

In contrast, when evaluating virtual platforms and advanced tools, a considerable gap is observed. In virtual learning environments (LMS), only 3% reported very high knowledge, while 54% indicated having no knowledge at all. Similarly, in the administration of these platforms, 55% lack knowledge, 33% possess a medium level, and only 3% a high level. In videoconferencing tools, barely 3% show a very high level, compared to 53% presenting a low level. Finally, 60% stated having no knowledge in web design (only 6% report a high level) and, in multimedia design, only 3% have very high knowledge, while 29% are completely unfamiliar with the subject. Overall, although 100% indicate possessing some degree of basic operational knowledge, specialized competencies show marked gaps.

Training Received or Identified Obstacles

In analyzing the digital training background, it was identified that 45% of the faculty has participated in institutional courses, while 32.5% developed their skills self-taught, and 22.5% indicate never having received formal training in the area. Among those who have trained, the predominant topics were the use of the Internet (46.25%) and operating systems (32.5%). Conversely, training in specific educational applications (6.25%), hardware maintenance (2.5%), and virtual education or programming (0%) proved marginal or non-existent.

Among the main obstacles to incorporating technology, teachers highlighted: lack of technical or pedagogical knowledge about the tools (32.5%), emergence of technical problems (8.75%), lack of time to plan and implement (6.25%), and scarcity of access or adequate connectivity (2.5%).

Access, Actual Use, and Teaching Practices

Regarding infrastructure, 92.5% of the personnel state having general access to information technologies, and 70% have their own or assigned computer equipment. In the didactic field, 100% frequently use computers for web searches, editing in Word, and presentations in PowerPoint. To communicate with students, 60% use them

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frequently and 40% occasionally; 66.25% use them to keep in touch with colleagues, and 36.25% to design multimedia materials.

Regarding the promotion of self-learning, 56.25% frequently motivate the use of technology in their students, 37.5% do so sometimes, and 7.5% never. Likewise, 31.25% frequently provide digital guides or notes for independent study, 52.5% sometimes, and 6.25% never. For evaluation and knowledge construction, 47.5% routinely employ ICTs to evaluate, and 55% to guide collaborative work. At the institutional level, a clear weakness in collegial work was identified: 56.25% indicated never meeting with other professors to plan the didactic use of technology, while 43.75% do so only occasionally.

Attitudes, Valuation, and Perception of ICTs

Faculty attitudes reflect an extremely favorable disposition toward digitalization. 79.95% agree that ICTs are indispensable in higher education (36.25% strongly agree and 43.7% agree), and the majority considers that their use favors more successful classes (78.75%), improves educational quality (80%), and increases learning (73.75%).

Likewise, 92.5% show willingness to take training courses if the institution provides them, 91.5% are willing to incorporate ICTs into academic programs, and 91% indicate that greater technical mastery would improve their perspective toward these tools. On a daily level, 93.75% point out that technology simplifies work and improves productivity, 97.5% rate their experience as satisfactory, and 100% as beneficial. Regarding limitations, 45% consider that the Academic Unit lacks sufficient technological resources, and 54% believe that ICT implementation requires considerable investments of time and money that are not always maximized.

DISCUSSION

The results obtained in the Agricultural Engineering Academic Program (PAIA) show a scenario characterized by a high attitudinal disposition and mastery of basic tools, which contrasts with marked limitations in advanced digital competencies and infrastructure needs.

Academic Profile and Instrumental Use

The solid academic background of the faculty (84% with postgraduate degrees) has facilitated the natural adoption of traditional office tools (Word, PowerPoint, web browsing, and email). However, teaching practice remains predominantly at an instrumental stage, where technology functions mainly as a substitute for paper or the chalkboard, without yet consolidating an interactive digital pedagogical design.

Challenges in Virtual Education and Teacher Training

The limited mastery in managing virtual learning platforms (LMS), online classroom administration, videoconferencing, and multimedia creation (where more than half report low or zero levels) represents a priority area of opportunity. This is partly explained by the focus of previous training sessions, which were oriented toward elementary technical aspects without delving into techno-pedagogical strategies. Likewise, the high proportion of self-taught learning (32.5%) evidences individual teacher commitment, but also the lack of structured institutional support.

Attitudinal Disposition

The faculty's openness toward professional development is noteworthy: over 90% express interest in training, integrating ICTs into their courses, and recognizing their positive impact on productivity. The main barrier does

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not lie in resistance to change, but in infrastructure conditions and the lack of collegial planning spaces, given that more than 56% never meet with peers to coordinate technology-mediated activities.

Recognition of Limitations

It is necessary to interpret these findings in light of the limitations of the methodological design. The cross-sectional nature of the study offers a situational diagnosis at a specific point in time; therefore, it is not possible to establish direct causal relationships or evaluate changes over time. On the other hand, the use of self-reported Likert-scale instruments may introduce social desirability bias or bias regarding perceived versus actual technical mastery. Despite this, the collected information constitutes a valid empirical foundation for institutional decision-making. To build upon these results, future research could incorporate mixed methods combining surveys with direct classroom observation, practical performance rubrics, and interaction analysis in virtual environments.

Table 2. Main strengths, weaknesses, opportunities, and risks identified in PAIA

Dimension	Main Diagnostic Findings
Strengths	• High faculty academic level (84% hold a Master's or Doctorate degree). • Consolidated mastery of basic office tools and information processing (100% usage in Word, PowerPoint, and web searches). • Favorable, open, and positive attitude toward the use and leveraging of technology (>90%).
Weaknesses	• Significant gap in knowledge and use of virtual educational platforms and multimedia design tools (>50% low or zero knowledge). • Absence of collegial academic planning spaces to coordinate ICT integration (56.25% do not meet with other teachers). • Training mainly oriented toward operational aspects without a pedagogical focus.
Opportunities	• High faculty willingness to participate in training and updating programs (92.5%). • Good level of access to computers in personal and home environments (92.5%). • Openness to transform traditional teaching strategies and incorporate self-learning.
Risks / Threats	• Perception of insufficient technological resources in the Academic Unit of Agriculture. • Lack of specialized technical support and a continuous institutional digital literacy plan. • Risk of teacher demotivation in the face of persistent technical failures and equipment shortages.

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CONCLUSIONS

1. Teacher Acceptance and Disposition: The faculty of the Agricultural Engineering Academic Program shows a receptive and favorable attitude toward the incorporation of ICTs, recognizing their value in enriching teaching processes and optimizing daily academic tasks.
2. Level of Instrumental Ownership: Current technological integration is predominantly located at an operational and document-support level (Word, PowerPoint, email, and web searches), with limited experience observed in handling virtual educational platforms, videoconferencing, and multimedia content development.
3. Need for Support and Infrastructure: The main difficulties identified relate to the lack of continuous technical assistance on facility premises, equipment shortages at the institutional level, and a training offer that needs to be oriented toward digital pedagogy and instructional design.
4. Isolated Work and Collegial Coordination: Technology adoption occurs mainly individually, without structured collegial work mechanisms that allow agreeing on tool usage and sharing didactic experiences among faculty.
5. Projection of Future Lines of Research: Based on the diagnosis obtained, two main perspectives are suggested to give continuity to this work: a) develop longitudinal studies measuring the impact of techno-pedagogical training programs before and after their classroom application, and b) conduct comparative research with other regional and national agricultural programs to contrast the findings of this census.

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