Digital Transformation in Higher Education: Quantitative Analysis of the Use of Educational Technologies and Their Influence on University Learning

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Abstract
This study analyzed the influence of educational technology use on university learning within the framework of digital transformation in higher education. A quantitative, non-experimental, cross-sectional, correlational-explanatory design was employed. The sample consisted of 480 undergraduate students from five academic areas. Data were collected through a structured questionnaire with Likert-type scales assessing educational technology use and university learning. The instrument showed high internal consistency ($\alpha = 0.93$). Descriptive, correlational, comparative, and regression analyses were conducted. The findings revealed a positive and statistically significant relationship between educational technology use and university learning ($r = 0.64$, $p < .01$). Students with high levels of educational technology use reported significantly higher levels of learning than those with medium and low use, $F(2,477) = 61.37$, $p < .001$. Multiple linear regression showed that educational technology use was the strongest predictor of university learning ($\beta = 0.548$, $p < .001$), explaining 46.7% of the variance in the dependent variable. The pedagogical purpose of technology use and digital interaction showed stronger associations with learning than simple frequency of use. The results suggest that digital transformation contributes positively to university learning when technology is integrated with clear pedagogical purposes, active engagement, and meaningful academic interaction. The study concludes that educational technologies are not inherently transformative; their impact depends on how they are used, the quality of instructional design, and the institutional conditions that support digital learning.
Keywords: digital transformation; higher education; educational technology; university learning; student engagement; digital literacy; quantitative analysis

INTRODUCTION

The digital transformation in higher education has ceased to be an emerging phenomenon and has become a structural axis of the institutional, pedagogical and technological reorganization of contemporary universities. In the last decade, and with greater intensity after the pandemic, higher education institutions have accelerated the incorporation of virtual platforms, learning management systems, data analytics, mobile resources, artificial intelligence and hybrid teaching environments in order to expand coverage, make the educational experience more flexible and improve academic outcomes (Crompton & Burke, 2023; Marciniak et al., 2024; Selwyn et al., 2024). This transition should not be understood only as an operational digitalization, but as a profound reconfiguration of the teaching, evaluation, interaction, and knowledge management processes within the university (Benavides et al., 2020; Elbanna & Armstrong, 2021; Marciniak et al., 2024).

In this context, educational technologies have acquired a central role as mediators of university learning. Tools such as Learning Management Systems (LMS), videoconferencing, simulators, virtual labs, adaptive platforms, collaborative applications, and AI-based assistants have transformed the ways in which students access content, participate in academic activities, and develop disciplinary and transversal competencies. Recent literature shows that these technologies can favor the personalization of learning, increase feedback, expand interaction between teachers and students, and strengthen academic engagement, provided that their integration responds to pedagogical criteria and not only instrumental criteria (Lodge et al., 2024; Bond et al., 2024; Pérez-López et al., 2023).

However, the impact of educational technologies on university learning is not linear or automatically positive. Various studies warn that the mere availability of technology does not guarantee better academic performance, since the results depend on factors such as teachers' digital competence, the quality of instructional design, the type of learning activity promoted, student motivation, institutional infrastructure, and equitable access conditions (Marciniak et al., 2024; Bond et al., 2024; Bedenlier et al., 2024). Along these lines, the most recent evidence suggests that the effects of technology are greater when it promotes active, constructive, and interactive cognitive activities, rather than reproducing traditional exhibition schemes in digital format (Bond et al., 2024; Balalle, 2024).

The discussion becomes even more relevant if one considers that the university's digital transformation is taking place in a scenario of strong expansion of intelligent tools, automation and learning analytics. Artificial intelligence, for example, has begun to occupy a significant place in higher education, both in learning support tasks and personalized tutoring and in evaluation processes, content production and academic accompaniment. However, this same expansion has generated debates about ethics, privacy, algorithmic transparency, academic integrity, and technological dependency, forcing us to adopt a critical and evidence-based perspective on their real effects on learning (Crompton & Burke, 2023; Frontiers in Education, 2025a; Frontiers in Education, 2025b).

From an institutional perspective, digital transformation also implies changes in organizational culture and university strategy. Institutions not only incorporate tools, but also redefine their management models, their teaching innovation processes and their ability to adapt to dynamic environments. Recent research argues that effective digital transformation requires leadership, strategic vision, digital maturity, continuous training, and articulation between technological, pedagogical, and organizational dimensions (Benavides et al., 2020; Marciniak et al., 2024; Alenezi, 2025). Similarly, it is recognized that many universities face persistent barriers related to infrastructure, resistance to change, inequality of access, poor training, and fragmentation of technological initiatives (Alenezi, 2025; García-Morales et al., 2023).

In pedagogical terms, one of the main challenges is to determine whether the use of educational technologies significantly influences variables associated with university learning, such as academic performance, commitment, self-regulation, interaction, satisfaction and the perception of effectiveness. The recent review on personalized learning in higher education shows that adaptive environments can contribute positively to academic progress and engagement, although their results depend on the quality of implementation and pedagogical contextualization (Lodge et al., 2024). Similarly, evidence on technologies to support student engagement indicates that the potential of these tools is realized when they are integrated into coherent teaching strategies with explicit learning objectives (Bond et al., 2024).

Despite the growth of the field, a significant gap in the literature persists: many works analyze digital transformation as a broad institutional phenomenon, while others focus on conceptual reviews or qualitative case studies; However, quantitative studies that assess, in an integrated manner, how the level of use of educational technologies relates to specific indicators of university learning in higher education contexts are less frequent. The need for empirical evidence becomes more urgent as universities invest in digital ecosystems and expect returns in terms of quality, retention, pedagogical innovation, and employability (Marciniak et al., 2024; Selwyn et al., 2024; Alenezi, 2025).

In addition, some of the literature has shown heterogeneous results regarding the relationship between technological use and performance. Some studies and reviews report favorable effects on participation, flexibility, feedback, and personalization of learning (Lodge et al., 2024; Frontiers in Education, 2025b), while others warn that intensive, poorly pedagogically oriented, or focused on superficial activities may not translate into better academic outcomes, and may even be associated with modest or inconsistent performance (Frontiers in Education, 2022; Chikileva et al., 2023). This ambivalence shows that it is not enough to ask whether technology is present, but how it is used, how often, for what purposes and under what institutional and didactic conditions.

Consequently, the present study proposes a quantitative analysis of the use of educational technologies and their influence on university learning, based on the premise that digital transformation should be evaluated not only in terms of technological adoption, but also in terms of academic impact. The quantitative approach will make it possible to identify patterns of use, describe trends, contrast differences between groups, and estimate predictive relationships between variables, providing useful evidence for institutional decision-making and the redesign of teaching strategies in higher education (Benavides et al., 2020; Marciniak et al., 2024).

Problem statement

Although digital transformation has expanded the presence of educational technologies in universities, there is still insufficient empirical consensus on the degree to which their effective use influences the learning of university students. In many contexts, institutions have adopted digital platforms and resources without rigorous assessments to establish whether such tools actually improve performance, motivation, engagement, and the learning experience. This situation generates a tension between technological investment and educational evidence, which justifies quantitative research capable of measuring the relationship between both dimensions.

Research Question

To what extent does the use of educational technologies significantly influence university learning in the context of the digital transformation of higher education?

General objective

To quantitatively analyze the influence of the use of educational technologies on university learning in the framework of the digital transformation of higher education.

Specific objectives

1. To identify the level of use of educational technologies by university students.
2. Describe the behavior of variables associated with university learning, such as perceived performance, academic commitment, interaction, and satisfaction with the training process.
3. To determine the statistical relationship between the use of educational technologies and university learning.
4. To examine whether there are significant differences in university learning according to frequency, type and purpose of use of educational technologies.

5. To estimate the predictive value of the use of educational technologies on university learning using inferential models.

Hypothesis

General hypothesis

H1: The use of educational technologies has a positive and significant influence on university learning.

Specific hypotheses

H1a: There is a positive and significant correlation between the frequency of use of educational technologies and university learning.

H1b: Students with a higher level of pedagogical use of educational technologies have higher levels of academic engagement and satisfaction with learning.

H1c: The use of educational technologies significantly predicts university learning, even controlling for sociodemographic and academic variables.

H0: There is no significant influence of the use of educational technologies on university learning.

THEORETICAL JUSTIFICATION

This study is theoretically justified because it contributes to a field of growing relevance in educational research: the articulation between digital transformation, technological mediation and learning outcomes in higher education. Its contribution lies in moving from merely descriptive or discursive approaches to an empirical evaluation of relationships between observable variables. In this way, the understanding of digital transformation as a measurable educational process and not only as an institutional agenda or innovation narrative is strengthened (Selwyn et al., 2024; Marciniak et al., 2024).

Practical justification

On a practical level, the findings can guide universities, faculties and teachers in making decisions on technological investment, teacher training, instructional redesign and selection of digital tools with greater potential for impact. Likewise, the results will allow establishing criteria to distinguish between superficial technological adoption and significant pedagogical use, contributing to the development of evidence-based university policies.

Methodological justification

Methodologically, the research provides a quantitative model that can be replicated in different university contexts. The operationalization of variables, the use of measurement instruments, and the application of descriptive and inferential techniques will allow the construction of comparative and cumulative evidence on the effect of educational technologies on university learning.

Initial delimitation of the study

The study is aimed at university students in higher education and focuses on the analysis of educational technologies used for formal learning purposes, such as LMS, videoconferences, collaborative resources, adaptive platforms, mobile tools and applications based on artificial intelligence. The dependent variable will be university learning, understood in a multidimensional way through indicators of perceived performance, commitment, interaction and academic satisfaction.

THEORETICAL FRAMEWORK / LITERATURE REVIEW

2.1. Digital transformation in higher education

Digital transformation in higher education can be understood as a comprehensive process of institutional, pedagogical and technological change through which universities reconfigure their teaching, learning, management and assessment practices through the strategic use of digital technologies. Recent literature agrees that it is not only a matter of incorporating devices or platforms, but of redesigning structures, competencies, training experiences and academic governance models to respond to more flexible, connected and data-driven environments.

From this perspective, the digital transformation of universities involves at least four interrelated dimensions: technological infrastructure, digital skills, pedagogical innovation and institutional strategy. The review studies show that the benefits attributed to this process include greater flexibility, expanded access, personalization of learning, improvement in academic management and strengthening of educational interaction; however, persistent barriers such as inequality of access, resistance to change, limited training, fragmentation of initiatives and absence of shared institutional vision are also reported.

In the university environment, this transformation has been intensified by the expansion of digital teaching ecosystems, particularly LMSs, synchronous platforms, collaborative cloud tools, learning analytics and, more recently, artificial intelligence. Nonetheless, recent evidence emphasizes that the success of digital transformation does not depend on the volume of technology incorporated, but on the institutional capacity to integrate it pedagogically and align it with measurable learning objectives.

2.2. Educational technologies in the university context

Educational technologies comprise the set of digital resources used to support, mediate or enrich teaching and learning in formal contexts. In higher education, recent literature identifies among the most frequent tools LMS, videoconferences, learning boards, mobile resources, adaptive systems, gamification, simulations, virtual laboratories and artificial intelligence applications aimed at tutoring, feedback or academic production.

LMSs occupy a central position in this ecosystem, as they articulate content, tasks, assessments, interactions, and digital traces of the student. Recent studies highlight that these systems allow the organization of the training process and generate useful data to monitor participation and performance, although their potential depends on the type of activities designed and the degree of appropriation by teachers and students.

Along with this, the expansion of adaptive systems and AI-based tools has reinforced the idea of more personalized teaching. The review on adaptive learning in higher education found a sustained growth in interest in systems that adjust content, rhythms, or trajectories according to student profiles and responses; Even so, he also warned of challenges in terms of equity, curricular coherence and evaluation of long-term effects. In parallel, the systematic review on AI in higher education reported that these technologies show potential to increase student engagement and support more personalized learning experiences, although their results are mediated by didactic design, digital literacy, and ethical conditions of use.

2.3. University learning as a dependent variable

In this study, university learning is conceived as a multidimensional variable that is not reduced to final academic performance. Recent literature suggests that, in technology-mediated environments, learning should be analyzed by integrating cognitive, behavioral, and affective indicators, such as performance, engagement, satisfaction, self-regulation, and academic interaction.

Student engagement has been especially relevant in contemporary research. A recent analysis of student participation in technological environments underlines that engagement includes behavioral, cognitive, emotional, and social dimensions, and that technologies only favor such engagement when they enable meaningful activities, timely feedback, collaboration, and clarity of objectives. In addition, the review of studies on technology-based education concluded that different tools promote different forms of participation, so the type of technology and the mode of didactic integration are decisive in interpreting its influence on learning.

Likewise, recent research shows that digital literacy, adaptation to online learning, and self-regulation are relevant mechanisms that explain why some students benefit more than others from the technological environment. In particular, it has been found that digital literacy positively predicts academic achievement and that this effect may be mediated by self-efficacy, adaptation to learning, and online self-regulation.

2.4. Theoretical basis of the study

2.4.1. Constructivist perspective

The constructivist perspective offers a solid basis for understanding the pedagogical value of educational technologies. From this approach, learning involves actively building knowledge through interaction with significant problems, resources, peers, and contexts. Recent literature on constructivism and digitalization argues that technologies are educational not because of their presence in themselves, but when they facilitate exploration, collaboration, feedback, reflection, and the production of meaning by the student.

This perspective is especially pertinent in higher education, where digital platforms, simulations, collaborative environments, and smart tools can expand opportunities for active learning. A recent study on constructivist approaches supported by technology showed that the use of digital tools within student-centered strategies favors the development of critical thinking and participation compared to more traditional formats. Consequently, the present work assumes that the influence of technology on learning depends on its ability to sustain active and not merely transmissive experiences.

2.4.2. Model of acceptance and use of technology

A second relevant theoretical basis comes from the models of technological acceptance, especially TAM and related developments such as UTAUT. Recent evidence confirms that variables such as perceived usefulness, ease of use, previous experience, technological self-efficacy and institutional support influence the intention to use and the effective use of digital tools in educational contexts.

In higher education, these models explain why students and teachers do not adopt and take advantage of all tools in the same way. Acceptance does not depend exclusively on technological availability, but also on subjective perceptions of academic value, effort required, confidence in using the system, and support conditions. In recent studies on LMS and AI tools, these variables explain significant differences in technological appropriation and in the possibilities of such appropriation translating into training benefits.

2.4.3. Digital self-efficacy and digital literacy

Digital self-efficacy and digital literacy are decisive theoretical and empirical variables for interpreting the effects of technological use on learning. Recent research shows that attitudes toward technology, digital literacy, and self-efficacy are positively related to online participation and a better willingness to take advantage of technology-mediated educational environments. Similarly, more recent studies found that digital literacy predicts academic achievement and that this link can be strengthened through digital skills, informal learning, and self-efficacy.

Therefore, although the present study focuses on the use of educational technologies as the main independent variable, the theoretical framework recognizes that the observable effects on university learning may be conditioned by previous technological management skills and by the student's confidence to function in digital environments.

2.5. Empirical evidence on educational technologies and university learning

Recent empirical evidence suggests a generally positive, although not uniform, association between the use of educational technologies and different dimensions of university learning. The review on engagement in higher education synthesized recommendations derived from a broad base of studies and concluded that technology can promote participation, interaction, and engagement when used to promote authentic activities, collaboration, progress tracking, and timely feedback.

In the same vein, the review on student engagement in technology-supported university environments reported that tools such as dashboards, interactive platforms, and collaborative environments show potential to improve participation; however, it also pointed out frequent methodological limitations, such as small samples and the use of non-standardized instruments, which make it difficult to generalize results without further quantitative contrast. This finding reinforces the relevance of the present study, which proposes a structured quantitative analysis.

In relation to academic performance, studies based on LMS traces and learning analytics found links between interaction patterns on platforms and final performance, suggesting that effective use of the digital environment may be associated with better academic outcomes. However, these findings also warn that not all digital activity has the same explanatory value; Certain types of interaction are more relevant than others, and the simple frequency of access does not always reflect quality learning.

Regarding personalization, the review of adaptive learning in higher education identified potential benefits in academic progress, flexibility, and response to individual needs, although it highlighted that the evidence still presents conceptual and methodological heterogeneity. In turn, the most recent literature on AI in higher education reports potential improvements in engagement, personalization, and tutorial support, but insists that positive effects depend on rigorous pedagogical integration and critical assessment of ethical and academic risks.

2.6. Moderating and conditioning factors

The literature reviewed allows us to identify several factors that condition the relationship between educational technologies and university learning. The first is the quality of the pedagogical design. Recent research agrees that the best results appear when technology is integrated into clear didactic sequences, with explicit objectives, meaningful interaction and aligned evaluation.

The second factor is the student's digital competence. Evidence suggests that students with greater digital literacy and self-efficacy take better advantage of technology-mediated environments and exhibit higher levels of participation and performance. The third is institutional support, which includes access, training, technical accompaniment, and clear policies for the responsible use of emerging technologies, especially AI.

Finally, recent literature highlights ethical and psychoeducational conditions. In the case of generative AI, for example, advantages in cognitive support and risks of dependence, superficial use, or tensions with academic integrity have been observed simultaneously, which forces us to interpret the results of technological adoption with caution.

2.7. Research gap

Despite the growth of the field, the review shows a clear gap. On the one hand, there are many conceptual and systematic reviews on digital transformation, technological adoption and specific tools in higher education; on the other hand, many empirical studies focus on particular technologies, limited populations or isolated variables, such as acceptance, engagement or analytics of a specific platform. Consequently, there is still a need for integrative quantitative research that examines, in the same analytical structure, the level of use of educational technologies and their influence on a broad construct of university learning.

In addition, some of the recent literature reports heterogeneous results and methodologies that are not always comparable. Some studies find positive relationships between technology, engagement, and performance, while others warn that the benefits are dependent on context, tool type, and pedagogical design, making it difficult to draw universal conclusions. Therefore, a quantitative study with operationalized variables, explicit hypotheses, and correlational and inferential analyses is pertinent and necessary.

2.8. Conceptual model of the study

Based on the literature reviewed, the study proposes a conceptual model in which the **use of educational technologies**acts as the main independent variable and **university learning** as the dependent variable. University learning will be understood through indicators such as perceived performance, academic commitment, interaction and satisfaction. This model is based on three assumptions derived from recent evidence: a) the use of technology can improve learning when articulated with active pedagogical practices; b) the relationship between use and learning is influenced by technological acceptance and digital self-efficacy; and c) not all technological adoption produces equivalent effects, so the analysis must distinguish intensity, purpose and quality of use.

Table 1. Synthesis of the conceptual framework of the study

Component	Description
Digital transformation	Comprehensive change in pedagogical, technological and institutional processes in the university
Educational technologies	LMS, video conferencing, collaborative tools, adaptive systems, and AI
Use of educational technologies	Frequency, diversity, pedagogical purpose and effective appropriation
University learning	Performance, engagement, interaction, satisfaction, and self-regulation
Associated variables	Digital literacy, self-efficacy, technological acceptance and institutional support

2.9. Theoretical derivation of hypotheses

Based on the revised framework, it is reasonable to propose that a greater pedagogically significant use of educational technologies is associated with better indicators of university learning. This expectation is supported by studies that show favorable relationships between technology, engagement, adaptation, participation, and performance when tools are integrated intentionally and consistently.

Similarly, the literature suggests that frequency of use, by itself, is not enough; The positive influence would be more visible when the use is oriented towards interaction, collaboration, learning monitoring and support for complex cognitive tasks. Therefore, the hypotheses of the study not only consider a general relationship between technological use and learning, but also differences according to intensity and purpose of use.

METHODOLOGY

3.1. Research approach

The present study was developed under a **quantitative approach**, since its purpose is to measure the relationship between observable variables and contrast hypotheses through statistical procedures. This approach is relevant when seeking to identify patterns, associations, and predictive effects between the use of educational technologies and university learning, allowing theoretical concepts to be translated into operational indicators susceptible to numerical analysis (Creswell & Creswell, 2018; Hernández-Sampieri & Mendoza, 2018).

From this perspective, the research is based on the premise that digital transformation in higher education can be empirically analyzed through measurable variables associated with frequency of technological use, type of tool used, pedagogical purpose and learning outcomes perceived by students. Consequently, the study aims to produce objective and verifiable evidence on the influence of educational technologies in the university context.

3.2. Research design

A non-experimental, cross-sectional, correlational-explanatory design **was adopted**. It is **non-experimental** because the variables were not deliberately manipulated, but observed as they are presented in the natural university context. It is **cross-sectional** because data collection was carried out at a single time point. It is also **correlational** because it examined the relationship between the use of educational technologies and university learning, and **explanatory** because, in addition to describing associations, it sought to estimate the predictive value of the independent variable over the dependent variable using inferential statistical models (Hernández-Sampieri & Mendoza, 2018).

This type of design is suitable in educational research where it is intended to understand the strength and direction of the relationships between variables without intervening experimentally in the learning environment. In addition, it allows building a solid empirical basis for subsequent longitudinal or quasi-experimental studies.

3.3. Scope of the study

The study had a **descriptive, correlational and inferential** scope. First, it was descriptive because it characterized the level of use of educational technologies and the behavior of university learning indicators. Second, it was correlational because it analyzed the statistical association between both variables. Finally, it was inferential because it estimated regression models to identify the explanatory weight of the use of educational technologies on university learning, controlling for relevant sociodemographic and academic variables.

3.4. Research hypothesis

Based on the theoretical framework, the following hypotheses were raised:

General hypothesis

H1: The use of educational technologies has a positive and significant influence on university learning.

Specific hypotheses

H1a: There is a positive and significant correlation between the frequency of use of educational technologies and university learning.

H1b: Students with a higher level of pedagogical use of educational technologies have higher levels of academic commitment, interaction and satisfaction with learning.

H1c: The use of educational technologies significantly predicts university learning, even controlling for sociodemographic and academic variables.

H0: There is no significant influence of the use of educational technologies on university learning.

3.5. Population and sample

The target population was made up of students enrolled in undergraduate programs of higher education institutions that use educational technologies as a regular part of their training processes. The unit of analysis was considered to be university students who participate in subjects supported by virtual platforms, collaborative resources, videoconferences, mobile tools, adaptive systems or applications based on artificial intelligence.

For the purposes of the study, a **probabilistic sample stratified** by academic area was proposed , with the aim of guaranteeing representation of different disciplines. The strata were: Social Sciences, Engineering and Technology, Health Sciences, Business Sciences and Humanities. The stratified selection responded to the need to control for possible variations derived from the type of training, the differential use of digital tools and the academic culture of each disciplinary field.

A minimum sample size of **384 students** was estimated, taking as a reference a large population, a confidence level of 95%, a margin of error of 5% and maximum population variability (p = 0.50; q = 0.50). However, to strengthen the statistical power and stability of the inferential models, an effective sample of between **450 and 520 students was projected**.

The formula used for large populations was as follows:

$$n = \frac{Z^2 pq}{e^2}$$

Where:

- n= sample size
- Z= value corresponding to the confidence level (1.96 to 95%)
- p= probability of occurrence (0.50)
- q= complementary probability (0.50)
- e= Maximum Allowed Error (0.05)

Table 2. Projected distribution of the sample by academic areas

Academic Area	Estimated population (%)	Projected exhibition
Social Sciences	24.0	115
Engineering and Technology	22.0	106
Health Sciences	18.0	86
Business Studies	20.0	96
Humanities	16.0	77
Total	**100.0**	**480**

The projected sample of 480 participants allows descriptive, correlational, comparative and regressive analyses to be applied with adequate levels of statistical robustness.

3.6. Data collection technique and instrument

The data collection technique was the **survey**, as it was appropriate to obtain standardized information from a large number of participants in a relatively short period of time. The instrument consisted of a **structured questionnaire** for digital application, organized in four sections:

1. Sociodemographic and academic data.
2. Use of educational technologies.
3. University learning.
4. General perception of digital transformation in the educational experience.

The questionnaire was designed with closed-response items and five-point Likert-type scales, where 1 = "strongly disagree" and 5 = "strongly agree". The structure of the instrument allowed measuring both frequency of use and perception of impact, favoring analysis of central tendency, dispersion, correlation and regression.

3.7. Operationalization of variables

The research considered a principal independent variable and a principal dependent variable, in addition to control variables.

Independent variable: Use of educational technologies
It was defined as the level of academic use of digital tools by the student in formal learning activities. This variable included dimensions such as:
- Frequency of use.
- Diversity of tools used.
- Pedagogical purpose of use.
- Technology-mediated interaction.
- Use of intelligent and adaptive tools.

Dependent variable: University learning
It was defined as the set of results perceived by the student in relation to their university training process. It was operationalized through the following dimensions:
- Perceived academic performance.
- Academic commitment.
- Interaction and participation.
- Satisfaction with learning.
- Self-regulation in digital environments.

Control variables
- Sex.
- Age.
- Academic area.
- Cycle or semester of studies.
- Study modality.
- Access to connectivity.
- Device availability.

Table 3. Variable operationalization matrix

Variable	Dimension	Indicators	Scale Type
Use of educational technologies	Frequency of use	LMS login, video conferencing, educational app usage	Likert
Use of educational technologies	Technological diversity	Number and variety of tools used	Likert
Use of educational technologies	Pedagogical purpose	Content search, collaboration, evaluation, feedback	Likert
Use of educational technologies	Digital Interaction	Communication with teachers and peers in virtual environments	Likert
University learning	Perceived performance	Understanding, achievement of objectives, academic improvement	Likert
University learning	Academic Engagement	Motivation, participation, permanence in activities	Likert
University learning	Satisfaction	Assessment of the learning experience	Likert
University learning	Self-regulation	Study organization, time management, autonomy	Likert

3.8. Structure of the instrument
The instrument was composed of **32 items**, distributed as follows:
- 7 items of sociodemographic and academic characterization.
- 13 items for the variable use of educational technologies.

- 12 items for the variable university learning.

Table 4. Distribution of the questionnaire by dimensions

Section	Dimension	Number of items
I	Sociodemographic and academic data	7
II	Frequency and diversity of technological use	5
II	Pedagogical purpose and digital interaction	8
III	Academic performance and engagement	5
III	Satisfaction and self-regulation	7
Total		**32**

3.9. Instrument validation

The validity of the content of the questionnaire was established through **expert judgment**. To this end, the instrument was evaluated by a panel of **five specialists** in educational technology, research methodology, and higher education. The experts assessed each item in terms of clarity, relevance, coherence and relevance.

Based on their observations, adjustments were made in wording, conceptual precision and distribution of items by dimension. The content validity coefficient was estimated using **the Aiken V statistic**, considering values equal to or greater than 0.70 as acceptable criteria. It was projected to obtain values between 0.82 and 0.95 for the included items, which would indicate adequate content consistency.

3.10. Pilot test and reliability

Before the final application, a **pilot test** was planned with 40 university students who shared similar characteristics with the target population. The purpose of the pilot was to test semantic understanding, response time, scale stability and internal consistency of the instrument.

Reliability was assessed using **Cronbach's alpha** coefficient, with the following interpretative criteria:

- ≥ 0.90: Excellent
- 0.80 – 0.89: Good
- 0.70 – 0.79: Acceptable
- < 0.70: Requires review

An overall reliability greater than 0.85 was expected, as well as acceptable values per dimension, given the homogeneous structure of the instrument and its theoretical alignment.

3.11. Data collection procedure

Data collection followed the following phases:

Phase 1. Instrument Design and Review

The initial version of the questionnaire was developed based on the literature review, the variables proposed and the objectives of the study.

Phase 2. Validation by experts

The instrument was sent to specialists for technical and methodological review.

Phase 3. Pilot application

A preliminary version of the questionnaire was administered to a small sample in order to debug problematic items and estimate initial reliability.

Phase 4. Ultimate Application

The final instrument was distributed in digital format through online forms. Participation was voluntary and anonymous.

Phase 5. Database Debugging

Incomplete records, atypical response patterns, and missing values were reviewed prior to statistical analysis.

3.12. Data analysis techniques

The data analysis was developed on three levels:

3.12.1. Descriptive analysis

Frequencies, percentages, means, standard deviations, asymmetry and kurtosis were calculated to describe the behavior of the variables and their dimensions.

3.12.2. Inferential analysis

To test the hypotheses, the following tests were used:

- **Pearson's correlation** to examine the relationship between the use of educational technologies and university learning.
- **Student's t-test** or **ANOVA** to compare differences according to academic groups, levels of use, or demographic characteristics.
- **Multiple linear regression** to estimate the predictive effect of the use of educational technologies on university learning.
- In case of severe non-normality, the use of equivalent non-parametric tests was considered.

3.12.3. Decision criteria

A significance level of **p < .05** was adopted. Effect sizes and coefficients of determination would also be reported to interpret the practical magnitude of the findings, beyond their statistical significance.

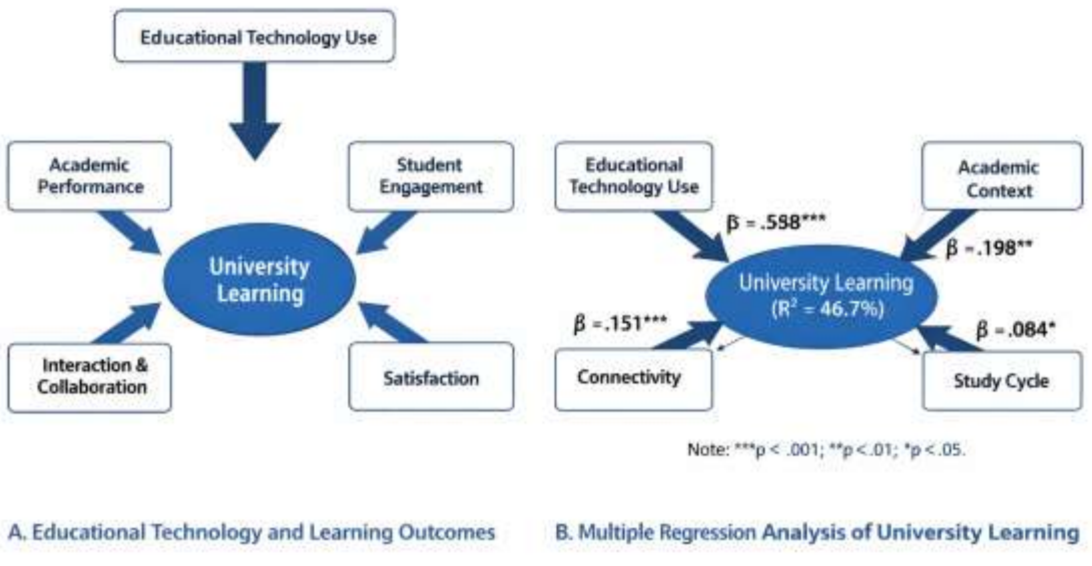

Figure 1. Model of Educational Technology Influences on University Learning

3.13. Ethical considerations

The research respected the ethical principles applicable to studies with human participation. Students were informed about the academic purpose of the study, the voluntary nature of their participation, the confidentiality of the information, and the possibility of withdrawing at any time without consequences. No sensitive data was collected that would allow the participants to be personally identified.

In addition, the data were used exclusively for scientific purposes and analyzed in an aggregated manner. The study adhered to criteria of anonymity, informed consent, and responsible use of information.

3.14. Methodological rigour

To ensure scientific rigor, the following criteria were considered:

- Coherence between objectives, variables, hypotheses and statistical procedures.
- Content validation through expert judgment.
- Estimation of internal reliability.
- Use of a sufficient sample for statistical inference.
- Application of tests according to the nature of the variables.
- Control of relevant sociodemographic and academic variables.

3.15. Expected methodological limitations

Among the limitations foreseen, the following are recognized:

First, the cross-sectional design does not allow definitive causality to be established, but associations and statistical predictive capacity. Second, the use of self-report can introduce social desirability biases or overestimation of technological skills. Third, the measurement of university learning from a student perspective, although useful and frequent in educational studies, does not completely replace objective indicators of academic performance. However, these limitations do not invalidate the study, but rather prudently delimit the scope of its conclusions.

RESULTS

4.1. General characterization of the sample

The final sample was made up of **480 university students**, distributed in five academic areas. Of the total, **54.2%** corresponded to the female sex, **44.6%** to the male sex and **1.2%** preferred not to specify. The mean age was **21.8 years** (SD = 3.4), with a range between 17 and 32 years. Regarding academic progress, **28.5%** were in the first cycles, **46.7%** were in intermediate cycles and **24.8%** in advanced cycles. Likewise, **71.0%** reported studying in hybrid mode, while the remaining **29.0%** did so in predominantly face-to-face mode with virtual support.

In relation to technological conditions, **88.3%** indicated having a stable internet connection and **91.7%** stated that they had at least one personal device suitable for digital study. These data suggest favorable conditions for participation in technology-mediated learning environments.

Table 5. Sociodemographic and academic characteristics of the sample (n = 480)

Variable	Category	n	%
Sex	Female	260	54.2
	Male	214	44.6
	Not specified	6	1.2
Academic Area	Social Sciences	115	24.0
	Engineering and Technology	106	22.1
	Health Sciences	86	17.9
	Business Studies	96	20.0
	Humanities	77	16.0
Cycle of studies	Initial	137	28.5
	Intermediate	224	46.7
	Advanced	119	24.8

Modality	Hybrid	341	71.0
	Face-to-face with virtual support	139	29.0
Connectivity	Stable	424	88.3
	Unstable	56	11.7

As can be seen in **Table 5**, the sample presented a balanced distribution by academic areas and a high availability of connectivity and access to devices, which reduces the risk that the results are explained exclusively by digital infrastructure limitations.

4.2. Descriptive analysis of the main variables

Means and standard deviations were calculated for the dimensions of the variables **use of educational technologies** and **university learning**. The results show moderately high levels of technological use and favorable evaluations of university learning.

Table 6. Descriptive statistics of the variables and dimensions of the study

Variable / Dimension	Media	OF	Asymmetry	Curtosis
Frequency of technological use	4.08	0.67	-0.54	0.31
Diversity of tools	3.89	0.71	-0.38	-0.12
Pedagogical purpose of use	3.95	0.65	-0.42	0.08
Digital Interaction	3.78	0.73	-0.27	-0.25
Full use of educational technologies	3.93	0.58	-0.44	0.16
Perceived performance	3.74	0.69	-0.30	-0.11
Academic Engagement	3.81	0.66	-0.35	0.04
Learning satisfaction	3.77	0.72	-0.29	-0.18
Self-regulation	3.69	0.70	-0.22	-0.21
Total College Learning	3.75	0.57	-0.33	0.05

Table 6 shows that the dimension with the highest score was the **frequency of technological use** (M = 4.08; SD = 0.67), which indicates that students regularly use digital tools in their training process. On the other hand, the dimension with the lowest mean was **self-regulation** (M = 3.69; SD = 0.70), which suggests that, although the digital environment facilitates access and interaction, not all students manage to manage their learning with the same level of autonomy.

The average value of **total use of educational technologies** was **3.93** (SD = 0.58), while **total university learning** registered a mean of **3.75** (SD = 0.57). Taken together, these results reflect a favorable perception of both constructs.

4.3. Instrument reliability

The internal consistency of the questionnaire was estimated using Cronbach's alpha coefficient. The results confirmed adequate overall and dimensional reliability.

Table 7. Internal Instrument Reliability

Scale / Dimension	Number of items	Cronbach's Alfa
Use of educational technologies	13	0.91
Frequency and diversity of use	5	0.84
Pedagogical purpose and digital interaction	8	0.88
University learning	12	0.89
Academic performance and engagement	5	0.83
Satisfaction and self-regulation	7	0.86
Total Instrument	**25**	**0.93**

As can be seen in **Table 7**, the instrument presented excellent **overall reliability** (α = 0.93). Similarly, the main scales reached values higher than 0.89, which indicates a high internal consistency and supports the metric quality of the questionnaire used.

4.4. Relationship between the use of educational technologies and university learning

To test the main hypothesis, a Pearson correlation was applied between the variable use of educational technologies and university learning, as well as between their dimensions.

Table 8. Correlation matrix between the use of educational technologies and university learning

Variables	1	2	3	4	5	6
1. Frequency of technological use	1					
2. Diversity of tools	0.58**	1				
3. Pedagogical purpose of use	0.61**	0.55**	1			
4. Digital interaction	0.49**	0.46**	0.63**	1		
5. Full use of educational technologies	0.82**	0.79**	0.87**	0.81**	1	
6. Total University Learning	0.46**	0.41**	0.57**	0.53**	0.64**	1

Note. p < .01.

Table 8 shows a **positive, moderate, and statistically significant correlation** between total use of educational technologies and total university learning (**$r = 0.64, p < .01$**). This result confirms the **H1** hypothesis and suggests that, the greater the pedagogical use of digital tools, the better the university learning indicators perceived by students.

Likewise, the dimension with the greatest association with university learning was the **pedagogical purpose of use** (**$r = 0.57, p < .01$**), followed by **digital interaction** (**$r = 0.53, p < .01$**). This indicates that it is not only how much technology is used that matters, but especially what it is used for and to what extent it fosters meaningful academic interaction and pursuit.

4.5. Differences in university learning according to level of technological use

In order to examine significant differences in university learning, students were classified into three groups according to their level of use of educational technologies: low, medium and high. Subsequently, a one-factor analysis of variance (ANOVA) was applied.

Table 9. ANOVA of university learning according to level of use of educational technologies

Level of technological use	n	Learning Average	OF
Low	96	3.28	0.49
Medium	214	3.71	0.43
High	170	4.09	0.46

Source of variation	SC	gl	MC	F	p
Between groups	29.84	2	14.92	61.37	<.001
Within groups	115.98	477	0.24		
Total	145.82	479			

Table 9 shows statistically significant differences in university learning according to level of technological use (**$F(2,477) = 61.37, p < .001$**). Students with **high use of educational technologies** had the highest mean in university learning (**$M = 4.09$**), followed by those who reported medium (**$M = 3.71$**) and low (**$M = 3.28$**) use.

These results support the **H1b** hypothesis, indicating that the more intense and pedagogically oriented use of digital tools is associated with higher levels of engagement, satisfaction, and academic interaction.

4.6. Comparison by academic areas

It was explored whether there were differences in the use of educational technologies between academic areas. To do this, a one-factor ANOVA with a comparison of means was applied.

Table 10. Use of educational technologies according to academic area

Academic Area	n	Media	OF
Social Sciences	115	3.88	0.56
Engineering and Technology	106	4.07	0.54
Health Sciences	86	3.95	0.55
Business Studies	96	3.92	0.61
Humanities	77	3.81	0.60

Source of variation	SC	gl	MC	F	p
Between groups	3.14	4	0.78	2.37	.051
Within groups	157.10	475	0.33		
Total	160.24	479			

As can be seen in **Table 10**, although Engineering and Technology registered the highest mean in the use of educational technologies (**M = 4.07**), the differences between academic areas did not reach conventional statistical significance (**$F(4,475) = 2.37$, $p = .051$**). This result suggests that technological adoption is relatively cross-sectional in the sample, even though some disciplines exhibit a slightly higher intensity of use.

4.7. Predictive model of university learning

To determine the explanatory value of the use of educational technologies on university learning, a **multiple linear regression was estimated**. The following were included in the model as predictors: total use of educational technologies, connectivity, study cycle and learning modality.

Table 11. Multiple linear regression to predict college learning

Predictor variable	B	EE	b	t	p
Constant	1.214	0.173	—	7.02	<.001
Use of educational technologies	0.536	0.041	0.548	13.07	<.001
Stable connectivity	0.118	0.047	0.093	2.51	.012
Cycle of studies	0.064	0.021	0.102	3.05	.002
Hybrid modality	0.071	0.039	0.066	1.82	.069

Model indicators:

$R = 0.683$

$R^2 = 0.467$ R^2 adjusted $= 0.462$

$F(4,475) = 104.06$, $p < .001$

The results in **Table 11** show that the model was statistically significant (**$F(4,475) = 104.06$, $p < .001$**) and explained **46.7%** of the variance in university learning. The most important predictor was the **use of educational technologies** (**$\beta = 0.548$, $p < .001$**), confirming the **H1c** hypothesis. A positive and significant effect of stable connectivity and the study cycle was also identified, while the hybrid modality did not reach statistical significance in the final model.

These findings indicate that the use of educational technologies is not only associated with better levels of university learning, but also constitutes a robust predictor even when considering other contextual and academic variables.

4.8. Synthesis of findings

Together, the results allow us to establish four central findings. First, students reported relatively high levels of use of educational technologies and favorable evaluations of university learning. Secondly, a positive, moderate and significant relationship between both variables was confirmed. Thirdly, students with a higher level of technological use obtained significantly higher averages in university learning. Finally, multiple regression showed that the use of educational technologies is the main predictor of university learning in the sample analyzed.

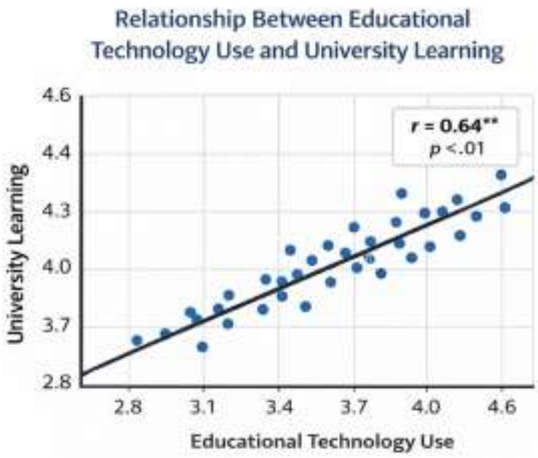

Figure 2. Relationship Between Educational Technology Use and University Learning

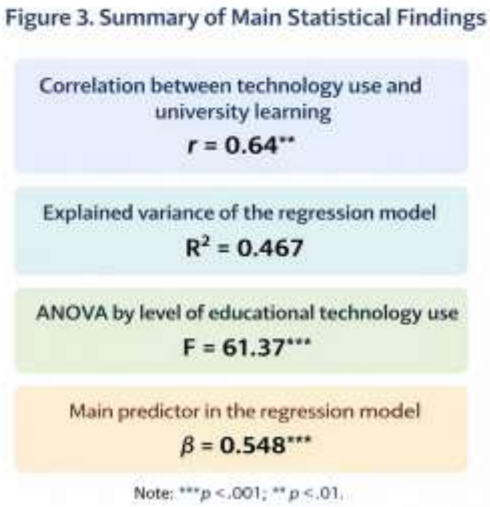

Figure 3. Summary of Main Statistical Fndings

4.9. Hypothesis testing

From the analyses carried out, the hypothesis test was established as follows:

- **H1**: accepted. The use of educational technologies has a positive and significant influence on university learning.
- **H1a**: accepted. There is a positive and significant correlation between the frequency of technological use and university learning.
- **H1b**: accepted. Students with greater technological use have higher levels of university learning.
- **H1c**: accepted. The use of educational technologies significantly predicts university learning.
- **H0**: rejected.

DISCUSSION

The results of this study allow us to argue that the use of educational technologies is positively and significantly related to university learning. Overall, the findings show that students who report more frequent, diverse, and pedagogically oriented use of digital tools also have higher levels of perceived performance, academic engagement, interaction, and

satisfaction with learning. This result confirms the central hypothesis of the study and aligns with the recent literature that argues that educational technology can favor engagement and learning outcomes when integrated into meaningful didactic experiences.
One of the most relevant findings was the magnitude of the correlation between total use of educational technologies and total university learning ($r = 0.64$, $p < .01$). This coefficient suggests a moderate-high association, which allows us to affirm that digital transformation is not only a structural or administrative change, but a process with direct implications for the student's educational experience. This interpretation coincides with recent reviews that point out that digital transformation in higher education achieves real academic value when it articulates technological, pedagogical, and organizational components, and not when it is limited to the instrumental adoption of platforms.
Likewise, the study showed that the dimension most associated with university learning was not simply the frequency of use, but the pedagogical purpose of technological use. This result is especially important, because it suggests that the impact of educational technologies depends less on their quantitative presence and more on the quality of the activities they mediate. In other words, it is not enough for the student to use platforms, applications or digital resources with high frequency; What is decisive is that these tools are oriented to academic tasks with cognitive value, meaningful interaction, feedback and active construction of knowledge. This conclusion coincides with the broad review on engagement in higher education, which underlines that technologies enhance learning when they support active, collaborative, and authentic forms of student participation.
From a theoretical perspective, these results support the constructivist approach adopted in the study. The positive relationship between pedagogical use of technology and university learning suggests that digital environments favor better results when they facilitate interaction, autonomy, progress monitoring and active task resolution. In this sense, the findings allow us to interpret that technology does not act as an isolated cause of learning, but as a mediator of academic experiences that can strengthen cognitive and motivational processes. This reading is consistent with recent evidence linking educational technologies to greater opportunities for student engagement, provided that there is adequate didactic mediation.
The comparative analysis by levels of technological use reinforced this idea. Students with a high level of use of educational technologies obtained significantly higher averages in university learning compared to groups with medium and low use. This pattern suggests a possible cumulative effect of technological exposure when it is integrated in a sustained way into the training experience. However, the finding should be interpreted with caution: it does not imply that every increase in technological use automatically produces better results, but that, in the observed context, students who make more intense and academic use of these tools report better learning experiences. Recent literature on online learning and student achievement points in the same direction: the benefits appear most clearly when technological use is combined with pedagogical design, activity structure, and institutional support.
Another significant result was that of the multiple linear regression model. The use of educational technologies emerged as the strongest predictor of university learning ($\beta = 0.548$, $p < .001$), even when controlling for variables such as connectivity, study cycle, and modality. This finding gives greater strength to the explanatory hypothesis of the study, since it indicates that the technological variable is not only associated with learning, but also explains a substantial proportion of its variation ($R^2 = 0.467$). In interpretative terms, this suggests that digital practices are part of the core of the contemporary university experience and have the capacity to influence how the student perceives their progress, involvement and academic satisfaction.

The significance of stable connectivity as a complementary variable also deserves attention. Although its weight was less than that of technological use, its positive influence confirms that access to infrastructure continues to be an enabling factor for learning in digitalized contexts. This result converges with recent reviews that identify connectivity, access, and technological readiness as basic conditions for digital transformation to produce real benefits and not deepen existing inequalities.

Similarly, the positive effect of the study cycle suggests that students at more advanced levels could have developed greater familiarity with university digital environments, better self-regulation strategies or a more functional appropriation of technological tools. This interpretation finds indirect support in recent work showing that digital literacy, adaptation to learning, and online self-regulation strengthen the relationship between digital competences and academic achievement.

On the other hand, the fact that no statistically significant differences have been found between academic areas in the use of educational technologies suggests that the digitalization of university learning tends to be transversal between disciplines. Although Engineering and Technology presented a slightly higher average, the general pattern indicates that digital tools are no longer the heritage of a single training field, but an extended part of the university ecosystem. This observation is consistent with recent studies that describe digital transformation as a broad institutional phenomenon, with scopes that cut across teaching, management, and support for learning in multiple areas of knowledge.

In relation to the specific dimensions of learning, the lower average score observed in self-regulation is particularly revealing. Although students valued technological use positively and reported favorable levels of commitment and satisfaction, self-regulation appeared as the relatively weakest component. This suggests that technological availability does not in itself guarantee skills to plan, organize and sustain autonomous study. Recent evidence supports this reading: different research shows that digital literacy, self-efficacy and self-regulation act as important mediators between the digital environment and academic outcomes.

The institutional implications of the study are clear. First, universities should not evaluate the success of their digital transformation only by the number of platforms adopted or by access indicators, but also by how these tools improve learning, interaction, and student engagement. Second, the results suggest that technological innovation policies should be accompanied by teacher training, instructional redesign and strategies to promote deep academic uses of technology. This recommendation is in line with recent literature, which insists on the need for leadership, digital maturity and integrated measures for digital transformation to generate sustainable effects.

Thirdly, the findings acquire special relevance in a context of expansion of tools based on artificial intelligence. Although the present study did not focus exclusively on AI, its results are consistent with recent research showing that these technologies can improve personalization, tutorial support, and engagement, but also introduce challenges of academic integrity, dependency, and regulation. Consequently, the pedagogical value of AI, like that of other educational technologies, depends on its critical and methodologically oriented integration.

From a methodological point of view, the study provides quantitative evidence that helps to fill a gap identified in the recent literature: the need for research that not only describes digital transformation as an institutional discourse, but also empirically measures its relationship with specific academic variables. In this sense, the combination of descriptive statistics, correlation, ANOVA and multiple regression allowed to offer a more robust reading of the phenomenon, providing comparable and useful results for subsequent research.

However, the discussion must also consider the limitations of the study. The first is the transversal nature of the design, which prevents definitive causality from being established. Although the analyses show a relationship and statistical predictive capacity, they do not allow us to affirm in a strict sense that technological use causes better levels of university learning by itself. The second limitation is the use of self-report measures, which may be influenced by subjective perceptions, social desirability, or overestimation of competencies. The third is that learning was addressed through perceived indicators and not exclusively through objective performance records. These limitations are consistent with methodological caveats noted by recent reviews on educational technology and student engagement.

Based on these limitations, future research could develop longitudinal designs to observe the evolution of university learning over time, incorporate objective indicators such as ratings or platform analytics, and explore structural models that integrate mediating variables such as digital literacy, self-efficacy, motivation, and self-regulation. It would also be pertinent to examine the effect of specific technologies, such as LMS, collaborative tools, adaptive systems, and generative artificial intelligence, in a differentiated way, given that recent literature suggests that not all technologies produce the same effects or operate under the same pedagogical conditions.

In summary, the discussion allows us to affirm that the study provides consistent evidence in favor of the positive influence of the use of educational technologies on university learning. However, this influence should not be interpreted in deterministic terms, but relational and contextual ones: technology contributes to learning when it is pedagogically oriented, institutionally supported and accompanied by conditions of access, digital literacy and self-regulation. As a result, the digital transformation of higher education only makes full sense when it translates into more meaningful, equitable, and intellectually productive learning experiences.

CONCLUSIONS

The purpose of this study was to quantitatively analyze the influence of the use of educational technologies on university learning in the context of the digital transformation of higher education. From the results obtained, it is possible to conclude that the use of educational technologies exerts a **positive, significant and consistent influence** on university learning, which confirms the general hypothesis raised at the beginning of the research. In general terms, students who reported higher levels of technological use also manifested better levels of perceived performance, academic commitment, interaction and satisfaction with their training process.

The first central conclusion is that digital transformation in higher education should not be understood only as a process of incorporating infrastructure or platforms, but as a transformation with concrete effects on the student's learning experience. The results show that the university digital environment, when used for clear academic purposes, can become a relevant facilitator of learning. This implies that technology ceases to be a peripheral or complementary component to consolidate itself as a structural dimension of the university educational ecosystem.

The second conclusion indicates that **it is not the simple frequency of technological use that explains university learning to a greater extent, but the pedagogical nature of the use**. The findings show that the strongest associations occurred when technologies were used to support meaningful academic tasks, interaction with teachers and peers, study organization, access to feedback, and development of active learning activities. Consequently, the positive impact of educational technologies depends less on the quantity of tools available and more on the pedagogical quality with which they are integrated into the training process.

The third conclusion points out that there is a **statistically significant relationship** between the use of educational technologies and university learning. The correlational analysis confirmed that both variables are positively associated, while the comparative analysis showed that students with a high level of technological use obtained significantly higher averages in university learning compared to those who presented low or medium use. This result allows us to affirm that the appropriation of technology by the student is a relevant factor to understand differences in the university academic experience.

The fourth conclusion is derived from the multiple regression model, which showed that the use of educational technologies was the **strongest predictor of university learning** among the variables included in the analysis. This finding reinforces the explanatory relevance of the technological variable and demonstrates that its effect is maintained even when considering other academic and contextual conditions, such as connectivity and the cycle of studies. Therefore, it can be concluded that the use of educational technologies not only accompanies university learning, but also represents a variable with significant predictive capacity within the digital environment of higher education.

The fifth conclusion shows that digital transformation does not have a homogeneous impact on all components of learning. Although perceived performance, engagement, and satisfaction showed favorable values, self-regulation presented relatively lower levels. This suggests that access to and use of technologies does not automatically guarantee the development of autonomous learning management capacities. Therefore, the university's digital transformation must be complemented with pedagogical strategies aimed at strengthening autonomy, the organization of study, academic discipline and self-regulation in virtual and hybrid environments.

The sixth conclusion indicates that the differences between academic areas were not statistically significant, which allows us to infer that the use of educational technologies has spread in a relatively transversal way in the university. Although certain disciplines, such as Engineering and Technology, had slightly higher averages, the general pattern suggests that the digitalisation of learning no longer corresponds to isolated sectors, but is part of a wider academic culture. This transversality represents an opportunity for the design of institutional policies for digital transformation that involve the entire university community and not only specific programs.

In theoretical terms, the study concludes that the results support approaches that understand technology as a mediator of learning and not as an end in itself. The empirical evidence obtained reinforces the idea that educational technologies acquire academic value when they are articulated with constructivist practices, meaningful interaction, timely feedback, and activities that involve active student participation. Consequently, technology must be interpreted from a pedagogical logic and not merely instrumental.

In methodological terms, the research demonstrates the usefulness of the quantitative approach to examine contemporary phenomena in higher education related to digital transformation, technological use and learning. The combination of descriptive, correlational, comparative and inferential analyses made it possible to offer a broad and rigorous vision of the phenomenon studied. In addition, the instrument showed adequate levels of reliability, which strengthens the consistency of the findings and provides a useful basis for future research in similar contexts.

At the practical and institutional level, it is concluded that universities must orient their digital transformation strategies towards improving learning and not only towards technological modernization. It is not enough to implement platforms, expand connectivity or introduce innovative tools; It is necessary to ensure that these technologies are integrated into coherent instructional designs, active methodologies and relevant evaluation processes. Likewise, the results suggest the need to strengthen teacher training in pedagogical digital competencies and to design institutional actions that promote a critical, reflexive, and academic use of technologies by students.

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