
University Competencies through Integration of Digital Tools in Hybrid Mode

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ABSTRACT

The objective of this research was to determine the impact of digital tools in hybrid mode on the achievement of competencies in university students in Guayaquil during the year 2024, in accordance with Sustainable Development Goal 4, aimed at guaranteeing inclusive, equitable and quality education, promoting learning opportunities for all. It was developed under a quantitative, basic approach, with a non-experimental, correlational-causal and cross-sectional design. The sample was made up of 100 students of the Graphic Design career of the University of Guayaquil, selected through random probability sampling. The technique used was the survey, applied through a previously validated instrument and with adequate levels of reliability. The results showed that 41.0% of the participants were at a low level with respect to the use of digital tools in hybrid mode, 30.0% at a medium level and 29.0% at a high level, reflecting a predominance towards low levels, especially in the collaboration dimension, while the other dimensions showed a more balanced distribution. Likewise, goodness-of-fit and logistic regression tests indicated values of 0.319 (32%) according to Nagelkerke, 0.283 (28.3%) according to Cox and Snell and 0.152 (15.2%) according to McFadden, which confirms a moderate fit of the model and evidences its significant contribution compared to the null model in relation to the variable analyzed.

KEYWORDS

technology, competencies, strategies.

1. INTRODUCTION

At the Summit on the Transformation of Education, the United Nations revealed that, because of the COVID-19 pandemic, more than 90% of students worldwide interrupted their training process, a situation that evidenced deep inequalities in access, permanence and educational quality. This context

highlighted not only the technological gaps between countries, but also the structural limitations of higher education systems to ensure the development of skills in technology-mediated environments.

In Latin America and the Caribbean, several studies indicated that a significant percentage of university students failed to consolidate digital skills, which directly affected their academic and professional performance (UNESCO, 2024).

Against this backdrop, the hybrid modality that combined face-to-face and virtual components became relevant as an alternative to give continuity to training processes. The integration of digital tools in this model made it possible to make teaching more dynamic, make learning more flexible and promote student participation. International organizations such as UNESCO (2023) highlighted that the pedagogical use of technological resources contributed to democratizing access to information and reducing the digital divide, provided that its implementation was accompanied by relevant didactic strategies and teacher training (UNESCO, 2023).

In line with Sustainable Development Goal 4, promoted by the United Nations, aimed at guaranteeing inclusive, equitable and quality education, universities took on the challenge of strengthening innovative training models. In this framework, this research focused on analyzing the impact of digital tools in hybrid mode on the achievement of competencies in university students in Guayaquil.

From the theoretical support, the proposal of meaningful learning, the theory of connectivism, was considered, who maintained that learning was built through the resolution of real and contextualized problems, promoting critical thinking, autonomy and collaboration. Likewise, the connectivism proposed by Siemens emphasized learning as a networked process, where technology facilitated the collective construction of knowledge. Similarly, Tobón's socio-formative approach highlighted comprehensive training based on competencies, articulating knowing how to know, knowing how to do and knowing how to be in hybrid scenarios. These perspectives founded the relationship between digital tools, meaningful learning and competence development (Fong Reynoso y otros, 2017) (Gutiérrez, 2011) (Pinzón Arteaga, 2024).

In the local context, it was observed that students from a public university in Guayaquil showed low interest, low participation and difficulties in the assimilation of content, which was associated with the limited or inappropriate use of digital tools under hybrid modality. This problem led to the formulation of the following research question: How did digital tools in hybrid mode influence the achievement of competencies in university students in Guayaquil in 2024?

The general objective was to determine the impact of these tools on the achievement of competencies, considering the dimensions of functionality, techno pedagogy and learning.

The research was justified at the theoretical level by providing empirical evidence that integrated different explanatory currents on learning and technology; on the practical level, by generating guidelines for the design of innovative didactic strategies; at the methodological level, by using valid and reliable instruments that could be replicated in other contexts; and at the social level, by contributing to the strengthening of a more inclusive and relevant higher education (Mendoza-Vega y otros, 2026).

It was hypothesized that digital tools in hybrid mode significantly influenced the achievement of competencies in university students. Consequently, the study sought to provide scientific foundations that would support institutional decision-making aimed at improving the quality of education and responding to the demands of the knowledge society.

2. METHODS

(Ducuara González & Jurado de los Santos, 2013) The research was developed under a quantitative approach, which allowed the variables to be measured using numerical data and statistically analyzed to contrast the hypotheses raised with objectivity and scientific rigor. This approach facilitated the identification of relationships between the integration of digital tools in hybrid mode and the development of university competencies, ensuring accuracy in the measurement and analysis of results.

The study was of a basic type, because it sought to expand theoretical knowledge about the variables analyzed without intervening directly in the reality studied. Likewise, it presented a non-experimental design, since the variables were observed in their natural context without deliberate manipulation, allowing to describe and explain the phenomena as they occurred in the academic environment (De Andrade y otros, 2025).

The scope was correlational-explanatory, since the relationship between the integration of digital tools in hybrid mode and the development of university competencies was examined, as well as the degree of influence of one variable on the other.

Manterola et al. (2023) The cross-section was cross-sectional, since the data collection was carried out at a single time during the 2024 academic period, allowing a photograph of the phenomenon to be obtained at that specific time.

The population was made up of 250 students of the Graphic Design career of a university in Guayaquil enrolled in the 2024 period.

The sample was made up of 100 students, selected through simple random probabilistic sampling, a procedure that guaranteed equal opportunities for participation and representativeness within the study. Inclusion criteria were considered to be enrolled in the corresponding academic period and voluntarily agree to participate in the research (Salcedo Galvis, 2011).

The data collection technique was the survey, applied through a structured questionnaire with a Likert-type scale, an instrument widely used in educational studies to measure perceptions, attitudes and frequency levels through ordinal categories that facilitate statistical analysis (Likert, 1932). The instrument was structured according to the dimensions of each variable.

(Alvear Mendieta & Espinoza de los Monteros, 2020) The independent variable corresponded to the integration of digital tools in hybrid mode, organized into dimensions such as technological use, pedagogical approach and digital collaboration. The dependent variable was the development of university competencies, understood as the integration of knowledge, skills, and attitudes necessary for academic and professional performance in changing contexts.

The validity of the instrument was established through the judgment of experts, who evaluated the relevance, coherence and clarity of the items in relation to the theoretical dimensions proposed.

Reliability was determined using Cronbach's alpha coefficient, which allowed measuring the internal consistency of the instrument and ensuring stability in the measurements obtained (Cronbach, 1951).

Collazo et al. (2025) data analysis was performed at two levels. At the descriptive level, frequencies and percentages were used to characterize the behavior of the variables. At the inferential level, Spearman's rho coefficient was applied to determine the relationship between ordinal variables and logistic regression to evaluate the explanatory capacity of the model, considering adjustment indicators that allow assessing the quality of the model against the null model.

The study respected fundamental ethical principles such as voluntary participation, informed consent, and confidentiality of the information collected (Guzmán y otros, 2025).

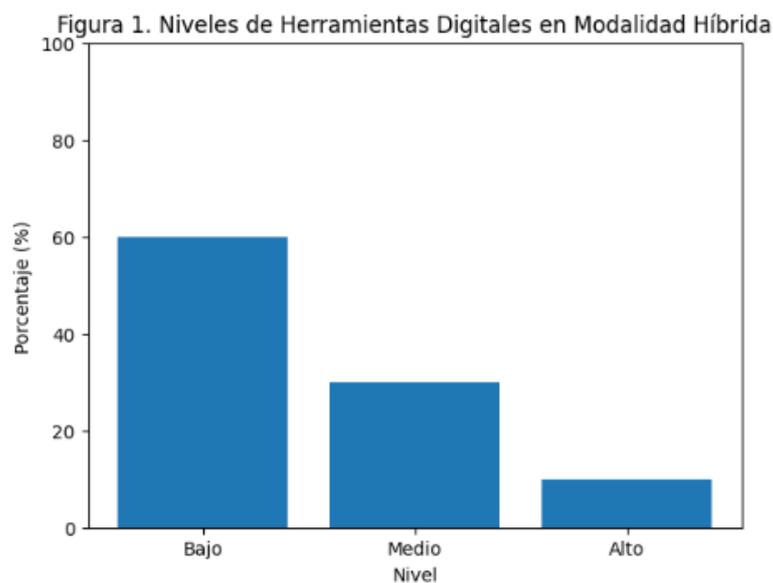
3. RESULTS

Descriptive analysis

In relation to the variable digital tools in hybrid mode (HDMH), the results showed that 41% of the students were at a low level, 30% at a medium level and 29% at a high level. This distribution shows a slight trend towards low levels, which indicates that a considerable proportion of students still do not optimally integrate digital resources into their training process.

Figure 1

Percentage distribution of levels of digital tools in hybrid mode

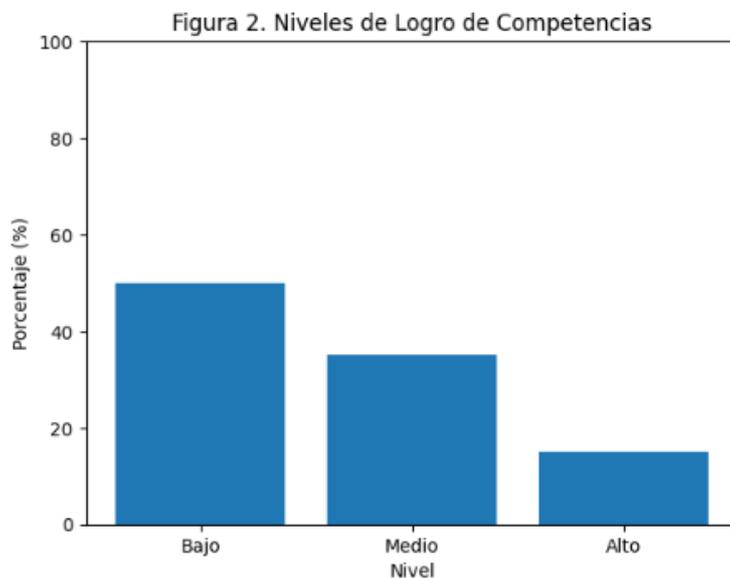


Note. Own elaboration (2026).

Interpretation; Regarding the dimensions of HDMH, the functionality presented a balanced distribution between low (37%) and medium (37%) levels, while the high level reached 26%. The techno-pedagogical dimension showed a predominance of the low level (41%). However, the collaboration dimension evidenced the most critical result, with 56% at a low level, reflecting weaknesses in collaborative work mediated by technology.

Figure 2

Low level by dimensions of digital tools in hybrid mode

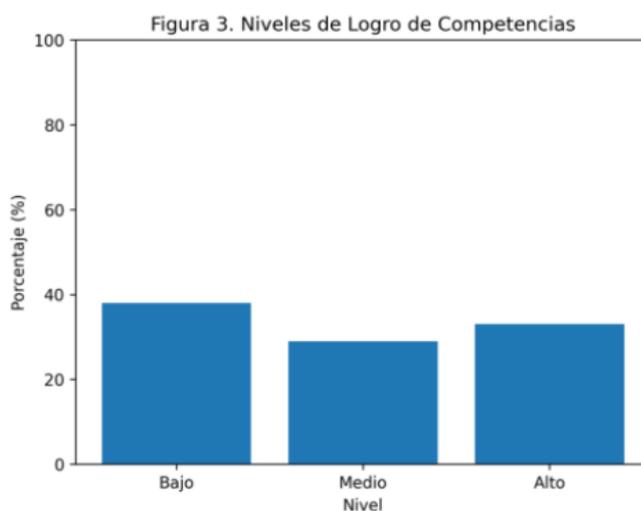


Note. Own elaboration (2026).

Regarding the **achievement of competencies (LC)**, 38% of the students were at a low level, 29% at a medium level and 33% at a high level, showing a slight predominance of low levels.

Figure 3

Percentage distribution of levels of competence achievement



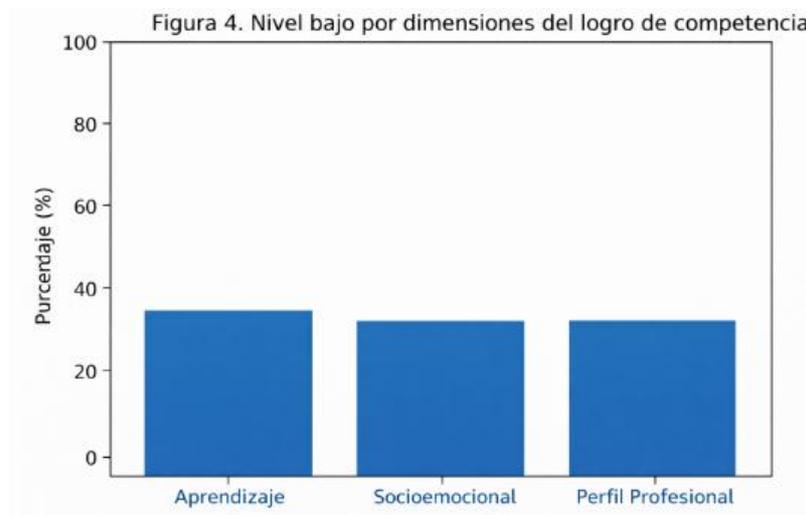
Note. Own elaboration (2026).

In the dimensions of the achievement of competencies, 39% were at a low level in learning, 36% in socio-emotional and 37% in professional profile. These results show the existence of a significant group with difficulties in the comprehensive development of competencies.

Figure 4 illustrates the predominant low-level trend in the dimensions evaluated.

Figure 4

Low level by dimensions of competency achievement



Note. Own elaboration (2026).

The cross-analysis showed that 76.3% of the students with a low level of HDMH also presented low achievement of competencies. In contrast, among those who achieved high levels of digital tools, 48.5% were at a high level of skills. This trend confirms a direct and upward relationship between both variables.

Correlational analysis

Spearman's correlation showed a positive, moderate, and statistically significant relationship between digital tools in hybrid mode and competency achievement ($\rho = 0.561$; $p < 0.01$). This indicates that as digital integration increases, the level of competence tends to increase.

By dimensions, the following were found:

- Techno pedagogy: $\rho = 0.830$ (strong correlation).
- Learning: $\rho = 0.587$ (moderate-high).
- Socio-emotional: $\rho = 0.585$ (moderate-high).
- Professional profile: $\rho = 0.478$ (moderate).

These results show that digital integration mainly impacts methodological and pedagogical processes, although it also influences socio-emotional and professional development.

Inferential analysis and explanatory model

The ordinal logistic regression model showed a significant fit ($\chi^2 = 33.289$; $df = 1$; $p = 0.000$), indicating that the predictor variable significantly improves the explanation of the model compared to the null model.

Goodness-of-fit tests (Pearson $p = 0.140$; Deviation $p = 0.156$) confirmed model adequacy. The values of pseudo R^2 (Nagelkerke = 0.319) indicate that approximately 32% of the variability in the achievement of competencies can be explained by the integration of digital tools.

The estimated coefficient was positive and significant ($\beta = 1.409$; $p < 0.001$), confirming that the increase in digital tools increases the probability of reaching higher levels of competencies.

5. DISCUSSION

The results of this research confirm the hypothesis, showing that the integration of digital tools in hybrid mode significantly influences the achievement of university competencies. The positive, moderate, and statistically significant correlation ($\rho = 0.561$; $p < 0.01$) shows that as the level of digital integration increases, the development of competencies increases. This finding is consistent with the constructivist approach of Jonassen (2009, 2011), who argues that technology-mediated learning favors higher cognitive processes when digital tools are used as instruments for authentic and contextualized problem solving.

From the descriptive analysis, the predominance of low levels in both digital tools (41%) and in the achievement of competencies (38%) reveals that the mere incorporation of technology does not guarantee optimal training results. This result coincides with what UNESCO (2022) points out, which warns that the digital transformation in education requires pedagogical support and the development of teacher capacities to generate a real impact on learning. In this sense, the data obtained reinforce the idea that the challenge lies not only in technological access, but in the quality of its didactic integration.

The collaboration dimension presented the most critical percentage (56% at low level), which shows weaknesses in collaborative work mediated by technology. This result can be interpreted in the light of the connectivism proposed by Siemens (2004), who states that learning in the digital age is built through interaction networks and knowledge nodes. When these networks are not strengthened through structured engagement strategies, technology loses its transformative potential. It also expands this perspective by pointing out that networked learning requires digital competencies and socio-emotional skills that allow the collective construction of knowledge, an aspect that in this study showed levels that are still incipient (Cabello y otros, 2020).

One of the most relevant findings was the strong correlation found in the techno-pedagogical dimension ($\rho = 0.830$), which confirms that didactic mediation is the factor with the greatest impact on competence development. This result is aligned with the socio-formative approach of , who argues that the development of competencies implies the articulation of knowing how to know, knowing how to do and knowing how to be in contextualized scenarios, where technology acts as a means and not as an end. Consequently, the empirical evidence obtained supports the need to strengthen teacher training in techno-pedagogical strategies that integrate digital resources with training intentionality (Ly y otros, 2026).

The cross-analysis showed that 76.3% of the students with a low level of digital tools also presented low achievement of competencies, which shows a direct and consistent relationship between both variables. This finding is consistent with Latin American research that has indicated that digital divides have a direct impact on academic performance and the acquisition of professional skills, especially in post-pandemic hybrid contexts (ONU, 2024).

From the inferential analysis, the ordinal logistic regression model evidenced a significant fit ($\chi^2 = 33.289$; $p = 0.000$) and a Nagelkerke value of 0.319, indicating that approximately 32% of the variability in the achievement of competencies can be explained by the integration of digital tools. Although this percentage reflects a moderate effect, it confirms that the predictor variable has a statistically relevant weight. However, it also suggests the existence of other intervening factors, such as academic motivation, socioeconomic context, teaching accompaniment and institutional culture, which could influence the development of competencies and that deserve to be explored in future research.

In line with Sustainable Development Goal 4, the results underscore the importance of strengthening hybrid educational models that integrate technology with pedagogical relevance and an inclusive approach. The evidence obtained provides empirical support for institutional decision-making aimed at consolidating comprehensive digital training strategies, promoting not only technical skills, but also socio-emotional and professional competencies necessary in the knowledge society (UNESCO, 2023).

Among the limitations of the study is the non-experimental and cross-sectional design, which prevents the establishment of absolute causal relationships. Likewise, the research was limited to students of the Graphic Design career of a public university in Guayaquil, which limits the generalization of the results to other disciplines or educational contexts. Future research could incorporate longitudinal or quasi-experimental designs, expand the sample and consider mediating variables that allow us to deepen the understanding of the impact of digital integration.

In conclusion, the integration of digital tools in hybrid mode is a significant factor for the strengthening of university competencies. However, its effectiveness depends on the quality of techno-pedagogical mediation and the development of collaborative dynamics that enhance networked learning. Higher education institutions are called upon to consolidate innovative hybrid models that articulate technology, pedagogy and comprehensive training as strategic pillars to guarantee quality education in the post-pandemic context.

CONCLUSIONS

The results confirm that the integration of digital tools in hybrid mode significantly influences the achievement of university competencies, evidencing a positive, moderate and statistically significant correlation ($\rho = 0.561$; $p < 0.01$). This shows that the strengthening of digital integration contributes to the development of competencies in higher education contexts.

The techno-pedagogical dimension had the highest incidence in the development of competencies ($\rho = 0.830$), which shows that didactic mediation is the determining factor in the formative impact of digital tools. It is not the technology itself that generates learning, but the way in which it is incorporated pedagogically.

A predominance of low levels was identified both in digital tools (41%) and in the achievement of competencies (38%), which reveals that there are still weaknesses in technological appropriation and in the comprehensive development of competencies, especially in the dimension of digital collaboration (56% at low level).

The ordinal logistic regression model showed a significant adjustment (Nagelkerke = 0.319), indicating that approximately 32% of the variability in the achievement of competencies can be explained by the integration of digital tools in hybrid mode. However, the remaining percentage suggests the influence of additional variables that should be considered in future research.

The findings support the need to strengthen hybrid models with a techno-pedagogical approach, in coherence with Sustainable Development Goal 4, aimed at ensuring inclusive, equitable and quality education.

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