

Research Article

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Use of Digital Tools and Academic Performance in University Students: A Cross-Sectional Study

Manuela Daishy Casa-Coila 

Abstract

Background/purpose. The use of digital tools influences academic performance, either improving learning or distracting students. In that framework, the research was conducted to analyze how the use of digital tools influences the academic performance of university students from a cross-sectional perspective. The objective was to investigate the relationship between the use of digital tools and academic performance among university students at the National University of the Altiplano (NUA) in Puno.

Materials/methods. The methodology was based on the positivist paradigm, with a quantitative, non-experimental approach and a cross-sectional correlational design. The population consisted of 2887 students, and the sample of 340 students was selected through probability sampling. The survey was applied for the two study variables and the instruments were the digital tools use questionnaire and the university academic performance scale. The normality test was performed using skewness and kurtosis, and it was found that the data have a normal distribution.

Results. The results indicate a positive average correlation between the study variables.

Conclusion. It is concluded that greater use of digital tools is significantly associated with better academic performance. However, the relationship is not strong, suggesting that other factors may be at play.

1. Introduction

The integration of information and communication technologies (ICTs) in education has been key to addressing significant educational challenges. Since the late 1980s, their implementation has been prioritized to reduce the digital divide, modernize learning processes, and develop students' cognitive competencies and skills. These tools have played a central role in educational transformation (Sunkel et al., 2014). In the university environment, the way students access information, organize their time, and develop academic skills has undergone significant changes. These tools enable them to perform tasks more efficiently, enhance communication with teachers and peers, and access a wide range of educational resources. However, the impact of these technologies on academic performance varies according to the type of tools used and the context in which they are implemented.

In order to effectively implement ICT in education, it is crucial to consider the factors that influence their transformation, as well as the impact they have on all the actors involved in the educational process (Llantoy et al., 2024). In this sense, some studies have highlighted that the use of specific digital tools, such as simulators, has shown significant improvements in academic performance, as students develop effective skills in their use, which positively contributes to their learning (Casa-Coila et al., 2023).

The Covid-19 pandemic significantly boosted the adoption of digital tools in education, forcing educational institutions to quickly adapt to a virtual environment, which completely transformed face-to-face teaching into remote mode (Ccoa & Alvites-Huamani, 2021). Thus, in Latin America, digital platforms have been implemented to ensure academic continuity during the confinement period (Hernández-Rovalino et al., 2023). This accelerated process has generated a greater dependence on technologies in virtual educational environments and has boosted the use of digital tools, especially in higher education, where its growth has been influenced by factors such as technological accessibility, the need to develop digital skills and the adaptation of training to the demands of the labor market (Oyarvide et al., 2024).

Currently, one of the main challenges in higher education is for teachers to effectively integrate ICTs into their teaching practices, promoting innovative approaches that enhance the teaching-learning process and prepare students for their future professional careers (Abarca, 2015). This context has led to prioritizing competency-based assessment, which requires transforming traditional methods with innovative approaches. The use of digital technologies enables more effective interaction among students, promoting dialogue and teacher guidance to enhance academic performance (González & Abad, 2020). Despite its benefits, access to these technologies presents challenges, including the acquisition of adequate equipment and adapting to digital platforms for academic and collaborative activities (Delgadillo et al., 2023).

On the other hand, the knowledge society has driven educational transformation through the use of mobile applications and ICTs, facilitating the self-management of learning and fostering more autonomous pedagogical models. To this end, educational institutions must adopt these resources, train their teachers and guarantee equal access to these tools (Garay, 2020). Additionally, the use of digital tools as motivational techniques can enhance students' enjoyment of learning and sense of accomplishment. However, teachers should avoid traditional methods and delayed grading, as this could negatively affect students' motivation (Rodríguez-Barboza et al., 2023).

In this context, the research aims to examine how the use of digital tools affects the academic performance of university students, taking into account both the positive aspects and the potential challenges that these technologies may pose. In this sense, the following question was posed: ¿What degree of correlation exists between the use of digital tools and academic performance in university students at the National University of the Altiplano (NUA) Puno, 2024? The general objective of the

study was to determine the correlation between the use of digital tools and academic performance in university students at the National University of the Altiplano (NUA), Puno, 2024.

2. Literature Review

2.1. Use of Digital Tools

At the international level, states seek to strengthen quality education as part of the fourth Sustainable Development Goal (SDG) of the 2030 Agenda. This goal promotes inclusion, equity, and lifelong learning for all. Key indicators include internet access to improve educational processes at all levels (ONU, 2018). Digital and research skills involve knowing how to properly select information, organize it effectively, utilize digital tools to analyze it, and collaborate with research teams (Peinado, 2023). In today's education, the incorporation of technology has been key to transforming teaching and learning strategies (Morales et al., 2024).

The use of digital tools refers to the application of technologies and software to facilitate tasks, improve communication, and optimize processes in various fields, such as education, work, and entertainment. These tools include applications, online platforms and electronic devices that enable automation, access to real-time information and remote collaboration, improving efficiency and productivity.

Under this perspective, the use of digital tools in education is fundamental in the current context, where ICT play an essential role in the teaching-learning process. According to Ortiz et al. (2023) the use of ICT in post-pandemic higher education has strengthened the academic performance of teachers and students, facilitating immediate access to information. It is crucial for teachers to integrate digital tools to improve their performance in virtual environments. The use of these tools promotes active student participation, which enhances meaningful learning and fosters the development of critical and collaborative skills.

On the other hand, the use of digital platforms such as Google Classroom, Moodle and other virtual learning environments (VLE) are increasingly used by teachers to manage educational topics and evaluate students' academic performance. Researchers Espinoza et al. (2018) emphasize that the incorporation of ICTs in teaching and learning highlights their importance and benefits, strengthening their use in basic education institutions to maintain constant communication, thereby contributing to learning and adapting to individual needs. Likewise, these platforms encourage the development of digital competencies in students.

Likewise, online learning platforms have become a fundamental tool in the virtual environments of the teaching-learning process, allowing a more accessible and flexible education and overcoming time and space barriers. These platforms have not only improved the quality of education, but have also been essential during the Covid-19 confinement, in which their use became essential to provide continuity in education (Mora-Cruz et al., 2023). Currently, many universities worldwide integrate virtual campuses and online modalities as part of their academic offerings, thus consolidating the central role of digital education in the educational environment (Fernandez & Rivero, 2014).

The interactive whiteboard is a technological tool that integrates a computer, a projector, and touch control, facilitating interaction in the development of the teaching-learning process. It allows editing of texts and images, taking notes, browsing the Internet, and using various educational resources. In addition, it uses specialized software to create digital content and highlight relevant information in real time (Zamarreño, 2017). Therefore, it is important to mention that the implementation of interactive whiteboards contributes to better learning by students, compared to previous courses where traditional methods were used to teach the contents (Acuña-torres et al., 2025).

The integration of digital tools in education promotes collaborative learning, enabling students to work in teams both synchronously and asynchronously, thereby enriching the learning process. These digital tools enable the diversification of didactic strategies, utilizing multimedia resources and simulations that facilitate the understanding of complex concepts visually and interactively.

2.2. Academic Performance

Academic performance is one of the most important indicators of educational success and is related to multiple factors that influence student learning. Therefore, academic performance refers to the level of achievement that a student demonstrates in their educational activities, as assessed by grades, standardized tests, and other indicators of academic success (Meza et al., 2024). Likewise, universities must go beyond the academic sphere, focusing on training self-confident people. Through feedback, students gain confidence in learning, which increases their motivation to achieve goals. Therefore, it is essential for institutions to foster competencies that reinforce self-efficacy, boosting performance and the intrinsic desire to learn (González-Benito et al., 2021).

On the other hand, Broc (2000) argues that current theories of the quality of the school environment, such as academic motivation, focus on expectations, value, and affective aspects, as well as new methodologies to develop skills and abilities to enhance academic performance, with a comprehensive approach to improve concrete learning.

Learning strategies and self-regulation of learning play a crucial role in students' academic performance, showing that metacognitive strategies are efficient and, moreover, prove to be the main predictor of academic performance (Barreto-Trujillo & Álvarez-Bermúdez, 2020). Likewise, Rodríguez-Barboza (2024) emphasizes that it is essential to foster emotional intelligence in order to optimize academic performance, developing emotional skills that enrich learning. This requires analyzing factors such as the family environment, educational practices and the impact of technology on new forms of learning. Additionally, it is crucial to implement targeted interventions that enhance these competencies.

3. Methodology

The research methodology was based on a positivist paradigm with a quantitative approach, employing a non-experimental and correlational design to analyze the relationship between two variables of the study (Hernández-Sampieri & Mendoza, 2018). The study population consisted of 2887 university students from the Faculty of Education Sciences (FES), of whom a probability sample of 340 students was taken, made up of 56.8% women and 43.2% men from 04 professional schools as shown in Table 1: Professional School of Secondary Education (PSSE) with its four study programs, Professional School of Physical Education (PSPE), Professional School of Primary Education (PSPE) and Professional School of Initial Education (PSIE). The average age of those investigated was 21.5 years.

Table 1. Sociodemographic Characteristics of the Population and Study Sample

Students of the (FES) - NUA Puno	Population		Sample		Sex		Average age
	N		n		M	F	
	f	%	f	%			
PSSE	1629	56.4	192	56.4	100	92	21.9
PSPE	410	14.2	48	14.2	35	13	20.7
PSPE	462	16.0	54	16.0	11	43	21.5
PSIE	386	13.4	46	13.4	0	46	21.7
Total	2887	100.0	340	100.0	146	194	21.5

Note. FES Academic Coordination

3.1. Research Instruments

To collect the data, the survey technique was employed for the two study variables. The research instruments consisted of a questionnaire on the use of digital tools, adapted from Cabero-Almenara et al. (2020), which comprised 20 items with a scale ranging from 0 (minimum) to 10 (maximum). This instrument was applied to a pilot test of 30 students, whose reliability according to Cronbach's Alpha was $\alpha=0.975$. For the university academic performance scale questionnaire, it was adapted from Preciado-Serrano et al. (2021), which consists of 20 items, whose rating scale was 0=never, 1=almost never, 2=sometimes, 3=regularly, 4=often, 5=almost always, 6=always. Concerning reliability, it was $\alpha=0.897$. This last instrument was chosen because it measured university academic achievement (RAU) from the student's perspective, rather than using indicators such as the grade point average assigned by professors.

Table 2. Reliability Analysis of Research Instruments

Reliability Statistics			
Use of digital tools		Academic performance	
Alfa de Cronbach	N° of elements	Alfa de Cronbach	N° of elements
.975	20	.897	20

3.2. Data Analysis

To analyze the data, the skewness and kurtosis values were statistically analyzed to determine the normality distribution, which shows information about the distribution of the data. Table 3 and Figure 1 present the results of skewness and kurtosis, which enable us to assess whether the variables exhibit a normal distribution. For the variable 'use of digital tools', the skewness is -0.279 and the kurtosis is -0.453. Moreover, for the academic performance variable, the skewness is -0.153 and the kurtosis is 1.044. Since these values are relatively close to zero and within the acceptable range of ± 1 for skewness and ± 2 for kurtosis (according to common criteria), both variables can be considered to have an approximately normal distribution. Since both variables exhibit an approximately normal distribution, a Pearson's r parametric statistic was used to analyze the relationship between the study variables. This approach allows us to evaluate the strength and direction of the linear relationship between two quantitative variables with a normal distribution, and its correlation coefficient ranges from -1.0 to +1.0.

Table 3. Normality Test of Digital Tool Use and Academic Performance Using Kurtosis and Skewness Statistics

	N	Media		Asimetría		Curtosis	
		Estadístico	Estadístico	Estadístico	Desv. Error	Estadístico	Desv. Error
Uso de herramientas digitales	340		6.132	-.279	.132	-.453	.264
Desempeño académico	340		3.488	-.153	.132	1.044	.264
N válido (por lista)	340						

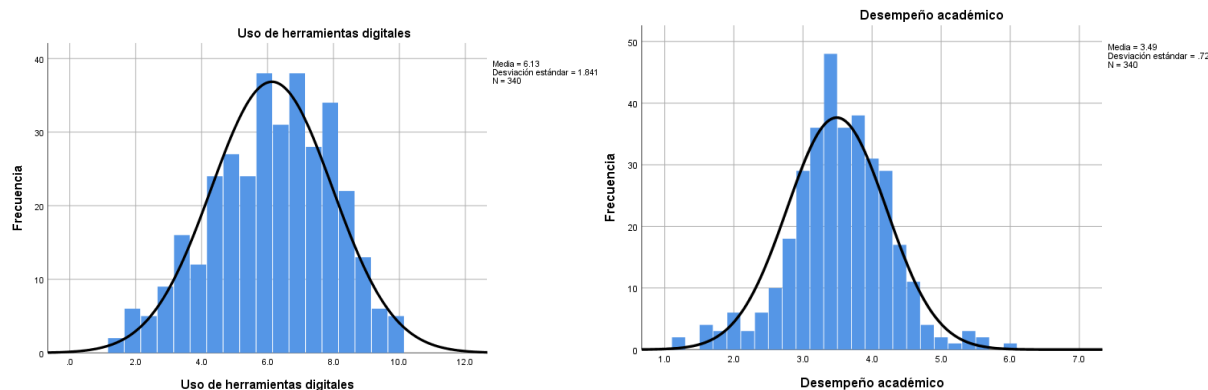


Figure 1. Skewness and Kurtosis

To corroborate the normality of the data in Figure 1, the histogram shows the distribution of digital tool use in a sample of 340 students. The overlaid curve represents a normal distribution, and it is observed that the data follow an approximately normal shape, with a slight symmetry around the mean of 6.13 and a standard deviation of 1.841. Most of the observations are concentrated between the values of 4 and 8, which is consistent with a normal distribution. This representation suggests that the use of digital tools in the sample is fairly evenly distributed, with no clear evidence of bias or extreme asymmetries. Likewise, the histogram of academic performance shows a distribution that approximates the shape of a normal curve, although with a slight asymmetry to the left. The mean is 3.49 with a standard deviation of 0.72, and it is observed that most of the data are concentrated between the values of 3 and 4.5. The superimposed normal curve indicates that the data are symmetrically distributed around the mean, although with a slight accumulation of frequencies towards slightly lower values. Despite this slight deviation, the distribution follows a close-to-normal shape, suggesting that academic performance scores in the sample tend to be distributed in a regular and predictable manner.

4. Results

The results of the research on the use of digital tools and their impact on the academic performance of university students are presented, in accordance with the objectives set out in the pilot study. These data allow us to analyze the relationship between access to and use of technological resources and academic performance, providing a detailed view of their influence on the learning process.

Table 4. Degree of Relationship Between the Use of Digital Tools and Academic Performance

		Use of digital tools	Academic performance
Use of digital tools	Pearson correlation	1	.431**
	Sig. (bilateral)		.000
	N	340	340
Academic performance	Pearson correlation	.431**	1
	Sig. (bilateral)	.000	
	N	340	340

****.** Correlation is significant at the 0.01 level (bilateral).

Table 4 presents the results of the analysis in a sample of 340 students, showing a positive average correlation ($r = .431^{**}$) between the study variables: use of digital tools and academic performance. This indicates that greater use of these tools is associated with better academic performance. The statistical significance ($p < 0.01$) confirms that this result is not a product of chance. However, correlation does not imply causation; other factors could influence this relationship.

Table 5. Correlation Matrix Between the Study Dimensions

	1	2	3	4	5	6	7	8
Technological literacy (1)	1	.716**	.746**	.670**	.643**	.413**	.008	.355**
Communication and collaboration (2)		1	.660**	.609**	.700**	.358**	.019	.395**
Information search and processing (3)			1	.778**	.738**	.456**	-.094	.411**
Digital citizenship (4)				1	.785**	.427**	-.044	.398**
Creativity and innovation (5)					1	.417**	-.009	.450**
Dedication to study (6)						1	-.086	.607**
Organization of didactic resources (7)							1	.051
Contributions to academic activities (8)								1

****.** La correlación es significativa en el nivel 0,01 (bilateral).

Table 5 shows the results of the correlation matrix, which reveal the strongest relationships are first between the dimensions of digital citizenship and creativity and innovation ($r = .785$, $p < .001$), meaning that the greater the creativity and innovation, the greater the digital citizenship followed by the dimensions of information search and processing with digital citizenship ($r = .778$, $p < .001$). Likewise, the technological literacy dimension with information search and processing ($r = .746$, $p < .001$), suggesting a close connection between the key digital competencies. High correlations are also observed between the dimensions of technological literacy and communication and collaboration ($r = .716$, $p < .001$), as well as between the latter and creativity and innovation ($r = .700$, $p < .001$), indicating that the ability to collaborate and communicate digitally is strongly related to other technological skills. On the other hand, moderate correlations are presented between dimensions such as dedication to study and contributions in academic activities ($r = .607$, $p < .001$), technological literacy and digital citizenship ($r = .670$, $p < .001$), and information search and processing with the creativity and innovation dimension ($r = .738$, $p < .001$). In contrast, low or non-significant correlations were found, as between organization of didactic resources and the other variables, or even negative ones, as between information search and organization of didactic resources ($r = -.094$, $p > .005$), suggesting independence or little relationship between these dimensions. Overall, the data show that digital skills tend to correlate significantly with each other, while other more operational or specific skills show less association.

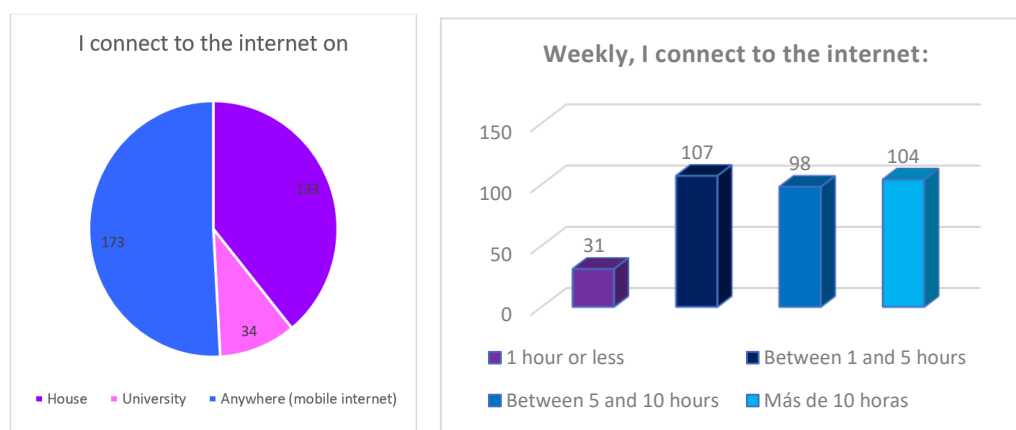


Figure 2. Descriptive Results on Connectivity and Internet Connection Time

Regarding the descriptive results of internet connectivity among the surveyed students, the findings reveal that the majority (50.9%) connect from anywhere using mobile internet, highlighting the importance of mobility in their access to the network. Meanwhile, 39.1% connect from home, indicating that the household remains a significant space for internet access. On the other hand, a smaller percentage (10%) of students connect at the university to carry out various academic activities, which could suggest a lower dependence on this infrastructure.

Regarding students' connectivity hours, there is a relatively balanced distribution. About 31.5% of students are online for 1 to 5 hours, while nearly a third (30.6%) spend more than 10 hours connected, which could suggest a high level of digital dependency among a significant group of students. Meanwhile, 28.8% of respondents are connected for 5 to 10 hours. Finally, 9.1% of students spend 1 hour or less online.

The results highlight an increasing mobility in internet access, with more than half of the students using mobile connections, emphasizing the need for educational strategies adapted to this digital reality. Although the home remains a key space for connectivity, the low dependence on university infrastructure suggests that institutions should optimize their digital services to enable more flexible learning. Moreover, the high percentage of students connected for more than 10 hours a day raises concerns about potential digital dependency, requiring a balanced approach that promotes responsible use of technology in the academic environment.

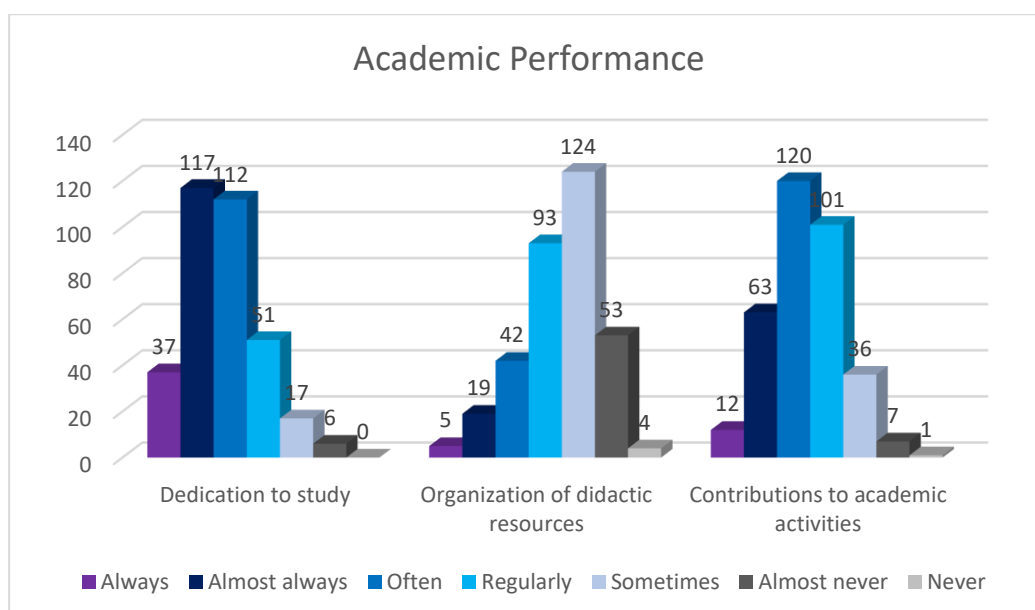


Figure 3. Academic Performance Results

Figure 3 shows the results of academic performance from the students' perspective, divided into three dimensions: study dedication, organization of learning resources, and contributions to academic activities. These results are classified according to the frequency with which students engage in these actions. Regarding the dimension of study dedication, most students fall into the "Always" and "Almost always" categories, indicating a high level of commitment to their studies. However, some students are also found in the lower categories. Whereas in the dimension organization of didactic resources, the category "Often" stands out, as it has the highest number of responses. This suggests that students tend to organize their materials frequently, but not consistently. Finally, in the dimension contributions to academic activities, the responses are concentrated in the categories "Almost Always" and "Often," which reflects an active level of participation in academic activities, although with less consistency compared to dedication to studying.

The results reflect a high level of student engagement in their dedication to studying, although differences persist in the organization of educational resources and participation in academic activities. This suggests that while students demonstrate consistency in their learning, there are still areas for improvement in managing study materials and academic interaction. Therefore, it is essential to promote strategies that encourage a more structured planning of study resources and greater participation in collaborative activities, thereby comprehensively strengthening academic performance.

5. Discussion

The results in Table 4 are similar to studies found from Balaji & Sahija (2022) where it refers that the correlation is positive between the effectiveness of ICT in improving the learning process in higher education, with a significant impact, and a value less than 0.05 between the study variables, standing out for improving attention, commitment and academic performance of students. Another study by Mancha et al. (2022) yields similar results, with a significance level of $p=0.00$ obtained using the nonparametric Chi-Square test, indicating that digital competencies are significantly related to learning achievement satisfaction among university students. Similarly, there is some similarity with the study by Pegalajar-Palomino & Martínez-Valdivia (2024), which shows that students perceive ICT-supported gamification positively, describing it as entertaining and dynamic in the university setting.

While the research of Llantoy et al. (2024) refers that the correlation analysis with Spearman's Rho coefficient showed a very strong relationship (0.999) between the variables, with statistical significance ($p=0.000 < 0.05$), results that suggest that, the educational use of ICT is closely related to the perception of teaching performance according to the students of a faculty of education.

On the other hand, the descriptive results found by Abarca (2015) indicate that 100% of teachers use technological tools in the classroom, with a notable emphasis on the use of videos (100%) and PowerPoint presentations (92%). They also use audio, e-mail (88%) and other tools such as YouTube, Google Docs (24%), and digital platforms such as TEC Digital (8%). Less used tools include forums (48%), blogs (36%), wikis, Facebook and Prezi (28%), with Twitter being the least frequent (4%). Another study related to the research by Oyarvide et al. (2024) indicates that 85% of students indicate that they use digital tools daily for academic activities. Among the most used are learning platforms such as Moodle, Classroom and Meet (88%), followed by communication applications (70%) and productivity software (60%). This reflects a high dependence on digital technologies in their education. Finally, Ortiz et al. (2023) indicate that 42% of students agree with the use of ICTs by teachers, while 18% are indifferent. As for teachers, 69% say they use them in class and 28% do so partially.

The results in table 5 are related to studies of Balaji & Sahija (2022) in their study on the effectiveness of ICT for improving learning in higher education. The significance values of the

components, according to the statistical coefficients, were 0.249, 0.010, 0.781, and 0.008. These values are lower than 0.05, suggesting a positive relationship between the study variables, thus supporting the relevance of this research. Likewise, the study by Castel (2018) states that ICTs are key in university literacy education, but their effectiveness depends on their alignment with the strategy, culture, and resources of institutions. In the face of a changing environment and educational convergence, it is essential to promote flexibility, innovation, and adaptability within institutions.

On the other hand, these results are corroborated by Navarrete et al. (2024), where the relationships between the use of digital tools and the communication dimension were investigated. The findings revealed significant correlations with a p -value $< .001$ and a correlation of 0.862, indicating a considerable correlation. Preciado-Serrano et al. (2021) also states that the $p < 0.001$ associated with the X^2 statistic is significant ($p < .001$), indicating that there are significant differences between the proposed model and the observed data. However, it is important to note that in models with large samples, the X^2 statistic tends to be significant even with reasonable model fit.

Regarding the adequacy of the university academic performance scale, although the X^2/df value suggests an acceptable fit, the statistical significance of the p -value indicates that the model does not perfectly align with the data. This means that while the model has a reasonable fit, additional adjustments could be explored or complementary analyses could be conducted to optimize the model and its interpretation in the context of university academic performance. This suggests that improving information search and processing skills could positively influence students' academic performance.

Similarly, another study shows similarity with the findings of Navarrete et al. (2024), as its results revealed a positive correlation between the use of digital tools and the informational dimension, with $r_s = 0.888$, indicating a substantial positive correlation. Additionally, the p -value ($p < .001$) suggests a statistically significant correlation. This implies that digital citizenship has a moderate and significant positive relationship with academic performance. In other words, students with higher digital citizenship competencies tend to achieve better academic performance.

Likewise, another result is corroborated by Ibrahimi et al. (2024), where it is stated that the use of ICT by science educators can enrich teaching and learning but faces challenges such as limited access, lack of training, and difficulties in integrating them into current curricula. Despite its potential, these barriers complicate its implementation in the classroom. On the other hand, the study by Meza et al. (2024) revealed a two-tailed asymptotic significance of 0.715 between the variables, concluding that school behavior does not affect academic performance. This underscores that student performance is a complex phenomenon influenced by multiple factors. Given that the correlation is significant, it can be inferred that creativity and the ability to innovate play a relevant role in academic achievement. To conclude, the results are similar to those of Navarrete et al. (2024), indicating that the correlation between the use of digital tools and the technology dimension was $r_s = 0.853$, representing a positive correlation with a significance level of 0.000.

In contrast to the research, the study by Lanuza et al. (2018) refer that 50% of teachers and students use ICT infrequently to produce original work. Many also do not collaborate in projects or problem solving using digital tools. Likewise, Iglesias et al. (2013) indicate that ICTs have not yet been incorporated naturally into educational processes. This experience shows that their integration is still a challenge. There is still a long way to go to adapt them effectively in institutional virtual environments. Therefore, the institution should focus on strengthening the integration of these actors in the educational process.

6. Conclusion

The results of the analysis conducted with a sample of 340 students show a positive correlation, of medium magnitude and statistically significant, between the study variables of the use of digital tools and academic performance. Likewise, a favorable relationship was identified between the different dimensions evaluated and the academic performance of university students. In particular, the analysis revealed that greater use of digital tools is associated with better academic performance, with a significance level of less than 0.000. This underscores the importance of fostering the development of digital competencies at the university level, as their positive impact on learning and academic performance is evident.

These findings not only reinforce the key role of digital competencies in higher education, but also highlight the need to implement educational strategies that promote their development. This would contribute to an education more adapted to the demands of today's digital environment, optimizing the preparation of students for the challenges of the academic and professional world.

Based on the results, it is recommended that higher education institutions systematically integrate the use of digital tools in the curricula, not only as technological support, but as an essential part of the teaching-learning process, through the incorporation of interactive digital platforms, multimedia resources and collaborative virtual environments, encouraging active student participation and strengthening digital competencies. It is also suggested to train teachers in the use of digital tools, ensuring a coherent and effective implementation that enhances academic performance.

Declarations

Author Contributions. The author has reviewed and approved the final version of the manuscript.

Conflicts of Interest. The author declares that there are no conflicts of interest related to this work.

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Data Availability Statement. Data are available upon request to the corresponding author.

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