

**The impact of digital skills on teaching performance in higher education: A meta-analysis****Roberto Líder Churampi-Cangalaya<sup>a\*</sup>, Miguel Fernando Inga-Ávila<sup>b</sup>, Kiko Richard Lopez Coz<sup>c</sup>, Jacqueline Juanita Churampi-Cangalaya<sup>c</sup>, Francisca Huamán-Pérez<sup>b</sup>, Enrique Mendoza Caballero<sup>d</sup> and Madelyn Apardo Quispe<sup>c</sup>**<sup>a</sup>Altoandina National Autonomous University of Tarma (UNAAT), Perú<sup>b</sup>National University of Central Perú (UNCP), Perú<sup>c</sup>Peruvian University Los Andes (UPLA), Perú<sup>d</sup>San Luis Gonzaga National University (UNICA), Perú**CHRONICLE****ABSTRACT***Article history:*

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The rapid progress of TICs has generated different ways to modify and transfer information, which implies the generation of new forms of knowledge. The objective of this study is to establish the relationship between digital competencies and university teaching performance in public higher education in Huancayo. The study is of a basic type with a quantitative approach and correlational level, developed with the partition as a sample of 272 teachers and 387 students who develop teaching-learning activities at the UNCP. The data were analyzed and modeled through structural equations based on PLS. The research arrived at the following results: a value of 0.890 in Spearman's Rho correlation coefficient and a significance level of .000, which shows that there is a high positive relationship between the study variables; likewise, the hypothesis is accepted. general which considers that there is a significant relationship between digital competencies and teaching performance in the classroom.

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**1. Introduction**

The use of TICs in higher education and especially university education has developed exponentially (García & Medina, 2009). In this context, today's society sees the urgent need to prepare to acquire these technological changes in a timely and effective manner (Chan, 2005). Information technologies (IT) are necessary; however, people's lack of IT training will represent a disadvantage compared to others (Inga-Avila, et al. 2023). From this academic perspective, technological progress influences different educational levels, which leads to developing new strategies in the teaching-learning process (Corriveau, 2021). The research will seek to be considered as a reference on the need to know and establish the level of knowledge and management of digital skills in higher education teachers (Jiménez y Calderón, 2020), with the aim of them being models in the management and use: responsible, creative and critical of TICs (Pérez-Almonacid, 2012) in university higher education students. The present research establishes the academic organization as an entity that has technological infrastructure where teachers resort to different technological resources (Martinez & Echevarria, 2009) such as necessary hardware and software through which they can increase their digital skills for the benefit of the collaborative, cooperative, autonomous teaching-learning process. and meaningful for teachers and students (Kuhn, 1971). The reason why the teacher is established as one of the main elements through which it will be possible for students to use TICs for their learning process. The university where the research is carried out, being state in nature, has formulated in its educational model the profile and competencies that teachers must possess for an adequate teaching process (Galvis, 2009), among them the management of technologies is mentioned as a vital support element (Herrera Rodríguez, 2018). Likewise, it has a teaching performance evaluation through

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which it is possible to plan actions that improve the teaching process.

The present research is justified in the evaluation of teaching performance based on digital competencies, which will allow contributing to scientific knowledge since it will provide theoretical aspects and information of interest. Methodologically, it is justified in the application of new strategies that allow digital competencies to be related by students through the use of virtual resources and online evaluations, a fact that will allow contributions to experiences.

Given that teaching performance is an important aspect in the process of teaching various subjects, the research will allow the design of training strategies that, in order to strengthen the digital skills less developed by university teachers, achieving educational quality. In accordance with the quality and licensing standards established by the National Superintendence of University Education.

Considering the above, the following specific objectives were established: Determine the relationship between technical, informational, educational, analytical and social-ethical competence and teaching performance in public higher education in Huancayo, Peru.

## **2. Literature review**

### *2.1. Structural equation models*

Structural equation models are considered multivariate statistical models that make it possible to determine the relationship or impact between two or more variables (Cepeda & Roldán, 2004). It is also considered a statistical analysis technique used for the analysis of several complex patterns, allowing theoretical and empirical models to be validated, and incorporating into its analysis constructs that are not directly observable (latent and unobserved variables) (Ruiz et al., 2010). Structural Equation Models (SEM) statistically measure various dependency relationships crosswise, presenting unobserved aspects in the relationship determination process. By assessing and monitoring every latent or unseen variable, they facilitate the study of each collection of variables. As a result, the correlations that were employed are strengthened, and estimations of the structural coefficients may be made with more accuracy (Escobedo et al., 2016).

### *2.2. Digital competence*

According to Lloyd & Cook (1993) competence is the ability to perform one's work in an adequate manner; precisely, these skills and abilities allow people to achieve their goals (Mateo, 2005). It is considered that competence is usually a mixture of knowledge, capacity, ability, attitude and value that contributes to the modification of a complex context, among the knowledge linked to said reality.

The European Commission (2004) establishes digital competence as the confident and critical use of technological systems to carry out work, recreation and dialogue of digital competence, and points out that for the development of digital competences it is necessary to have an adequate understanding and extensive knowledge about the nature, function and opportunity of technology in the information society, in the face of an everyday situation of personal, social and professional life (Castells, 2003).

In this way, by using TICs, the interaction between teachers and students is carried out in real time and, in turn, access to information to strengthen the formation of knowledge is immediate (Inga-Ávila et al., 2020).

In this regard, Chan (2005) points out that the type of competence that is needed to be able to act within digital contexts is called mediational, these contribute to the development of critical thinking, participation, communication, tolerance and variety, to produce new knowledge and the functionality of learning.

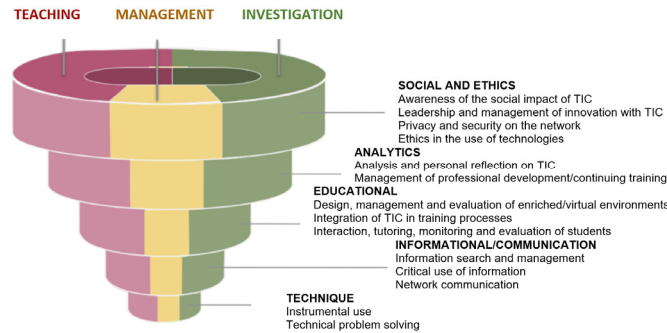
According to the Institute of Educational Technologies (ITE) (cited by Veytia, 2014), it consists of the provision of a series of skills that contribute to the individual in the search, obtaining, processing and transmission of information, and in this way achieving a series of factors to transform knowledge.

Thus, this process integrates a variety of skills, among which there is accessibility to information, so that the results are analyzed, applied and communicated. When there is an assessment of competence from an attitudinal perspective, it stands out as a central axis of autonomy, responsibility, ethics for the management and use of information, as well as the ability to analyze and synthesize.

For the reasons stated above, we consider that capabilities and knowledge are permanently adapted to changes in social dynamics.

By virtue of these reasons, it can be understood that the teacher's digital competencies are directly related to the management of data and information, which entails having knowledge in the use of TICs directly related to concepts, functions, types, particularities for an adequate development of the teaching and learning process.

For Marzal & Cruz (2018) digital skills as part of the training of people and citizens make it possible for them to acquire elements of empowerment on employability, economic, social and cultural aspects; likewise on elements of entertainment and leisure.



**Fig. 1.** Digital Teaching Competence Model of the University Professor (Prendes, 2017).

- a. **Technical competence:** Technical competence is considered the first level of competence that once possessed will make it possible for the education professional to be trained in the proper management of TICs and other related elements. This competence shows the actions that are developed for one of the instruments. and specific tools, as well as the solution of technical problems. According to Martínez et al. (2009) technical competence is evidenced by specialized knowledge related to the specific field of the professional, which will allow adequate and expert mastery of the contents, as well as the tasks of the profession.
- b. **Informational/Communicative Competence:** Informational competence is the adequate management of information, documentary research skills, information literacy, informational skills that professionals develop when teaching (Jiménez & Calderón, 2020). On the other hand, Ortoll (2003) considers that information competence is the ability to recognize the obligation to obtain information and the sufficiency to be able to identify it, locate it, communicate it, organize it and evaluate it to solve problems for learning and daily tasks.
- c. **Educational Competence:** Educational competence is considered a later phase; Mastery of this competence demonstrates that the professional is capable of using and taking advantage of the different TICs tools and elements in the educational context in an appropriate and timely manner (specifically in the activities of design and management of virtual or educational environments or environments developed with TICs and evaluation, collaboration or interaction processes through these means)(Prendes, 2017).
- d. **Analytical competence:** Analytical competence is considered a more advanced level in relation to the development of digital competence, which demonstrates that the professional is capable of critically reflecting on the same competence and can manage the different training processes, and teaching and learning on a permanent basis. This competence is shown from the reflection that the professional makes on the use of TICs, allowing this management to be managed in daily activities (Gustems et al., 2017).
- e. **Social and Ethical Competence:** Considered the highest level of all the dimensions, this competence concerns the cultural and social impact of technologies in the different actions that the teacher develops during the teaching process, it is directly related to the dimensions of ethics and ethics. Security, this competence is the most difficult to develop and measure since it must be carried out in a subjective way or specific analysis.

## 2.2. Teaching performance

Performance is defined as a group of activities carried out by a person in a specific function with the aim of obtaining the objectives and results proposed within an entity (Chiavenato, 2002). There are different terms to mention teaching performance, among which some choose pedagogical or teacher professional performance; But it is true that in this context, studies on its performance are of utmost importance since it is a generator of the service which is provided to students and generates a direct impact on their learning; without this meaning the loss of its nature. Teachers have different axes of intervention in their professional field such as value management, tolerance, commitment, responsibility, whose objective is to achieve solid student training in the scientific and academic field. The teacher plays a very important role in the process of training human beings at different educational levels, since through their actions they provide a sense of action to students, allowing them to have a sense of belonging based on one of their objectives. clear. Peña (2002) defines teaching performance as any action carried out by a professional supported by the different pedagogical and administrative tools that his or her work entity has. For Valdés, (2005) the teacher's performance "is understood as the performance of his or her work: which is determined by a series of components that are linked to the teacher, student and their environment" (p.19). In relation to Rizo, (2005) he conceptualizes teaching performance as a set of processes for the transformation of his professional capacity, his social commitment and willingness to obtain the link between the factors that generate an impact on teacher training; It also includes intervention in strengthening the customs of the institution, educational management and participation in its design, in the same way the different educational policies are generated and evaluated at different levels such as local and national, promoting in students the learning and the formation of a set of skills and competencies (p.148).

## 3. Methodology

### 3.1 Research methodology

Because it discovered the features in their natural setting, the research used a non-experimental design while considering the

analysis and consequences of the problem (Nieto, 2018) (Hernández-Sampieri & Mendoza, 2019). The study did not create any specific scenario (Ocampo, 2017); instead, it observed the population at that point in time and used inference to determine the association between the variables (Gallardo-Echenique, 2017). The population, from which the corresponding samples were taken, consisted of teaching staff and students from the various UNCP faculties who engage in in-person and virtual academic activities. Non-probabilistic random sampling was also employed due to the population's time, cost, and accessibility constraints.

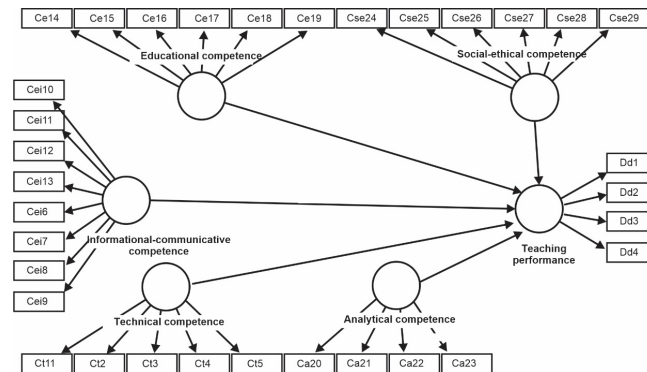
**Table 1**

Sample of studies from the population

Cluster	Population	Sample
Students	11141	387
Teachers	764	272

### 3.2 Research model

The model for this research is presented in Figure 2, which shows the relationship between the dimensions of digital competence (Armas y Armas, 2011) such as technical, informational-communicative, educational, analytical, social-ethical competence (Prendes, 2017).



**Fig. 2.** Research model proposal

Based on the described model, the following specific hypotheses were proposed:

**Specific hypothesis 1 (H1)** There is a significant relationship between technical competence and teaching performance in public higher education in Huancayo 2023.

**Specific hypothesis 2 (H2)** There is a significant relationship between informational-communicative competence and teaching performance in public higher education in Huancayo 2023.

**Specific hypothesis 3 (H3)** There is a significant relationship between educational competence and teaching performance in public higher education in Huancayo 2023.

**Specific hypothesis 4 (H4)** There is a significant relationship between analytical competence and teaching performance in public higher education in Huancayo 2023.

**Specific hypothesis 5 (H5)** There is a significant relationship between social-ethical competence and teaching performance in public higher education in Huancayo 2023.

### 3.3 Data collection and processing process

Utilizing the survey approach for data collecting, we were able to create and employ two distinct instruments: a) a 30-item digital skills questionnaire and b) a 20-item teaching performance questionnaire. Both tools were used using the Google Form and Microsoft Form platforms; the sample members who were able to respond to the surveys were given access to them. Anonymity, data confidentiality, and informed permission were guaranteed for those who answered the questions. Following the collection of data, a data matrix was created and processed using the following software: SmartPLS 4.0, Microsoft Excel 2023, and SPSS version 27.0 for descriptive analysis.

## 4. Results

### 4.1 Presentation of collected and processed results

In this sense, it can be observed that of the processed data, 41% consider the information/communicative dimension good, 41% consider the educational dimension good, and 45% consider the analytical dimension good. This indicates that the professionals in charge of developing the teaching process TICs appropriately in their various educational processes in the public university are demonstrating digital competence based on the levels of acceptance of its dimensions.

**Table 2**  
Dimensions of Digital Competence in public higher education.

		Groups									
		Technique		Informational/ Communicative		Educational		Analytics		Social and ethics	
		F	%	F	%	F	%	F	%	F	%
Digital competence	Deficient	80	31%	75	29%	52	twenty%	60	23%	69	27%
	Regular	75	29%	77	30%	100	39%	82	32%	89	35%
	Well	102	40%	105	41%	105	41%	115	Four. Five%	99	39%
Total		257	100%	257	100%	257	100%	257	100%	257	100%

Source: Digital skills questionnaire in public higher education.

**Table 3**  
Dimensions of teaching performance in public higher education

		Groups							
		Didactic planning		Didactic execution		Assessment		Institutional identity	
		F	%	F	%	F	%	F	%
Teaching performance	Deficient	95	26%	106	28%	101	27%	35	9%
	Regular	105	28%	126	3. 4%	135	36%	108	29%
	Well	172	46%	140	38%	136	37%	229	62%
Total		372	100%	372	100%	372	100%	372	100%

Source: Teaching performance questionnaire in public higher education.

The degrees of perception of the various aspects of teaching performance are displayed in Table 3; In terms of the didactic planning component, 46% of respondents think it's excellent, 28% think it's average, and 26% think it's bad; Regarding the didactic execution dimension, 38% rate it as excellent, 34% as ordinary, and 28% as poor; The teaching performance in public higher education is competent, as evidenced by the evaluation dimension's 37% good, 36% regular, and 27% bad ratings, as well as the institutional identity dimension's 62% good, 29% regular, and 9% poor ratings.

4.2 Model confirmation

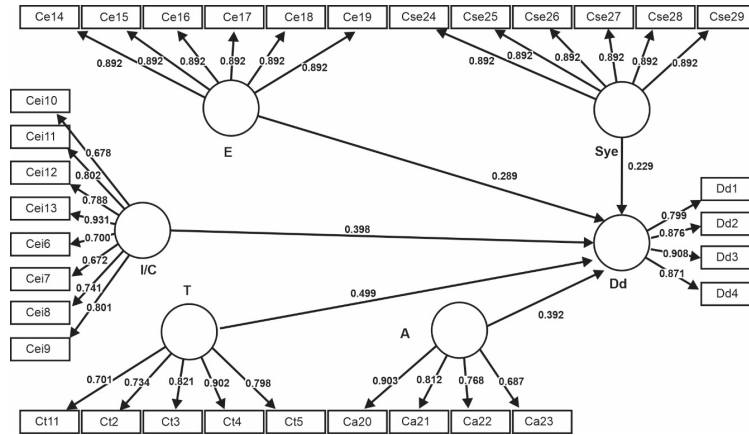
Table 4 presents the model's confirmation, with the reliability of the model being measured by Cronbach's alpha and composite reliability. According to Nunnally's (1978) assertions and the data collected, the internal consistency is sufficient because Cronbach's alpha consistently has a value larger than 0.9. Moreover, the composite reliability coefficients are higher than 0.9, indicating a very high level of composite dependability. On the other side, Cepeda & Roldan (2004) use discriminant validity and convergent validity to examine the validity of the construct. According to Hair et al. (2017), the variance between a concept and its indicators is calculated using the AVE coefficient, and this number ought to be more than 0.50. According to Fornell & Larcker (1981), the current study's observed values are more than 0.57, indicating sufficient convergent validity. However, discriminant validity was acquired by comparing the correlations between latent variables with the square roots of the AVE (Fornell & Larcker, 1981). In this regard, we may draw the conclusion that Table 4 presents the model—that is, the items—that is used to measure the current study.

**Table 4**  
Confirmatory model

	Reliability		variance extracted		Discriminant validity					
	Cronbach Alpha	Composite reliability	Average	variance extracted (AVE)	CD	T	I/C	AND	TO	M&E
Digital competence	0.905	0.942	0.882	0.912						
Technique	0.899	0.906	0.910	0.923	0.975					
Informational/communicative	0.991	0.912	0.902	0.941	0.945	0.962				
Educational	0.941	0.999	0.972	0.982	0.936	0.941	0.888			
Analytics	0.921	0.936	0.945	0.864	0.887	0.891	0.895	0.963		
Social and ethics	0.911	0.944	0.972	0.988	0.812	0.881	0.878	0.889	0.878	
Reference values	>0.7	>0.7	>0.5							

4.3 Analysis of structural equation models

Based on the results obtained, we can mention that hypotheses 1, 2, 3, 4 and 5 are accepted. These hypotheses present a significant relationship with teaching performance (Dd), since they have the following values: Technical Dimension (T)  $\beta=0.292$ ,  $p= 0.002$ . Informational / Communicative Dimension (I/C)  $\beta=0.285$ ,  $p= 0.000$ . Educational Dimension (E)  $\beta=0.3902$ ,  $p= 0.000$ , Analytical Dimension (A)  $\beta=0.375$ ,  $p= 0.039$  and Social and Ethical Dimension (Sye)  $\beta=0.388$ ,  $p= 0.000$ . In all of them, the relationship between the different dimensions corresponding to digital competence and teaching performance is accepted. Similarly, the Standardized Root Mean Square Residual (SRMR) was computed, which is regarded as an absolute fit metric between the predicted and observed correlation. Hu & Bentler (1999) state that the Standardized Root Mean Square Residual (SRMR) should fall between 0 (perfect fit) and 0.08 (excellent fit). In this regard, the SRMR value of 0.069 in this study is indicative of a good match.



**Fig. 3.** Confirmatory structural model

The results shown in Fig. 3 determined whether the particular hypotheses put forth were accepted or rejected.

Hypotheses	Mean sample	standard deviation	Path beta value	Student's statistics	p value	Decision
H1: T →Dd	0.347	0.202	0.292	2,986	0.002	Accepted
H1: I/C →Dd	0.395	0.245	0.285	2,896	0.000	Accepted
H1: E →Dd	0.385	0.398	0.385	3,902	0.000	Accepted
H1: A →Dd	0.389	0.365	0.375	3,139	0.039	Accepted
H1: Sye →Dd	0.398	0.388	0.329	2,899	0.000	Accepted

$t > 1.96$ ;  $p < 0.05$

## 5. Discussion and Conclusion

### 5.1. In relation to technical competence and teaching performance

The research allowed ratifying the relationship between technical competence and teaching performance, this was possible on the basis of the value obtained at the level of significance, this being 0.002 and a Spearman correlation coefficient of 0.945 (Martínez et al., 2009), these values show the presence of a very high positive correlation between the research variables; This shows that technical competence is necessary since the teacher develops his abilities through the proper use of TICs and other related elements such as the use of specific instruments and tools allowing the resolution of technical problems within the classroom. The results obtained agree with Parillo's study (2020) who identified that for the adequate development of the activities of the teaching process, teachers of higher training institutions must have technical competence specifically in the management of applications made up of software, web pages, among others, which must be demonstrated in the class sessions allowing information to be transferred directly to students in a synchronous or asynchronous manner.

### 5.2. In relation to Informational/communicative competence and teaching performance

The research allowed ratifying the relationship between informational/communicative competence, this was possible on the basis of the value obtained at the level of significance, this being 0.000 and a Spearman correlation coefficient of 0.825 (Martínez et al., 2009) these values show the presence of a high positive correlation between the research variables; this shows that the teacher in the teaching process when developing activities within the classroom must show abilities related to providing information, documentary research skills, information literacy and informational skills. Likewise, he must show abilities to recognize the obtaining of relevant information and sufficient ability of being able to identify them, locate them, communicate them, organize them through virtual organizers which will make possible the resolution of practical cases in which students can do. The results obtained agree with the study by Zevallos (2018) who considers that higher education teachers must have the ability to provide timely and adequate information to their students through literacy and communication using technological resources provided through institutional platforms. The transmission of experiences and knowledge using digital tools is important as part of knowledge management (Inga-Ávila et al., 2023).

### 5.3. In relation to educational competence and teaching performance

The research allowed us to ratify the relationship between educational competence and teaching performance, this was possible on the basis of the value obtained at the level of significance, this being 0.000 and a Spearman correlation coefficient of 0.691 (Martínez et al., 2009) these values show the presence of a correlation moderate positive between the research variables; This shows that this competence is very important within the teaching-learning process since the teacher is able to use and take advantage of the different TICs tools and elements in the educational context in a timely and appropriate manner, specifically in design activities and management of virtual or educational environments or environments developed with TICs and evaluation, collaboration or interaction processes through these means. The results obtained agree with the study by Guizado et al. (2019) who demonstrate that the university teacher must have practical and effective mastery of the different technological tools such as the management of virtual platforms, specific applications and various forms of evaluation through rubrics and use of resources in a synchronous and asynchronous manner.

#### 5.4. In relation to analytical competence and teaching performance

The research allowed ratifying the relationship between educational competence and teaching performance, this was possible on the basis of the value obtained at the level of significance, this being 0.039 and a Spearman correlation coefficient of 0.899 (Martínez et al., 2009). These values show the presence of a correlation high positive among the research variables; demonstrating that this competence, considered one of the most advanced in relation to the previous ones, directly influences teaching performance since the university teacher demonstrates to be able to reflect critically on the same competence and manage the different training processes and teaching and learning on a permanent basis, it also shows reflection based on the use of TICs, allowing this management to be managed on a daily basis. The results obtained agree with the study by Fernández et al. (2018) who, in one of his conclusions, considers that the teacher must be in the constant and permanent capacity to carry out a process of analysis of the teaching activity, allowing the development and presentation of feedback activities for the actions carried out on a daily basis, this will make it possible to develop continuous improvement in teaching activity.

#### 5.5. In relation to ethical social competence and teaching performance

The research allowed ratifying the relationship between educational competence and teaching performance, this was possible on the basis of the value obtained at the level of significance, this being 0.000 and a Spearman correlation coefficient of 0.925 (Martínez et al., 2009) these values show the presence of a correlation very high positive among the research variables; establishing that the university teacher adequately measures the cultural and social impact of technologies in the various teaching-learning processes, in the same way it is directly related to the ethics and security of the data and information used since this can be measured subjective way. The results obtained agree with the Tongo study (2018) where it considers that the information used in the teaching process must be used appropriately, respecting ethical elements such as authorship through citations and others.

### 6. Conclusion

Research has shown that the mastery of digital skills by teachers in higher education institutions belonging to State institutions is essential, since their mastery will allow the development of a more efficient, effective, timely and comprehensive teaching-learning process. This will allow this activity to be developed through the use of information and communication technologies, allowing the opening of digital environments to students; Likewise, we can conclude that the research shows that different competencies such as technical, informational/communicative, educational, analytical, social and ethical will allow the teacher to use different technological resources in the teaching process according to the new trends that are developed currently.

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