

## Digital Competencies of Higher Education Teachers in the E-Learning Process During the COVID-19 Pandemic

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**Abstract:** The COVID-19 pandemic has brought great challenges to the teaching and learning process. This study aimed to determine university teachers' digital competencies in the virtual teaching-learning process in the context of the COVID-19 pandemic. Data were collected using the Google Form software to generate a questionnaire describing the participants' subjects, of which 39 teachers of higher education met the inclusion criteria and signed informed consent; forming a non-probabilistic objective sample, all participants of the education program Bachelor's Degree in Nursing at the Universidad Autónoma de Nayarit, Mexico; delivering theoretical and practical courses. Socio-demographic questionnaires were characterized by frequencies and proportions, and Spearman correlation coefficient ( $\rho$ ) nonparametric test to measure the correlation between variables. The results indicate that the teachers who present a high level of competencies in both subscales have a higher level of competencies in online education and of course a better performance in the teacher's teaching role. The use of these tools is associated with high use of the Google Suite in general, a result that the teacher's mastery over these tools intervenes in the performance of digital competencies and therefore the teacher can better perform his activities in his educational work.

**Key words:** digital competencies, higher education, e-learning, COVID-19

### 1. Introduction

Since the arrival of humans on earth, education has been implicit as a means of survival to grow and develop in their environment; in primitive times, humans transmitted to their descendants the teaching of skills and knowledge for providing food, protecting against enemies, as well as the establishment of communication forms for living in their environment. The beginnings of education were reflected in the teaching of religion in the peoples of ancient Egypt and the Middle East; the schools that existed at that time taught writing, physics, mathematics, and architecture. Priests were the main representatives of teaching (Ruiz-Rodríguez, 2010). This concept from an anthropological point of view is not only based on the acquisition of knowledge, in the forms or processes of how they are acquired; this perspective tells us that education involves the experience of living with

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others, the perception of things, emotions or feelings; under these conditions, schools must implement in their educational strategies teaching to students so that they can relate their environment or activities of their daily lives, favoring the construction of knowledge (Ayala-Reyes, 2020). Silva & Gomes (2015) mention that education from an anthropological perspective consists of all the processes of socialization, forms of modulation, modeling, and formation of knowledge in educational environments.

On 11 March 2020, the World Health Organization (WHO) declared a global pandemic disease COVID-19, a disease caused by a virus called SARS Cov-2, which means severe acute respiratory syndrome, which mainly affects humans and a small part of other life forms, affecting the lives of thousands of people around the world in various aspects of life. As a result of this problem, governments must take measures and decisions to overcome it, and one of the measures taken was confinement and isolation to prevent the spread of SARS CoV-2, and educational institutions must close their facilities to address this major problem and help reduce the number of infections to protect the health of students, teachers, and the general population (Apaza et al., 2020; Rodriguez-Morales et al., 2020).

As a result of this situation, educational institutions have had a great challenge in the teaching-learning process by moving from face-to-face mode to virtual mode, a mode that was not established in many teachers and that has brought great challenges in teaching. Technology has taken on important priority in the XXI century in the field of education, creating new approaches or modalities in the teaching and learning process, such as new ways of giving or appropriating knowledge.

The implementation of the use of technology in education provides tools that help teachers and students to conduct distance education when there are factors that make face-to-face education impossible; online education is an alternative to the process of teaching-learning in the virtual world of higher education, offering flexibility in the schedule, a dynamic class through the use of existing technologies, such as audio and visual aids, as well as the establishment of synchronous and asynchronous classes so that students have the necessary information and better learning development (Cencia-Crispín et al., 2021). Online education has been an alternative to sharing and building knowledge through technology through the use of virtual spaces when traditional models, where there is a face-to-face interaction between teachers and students, cannot be achieved. Online education is derived from the term “electronic learning”, based on the use of information and communication technologies (ICTs), including the use of the Internet in learning management systems, with the implementation of technology tools for teaching, creating a new learning strategy (Rentería, 2021).

According to Ibáñez (2020), the benefits of this type of education are as follows:

- Reduces geographical barriers between teachers and students, allowing access to classes from anywhere.
- Students can manage their learning, which promotes personal autonomy and self-management in gaining knowledge.
- Online education promotes debate and dialogue, with greater interest in academic knowledge among students.
- Reduction of economic expenditure.

Education has faced great challenges in this pandemic and one of them is the use of technological tools by teachers in the process of teaching-learning; the transformation of the teaching model from face-to-face to virtual has had a great influence due to the need and adaptation of strategies for achieving the learning of students through technology (González-González et al., 2020).

To achieve student learning, the teacher requires certain skills to direct online education; the achievement of this goal is transcendent in the presence of the COVID-19 pandemic in the teaching-learning process. The adoption of technology in the professional field, and the rejection of the traditional teaching model for decades, have created a great challenge for teachers and a great challenge (López, 2021). In Mexico, the Ministry of Public Education (SEP) explains that competent teachers can integrate cognitive resources to solve complex and open problems in different environments (Concheiro, 2020). The competencies in the field of education lead the teacher, tutor, or facilitator to identify, select, coordinate, and mobilize all these resources in a particular context so that the student can achieve meaningful learning. Becerril et al. (2015) states that the characteristics of teachers in online education are provided by the different competencies in certain dimensions, as defined below:

- Educational competencies: These competencies enable the teacher to obtain significant student learning through teaching strategies.
- Social competencies: These are the functions of teachers within the social role in a virtual environment through leadership actions, cooperation, and teamwork, establishing a trusting and friendly environment, and promoting collaborative learning.
- Technical competencies: Refer to the teacher's ability to manage ICT using digital tools that can be implemented in the educational environment. The teacher must achieve these abilities to develop in a virtual environment where resources and tools are applied in the teaching and learning process.

When it involves a virtual environment as an educational medium, it should be considered that the teacher's pedagogical and technological competencies consider specific aspects of the design of education in the virtual university education and are composed of the teacher's know-how and the technological infrastructure, the proper of the technological competences, on the one hand, and the teacher's knowledge, the right of the educational competencies, on the other. Therefore, the competencies required for the process of teaching design in virtual education are based on the knowledge, attitudes, skills, and abilities expressed in the teacher's being, knowing, doing, and living to guide his virtual practice, through an instructional design based on theories relating to human learning, to develop the student in different contexts from pedagogical mediation with educational technologies that will allow him to test, evaluate and review himself effectively and continuously, i.e., to receive satisfactory attention to his learning needs in virtual environments (Alvarado-Estrada et al., 2022; Buitrago-Bohórquez & Sánchez, 2021).

In virtual learning environments, the role of the teacher must influence the success of the student-focused learning activity and strengthen their autonomy to develop skills in the use of technology tools and management strategies that enable them to obtain the knowledge and skills necessary in the professional field in which they are trained, i.e., the student himself takes the lead role that involves much will for the development of individual activities and work, as well as shared ones (Rizo-Rodríguez, 2020).

In the beginning, teachers performed electronic reading actions on virtual platforms rather than electronic teaching. This had an impact on the low quality and quantity of interaction and feedback from the student's activity, which became a constant. The problem was not only a technological change but also in the concept of learning, in which teachers also reflected the belief that education is oriented towards the learning of students rather than the satisfaction of the content. Teachers are familiar with the use of digital tools but rarely dare to create personalized digital content. Similarly, among the strengths of teachers is that they know how to adapt to the tools available to make the most of their training activities; to promote the integration of technologies into the study context (Pérez & López, 2020). Covid19 meant a break with some of the characteristics of traditional

education, such as time, space, and action unity. All this has been achieved and has forced us to think that, if technology transforms society, it does not transform educational institutions, and this has arisen in this non-typical scenario as the greatest challenge we must address as teachers (Cabero-Almenara & Llorente-Cejudo, 2020).

In the educational context, it is assumed that students are very competent in the instrumental processing of technologies and, on the contrary, that teachers are not; this implies that teachers are perceived as unqualified in the technological environment and that students with high abilities. Research and the pandemic show the opposite, as students are not as competent in the use of technologies applied to training, as they use a limited number of them, and the uses they operate are more concentrated on leisure than on training actions. These differences also exist in the university context. Thus, it is increasingly necessary, and this education crisis is corroborating it, to set up training plans for digital skills for students so that they are no longer native digitals and are known as digital learners, simply because of the speed with which they deal with certain technologies from an instrumental point of view.

Digital natives are people who have grown up in an environment where digital technology has been present from an early age. This concept was first introduced in 2001 by Marc Prensky. Digital learners, on the other hand, are those who are currently in school age and who are used to using digital technology in their everyday lives. Digital learners have a different mindset than their predecessors, the so-called “digital immigrants”. Digital learners are accustomed to constant access to information, immediate communication, and online collaboration (Akçayr & Akçayr, 2018). The relationship between digital competence and the academic success of digital learners is a key factor influencing their academic success through teachers' digital competencies (Hatlevik, 2017). Currently, virtual education is of great importance for the training of nurses due to access to digital tools and flexibility to adapt to their needs and schedules, and the design of programs and contents is based on the application of educational technologies to provide online learning (Kalanlar, 2022). Virtual nursing education is a valuable tool for the education of students, although there are still related challenges such as the lack of technology in some places, the need for technical abilities to use online teaching tools, and the lack of face-to-face interaction with teachers and peers (Salari & Sepahi, 2021). From this theoretical point of view, we propose to determine university teachers' digital competencies in virtual teaching and learning during the COVID-19 pandemic.

## **2. Material and Methods**

Research is quantitative, cross-sectional - descriptive. The population of participants is 58 subjects, of which 39 teachers of higher education met the inclusion criteria and signed informed consent; forming a non-probabilistic objective sample, all participants of the education program Bachelor's Degree in Nursing at the Universidad Autónoma de Nayarit, Mexico; delivering theoretical and practical courses. Data were collected using the Google Form software to generate a questionnaire describing the participants' subjects; the questionnaire on teaching competencies in online education was applied (44 items on the Likert scale with four response categories) consisting of the Didactic prediction and interaction section (30 items) and management of the teaching process and assessment of learning (14 items). The instrument used to evaluate the use of Google G Suite platforms for education (13 Likert scales with four response categories) is also applied as a collaboration tool (8 items — Google Classroom, Docs, Sheets, Slides, Forms) and a communication tool (5 items — Google Meet, Gmail, Chat, Calendar). The information was analyzed using IBM SPSS Statistics version 28, and socio-demographic

questionnaires were characterized by frequencies and proportions, and Kolmogorov-Smirnov and Shapiro-Wilk normality tests were used to determine the application of the Spearman correlation coefficient (rho) nonparametric test to measure the correlation between variables.

### 3. Results

Of the participants, 25.6% were men and 74.4% were women. Participants had to undertake postgraduate studies (20.5% and 64.1%), as well as andragogical training (53.8%), pedagogical training (92.3%), as well as the competence to conduct online education (Table 1).

**Table 1 The Socio-Demographic Questionnaire of the Participants**

Gender	Frec, %
Male	10, 25.6%
Female	29, 74.4%
Total	39, 100%
Academic level	
Bachelor's degree	2, 5.1%
Specialty	4, 10.3%
Master's Degree	8, 20.5%
Doctorate	25, 64.1%
Andragogical training	
Yes	21, 53.8%
No	18, 46.2%
Educational training	
Yes	36, 92.3%
No	3, 7.7%
Training for online teaching delivery	
Yes	37, 94.9%
No	2, 5.1%

In Table 2, the statistics of two tests were applied to determine the distribution of data in the variables. The results indicate that the only variables with a normal distribution are the Prevision and Didactic Interaction (PDI) and the score obtained by the Online Education Teaching Competencies Questionnaire (OETCQ), which allows for an inference analysis of information using non-parametric statistics.

**Table 2 Tests to Determine the Normality of the Data**

Parameter	Kolmogorov-Smirnov		Shapiro-Wilk	
	Statistic	p	Statistic	p
1a. PDI	.104	.200	.968	.317
2b. MTPAL	.224	.000	.755	.000
3. OETCQ	.121	.156	.958	.152
4a. COLT	.275	.000	.624	.000
5b. COMT	.226	.000	.726	.000
6. GSAI	.284	.000	.626	.000

Note: PDI = Prevision and didactic interaction; MTPAL = Management of the teaching process and assessment of learning; OETCQ = Online Education Teaching Competencies Questionnaire; COLT = Collaboration tools; COMT = Communication tools; GSAI = Google Suite assessment instrument.

In Table 3, the correlation results of the variables are presented using the Spearman correlation coefficient (rho) test, indicating that the Dimension of Management of the Teaching Process and Learning Assessment (MTPAL) has a very significant correlation coefficient with the Dimension of Didactic Prevision and Interaction (PDI); indicating that the higher the competence level of these two dimensions, there is a high level in the values of the Online Education Teaching Competencies Questionnaire (OETCQ); likewise, it is shown that there is a very significant correlation coefficient between the values of the Collaboration Tools (COLT) and Communication Tools (COMT) with the values of the Google Suite Assessment Instrument (GSAI); indicating in the same way a direct relationship between the scores.

On the other hand, it was obtained that the correlation between the scores of the variables of the Online Education Teaching Competencies Questionnaire (OETCQ) and the Google Suite Assessment Instrument (GSAI) are not related to the values of PDI, MTPAL, and OETCQ; indicating that the degree of teachers' competencies in online education does not depend directly on the use of the Google Suite tools, but if they are used as emerging media as collaboration and communication tools (statistics 0.712\*\* and 0.768\*\*).

**Table 3 Association of Teaching Competencies With Google Suite for Collaboration and Communication**

Parameter	OETCQ			GSAI		
	1a	2b	3	4a	5b	6
1a. PDI	-					
2b. MTPAL	.753**	-				
3. OETCQ	.994**	.809**	-			
4a. COLT	.066	.241	.103	-		
5b. COMT	.288	.156	.279	.203	-	
6. GSAI	.252	.223	.262	.712**	.768**	-

Note: PDI = Prevision and didactic interaction; MTPAL = Management of the teaching process and assessment of learning; OETCQ = Online Education Teaching Competencies Questionnaire; COLT = Collaboration tools; COMT = Communication tools; GSAI = Google Suite Assessment Instrument.

\*\*p < .01. \*p < .05

#### 4. Discussion

The results of the Online Education Teaching Competencies Questionnaire (OETCQ) indicate that the first subscale Prevision and Didactic Interaction (PDI) had a very significant correlation coefficient (rs = .753) with the subscale Management of the teaching process and learning assessment (MTPAL); meaning that the organization of activities before the classes taught by the teacher influences the management of the teaching process, just like the result presented by Chaupis (2019) when he also identified in his study a correlation between strategic educational management and pedagogical management.

The subscales Prediction and didactic interaction (PDI) and Management of the teaching process and learning assessment (MTPAL) have a highly significant correlation coefficient (rs = .994 and rs = .809) respectively as subscales of the Online Education Teaching Competencies Questionnaire (OETCQ), which indicates a direct relationship; the higher the degree of the level of competencies of both subscales the higher the level of competencies of teachers to deliver online education, as it happens in the study of Garcia-Conislla (2020), in which the relationship of curricular execution with teaching performance, also occurs during the execution in technical, affective and scientific aspects.

Regarding the results of the Google Suite Assessment Instrument, it is observed how the two subscales Collaboration Tools (COLT) and Communication Tools (COMT) have a highly significant correlation coefficient  $r_s = .712$  and  $r_s = .768$  respectively with the final values of the Google Suite Assessment Instrument (GSAI) indicating that the greater the use of tools of these subscales for collaboration and communication, the greater the use of the Google Suite. This correlation is also observed in the study conducted by Escoda & Conde (2016) in the assessment of digital competencies self-perceived by teachers, showing that the higher the level of self-perception in different areas of competence the better level of digital competencies they develop.

It was identified that there is no correlation of significance ( $r_s = .262$ ) between the score generated by the Questionnaire of Teaching Competencies in Online Education (OETCQ) and the score generated by the Google Suite Assessment Instrument (GSAI); indicating that the level of teachers' competencies in online education is not largely determined by the use of Google Suite tools, meaning that this low correlation could be associated with the use of other digital tools due to an insufficient level of digital competencies in teaching practice as also indicated by Escoda & Conde (2016).

## 5. Conclusions

There is a direct relationship between the subscales Prevision and didactic interaction (PDI) and Management of the teaching process and Assessment of Learning (MTPAL) with a significant correlation coefficient, implying that the first subscale, which consists of planning and organization of materials and activities, intervenes in the conduction of the teaching-learning process and the assessment of the processes or mechanisms of the course so that the teacher performs his activities more efficiently.

The subscales of Prevision and didactic interaction (PDI) and Management of the teaching process and assessment of learning (MTPAL) have a high correlation coefficient of significance respectively with the Teaching competencies in Online Education (OETCQ), therefore, the degree of level of these subscales are associated in the values of the level of competences in online education. This implies that teachers who present a high level of competencies in both subscales have a high level of competencies in online education and of course a better performance in the teaching role.

The subscales Collaboration Tools (COLT) and Communication Tools (COMT) have a high correlation coefficient of significance that associates them with a direct relationship with the use of the Google Suite, therefore the use of these tools is associated with high use of the Google Suite in general, a result that the mastery that the teacher has over these tools intervenes in the performance of digital competencies and therefore the teacher can better perform his activities in his educational work.

Teachers may have high or low levels of teaching competencies in online education, where they do not exclusively use Google Suite tools to deliver their classes, but involve other types of technological means external to Google Suite.

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