



## Digital teaching competences and the challenges posed by virtual education as a result of COVID-19

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### Abstract

**Objective:** to determine teachers' digital competences following the implementation of virtual education in a higher education institution located in the department of Valle del Cauca - Colombia owing to the COVID-19 pandemic. **Method:** descriptive methodology was adopted. The population comprised fifty-two (52) teachers working during the academic period 2020-I. The sampling error was 6.5%. Data gathering was performed through two questionnaires whose reliability was 0.937 for both, measured through the Cronbach's alpha coefficient. **Results:** the research highlights the ease of classifying digital information (78.85%), sharing information through virtual media (50.00%), editing digital content (40.38%), protecting personal data (40.38%), and developing conceptual skills (42.31%). Direct, positive, and strong correlations exist among three of the competences. The level of capabilities is in integrator II (52.00%). **Discussion and Conclusions:** computerization and information literacy, communication and collaboration, and problem solving are the most developed competences; digital content creation and security are the weakest. Few teachers acquire an innovative level of skills. Strengthening strategies must be implemented, anticipating the extension of mandatory preventive isolation as a result of the COVID-19 pandemic and the need to guarantee the quality of the educational service provided by the institution.

**Keywords:** digital competences, COVID-19, higher education, virtual education.

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## Introduction

On March 6, 2020, the [Ministry of Health of the Republic of Colombia \(2020\)](#) announced the first confirmed case of COVID-19 in the country. From that moment, health alerts were activated throughout the national territory where, in an articulated manner, the ministerial cabinet together with the departmental and municipal authorities established social distancing strategies involving the complete reorganization of the socioeconomic system.

Within this context, the President of the Republic Dr. Iván Duque Márquez requested that from March 16, Monday, 2020 to March 20, Friday, 2020, higher education institutions develop virtual education strategies as an alternative measure of social distancing; after executive order No. 457 issued by the [Presidency of the Republic \(2020\)](#), this requirement became mandatory until April 13, 2020, which was extended until April 27, 2020 ([El Tiempo, 2020](#)) and further extendable, at least, until May 11, 2020 ([Semana, 2020](#)).

This situation represents ease of work for some teachers but serious difficulties for others who, as stated by [Martínez, Burbano and Burbano \(2019\)](#), consider the use of Information and Communications Technology (ICT) as a difficulty in their teaching process. However, virtual education is not something new, and its implementation in higher education institutions has been progressive.

[Fernández, Govea and Belloso \(2002\)](#) affirmed that the first representations of this modality had a semi-presential organization—also called remote education—whose purpose was to be able to expand the offer to students with lower costs, thus providing them with the alternative of enrolling additional subjects, in a faster and cheaper way. This option is especially feasible, although not unique, for the development of curricular proposals in public administration training institutions that usually have a high precariousness of financial and educational resources ([Olmedo, Gómez & Pintor, 2014](#)).

[Copertari and Sgreccia \(2011\)](#) maintained that the implementation of this non-classroom study modality allows: a) an academic management style at the service of students, b) collaborative online learning through the available pedagogical and didactic resources, c) the development of cognitive and metacognitive skills in students that help them achieve a genuine understanding guided by tutorial actions, d) a system of procedural and permanent evaluation equal to that of face-to-face modalities, e) flexibility of accessibility, permanence, and graduation of students, and f) technological and didactic resources that promote interactivity.

In addition to the foregoing, [Varguillas and Bravo \(2020\)](#) stated among the benefits of the virtual learning modality: a) the abundance of web information available in different formats, b) the use of additional technological resources to those of a face-to-face class,

such as forums, chats, and videoconferences, c) the possibility of a more interactive and participatory learning, d) development of student autonomy, and e) asynchronous feedback to make better use of students' time.

Thus, these virtual learning spaces are highly beneficial for students who, due to their work or various occupations, cannot have the option of entering a face-to-face training system. The remote option is an ideal alternative for the development of their academic activities and the achievement of their professional goals (Andrade and Andrade, 2017). In addition, the acquisition of digital competences in the teaching–learning process makes it possible to face social changes, and they are effective in providing a response to the needs of an increasingly globalized society (Martínez and Lugo, 2018; Martínez, 2017; García and Vírveda, 2016; Duque, 2016).

However, from the teaching perspective, the use of communication and information tools in virtual training environments is limited, conditioned by motivation. In many cases, it is weak in terms of their training to handle them; many lack sufficient expertise in the use of instruments that can be used in their remote teaching and methodology (Pincay, 2018; Cabero and Marín, 2014). For Osuna and López (2015), this situation becomes critical when it is considered that information and communication are not capable of generating knowledge by themselves unless they are mediated with strategies that contribute to the development of critical thinking in the participants.

Due to this context of a global pandemic generated by COVID-19 and its consequent social distancing where there is no other option than to adapt to virtual education to achieve educational processes, what gains special relevance is the fact that teachers have digital competences for managing resources useful in their classes and of benefit to the students. In this way, the present research determines the digital competences of teachers to be able to face the implementation of virtual education in a higher education institution located in the department of Valle del Cauca - Colombia owing to the COVID-19 pandemic.

The digital competences of teachers are conceptualized as their ability to understand, use, and critically evaluate digital communication media (Ala-Mutka, Punie & Redecker, 2008). Krumsvik (2008) also considered that the use of these tools for the teaching–learning process must be based on didactic and pedagogical criteria with ethical and moral awareness. Thus, the digital competence of a teacher implies the relation among discipline, pedagogy, and technology (Koehler & Mishra, 2009). The Common Framework for Digital Teaching Competence published by the National Institute of Educational Technologies and Teacher Training (2012) is then considered, where it is established that the digital competences that all teachers must develop include 1) computerization and information literacy, 2) communication and crafting, 3) digital content creation, 4) security, and 5) problem solving.

## Methodology

The materials and methods used in the research are set forth below:

The methodology used is descriptive based on the description, registration, and analysis of the object studied in its natural environment (Tamayo, 2004). The data were gathered directly from the real scenario wherein they were developed without subjecting the studied variable to any type of manipulation (Hurtado, 2010; Arias, 2004). Regarding the period of time covered, it is considered a transactional study since the measurement was made only once, specifically on April 16, 2020, when one month was completed since the mandatory transition to the virtual education modality in the institution studied as a consequence of the social isolation caused by the COVID-19 pandemic (Hernández, Fernández and Batista, 2006).

## Participants

In accordance with the stated objective, the participants in the research were the members of the teaching staff and administrative staff with lighter teaching load linked to the higher education institution under analysis during the academic period 2020-I, the period in which the spread of the COVID-19 pandemic began in Colombia. A total of sixty-seven (67) teachers were given a questionnaire via Google forms to be answered voluntarily. Furthermore, fifty-two (52) completed surveys were gathered, thus obtaining a sampling error of 6.5% and demonstrating the high representativeness of the sample compared with the total population.

## Instruments

The data gathering technique used was the survey, and the instruments designed for it were two questionnaires. The first was oriented to the description of digital competences and comprised fifteen (15) items, with response options on a Likert scale from 1 to 4 where 1 corresponds to "Difficult" and 4 corresponds to "Easy" with intermediate points of positive and negative trend. The second one focused on determining the level of digital skills through eight (8) items with dichotomous response options, both in correspondence to the dimensions established for the research variable "teacher digital competence" (see Table 1: operationalization of the variable). Reliability was determined by calculating the Cronbach's alpha coefficient which, with 100% of valid cases compared with fifty-two (52) observations, yielded a result of 0.937 for both instruments, demonstrating that they are statistically reliable and have a robust structure.

**Table 1**  
*Operationalization of the variable*

<b>Variable</b>	<b>Dimension</b>	<b>Items</b>
Teacher's digital competences	Computerization and information literacy	1, 2, 3
	Communication and crafting	4, 5, 6

Digital content creation	7, 8, 9
Security	10, 11, 12
Problem solving	13, 14, 15
Level of competences	16-23

**Source:** Author's own elaboration (2020).

For the presentation of the results and their debate, tables with descriptive statistics were prepared, expressing figures in relative frequency. For the analysis of correlations, Spearman’s Rho coefficient ( $\rho$ ) was calculated using the Statistical Package for the Social Sciences (SPSS) v.26.0 as a support tool.

### Results and Debate

For Moll (2018), the first teaching digital competence is computerization and information literacy. This constitutes the easiness to locate, identify, and classify digital information considering its purpose and relevance. In this sense, Tarango and Machado (2012) argued that through this competence, an individual can use the accumulated knowledge and the wealth of experiences of other professionals to, through communication and information technologies, nurture new generations with a focus on cyberculture. Table 2 presents the results obtained on this competence in the university case studied.

**Table 2**  
Computerization and information literacy

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>Locate</b>	5.77%	5.77%	30.77%	57.69%
<b>Identify</b>	3.85%	13.46%	25.00%	57.69%
<b>Classify</b>	3.85%	1.92%	15.38%	78.85%
	<b>Difficult</b>	<b>&lt;</b>	<b>&gt;</b>	<b>Easy</b>

**Source:** Author's own elaboration (2020).

Table 2 indicates how among the participants in the research, 57.69% consider that it is easy for them to locate relevant digital content for their classes on the network. The result demonstrates that through digital libraries and repositories, they satisfy their information needs together with 30.77%, maintaining a positive trend (Caraballo and Castro, 2015).

Similarly, 57.69% consider it easy and 25% have a positive tendency to identify which part of the localized content is most suitable for their classes, which helps the use and evaluation of the information used to be fruitful for generating new knowledge (Cruz, 2009). However, the fact that 13.46% negatively responded to this indicator stands out, showing that this action is difficult for them. As for classifying information, 78.85% consider it easy and 15.38% maintain a positive tendency about it. Proper classification is what

facilitates the location of digital material (either in local storage or on the web) for later consultation (Delis, 2005).

The second teaching digital competence is communication and collaboration. This is what allows teachers to use digital environments to share resources using online tools, promoting connection and collaboration with others through the construction of social networks (Moll, 2018). In this regard, Table 3 presents the results obtained among the subjects addressed.

**Table 3**  
*Communication and crafting*

<b>Communicate</b>	3.85%	13.46%	48.08%	34.62%
<b>Share</b>	1.92%	9.62%	38.46%	50.00%
<b>Collaborate</b>	5.77%	21.15%	44.23%	28.85%
	<b>Difficult</b>	<	>	<b>Easy</b>

**Source:** Author's own elaboration (2020).

In Table 3, there is a moderately positive trend of 48.08% in terms of the ease of communication; however, a significant quantity of 34.62% believe that establishing communication with their students under digital environments is definitely easy considering the proper use of the different available formats (Canton, Cañón and Grande, 2017).

As for sharing, the trend remains positive where 50.00% state that it is easy for them, together with 38.46% who also agree with this criterion, to share content with their students in digital environments, encouraging connection and collaboration (Arroyo, 2017). On this last aspect, collaborating presents a moderately positive trend of 48.08% in terms of ease. However, a significant quantity of 34.62% consider that collaborating with other teachers for the training of their students in digital environments is definitely easy, thereby promoting the exchange of ideas and interpersonal relationships between teachers and students (Castro, Cedillo and Valenzuela, 2015).

The third teaching digital competence is the creation of digital content. Creativity plays a special role in it to be able to generate, edit, integrate, and rework digital content, bearing in mind aspects of intellectual property and use licenses such as creative commons (Moll, 2018). Table 4 presents the results obtained on this digital competence among the surveyed teachers.

**Table 4**  
*Digital content creation*

<b>Create</b>	1.92%	23.08%	42.31%	32.69%
<b>Edit</b>	3.85%	17.31%	38.46%	40.38%
<b>Manage (licenses)</b>	23.08%	36.54%	19.23%	21.15%
	<b>Difficult</b>	<	>	<b>Easy</b>

**Source:** Author's own elaboration (2020).

As for creating, the trend remains positive where 32.69% state that it is easy for them, together with 42.31% who also agree with this criterion, to produce completely new digital content to use in their classes under digital environments. In this way, new content and programs are produced for use in educational practice (Vargas, 2019).

Editing presents a positive trend of 38.46% when added to 40.38% who assure that it is easy for them to edit previously existing content and adapt it to the needs of their classes under virtual environments. A 17.31% indicate a negative inclination toward this aspect. In this sense, making changes to digital material must respect the restrictions of use and proper citation (Martínez & Rodríguez, 2018). Regarding this aspect, the item handling licenses such as creative commons presents a notable negative trend of 36.54% and 23.08% who consider it very difficult to identify and manage these use permits, possibly due to a lack of culture in handling copyright licenses (Castillejos, 2007).

The fourth competence is security related to the knowledge, attitudes, and skills of teachers to design and develop digitally responsible learning experiences with adequate privacy, integrity, and efficiency of the information handled through the Internet (Gallego, Torres and Pessoa, 2019). Therefore, for Torres, Pessoa and Gallego (2019), digital security and the reduction of its associated problems go hand in hand with becoming aware of the risks that exist in the virtual world. Table 5 presents the results obtained in relation to this competence.

**Table 5**  
*Security*

<b>Informatic security</b>	15.38%	30.77%	32.69%	21.15%
<b>Data protection</b>	19.23%	25.00%	40.38%	15.38%
<b>Identity protection</b>	17.31%	32.69%	30.77%	19.23%
	<b>Difficult</b>	<	>	<b>Easy</b>

**Source:** Author's own elaboration (2020).

In terms of making use of computer security when developing their classes under digital environments, the responses focus on non-absolute trends where 32.69% are inclined to ease while 30.77% consider that, on the contrary, it is usually difficult to use. Furthermore, the protection of personal data shows a high positive trend (40.38%) that it is easy for the surveyed teachers to maintain it. However, identity protection is maintained with a negative inclination of 32.69% and 17.31% who consider it very difficult to establish digital protection protocols when developing their classes under virtual environments. In this sense, protection and security are very important and should be considered as an opportunity to achieve digital literacy (Arrieta and Montes, 2011).

The fifth and last competence is problem solving oriented toward the identification of needs, decision making, and resolution of conceptual problems through digital tools, creatively using technology to update own and collective competencies (Moll, 2018). Table

6 gathers the results obtained on this competence.

**Table 6**  
*Problem solving*

<b>Solve</b>	7.69%	11.54%	46.15%	34.62%
<b>Use</b>	3.85%	17.30%	36.54%	42.31%
<b>Develop</b>	7.69%	11.54%	38.46%	42.31%
<b>Difficult</b>		<	>	<b>Easy</b>

**Source:** Author's own elaboration (2020).

In Table 6, it is observed that solving conceptual competences on their subjects taught under digital environments concentrates a positive trend of 46.15% together with 34.62% who consider it absolutely easy for them, thus guiding the construction of knowledge from virtuality (Durán, Gutiérrez and Paz, 2016). Regarding the creative use of technology in their subjects taught under digital environments, the results are highly positive with 36.54% added to 42.31% who consider it absolutely easy. For Marcelo (2013), this creativity is what allows finding the most optimal way to address learning difficulties in students and redirect their problems.

In this order of ideas, 38.46% show a positive trend together with 42.31% who consider it completely easy to develop their own digital competences in their subjects taught under virtual environments, thus allowing technological appropriation from their area of knowledge, through training resources, to correctly guide the learning and skills of students (Albertos, Domingo and Albertos, 2016).

Following this logical order, the correlations between the teaching digital competences of the population studied were calculated. To do this, nomenclatures were assigned to each of them, where computerization and information literacy = IAIX, communication and collaboration = CEX, digital content creation = CCDX, security = SX, and problem solving = RPX. Thus, the results obtained in this regard are shown in Table 7.

**Table 7**  
*Correlations of teaching digital competences (Spearman's Rho)*

		<b>IAIX</b>	<b>CEX</b>	<b>CCDX</b>	<b>SX</b>	<b>RPX</b>
<b>IAIX</b>	Correlation coefficient	1.000	.620**	.702**	.471**	.703**
	Sig. (bilateral)		.000	.000	.000	.000
	N	52	52	52	52	52
<b>CEX</b>	Correlation coefficient	.620**	1.000	.667**	.513**	.665**
	Sig. (bilateral)	.000		.000	.000	.000
	N	52	52	52	52	52



<b>CCDX</b>	Correlation coefficient	.702**	.667**	1.000	.577**	.710**
	Sig. (bilateral)	.000	.000		.000	.000
	N	52	52	52	52	52
<b>SX</b>	Correlation coefficient	.471**	.513**	.577**	1.000	.539**
	Sig. (bilateral)	.000	.000	.000		.000
	N	52	52	52	52	52
<b>RPX</b>	Correlation coefficient	.703**	.665**	.710**	.539**	1.000
	Sig. (bilateral)	.000	.000	.000	.000	
	N	52	52	52	52	52

\*\* . The correlation is significant at the 0.01 level (bilateral)

**Source:** Author's own elaboration (2020).

Table 7 shows that the main existing correlations are 1) Problem solving-Computerization and information literacy ( $\rho = .703$ ), 2) Computerization and information literacy-Creation of digital content ( $\rho = .702$ ), and 3) Creation of digital content-Problem solving ( $\rho = .710$ ). Thus, the easier it is for the teacher to locate digital content on the network, identify which of that content is the most suitable for their classes, as well as store and classify it for later consultation, the more effective they can be in terms of solving conceptual competencies of their subject and using technology in a creative way together with what is related to the creation and edition of digital material attached to the use of licenses such as Creative Commons.

Finally, to determine the level of digital competence in the teachers surveyed, the model proposed by the [Ministry of National Education \(2013\)](#) was adapted, establishing three levels with their respective sublevels, namely, exploration (I, II, III, IIII), integration (I, II, III), and innovation. Graphic 1 shows the results obtained in relation to this.

**Graphic 1**  
*Level of digital competence*

PHASE	YES	NO														
EXPLORATION (I)	92.31 %	7.69 %														
EXPLORATION (II)			86.98 %	13.02 %												
EXPLORATION (III)					81.55 %	18.45 %										
EXPLORATION (IIII)							79.22 %	20.78 %								
INTEGRATION (I)									71.26 %	28.74 %						
INTEGRATION (II)											52.00 %	48.00 %				
INTEGRATION (III)													43.93 %	56.07 %		
INNOVACIÓN															34.02 %	65.98 %

**Source:** Author's own elaboration (2020).

In Graphic 1, Integration II level covers most of the surveyed teachers (52.00%) before the trend becomes reversible. At this level, it is considered that teachers 1) use ICTs by themselves, 2) use them in their daily tasks, 3) understand the ethical implications of their use in educational processes, 4) integrate them in a pertinent way with the institutional educational project, 5) combine different tools for the design of learning environments, and 6) are considered pioneers in adopting new technological ideas. It is relevant that only 34.02% reach the level of innovation where, in addition to the above, they 1) establish criteria to argue how ICTs facilitate learning and 2) share their applied activities and adjust them according to feedback with their peers.

### Conclusions

Undoubtedly, this health emergency generated by COVID-19 has wreaked havoc in all corners of the planet and will bring future repercussions that will modify lifestyles and consumption. The educational sector, as an essential component of society, must adapt to these new demands where virtuality, which was previously an option, has now become a practically mandatory modality. Therefore, the development and strengthening of digital competences in teachers is imperative. In relation to the survey respondents who became subjects of this research and considering the objective set for it, it was possible to determine the five essential digital competences for academic development:

a. *Computerization and information literacy.* They have the facility to locate digital information through libraries and repositories on the network that is useful for their classes, identifying which is the most suitable for the generation of new knowledge and being able to classify it appropriately for later consultation, either from a local storage or from the same website.

b. *Communication and collaboration.* Communication with their students through digital media is fluid and conceived through different formats, thus allowing them to share content and experiences that strengthen connection and collaboration. The latter is considered especially simple when establishing personal and professional relationships with their academic peers to achieve training objectives.

c. *Creation of digital content.* It is one of the weakest competences because although most consider it easy to create digital content for their educational practice, they present difficulties when editing existing digital material and many limitations in relation to the identification and management of use licenses such as Creative Commons, evidencing a lack of culture in terms of copyright management.

d. *Security*. It is the weakest competence among all. Aspects such as personal data protection, identity protection, and digital protection are handled with difficulty, which prevents, in addition to guaranteeing the protection and security of handling information on the network, achieving growth in terms of digital literacy.

e. *Problem solving*. It is considered highly developed. Through it, teachers consider that they can easily solve digital competences around the subjects they teach using technology creatively and appropriating them, thereby generating training resources that guide the knowledge and skills of the students.

Regarding the correlations, it is concluded that there is an important need to develop in the short term a strengthening plan for competences related to computer security and communication and digital content development, anticipating an extension of virtual classes, at least, until the end of 2020. This is because they were the ones that presented the weakest and least positive correlations.

Finally, in terms of the level of digital competence achieved, most teachers addressed are in the Integration II stage, where it is considered that they are capable of making use of information technologies by themselves in their personal and work life, articulating them to the objectives of the institutional educational project for the development of virtual learning tools considering ethical and moral aspects.

However, few of them reach the innovative level, a situation that allows guiding future strategies to strengthen their digital competences, foreseeing that the compulsory preventive isolation resulting from the COVID-19 pandemic may possibly extend for a longer period of time. Despite the foregoing, the quality of the educational service provided in the institution must be guaranteed.

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