

Didactic digital skills and virtual education in times of COVID-19

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Abstract– This study aims to establish the relationship between instrumental digital competencies and virtual education in times of covid-19. Its approach is quantitative, descriptive, correlational, and cross-sectional. The population consisted of 5940 students from seven faculties of a public university in Lima, distributed in 53 study programs of the 2021-I academic cycle. A representative probability sample of 360 was established. These results are encouraging since they show that teachers are integrating ICT in the teaching-learning process. For example, 66.7% of students have perceived habitual management of technological tools in virtual classroom environments; this being a good level of didactic digital skills. It is necessary to continue working to improve these indices and adapt to the demands of an increasingly technological world.

Key Words: Digital competences, didactics, teaching, virtuality

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I. INTRODUCTION

Virtual education has acquired great importance in recent years due to the presence of restrictions and social distancing measures implemented in many countries due to COVID 19. It is from this experience that this modality became a viable alternative to guarantee that students continue to receive a quality education while being protected from the spread of the virus around the world. The confinement affected all areas, for a moment it was rethought how to continue under this new normality. It is with this scenario that technological solutions to the great challenges were determined, especially in education; since until 2020 the vast majority studied in the face-to-face modality. Faced with these singular challenges, it was possible to continue classes with the slogan that all students must be attended to permanently [1]. The most challenging is ensuring that all students have access to technology and a reliable Internet connection, which is not always possible in all communities.

This lack of connectivity is one of the biggest gaps that cannot be closed up to now; So far there are many students worldwide who lost at least one year of studies or delays due to not having access to the internet, computers or both [2]. This is another of the great challenges that all countries and institutions must resolve to ensure access to academic training. All this is added to the fact that many students and teachers were not used to it and found it difficult to maintain interest and motivation online, since all generations have been trained in traditional classrooms; changing the modality for a few months or another makes it difficult for all educational actors to adapt [3],

Despite these challenges, it has proven to provide unique opportunities. For example, students can access a wide variety of online resources, such as videos, presentations and interactive study materials, which allow them to learn at their own pace and schedule. In addition, to offer them the opportunity to connect with classmates and teachers from around the world, which enriches their educational experience and broadens their global perspective. Therefore, virtual education has proven to be a viable alternative, but it is important to face the challenges it presents and take advantage of its opportunities. We can ensure students receive a quality education so they can achieve academic and career success [4].

Therefore, it is essential that teachers acquire basic skills to perform in virtual environments; especially the acquisition and development of didactic digital skills, since they must be able to use digital technologies to carry out their classes effectively and efficiently with digital tools. To create motivating experiences that allow the acquisition of knowledge and the development of certain skills in the learning sessions; therefore, they must be able to select the materials, resources or other virtual elements that support the

creation of significant experiences in students [5]. Among the most important didactic competencies in virtual environments that professors should have are those of knowledge of information and communication technologies (ICT) [6]. Teachers must be familiar with the use of digital technologies, such as videoconferencing software and online learning platforms to conduct classes and present teaching materials effectively. They must also have skills in instructional design, as they must be able to create online teaching materials that are engaging, interactive, and motivating for students [7].

Another point is the facility to communicate online effectively across platforms and use online tracking and assessment tools to monitor students' progress. In addition, they must be able to adapt to new technologies and situations to ensure that they are always up to date with the latest online teaching tools and methods [8]. Finally, their online collaboration skills must be evidenced with other teachers and students in a virtual environment.

These didactic competencies are crucial to ensure that professors can provide quality education in virtual environments; therefore, developing and improving them should be the purpose of every teacher of this era. This is complemented by the study of [9]; which indicates that the strengthening of digital competencies becomes a great educational reference that helps to improve and transform the teaching-learning processes from an ICT-mediated environment.

Those are crucial to ensure that professors can provide quality education in virtual environments; therefore, developing and improving them should be the purpose of every teacher in this era. However, as mentioned by Alvarez [10] many teachers face difficulties in acquiring these skills, such as lack of training, therefore, they feel uncomfortable or not trained to use digital tools in the classroom. Almeyda and Rodriguez [11] show that there is a significant digital gap between teachers and students; which can make the integration of digital technologies in teaching even more difficult. This is in addition to what is mentioned by Domingo-Coscollola [12], which indicates that the lack of access to technology and resources hinders teaching. Another aspect highlighted by [13] in his research is that many are reluctant to adopt new technologies and online teaching methods due to lack of confidence or aversion to change. Furthermore, it adds to what is stated by Esteve-Mon [14] who highlights that not all teachers have access to equal professional development opportunities in terms of digital competence, which may result in a gap among teachers in terms of their digital skills. All of these difficulties can prevent teachers from effectively integrating technology into their teaching and can limit students' ability to learn and develop important digital skills. Therefore, it is important to address these challenges to ensure that professors have the skills and resources necessary to provide quality education in a digital environment.

All that has been mentioned about the importance of teacher training is supported by the research conducted by [15] which indicates that well-designed didactic and pedagogical e-learning in higher education can positively contribute to student learning outcomes; it also offers several advantages in the process, such as greater flexibility and accessibility, personalized learning, and the ability to engage students in collaborative activities. However, it is important to highlight several challenges, such as the need for adequate technical support, appropriate course design, and effective communication with students. The findings suggest that educators should be trained in the effective use of e-learning tools and design courses that align with learning outcomes and student needs.

On the other hand, Vergara et al. [16], in their research on the assessment of virtual reality as a didactic resource in higher education, found that it can improve the learning experience and increase student motivation and engagement; it can also be a valuable didactic resource especially in areas such as architecture, engineering, and medicine, where practical training is essential. However, it is important to note that virtual reality and this new mode of teaching that has emerged in the last two years are still in their early stages, and further research is needed to evaluate their long-term impact on learning outcomes. Therefore, it is necessary for educators to be trained in the effective use of these tools to design experiences that align with learning outcomes and student needs.

At the time of the pandemic, all educational actors without exception entered the virtual modality, prepared or not; we learned to function in virtual environments. It is necessary to identify how students perceive us in this environment. In this sense, to know how teachers have been evaluated by students in the pandemic on didactic digital skills; that is, to evaluate the performance of teachers in this modality and how it is related to the virtual education provided to students in times of COVID-19. In addition to knowing if this relationship is positive or negative. Therefore, this study aims to establish the relationship between didactic digital competencies and virtual education in COVID-19 times.

In addition, this research aims to provide the scientific community that teachers' digital competencies can be measured and thus, be of great importance for other studies, as well as to expose that a low digital competence in professors could be associated with low performance in the performance of their profession.

II. METHODOLOGY

The study was conducted under a quantitative approach of descriptive design for the description of each variable,

correlational because it seeks theoretical, empirical and statistical relationships between two variables, and cross-sectional because the application of the instrument is given to a given period of the reality in question.

The population consisted of 5940 students, corresponding to the 7 faculties of a public university in Lima, distributed in 53 study programs among them in the Faculty of Technology with specialties in Industrial Automation, Production Mechanics, Telecommunications and Informatics and Motive Power, Industrial Design and Architecture among others during the 2021-I academic cycle. A representative probability sample of 360 students was established with a confidence level of 95%. A proportional allocation was made to determine the number of respondents to apply per major as shown in Table 1.

TABLE I
STUDENT POPULATION AND SAMPLE 2021-I

Universidad Nacional de Educación Enrique Guzmán y Valle (Faculty)	Students	
	Population	Sample
Agriculture and Nutrition	384	25
Science	776	50
Administrative Science	604	39
Social Sciences and Humanities	1409	92
Initial Education	428	28
Pedagogy and Physical Culture	905	59
Technology	1034	67
Total	5540	360

The instruments used are two questionnaires. The first is the questionnaire on teachers' digital competencies which consists of 28 items: 10 on instrumental digital competencies; 10 on didactic competencies and 8 on cognitive competencies; with five response alternatives: Never (1); Seldom (2); Sometimes (3) Almost always (4) Always (5), with a duration of 30 minutes for its application. Measures the students' perception of the teachers digital competencies

The second is the questionnaire on virtual education in times of covid-19 which consists of 20 items that are divided into four dimensions, which are the informative, practical, communicative, and tutorial dimension with 5 questions; each with five response alternatives: Never (1); Rarely (2); Sometimes (3) Almost always (4) Always (5), with a duration of 20 minutes. It measures the perception of students about their virtual education in times of covid-19.

For the validation of both instruments, they were submitted to expert judgment and an excellent reliability was obtained according to the Cronbach's Alpha coefficient of the variable Instrument: Digital Capabilities of Teachers and Virtual

Education in the COVID-19 era, which yields reliability values of 0.923 and 0.906 close to 1.

III. RESULTS AND DISCUSSION

It is necessary to indicate that this research is an advance to determine the relationship between teaching digital competencies and virtual education in times of covid-19. These results correspond to the dimension of instrumental digital competencies that aims to establish the relationship between instrumental digital competencies and virtual education in times of COVID-19.

A. Descriptive analysis

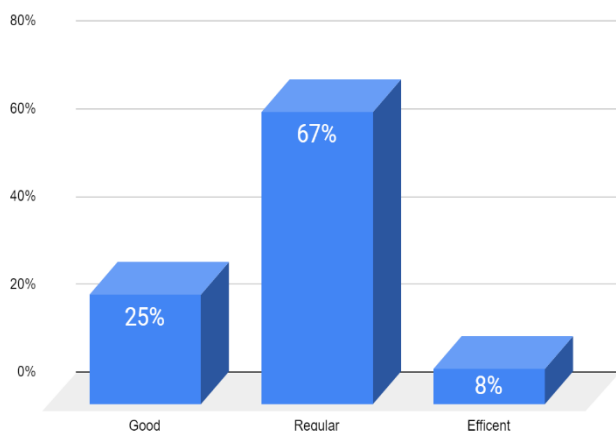


Fig. 1 Didactic digital skills

Of the 360 students surveyed from the Universidad Nacional de Educación Enrique Guzmán y Valle, period 2021-I, 66.7% (240) considered the digital didactic competencies of teachers to be fair, 25.0% (90) considered it good, 8.3% (30) considered it deficient, and 0.0% (0) considered it efficient, as shown in Fig. 1.

These results are encouraging, since they show that teachers are integrating ICT in the teaching-learning process. For example, 66.7% of the students have perceived the habitual management of technological tools; it is necessary to continue working to improve and adapt to the demands of an increasingly technological world. This coincides with [17] in that they have transformed the modern world and their impact has been significant in the teaching-learning process. From the use of interactive videos and educational games to real-time connectivity between students and teachers, ICTs offer new ways to improve education.

This statement is complemented by the study [18] in which mention that in the teaching-learning process, ICT can help improve student motivation and interest, as well as provide a more interactive and participatory approach in the

classroom. For example, students can collaborate in groups and share information more effectively through the use of online platforms, thus fostering creativity and innovation. Therefore, it is necessary to continue with the development of digital skills and continue adapting to virtuality [19]. Developing virtual skills implies the digital literacy of students, as well as the teacher's reflection on their practice in digital environments [20].

Another percentage of students indicates that 25.5% of teachers have a good command of didactic strategies in virtual environments. That is, they consider the effective and pertinent use of ICT to carry out their classes by teachers; this means that the use of technological tools streamlines the teaching-learning process. This statement coincides with the results of Domingo-Coscollola [21] that show that didactic strategies and digital skills have a positive impact on teaching practice.

On the other hand, 8.3% (30) consider it deficient and 0.0% (0) consider it efficient. These results allow us to observe that there is still a long way to go for the development of virtual skills, since the students did not identify any teacher who manages efficiently or develops naturally in these new environments. It is worrisome, because there is no reference to ensure orientation in these virtual spaces. This result shows that there is still a gap in the development of teachers' digital skills, as suggested by Almenara & Gimeno [22]. It is important that higher education institutions become aware of the integration of ICTs as catalysts in the student training process and take improvement actions through the training of their staff, as according to multiple studies. The resources of the educational environment have been increasing intensely in the last decade, and its intense scientific and pedagogical development is observed. However, little attention is paid to the readiness of teachers to work with constantly evolving technological tools [23].

Didactic strategies and digital competencies in teaching practice support teachers to effectively integrate technology into their teaching and provide quality education in a digital environment. Furthermore, as indicated by the study of [24] where the importance of addressing digital divides and providing equitable access to technology and resources to ensure that all students have the opportunity to learn and develop important digital skills should be highlighted

B. Inferential analysis

Step 1: Statement of the null hypothesis (H₀) and alternative hypothesis (H₁):

Null hypothesis (H₀):

No, there is a significant relationship between didactic digital skills and virtual education in times of covid-19.

Alternative hypothesis (H₁):

There is a significant relationship between didactic digital skills and virtual education in times of covid-19.

Step 2: Select the level of significance

The significance level consists of the probability of rejecting the null hypothesis, when it is true, this is called Type I Error, some authors consider that it is more convenient to use the term Risk Level, instead of significance. This level of risk is denoted by the Greek letter alpha (α).

For the present investigation it has been determined that: $\alpha = 0.05$

Step 3: Choose the statistical value of the test

In order to establish the degree of relationship between the variables, Spearman's Chi Square and Rho Correlation Coefficient has been used.

TABLE II
CONTINGENCY TABLE: DIDACTIC DIGITAL SKILLS VIRTUAL EDUCATION IN TIMES OF COVID-19

Didactic digital skills	Virtual education in times of covid-19								Total	
	Deficient		Regular		Good		Efficient			
	n	%	n	%	n	%	n	%	n	%
Efficient	0	0,0	0	0,0	0	0,0	0	0,0	0	0,0
Good	0	0,0	0	0,0	90	25,0	0	0,0	90	25,0
Regular	0	0,0	90	25,0	15	41,7	0	0,0	24	66,7
Deficient	30	8,3	0	0,0	0	0,0	0	0,0	30	8,3
Total	30	8,3	90	25,0	24	66,7	0	0,0	36	100,0
Chi squared = 13,687 g.l. = 4 p = 0,000 < 0,05 Spearman's Rho correlation= 0,701										

Table II shows that 25.0% of the students consider the teachers' digital didactic skills to be good, as well as the virtual education received in times of covid-19. 25.0% of the students who consider the teachers' digital didactic skills to be regular. On the other hand, 8.3% of students consider the digital didactic skills of teachers deficient in times of covid-19.

These data reveal that there is a good perception of virtual education on the part of the students; and that they relate it to the good management of ICT with efficiency in the class sessions. This efficient performance of teachers can, as indicated by García-Holgado (2020) [25]. Although some educational institutions have taken on the challenge of preparing their teachers to develop digital skills, others have remained on the sidelines; limiting pedagogical training to

disciplinary areas that allow solving problematic situations of traditional teaching. However, due to the pandemic, all educational actors have had to enter the virtual world; although the results still show that the level of the Teachers still needs to be increased. The other 25% of students indicate that the virtual education of teachers is regular in communicative interaction such as the design and selection of digital materials.

For this reason, as Orosco-Fabian [26] concludes in his research that it is important to prepare the reflexive integration of digital skills in teacher training programs and thus optimally face tomorrow's challenges in learning sessions. . In accordance with Ambros [27] in his findings where he indicates that there is currently a lack of essential digital skills. The study refers that the majority of education students as well as those of other professions feel unprepared for the challenges that will come as teachers in the modern world.

This also coincides with [28] and the developments by COVID-19 that accelerated a trend that was already underway as the increasing use of distance education through platforms. The potentialities of the internet and didactics enabled a continuity of teaching and it is likely that this approach is maintained even after the end of all restrictions related to COVID-19. In other words, it is of great importance that professors, students and other personnel, such as technicians and program directors in the field of education possess digital skills.

The integration of the teaching-learning process of the traditional classroom with technology must occur and must be gradual and methodical on the part of all actors, but especially the professor, since he acts as a mediator, guide or facilitator who accompanies the student in his formation. The virtual world allows the incorporation of different learning contents in different formats, so the limit of creativity is subject to the professor [29].

Consequently, new educational practices can be explored in virtual worlds based on consolidated pedagogical models or those in the process of being consolidated, promoted by emerging technologies and ICTs. The pedagogical and methodological wealth contained in the sessions makes them ideal for both the teacher and the student in terms of interactivity and management of digital resources. They can be adjusted to the needs of a subject, in addition to its scalability in the modification and implementation of other ICTs. The tools that are required as appropriate and even expand the metaverse by creating new regions, thus diversifying its spectrum of applications according to academic, research or leisure needs. In other words, from this point of view, if we do not insert this new technology, we would be condemned to academic lag [30].

Interpretation of Spearman's Rho

It is observed that the level of didactic digital skills is directly related to virtual education in times of COVID-19. In other words, the higher levels of didactic digital skills of the teacher, the higher levels of virtual education are obtained. Also according to Spearman's correlation of 0.701 this represents an average positive correlation. If we raise r^2 we obtain the variance of common factors $r^2 = 0.491$, therefore there is a shared variance of 49.1% [31].

Consequently, it is verified that: There is a significant relationship between didactic digital competencies and virtual education in covid-19 times as seen in Fig. 2.

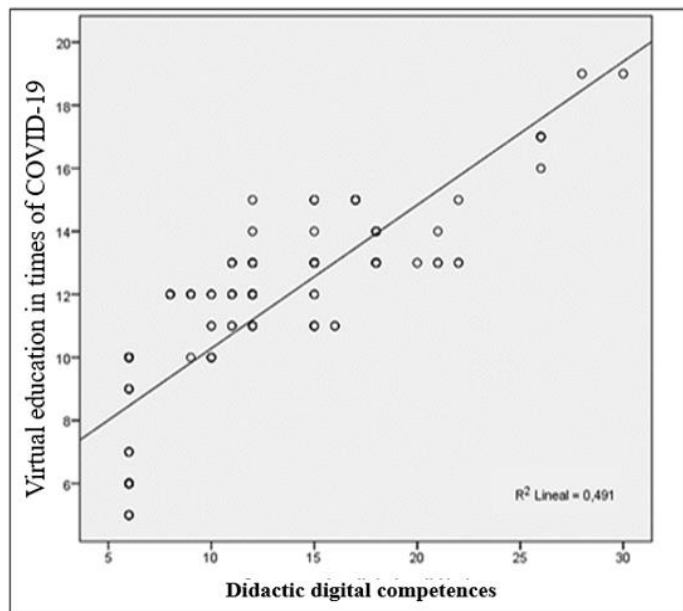


Fig. 2 Diagrama de dispersión: Competencias digitales didácticas - Educación virtual en tiempos de covid-19.

In other words, if there is an effective and pertinent management of diverse technological resources and methodological strategies in class sessions, this will have an effect on improving the students' experience in virtual environments.

This result indicates that in the context of the COVID-19 pandemic, the level of digital didactic competencies of teachers has had a significant impact on virtual education. That is, those teachers who have had adequate training in these competencies have had greater skills and tools to adapt to virtual education and face the challenges that arise in this context. Therefore, training becomes even more important, as it can be a determining factor for success in virtual education.

In other words, the development of new didactic strategies in virtual environments is a multidisciplinary task that takes time; therefore, training and predisposition are necessary to achieve their management, since it is through the

professor that the students will live the experience and their formation.

IV. CONCLUSIONS

In conclusion, it has been established that there is a significant relationship between digital didactic competencies and virtual education in COVID-19 times (with a $p < 0.05$), finding a Spearman's Rho correlation = 0.701 average positive correlation. In other words, the higher the level of digital didactic competencies of the professors, the higher the level of virtual education received.

These data indicate that if there is an effective and relevant management of various technological resources and methodological strategies in class sessions; this will have an effect on improving the experience of students in virtual environments. It has been determined that students are the best perceivers of the digital competencies of their professors and also of the virtual education received in COVID-19 times. Therefore, it is necessary to educate the professors through alternative educational programs that help improve their digital competencies in favor of student learning, especially in stages of restrictions or without them, since this modality is here to stay.

Although cross-sectional research on digital teacher skills and virtual education in times of COVID-19 is of particular value, it is necessary to recommend carrying out research-action and other qualitative work. To open new perspectives on the subject, above all, to start studies that perceive other edges of the subject and how these variables are perceived after confinement. It would be interesting to identify from the experience of teachers and students what criteria they use to measure the level of expertise in virtual environments. Knowing and interpreting these future results will help improve the quality of education and will ensure the training of students not only in their respective specialties, But will also allow them to be prepared to be digital citizens through teaching. Therefore, delving into the literacy level of teachers and students will allow us to obtain a broad vision of the needs and urgency in this matter.

Currently, the generation of teachers makes intensive use of Internet resources; however, the results of the research indicate that 66.7% of the students surveyed considered that the digital didactic competences of teachers are average. 8.3% deficient and 0.0% efficient, this result allows us to identify that they have a basic level of ICT use, which is not enough for effective implementation in their virtual classes or the management of strategies.

Only 25% of the students considered the digital competencies of their professors to be good, which reflects the fact that few education professionals were prepared to adapt to permanent virtual environments without major difficulties,

since, as we have experienced worldwide, classes continued remotely through virtual platforms.

Therefore, despite the increasing adoption of technology in education, there are still a large number of teachers who lack adequate digital didactic competencies. The research results suggest that there is a need for greater investment in the training and education of educators so that they can effectively use digital resources in their teaching. Additionally, it is important to recognize that technology is not a magic solution to educational challenges, but rather a tool that can improve the learning experience if used correctly and in conjunction with a solid pedagogical approach. That is why teacher training in this field should be a priority to improve the quality of education in the digital era.

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