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Perceptions and Resilience of Teachers in Digital Adaptation during COVID-19: A Case Study at UAS Guasave

Sandra Marlene LIZÁRRAGA SÁNCHEZ[1]
Mary Cruz SÁNCHEZ ALCALDE[2]*
Víctor Manuel PEINADO GUEVARA[3]
Héctor José PEINADO GUEVARA[4]
Jesús Alberto PEINADO GUEVARA[5]
Griselda Karina GONZÁLEZ FELIX[6]
Radames CASTRO RIVERA[7]

[1] Undergraduate Student at the Faculty of Economics and Administrative Sciences, Autonomous University of Sinaloa, Sinaloa, Mexico; sandralizarraga372@gmail.com; ORCID: https://orcid.org/0009-0005-7706-7531;
[2] Professor and researcher at the Faculty of Economics and Administrative Sciences, Autonomous University of Sinaloa, Sinaloa, Mexico; marycruz.alcalde@uas.edu.mx; ORCID: https://orcid.org/0000-0003-1901-001;
[3] Full-time professor and researcher at the Faculty of Economics and Administrative Sciences, Autonomous University of Sinaloa, Sinaloa, Mexico; victorpeinado@uas.edu.mx; ORCID: https://orcid.org/0000-0003-2692-088;
[4] Full-time professor and researcher at the Faculty of Economics and Administrative Sciences, Autonomous University of Sinaloa, Sinaloa, Mexico; hpeinado75@uas.edu.mx; ORCID: https://orcid.org/0000-0002-4816-2581;
[5] Professor and researcher at the Eustaquio Buelna Pérez High School, Autonomous University of Sinaloa, Sinaloa, Mexico; jesuspeinado@uas.edu.mx; ORCID: https://orcid.org/0000-0002-6672-7232;
[6] Professor and researcher at the Faculty of Economics and Administrative Sciences, Autonomous University of Sinaloa, Sinaloa, Mexico; griselda.gonzalez@uas.edu.mx; ORCID: https://orcid.org/0000-0003-3798-0105;
[7] Professor and researcher at the Faculty of Economics and Administrative Sciences, Autonomous University of Sinaloa, Sinaloa, Mexico; radamescastro@uas.edu.mx; ORCID: https://orcid.org/0009-0006-5678-9735;
* *corresponding author: marycruz.alcalde@uas.edu*

Abstract: *Resilience has become a key concept for understanding how individuals adapt and respond to adversity in diverse contexts. In education, teachers' resilience is reflected in their capacity to adjust to unexpected challenges, such as those generated by the COVID-19 pandemic. This study aims to analyze teachers' perceptions and resilience in digital adaptation during the pandemic, examining how the integration and use of ICT facilitated their transition to remote teaching and their ability to cope with associated challenges. The research followed a descriptive quantitative approach through a case study at the Autonomous University of Sinaloa, Guasave Campus. A total of 74 teachers aged 30 to 69 participated, and the reliability of the instrument was evaluated using Cronbach's alpha and McDonald's omega coefficients. Results indicate that teachers exhibited adaptive resilience by rapidly adopting digital tools to sustain academic continuity. The integration of ICT supported teaching processes and helped manage technological and emotional demands. Statistical analysis revealed predominantly positive perceptions toward digitalization and its influence on teaching practices, although emotional and workload factors varied among participants. It is concluded that teachers' resilience during the COVID-19 pandemic was manifested in their capacity to remain flexible and adapt to remote education despite technological, social, and emotional limitations.*

Keywords: *educational adaptation; remote teaching; teacher resilience; digital tools; teaching practices.*

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Introduction

The arrival of COVID-19 impacted society in many ways, and educational institutions were no exception. The pandemic caused a drastic change in the way teaching was carried out, forcing schools and universities to adopt distance learning indefinitely. This sudden shift to virtual learning posed a considerable challenge for teachers, most of whom were unprepared for such an abrupt transition. Facing new protocols and taking on new responsibilities, often without the necessary knowledge, causes stress and psychological problems, reducing their level of resilience (Toro et al., 2023).

Another significant impact of the pandemic was on teachers' mental health. Factors such as uncertainty, increased workload, and lack of direct interaction with their students generated high levels of stress and anxiety among teachers (Kim & Asbury, 2020).

During lockdown, information and communication technologies (ICT) became essential tools for conducting distance learning, and the situation posed various challenges that forced teachers to adapt to online teaching (König et al., 2020).

In this context, it should be noted that teachers, particularly those of advanced age, faced additional difficulties due to their lack of familiarity with the technological tools necessary to carry out their work. The absence of adequate training in educational technologies was a crucial factor in this change, as many teachers needed to acquire new skills and competencies to use digital tools effectively (Silva & Coutinho, 2024).

In this sense, teacher resilience became a key element in overcoming the barriers imposed by a lack of technological preparation, especially in the case of older teachers. Despite the difficulties, they managed to develop new skills and adapt to the demands of the digital environment, demonstrating their ability to learn and adapt. Understanding these processes not only allows us to value individual efforts, but also to identify institutional strategies that promote teacher well-being and strengthen their preparedness for future challenges.

Analyzing teachers' resilience during the pandemic is essential to understanding how they managed to adapt and what tools they used to keep teaching active. This allows for strengthening institutional support and promoting teachers' emotional well-being in the future, ensuring that they are better prepared to face similar scenarios. For this reason, the objective of this research is to analyze teachers' perceptions and resilience in digital adaptation during the pandemic, examining how the integration and use of

ICT facilitated their transition to remote teaching and their ability to cope with associated challenges.

Theoretical framework

Pandemic

The pandemic, understood as a global health crisis due to the spread of a new disease, evokes a sense of gravity and even fear (Kuri-Morales, 2020).

For their part, Machado and Olmeda (2021) highlight that the pandemic, specifically the one caused by COVID-19, has had a global impact, affecting different areas or sectors such as education, causing sudden changes in the development of academic activities due to this disease.

Due to this phenomenon, the search for alternatives for communication was promoted. However, the transition to virtual environments, especially in the field of education, presented multiple challenges, particularly due to the lack of access to adequate technological equipment. As Silva and Coutinho(2024) mention, the lack of access to the internet and adequate devices led to social inequalities, thus generating an imbalance in access to education and creating a worrying scenario for teachers during the shift to virtual teaching.

This situation generated a series of emotional reactions in teachers, including anger, distress, guilt, and helplessness, with an increase in stress levels resulting from the abrupt transformation in teaching dynamics. However, the situation also had positive aspects, as it allowed teachers to spend more time with their families and reflect on their professional practice. In addition, many managed to implement changes that favored their personal and academic development, strengthening their ability to adapt and their resilience in the face of new challenges (Urrutia et al., 2020; Gervacio & Castillo, 2022).

Resilience in educational contexts during the pandemic

Resilience is commonly described as the human capacity to cope with unusual or unexpected situations and overcome obstacles so as not to give in to pressure, regardless of the circumstances (Clínica de Psicología de la Universidad Anáhuac, 2022).

Quezadas Barahona et al. (2023) emphasize that resilience should not be understood simply as passive resistance, but rather as a dynamic process that allows individuals to transform and adapt effectively to adverse situations by identifying both potential threats and the resources available to deal with them. Similarly, Nina Mallqui (2022) highlights its importance in

the educational field, noting that teacher resilience refers to the ability of education professionals to effectively cope with the complexities inherent in the teaching-learning process.

In the context of teaching during the pandemic, resilience not only made it easier to overcome difficulties, but also proved to be a key factor in integrating ICT into educational practice. Thus, even those who lacked sufficient technical knowledge were able to continue teaching, largely thanks to their great ability to adapt to the crisis.

Given its multifaceted nature, resilience in the educational context can be analyzed from two complementary perspectives: academic resilience, which focuses on the ability to adapt and succeed in learning environments, and teacher resilience during the learning process in the pandemic, which examines how educators maintained their professional performance and emotional stability amid the challenges imposed by COVID-19. The following sections address each of these dimensions in detail.

While academic resilience generally refers to students' adaptive capacity in the learning process, teacher resilience focuses on educators' ability to sustain their motivation, commitment, and effectiveness despite professional challenges. During the learning process in the pandemic, this adaptability proved to be an essential resource for teachers to maintain their work in adverse and uncertain conditions.

Teacher resilience refers to events in academic work that are taken on with an attitude of overcoming and adapting on the part of teachers, which is reflected in students, in order to have a better social environment (Rivadeneira et al., 2022).

Andrade (2022) points out that teachers feel increasingly pressured by the demands they must meet to achieve quality education. In this context, resilience allows them to know their capabilities to face different situations. However, stress is a factor that stands out because they sometimes face situations of great tension or that cannot be controlled, which leads to a decrease in adaptability.

Fardoun et al. (2020) argue that teacher resilience is developed by university professors as a resource to maintain their commitment to teaching despite challenging working conditions, so that they not only withstand adversity but thrive in the face of it.

Meanwhile, Silerio et al. (2018) mention that, in the teaching-learning process that took place during the pandemic, teachers were able to develop positive and flexible mental health that enables them to cope with situations in different areas, such as personal, social, and environmental, and ultimately enjoy a full life in the sense of resilience.

COVID-19 has had a major impact on people's lives in different circumstances, including health and the economy, causing stress and anxiety. Teachers were afraid of losing their jobs and faced economic problems, not to mention the fear of being infected. Resilience helps to cope with these types of situations, however, it is important to note that there are important factors for resilience to function properly, such as social and family support and the trust provided by institutions (Hernández-Suárez et al., 2021).

Transformational learning theory

Teachers' resilience during the pandemic can be understood within the framework of transformational learning theory, which focuses on learning processes aimed at changing entrenched beliefs that may limit adaptation or change and asserts that new experiences modify prior knowledge (Sánchez & Ariza, 2020). In this sense, effective learning occurs when individuals acquire new ways of interpreting reality or develop more flexible and open perspectives in the face of challenges, which implies that teachers not only incorporate new knowledge or tools, but also critically reflect on their own learning process and how it transforms their professional practice (Prado, 2021). According to Taylor (2008), this type of experience intensifies transformative learning, promoting significant changes in professional practice and strengthening teacher identity.

Mezirow's transformative learning posits that situations like the COVID-19 pandemic generate a significant change in teaching and learning circumstances, leading to a disorienting dilemma that precipitates transformative learning (Code et al., 2022). The model proposes three fundamental stages: awakening, which involves taking an interest in learning, understanding new concepts, modifying mental frameworks, and accepting challenges; fixation, which consists of consolidating the knowledge acquired by understanding its relevance and purpose; and transformation, which manifests itself through critical thinking, the revision of beliefs, and self-knowledge (Mezirow, 1991).

According to Espejo Leupin and González-Suárez (2015), university teaching development can be understood as a process of transformation of the teacher's personal knowledge, where critical reflection on pedagogical practice allows the modification of assumptions and adaptation to new educational realities. From the perspective of Alhawsawia et al. (2022), digital teaching represented a turning point for educators, challenging their traditional beliefs and methods while fostering a profound process of adaptation. These processes can be understood, through Mezirow's theory, as a disorienting dilemma that drives transformative learning, allowing

teachers to restructure their previous assumptions and strengthen their professional resilience in the face of change, highlighting the importance of critical reflection in the learning process.

Teachers' digital competence before, during, and after COVID-19

Aravena (2022) mentions that the arrival of the COVID-19 pandemic posed a major challenge to the continuity of education, as many teachers were not prepared to work with technology or to teach classes virtually and in isolation. Teachers found themselves having to find different ways to organize their classes, facing successes and mistakes. Although some had more ICT knowledge than others, everyone had to learn quickly because institutions closed and classes had to continue.

The same author points out that, during the pandemic, teachers were forced to change the way they worked, adapting to circumstances and needs, and having to find new ways of teaching their classes to ensure that students understood the content.

On the other hand, Ambuludi-Marín & Cabrera-Berrezueta (2021) mention that, although the use of ICT was mandatory, it allowed classes to continue and demonstrated the benefits of technology in the classroom. However, teachers did not have the time or training necessary to make the most of these tools.

Maggio (2021) highlights that, during this period, teachers learned to use digital platforms, which allowed them to teach and, in turn, continue learning. The pandemic prompted a reinvention of education, reflecting the profound changes the world has undergone. In this context, educators were forced to adopt new technologies, as the continuity of learning depended on their ability to integrate them into their daily practice.

Preparation for future remote teaching scenarios

Baptista et al. (2020) mention that, for future scenarios, it will be necessary to support teachers in the educational process by providing digital and non-digital resources and developing curriculum plans relevant to socio-educational contexts, with ongoing training to guide learning inside and outside school.

A study conducted by Ambuludi-Marín & Cabrera-Berrezueta (2021) found that, although teachers were forced to use technology at the beginning, this experience taught them a great deal. They agree that it is essential to offer training on the use of technological applications and resources. In this way, they will be able to reinforce the knowledge they have acquired and be better prepared for future scenarios.

Methodology

This research is conducted as a case study, with a descriptive quantitative approach. Specifying the important properties of individuals, groups, communities, or any other phenomenon under analysis (Hoyos & Espinoza, 2013), intentional non-probabilistic sampling was used, which allows specific cases to be selected within a population, restricting the sample to these cases only. This technique is useful when the population is highly variable, and the sample size is small (Otzen & Manterola, 2017).

A total of 74 surveys were administered to teachers aged 30 to 69. The participants were intentionally selected for their affiliation with the study region. All were faculty members at the Autonomous University of Sinaloa who performed their teaching duties during the COVID-19 pandemic, representing a sample drawn from a total population of 124 teachers. Variables such as gender, age, and academic degree of the participants were considered in the data collection.

The sample size was calculated using the statistical formula proposed by Torres et al. (2006), establishing a 95% confidence level and a 5% margin of error:

$$n = \frac{NZ^2 \ pq}{d^2(N-1) + Z^2 \quad pq}$$

Where:

N =	Population size (124 teachers)
Z =	Confidence level 95% (Z=1.96)
P =	Probability of success (50 %)
Q =	Probability of failure (50 % from the results of the pilot test)
D =	Precision (7.3%)

Substituting values:

$$n = \frac{124(1.96)^2 \ (0.50)(0.50)}{(0.073)^2(124-1) + (1.96)^2(0.50)(0.50)} = 74$$

According to this calculation, the number of respondents is 74. The surveys were structured in a Google form and sent via WhatsApp. In the design of the instrument, the Likert scale was used to determine the respondents' perception of each item, presented in the form of statements to which the respondent reacts. Canto de Gante et al., (2020) used a scale of 1, 2, 3, 4, and 5 for each item, where 1 is completely disagree, 2 is disagree, 3 is between agree and disagree, 4 is agree, and 5 is completely agree. The survey is structured into 5 sections and 11 subcategories. To facilitate the analysis of

the information, the data was organised into categories and subcategories, which allowed for better structuring and understanding of the results (see Table 1):

Table 1. Categories of analysis on teachers' perceptions of virtual teaching during the pandemic.

Category	Subcategory
Emotions and perceptions	Fear and uncertainty
	Stress and discouragement
Working conditions	Equipment and resources
	Working environment
	Workload
Use of digital tools	Mastery and learning
	Resources used
Impact on the educational process	Process efficiency
	Teacher adaptation
	Students' performance
External factors	Personal and family health

Own elaboration with data obtained from (Ambuludi-Marín & Cabrera-Berrezueta, 2021; Andrade, 2022; Baptista et al., 2020; Gervacio and Castillo, 2022; Marsollier et al., 2024; Toro et al., 2023)

The reliability of the instrument was assessed using Cronbach's alpha and McDonald's omega coefficients with the free software JASP 0.19.0.0, which measure the internal consistency of the items and reliability, respectively, considering factor loadings, with values above 0.9 being considered excellent (Colorado Romero et al., 2025; JASP Team, 2024).

Likewise, the categories in this study were analyzed in histograms, with the aim of obtaining a graphical representation that summarized the variability of a data set, which is mainly used to verify theories and evaluate the validity of the results; their analysis allows both the identification and classification of patterns of variation and the development of coherent and meaningful interpretations of these patterns (Juan et al., 2006).

From the categories analyzed, a dendrogram was constructed using the simple linkage rule, which joins groups according to the smallest distance between their elements, using the Euclidean metric without standardizing the values and reflecting the degree of dissimilarity between the clusters in the height of the branches. In a dendrogram, the most similar elements are

connected by branches at a low height, while the union of larger and more heterogeneous groups occurs at a higher height, so that the vertical position of the branches reflects the degree of dissimilarity between the combined groups (Losada Campa, 2025).

Analysis and discussion of statistical results

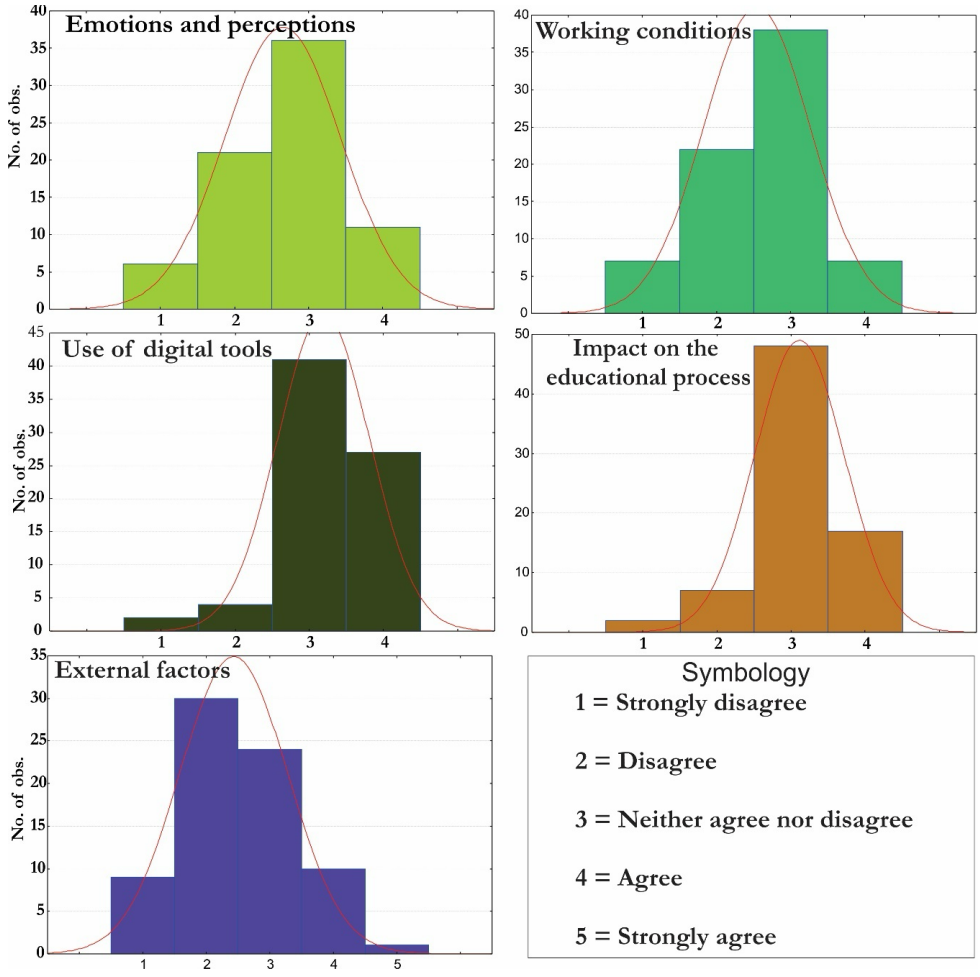
The reliability analysis revealed that the instrument has excellent internal consistency, with a McDonald's ω coefficient of 0.935 and a Cronbach's α of 0.933. These results reflect that the items are strongly correlated and consistently measure the same construction.

As shown in Figure 1, the emotions and perceptions category recorded a mean value of 3.13 with a standard deviation (SD = 0.78), concentrating mainly on neutral responses, reflecting an ambivalent stance without extreme tendencies. In the case of the working conditions category, the mean was 3.03 (SD = 0.72), with a predominance of intermediate positions suggesting an acceptable but not entirely satisfactory assessment.

The category of digital tool use achieved the highest means of 3.67 (SD = 0.61), showing a mostly positive perception of the incorporation of technological resources in the educational process. Similarly, the category of impact on the educational process had an average of 3.59 (SD = 0.60), with a concentration in the agreement categories, indicating widespread recognition of the positive effects.

On the other hand, external factors obtained an average of 2.91 (SD = 0.84), with a heterogeneous distribution of responses across the scale. This reflects the fact that, while some participants recognize a strong impact of external factors on the educational process, others perceive it as marginal or non-existent.

Figure 1. Histogram of Responses on Work-Related and Educational Factors Among Participants

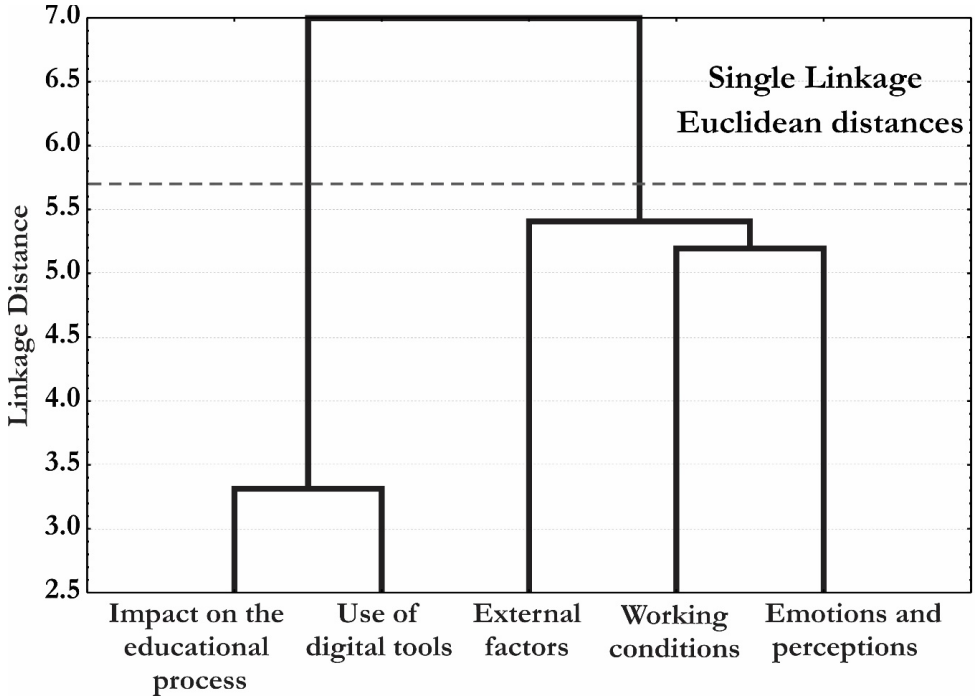


Source: Prepared internally based on data obtained from statistical analysis.

Figure 2 shows the dendrogram highlighting two different patterns in respondents' perceptions. On the one hand, there is a positive core grouping the use of digital tools and their impact on education, suggesting that digitization is perceived as a driver of improvement in teaching. On the other hand, the more "conditional" factors (such as emotions, perceptions, working conditions, and other external factors) form a separate group, reflecting more diverse and heterogeneous opinions, which is consistent with the neutrality and dispersion observed in the histograms.

Overall, both the histograms and the hierarchical analysis indicate that the most favorable perceptions are concentrated around digitization and its positive effect on education, while emotional, work-related, and external aspects show more varied and less consistent responses among participants.

Figure 2. Dendrogram of variable clustering by similarity



Source: Prepared internally based on data obtained from statistical analysis.

Analysis and discussion of results

During the COVID-19 pandemic, the education system faced a series of unprecedented challenges. In the case of the Universidad Autónoma de Sinaloa [Autonomous University of Sinaloa] (UAS, 2021), total enrollment showed a variation of 3.4% between the 2020-2021 and 2021-2022 academic cycles, reflecting the impact that health and social conditions had on academic continuity. This institutional context helps to understand the relevance of analyzing the resilience and adaptation of university faculty, particularly on the Guasave campus, where this study was conducted.

The results obtained highlight that 58% of respondents are women and 42% are men. Regarding age, this varies; 24% are aged between 30 and

39, 43% are aged 40 to 49, 28% are aged 50 to 59, and 4% are aged 60 to 69, with the most prevalent age group among women being 40 to 49 (31%) and among men being 50 to 59 (19%).

The transition from face-to-face to virtual education during the COVID-19 pandemic represented a significant challenge for teachers, who faced situations where fear and uncertainty arose from the need to adapt their teaching methodologies and master new technological tools in a short period of time. Lack of preparation, difficulties in accessing digital resources, and pressure to maintain educational quality increased stress and feelings of vulnerability in many teachers (Andrade, 2022). In this context, teacher resilience became a key factor in facing these challenges, allowing them not only to overcome difficulties but also to develop innovative strategies that enriched their teaching practice, even after the return to face-to-face teaching.

In this regard, Ortiz & Gidi (2024) point out that teachers with postgraduate degrees coped more easily with the challenges, learned new ways of working, and enriched their return to the classroom with the use of technology, showing resilience and a positive outlook despite the difficulties. According to Marsollier et al. (2024), teachers with postgraduate degrees adapted to digital access and culture, which enabled them to face the challenges they encountered. This can be linked to the results obtained in the present study, which show that 68% of teachers have postgraduate studies.

Academic degrees were analysed by gender, finding that (see Table 2) in the case of males, 14% have a bachelor's degree, 8% a master's degree and 20% a doctorate. In the case of females, 19% have a bachelor's degree, 14% a master's degree and 26% a doctorate.

Table 2. Academic degree

Age	Female	Male	Female	Male	Female	Male	TOTAL
	Bachelor´s degree		Master's degree		Doctorate		
30-39	8%	7%	1%	1%	7%		24%
40-49	7%	1%	12%		12%	11%	43%
50-59	4%	4%		7%	5%	8%	28%
60-69		1%			1%	1%	4%
TOTAL	19%	14%	14%	8%	26%	20%	100%

Source: Prepared internally using data obtained from a survey.

About the above information, it can be observed that, in academic terms, women have sought continuing education in order to provide students with greater pedagogical resources, despite the fact that, historically,

society has assigned women most of the responsibility in the family sphere. In recent decades, there has been an increase in female participation in higher education and postgraduate studies (Khanna & Mukherjee, 2024). Muñoz (2020) reports that women have made a significant contribution at all levels of education in Latin American countries for several decades.

Emotions and perceptions

Within this category, the subcategories of fear and uncertainty, stress and discouragement were studied regarding fear of losing one's job, fear of contagion, uncertainty about virtual classes, and stress due to the changes caused by lockdown.

According to the data in Table 3, 48% of respondents reported no fear or uncertainty about losing their jobs, teaching virtual classes, or becoming infected during lockdown, as they considered the situation to be temporary and had no major concerns in this regard. Segura & Vilchis (2021) mention that, before the pandemic, few institutions had implemented distance learning, but with the arrival of COVID-19, they were forced to adopt virtual classes, even without the necessary knowledge for their correct application.

Meanwhile, 34% did feel fear or uncertainty about losing their jobs, teaching virtual classes, and/or becoming infected. In this regard, the pandemic caused economic problems and emotional changes, notably stress and depression, causing uncertainty among teachers due to the situation they were experiencing (Cuesta-Toro et al., 2023).

According to the data presented, 58% of teachers reported feeling stress due to the changes caused during the pandemic, while 23% indicated that they had not experienced stress or mood swings. In this regard, Vera et al. (2025) states that the pandemic brought about a new normal that caused frustration and uncertainty, leading to physical and emotional health consequences such as exhaustion, stress, and job abandonment.

Many teachers experienced stress and emotional changes due to lockdown, as it was a drastic change to go from face-to-face classes to virtual classes without prior notice. The situation led them to undergo various changes, the most notable of which was stress due to the circumstances, as there was no certainty about when face-to-face classes would resume.

Table 3. Teachers' levels of perception of emotions and stress during the COVID-19 pandemic

Category	Subcategory	Level of perception		
		Agree	Neutral	Disagree
Emotions and perceptions	Fear and uncertainty	34%	18%	48%
	Stress and discouragement	58%	18%	23%

Source: Prepared internally using data obtained from a survey.

Working conditions

This section evaluated the subcategories of equipment and resources, working environment, and workload about the lack of equipment for virtual classes, concerns about the lack of internet access, working environment, difficulty adapting to the new way of working, discomfort working from home, workload, and increased hours spent evaluating and preparing classes. According to the data obtained from the teachers surveyed (see Table 4), 84% stated that they did not lack equipment and resources to teach virtual classes. Although this was not observed to be a problem, the lack of equipment and resources is essential for teachers, especially in situations such as pandemic lockdown. Zerna et al. (2025) supports the view that not having access to electronic devices or an internet connection creates educational inequalities.

Table 4. Working conditions and access to technological resources for virtual classes

Category	Subcategory	Item	Level of perception		
			Agree	Neutral	Disagree
Work conditions	Equipment and resources	Lack of equipment for virtual classes	7%	8%	84%

Source: Prepared internally using data obtained from a survey.

The level of perception was also analysed according to concern and lack of internet access in the place where they live (see Table 5). As mentioned above, 48% indicated that poor or lack of internet access did not represent an obstacle that would cause concern or affect their performance, while 32% were concerned about the lack of connection. The lack of internet access was a problem for some teachers because the connection in

their place of residence was unstable, causing them problems in connecting to their virtual classes on time. As mentioned by Fernandez & Ocaña (2021), some of the difficulties faced by teachers were internet connectivity and access to technological devices.

The transition from teaching in a classroom to teaching from home can be challenging, especially when the new working environment does not have the right conditions for teaching, which can affect concentration, class dynamics and teacher performance. Linne (2021) mentions that teaching from home is not an ideal environment as there are annoying noises, interruptions, internet problems, and a lack of interest from students. In this regard, 28% of respondents said that home was not the ideal environment, which made their adaptation process difficult.

Similarly, Lizarro (2020) argues that the drastic change in the way of working, from face-to-face to virtual classes, was complicated because they had to adapt to a new way of working, employing new teaching and learning habits in students. As Segura & Vilchis express, this difficulty arises from a lack of knowledge regarding the use of Information and Communication Technologies (ICT) (2021). To this purpose, the University created 74 Moodle instances (virtual classrooms) in which the courses and users of each academic unit were enabled. In 2021, the institution had 75,781 students, 3,722 teachers, and 12,268 active courses, which cover the region under study (UAS, 2022).

Another factor analysed was the workload, identifying that 59% of teachers recognised that the time spent assessment had increased, while 24% did not agree that they had experienced an increase in their working hours. In this regard, Sáez-Delgado et al. (2023) point out that teachers faced difficulties in calculating the academic workload of students, as the amount of time they spent on academic activities increased, as well as the lack of skills and knowledge in online education.

In relation to the above, many teachers faced drastic changes in assessment and lesson preparation due to the increase in time spent creating activities. This was due to students' difficulty in understanding instructions received via a screen, forcing teachers to modify their teaching and assessment methods. Similarly, Huamán points out that teachers' work became more burdensome because they had to accompany students in attendance and provide feedback after class (2021).

Table 5. Resources used by teachers during the pandemic.

Category	Subcategory	Level of perception		
		Agree	Neutral	Disagree
Work conditions	Equipment and resources	32%	19%	48%
	Working environment	28%	26%	44%
	Workload	59%	17%	24%

Source: Prepared internally using data obtained from a survey.

Use of digital tools

The following category addresses the subcategories of proficiency and learning with regard to greater preparedness in terms of technology after the pandemic, resources used, social media, and use of technological tools used at home and communication tools before the pandemic.

Regarding the use of digital tools and proficiency in their use, 70% mentioned that they were proficient in the technologies necessary to continue the educational process. In other words, teachers did not encounter significant difficulties in using basic technologies to teach classes. However, analysis of the results found that the teachers who did encounter difficulties were older teachers (8%), as they were not proficient in the technologies because they were not familiar with them. A study by Cabero-Almenada et al. (2021) shows that teachers aged 30 to 49 demonstrate greater mastery of digital teaching skills, i.e., they have a positive attitude towards the use of ICT and a greater interest in training in these skills.

A study conducted in Argentina by Chiecher (2022) indicates that teachers underwent changes since the beginning of the pandemic, as they reported favourable changes about ICT in the learning process. The arrival of the pandemic strengthened their prior knowledge, but also modified it, and they had to make use of other tools. After the pandemic, teachers are better prepared in terms of technological tools. Assessment platforms facilitate processes and reduce the time invested, because during the time they worked from home, teachers were able to learn how to use these tools (Anduquia, et al., 2023).

In terms of technological knowledge, teachers perceive an improvement in their preparation regarding the use of technologies compared to before the pandemic. During online classes, they acquired skills and became familiar with different digital tools while using them, which now makes it easier for them to implement these technologies in the classroom to strengthen the teaching-learning process. According to the data obtained

from the survey (see Table 6), 84% agreed with the statement: they are more prepared than before the pandemic.' Alibrahim (2024) determines that teachers improved their technological skills after online learning, strengthening their ability to integrate technology into teaching.

Eradze et al. (2023) mention that the pandemic opened up opportunities for teacher development, driving the adoption of digital technologies and educational innovation, where learning networks facilitated the exchange of knowledge and the improvement of digital skills in the post-pandemic stage.

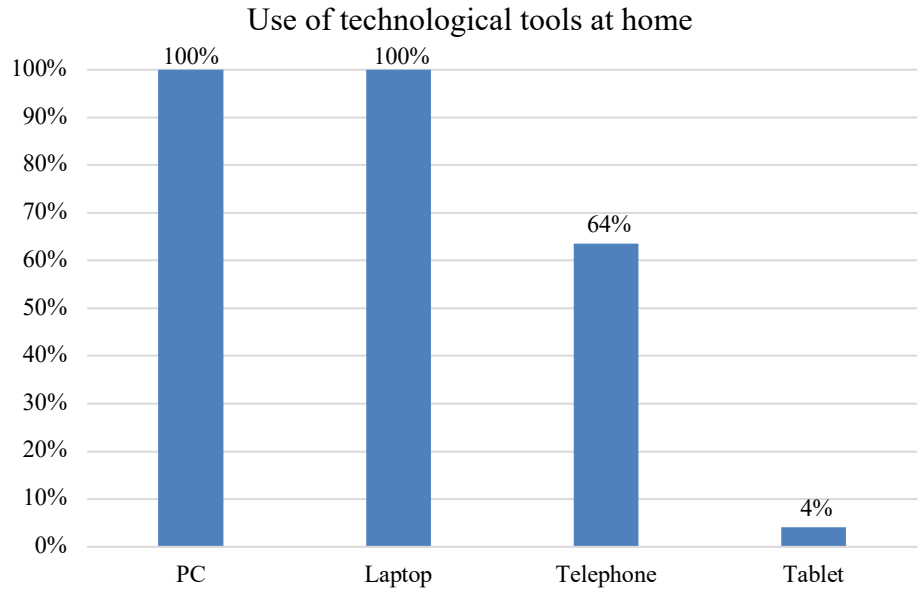
Table 6. Level of ICT proficiency and preparation among higher education teachers.

Category	Subcategory	Item	Level of perception		
			Agree	Neutral	Disagree
Use of digital tools	Proficiency and learning	Proficiency in educational technologies	70%	22%	8%
		Greater ICT preparedness post-pandemic	84%	14%	5%

Source: Prepared internally using data obtained from a survey.

Regarding the tools most used by the teachers surveyed during the pandemic, Figure 3 shows that 100% used a laptop or PC, both to teach classes and to communicate with their students. In contrast, mobile phone use reached 64%. Based on Salgado et al. (2024), educational technologies were of great help in achieving learning from home, facilitating collaborative work.

Figure 3. Technological devices are used for virtual teaching by teachers.

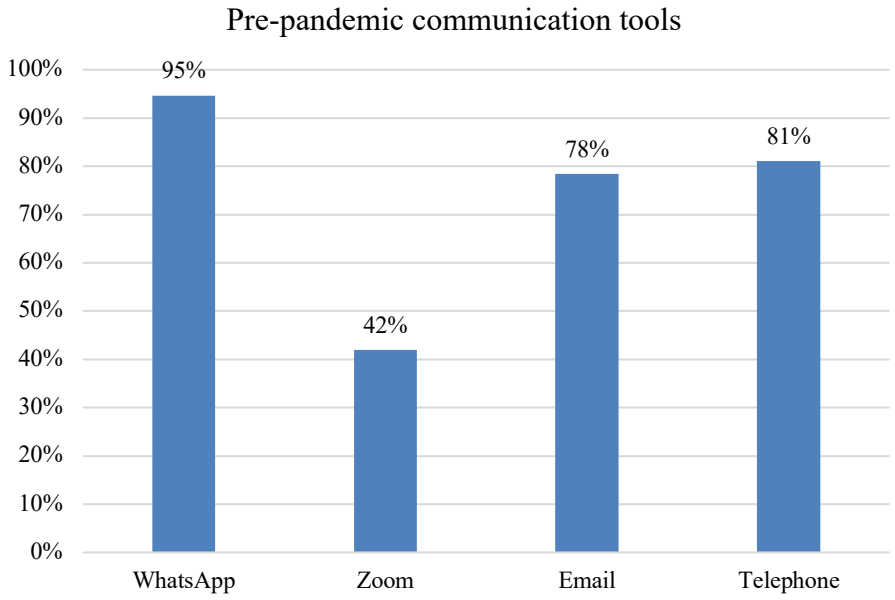


Source: Prepared internally using data obtained from a survey.

Regarding the use of technological tools, Sosa et al. (2022) mention that, even before the pandemic, teachers used WhatsApp and email to carry out activities or communicate with students, and had some tools installed on their computers. Meanwhile, Díaz et al. (2022) mention that online and distance learning led to the use of various applications for educational purposes, such as Skype, Google Classroom, Zoom, each institution's platforms, Gmail, and Google Meet.

In relation to the above, the results show that teachers were already using communication tools before the pandemic. This reflects that they had prior knowledge of these technologies, which may have facilitated their adaptation to virtual teaching. Faced with the pressure and need to communicate with students, the pandemic allowed teachers to reconfigure their knowledge of the communication tools or social networks they used (López, 2021). The results show that teachers simultaneously used tools such as WhatsApp (95%), Zoom (42%), email (78%) and telephone (81%) (see Figure 4).

Figure 4. Communication tools used by teachers before the pandemic.

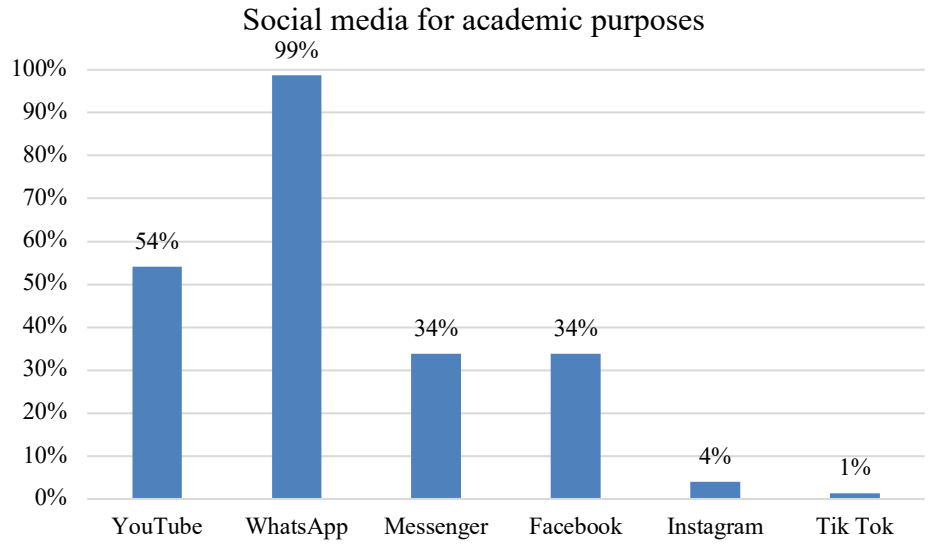


Source: Prepared internally using data obtained from a survey.

A study conducted by Pinos-Coronel et al. (2020) found that, in Ecuador, the social network most used during the pandemic by students and teachers for academic purposes was Facebook, which was used correctly and employed as an educational tool. Meanwhile, in Argentina, Exposito & Marsollier (2020) determined that most institutions adopted WhatsApp for learning systems, as they could use its groups and hold video conferences there.

In the case of Mexico, Guiñez-Cabrera & Mansilla-Obando (2021) reveal that online classes led to the use of social networks and technological tools as a form of communication and also for teaching classes, with WhatsApp being the most widely used, followed by Facebook for academic purposes. With regard to social media, the results show that the most used platforms were WhatsApp (99%), YouTube (54%), Facebook (34%) and Messenger (34%). (see Figure 5)

Figure 5. Social media tools used by teachers for communication during the pandemic.



Source: Prepared internally using data obtained from a survey.

Impact on the educational process

This category addresses the following subcategories: process efficiency, teacher adaptation, and student performance, with respect to perceived success in the educational process, preference for face-to-face education, increased use of technology, challenges in programme design, and decline in student learning.

Education was affected by the arrival of COVID-19, bringing new challenges for teachers and students, who had to face radical change. However, it also had positive effects that fostered resilience in teachers, such as the acquisition of new knowledge and the ability to adapt to a new scenario. For many teachers, the educational process was perceived as successful (53%), but for a small percentage, this was not the case, which is linked to the resilience of teachers. As González et al. (2022) mention, the greater the resilience, the lower the stress in teachers, indicating that this is a key factor for teachers to successfully face any situation that arises.

Pinos-Coronel et al. (2020) highlight that among the reasons for the success of the educational process was that students were able to use social media and technologies that facilitated participation and communication skills, and that teachers took on the role of guides and facilitators, finding different techniques to carry out their classes.

About teacher adaptation (see Table 10), 86% of those surveyed agreed that they prefer face-to-face education because it is an easy way to carry out the process, teach classes, and because it provides the right environment for teaching. Anduquia et al. (2023) determined that it is better to attend school because the time is moderate, there is a prudent approach to students, there is interaction with students and co-workers, it promotes learning, and it is important to mention that the face-to-face modality is the most effective for learning.

Eighty-four per cent of teachers perceived greater use of technology during the pandemic compared to face-to-face teaching. This was more intense as it became the main tool for teaching, assessing and carrying out activities, which required teachers to devote more time due to a lack of prior knowledge. Pathiranage & Karunaratne (2023) point out that online teaching represented a challenge for teachers due to the lack of technological support and unfamiliarity with digital tools. Similarly, Díaz et al. (2022) identify that the lack of training in digital skills made it difficult to adapt to new tasks, which highlights the lack of preparation for virtual education.

Another relevant aspect to consider is the impact of student performance on teachers' mood. The lack of attendance, attention, and commitment on the part of students, manifested in the omission of activities and low participation in class, generated demotivation and frustration among teachers. However, this is where teacher resilience plays a fundamental role, allowing teachers to adapt to these difficulties, implement strategies to maintain student interest, and continue their educational work despite the challenges.

In this context, 51% of teachers mention that student learning declined significantly during online classes (see Table 7). According to the United Nations Educational, Scientific and Cultural Organisation and the International Institute for Higher Education in Latin America and the Caribbean (UNESCO-IESALC, 2020), stress and fear had an impact on students' ability to learn, as they did not focus on academic content and therefore did not participate during class, leading to a decline in learning.

Table 7. Evaluation of the virtual educational process from the teachers' perspective.

Category	Subcategory	Item	Level of perception		
			Agree	Neutral	Disagree
Impact on the educational process	Efficiency of the process	Perceived success in the educational process	53%	34%	14%
	Teacher adaptation	Preference for face-to-face education	86%	9%	8%
		Greater intensity in the use of ICT	84%	9%	7%
	Student performance	Decrease in student learning	51%	36%	12%

Source: Prepared internally using data obtained from a survey.

External factors

Personal health is an important aspect for the proper performance of activities, whether emotional or physical health, and when it is affected, it can have a negative impact on work performance. In this sense, resilience plays a key role as it allows teachers to face and overcome the challenges arising from the impact of the pandemic, adapting to new working conditions and managing the associated stress.

Tenorio-Vílchez & Sucari (2021) mention that teacher resilience is developed by university lecturers as a resource to 'maintain their commitment to teaching despite the challenging conditions of the job' so that they not only withstand adversity but thrive in the face of it. The relationship between resilience and burnout syndrome: teachers show high levels of stress and very low levels of resilience, with a risk of burnout syndrome due to working conditions related to characteristics of the individual that involve emotional and physical aspects that place each individual in a vulnerable position (Rodríguez et al., 2022).

In the analysis of external factors that could affect teachers' resilience, personal and family health was found (see Table 8), with 26% of respondents agreeing that their work decreased, while 51% disagreed that becoming ill or having sick relatives was a distraction from their work. As a result of the research conducted by Andraca et al. (2023), it is noteworthy that teachers presented socio-emotional aspects such as sadness, emotional exhaustion, restlessness, boredom, and anxiety. In addition to this, they were affected by the virus, and in some cases, they had sick family members, which decreased their work performance.

Table 8. Perception of the impact on personal and family health in teaching work

Category	Subcategory	Level of perception		
		Agree	Neutral	Disagree
External factors	Personal and family health	26%	22%	51%

Source: Prepared internally using data obtained from a survey.

These results demonstrate that resilience enabled teachers to cope with the challenges of the pandemic by adapting to online teaching. Thanks to this adaptability, they were able to manage stress and uncertainty by reconfiguring their teaching strategies and acquiring new digital skills that allowed them to overcome professional and personal challenges. This not only helped them overcome the challenges of the pandemic but also strengthened their teaching in the post-pandemic environment.

Conclusions

The findings of this research provide insight into how higher education teachers faced the challenges posed by the COVID-19 pandemic, highlighting both the obstacles and the opportunities for personal and professional growth. Firstly, there is a marked female participation in the teaching field, with a higher level of academic preparation than their male counterparts, which coincides with recent trends showing a growing presence and advancement of women in higher education.

The reliability analysis confirmed that the instrument used had excellent internal consistency, which supports the robustness of the results obtained. Overall, the results reveal that university professors had a generally positive perception of the integration of digital tools and their impact on the educational process, highlighting digitization as a key factor in promoting resilience and adaptation during the pandemic. However, the more heterogeneous responses observed in the emotional, work-related, and external dimensions suggest that resilience is not uniform, but is influenced by personal and contextual factors that shape each professor's experience.

In terms of emotional and work-related aspects, a significant proportion of teachers reported experiencing stress during lockdown, mainly associated with changes in working conditions, intensive use of technology and forced adaptation to virtual learning. However, resilient responses were also identified that enabled them to successfully cope with the teaching-

learning process in digital environments, strengthening their technological skills and adaptability.

Although most teachers had adequate equipment to teach virtual classes, it was evident that the home environment was not always conducive to academic activities, which affected concentration and class dynamics. In addition, work overload was observed, especially in relation to student assessment and academic monitoring processes, which coincided with a lack of prior preparation in online education strategies.

Regarding the use of technological tools, laptops or PCs were the most widely used devices, followed by mobile phones, while social networks such as WhatsApp, Facebook and YouTube were used as complementary teaching resources. These tools facilitated communication and interaction between teachers and students, although they did not replace the pedagogical effectiveness of face-to-face teaching.

In general terms, the preference for face-to-face education was predominant among teachers, who perceive this modality as more effective for learning, interaction and classroom management. Even so, the experience during the pandemic contributed to strengthening teacher resilience, understood as the ability to adapt, learn and reinvent oneself in the face of adverse situations.

Finally, this study concludes that academic preparation, technological proficiency, emotional stability, and family and work environment are key factors that influence teachers' resilience in crisis situations. Recognising and strengthening these dimensions is essential to ensuring inclusive, sustainable, and quality educational processes in contexts of uncertainty.

Statement on the Use of AI Tools | *The authors acknowledge the use of artificial intelligence tools exclusively for language-related purposes during the preparation of this manuscript. Specifically, DeepL was used for style correction and translation, LanguageTool for grammar and spelling verification, and ChatGPT (OpenAI) for paraphrasing and improving text cohesion through the suggestion of connectors. None of these tools were employed for data analysis, interpretation, or the generation of research results. All analyses, interpretations, and conclusions are the sole responsibility of the authors.*

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