Factors influencing higher education students' performance and satisfaction with virtual classes during the Covid-19 pandemic: the case of Peru

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Abstract

The Covid-19 pandemic had a very strong impact on various sectors. The higher education sector is one of those which experimented various changes and challenges. In Peru, where the educational system is limited, there is a large population who do not have the chance to attend higher education institutions. In addition, from those who were studying and were part of the transition to virtual classes, not all could adapt to this new context from the beginning, or some of them did not manage to adapt to it completely. In consequence, around 174,000 higher education students dropped their studies in 2020 because of the lack of resources or low performance during the pandemic. Accordingly, the objective of this study is to identify the main factors that affected Peruvian higher education students' performance when dealing with virtual platforms during the pandemic. An integral research model based on the features of all stakeholders—students, teaching staff, systems—was developed, and a total of 175 observations were collected online. The findings suggest that technostress, instructor quality, web design quality of the system, perceived ease of use, and perceived usefulness influence higher education students' performance. Finally, theoretical, and practical implications are discussed, along with recommendations for universities in terms of adaptability to virtuality.

Keywords: virtual classes, higher education, performance, satisfaction, Covid-19

Introduction

Historically, humanity has been constantly challenged by nature in the form of pandemics. For example, the Black Death between 1346 and 1352, the Spanish Flu between 1918 and 1920, smallpox around the 17th century, and the recent Covid-19 pandemic from 2019. This last pandemic has disrupted various human activities, being responsible for 6,484,136 confirmed deaths (World Health Organization, 2022). Because of its mortality rate and ease of propagation, governments around the world were forced to mandate lockdowns in their countries. This strategy came with negative effects on the worldwide economy, supply chains, health systems, political systems, sports, and education systems. This last field has been specially challenged by the pandemic because the system was not prepared to move to an unplanned virtual context. Education, in schools and universities, had been always face to face, and thus classes had been designed to be delivered in classrooms, where students can socialize with their classmates during knowledge transfer. However, Covid-19 forced these institutions to close their doors and step into a virtual environment without any prior planning. Daniel (2020) postulates that the development of a culture of a virtual teaching environment should include not only the students but also the teaching staff in order to develop their ability to teach using these tools, thus recognizing the big challenge that educational institutions faced with the pandemic.

Having already brought up the subject of education, it is important to bear in mind that one of the types that has undergone the most changes is higher education because of its characteristics such as a large volume of students showing up for classes, the different variations that exist, having exchange or international students, and the fact that most of the teaching staff may not be trained to teach in a virtual context. In the case of Peru, it may be worse considering taht this country ranks last in students' perceptions of education quality, in comparison with other countries in the region like Colombia, Mexico, and Ecuador (Alvarez-Risco et al., 2021). Indeed, Peru assigned less than 5.5% of its GDP per year during the pandemic (Ministerio de Economía y Finanzas, 2018, 2019, 2020, 2021), and is important to highlight that before the pandemic this indicator was even less than 4% on average (Trofimov, 2011). In addition, the Peruvian government executed just 90% of this budget over the last three years (Ministerio de Economía y Finanzas, 2022).

Based on the above discussion, there are challenges faced by Peruvian higher education students to achieve a good performance during virtuality in the pandemic. Prior studies have identified important factors impacting on students' performance in planned e-learning contexts. On the student side, for example, it can be accumulated stress, whether due to their day-to-day life, family concerns, or concerns about using a new virtual teaching tool (Jena, 2015). On the side of the teaching staff, it can be the quality of teaching in a virtual context, for instance (Rizun & Strzelecki, 2020). Understanding these factors is important because of their potential negative consequences. In Perú, for instance, the Ministerio de Educacion (2021) reported that 174,000 university students stopped studying in 2020 because of Covid-19. This statistic shows the reality of an educational system that was not ready for a new study method in the presence of various exogenous factors affecting students. The objective of this study is to identify the factors impacting on Peruvian higher education students' performance during the compulsory virtual context, by focusing on the three main stakeholders of virtual classes, that is, students, teaching staff, and systems.

Literature review

Various previous studies defined virtuality and e-learning in general. (See Appendix 1.) For example, Al-Fraihat et al. (2020) discussed the idea that there is no longer a definition of e-learning that everyone uses because of the continuous evolution of technology. Coman et al. (2020) postulated that e-learning involves the creation of learning experiences, through the use of technological tools and information, which refers to the way teaching staff and students transfer knowledge through electronics devices. This statement highlights the importance of a good context for the success of virtual classes, which is then translated into a good experience and performance.

Among the studies based on the factors that can affect the performance of higher education students, Azmi et al. (2022) confirmed that students' stress, worry, or fear associated with examinations can decrease productivity, and this situation is significantly associated with an increased level of depression. Similarly, Jena (2015) conducted an analysis on technostress, which refers to the stress generated by the adaptation to a new technology, during planned e-learning scenarios. This study suggests that there is a direct relationship between technostress and students' performance and satisfaction. However, no empirical evidence has been found that demonstrates the existence of this relationship in a context characterized by compulsory virtual education.

Al-Fraihat et al. (2020) considered the importance of evaluating various aspects related to the quality of the system and how these aspects of the system can impact on student performance. Likewise, Salloum et al. (2019) analysed these aspects and studied how they can affect users' perceived usability, their attitude towards the system and its usefulness. All these analyses were performed using the Technology Acceptance Model

(TAM), and conducted in planned e-learning scenarios. In addition, variables outside the technical scope of the system (student and teaching staff) will be added to our model. It is expected that this study will contribute to the theory by integrating variables not only related to students, but also to the teaching staff and systems, which may lead to a better understanding of higher education students' performance.

In short, this study seeks to contribute to filling the gaps identified in the above discussion: 1) there is no empirical evidence about how variables like technostress and characteristics within the system or outside it can affect performance in a context of compulsory virtual education, and 2) lack of studies that integrate characteristics of the primary stakeholders—students, teaching staff, and systems—in virtual contexts.

Theoretical framework

This section defines the variables used to build the research model. It is important to break virtual classes down into factors in order to capture all the features of this context. According to Chikh and Berkani (2010), different actors can be identified within a general e-learning scenario: the platform itself, and the users who interact through it, by making inquiries or replying to them, and thus interchanging knowledge through the system. Accordingly, this study will focus on three main stakeholders: the system, the students, and the teaching staff, which will help to explain student performance on virtual platforms and their satisfaction with said platforms (Lapitan et al., 2021).

Perceived performance

Cheng (2011) defines performance as the degree to which higher education students think their academic results are better or worse than before. It can then be inferred that if students identify that their results are better than previous ones, they will be satisfied with their performance on the platform. By satisfaction, this study refers to the degree to which the actual use of the system helps students to achieve their expected academic performance. Thus, if students consider their results are not as expected, they will feel rejection towards the platform. In short, the level to which higher education students believe virtual platforms are affecting their grades and learning has a direct impact on students' satisfaction with these platforms. Hence, this study hypothesizes:

H1: *Perceived performance positively affects students' satisfaction.*

Student aspects -*Technostress*

According to Jena (2015), this term is defined as the inability to cope with the new computer technologies in a healthy manner. This concept was previously seen by Tarafdar et al. (2010), who conducted a study on technostress-related strains from the end-user computing perspective. These studies used and analyzed the antecedents to technostress to identify a relationship between this variable with performance and satisfaction. In short, if the students perceive that the learning method is inadequate, it may stand as a barrier for their adaptation to these systems, which may result in the increase of their stress along with poor performance. Based on the above discussion, the following hypothesis is postulated:

H2: *Technostress negatively affects students' perceived performance.*

Teaching staff aspects -*Instructor quality*

As reviewed by Mishra et al. (2020), students showed they were reluctant and unenthusiastic at the pace of teaching of the teaching staff, which has a lot to do with their way of teaching. As seen in the literature review, teaching staff may lack the soft skills to teach students, this can be reflected in the teaching staff' ability to teach, or their ability to make students interested in the topics of their course. Al-Fraihat et al. (2020) defined this concept as the degree of response time of the instructor and the way he or she encourages students in an e-learning environment. This concept was reinforced by Kapasia et al. (2020) when studying the interest of teaching staff in teaching.

For this study's context, this concept refers to teaching staff's willingness to teach in the best way and to provide educational support to students within their possibilities. Accordingly, if a student is encouraged by their instructor to use the platform, to develop their abilities, and to solve their doubts, this student will be more likely to perform better. Based on this discussion, it is hypothesized:

> **H3:** *Instructor quality positively affects students' perceived performance.*

System aspects

Prior literature has summarized the characteristics of information systems under the umbrella of user interface (UI) design. Nielsen et al. (1993) claimed that a system's usefulness is defined as its ability to achieve a desired goal. Thus, a system should be both useful and usable (Grudin, 1992). Usefulness refers to the system's ability to do what is needed (Nielsen et al., 1993), whereas usability refers to the extent to which the system enables a user to use its functionalities (Nielsen et al., 1993). In this UI framework, usability impacts on the usefulness aspect (Nielsen et al., 1993).

In the case of usability, this dimension embraces aspects such as how easy it is to learn the system, how easy it is to remember it, if its usage is efficient, if it has few errors, if it has consistency and allows the user good control of the functionalities, among others (Nielsen et al., 1993; Lyzara et al., 2019; Rivas-Delgado & Libaque-Saenz, 2022). This study thus proposes two broader dimensions to capture the usability of virtual classes' platforms: how easy it is to use the system (perceived ease of use), and how well the system is designed (Website design quality).

Finally, considering the limited connectivity of developing countries, and given that a system can be useful only if it is accessible, this study has included system availability as a potential antecedent of usefulness.

Perceived usefulness

Salloum et al. (2019) defined perceived usefulness as the degree to which a person believes that using a technology can increase their chances of doing their tasks well on the given platform. In this way, if people think or perceive they are performing their tasks better than before using the platform, they will perceive a better performance as well. Thus, this study hypothesizes:

> **H4:** *Perceived usefulness positively affects students' perceived performance.*

It is important to highlight that perceived usefulness is an overall assessment of the platform. This overall assessment would be affected by more specific perceptions such as: system availability, web design quality, and ease of use.

System availability

Parasuraman et al. (2005) reviewed this concept and defined it as the correct technical functioning of the site. With this concept, this study refers to the fact that the system can always be available, that the screen does not freeze when making a query or that its servers have the capacity to have classes without any problem throughout the semester. Thus, if a group of students have problems with accessing their study platform, or it freezes, it is obvious that they will not reach their expected learning, and in turn they will perceive that their tasks are being affected negatively. Hence, this study hypothesizes:

H5: System availability positively affects students' perceived usefulness.

Web design quality

Web design quality refers to is the appearance of the system and to ease of navigation (McKnight et al., 2002). Web design quality may play an important role in students' satisfaction towards the platform because a well-designed platform may enable students to properly use and navigate it. Indeed, it is useless to upload good quality content if it cannot be correctly viewed, or the students simply cannot locate it, so their experience on the platform will not be good. Thus, if students perceive that the design of the platform is not the best and is not of good quality, it is possible to infer that they will not be able to perform their tasks properly, so their perceived usefulness will be negatively affected. Thus, this study hypothesizes:

H6: Web design quality positively affects students' perceived usefulness.

Perceived ease of use

Salloum et al. (2019) link this concept to the degree to which an individual perceives that the use of a specific technology will not be complicated. Thus, it can be inferred that, if students perceive that a platform is not difficult to use, they will use it better, being able to perform tasks well, which will ultimately be reflected in their performance at the end of the course. This rationale is supported by the fact that if a platform cannot be used well, students' experience will not be good and the benefit that students can obtain from the platform will be limited. Based on this discussion, the following hypothesis is proposed:

H7: Perceived ease of use positively affects students' perceived usefulness.

Figure 1 shows the research model proposed in this study, together with all the variables and their relationship with both perceived performance and student satisfaction.

Control variables

This study included some potential covariates such as: gender, age, previous experience with face-to-face classes, whether the student comes from a public or private university, whether the student is from a university in the capital or elsewhere in the country, and whether the student works or not. Although the two first variables were widely included in prior studies, the remaining four are somehow specific to this context. First, if the students have previously experienced face-to-face classes at their universities, they may be more likely to dislike virtuality because of its lack of interaction with other university members. Second,

students from public universities and places other than the capital may dislike virtual classes because of poor connectivity conditions. Finally, if the student works, they may prefer virtual classes because of the flexibility they allow.Figure 1 summarizes the research model of this study.
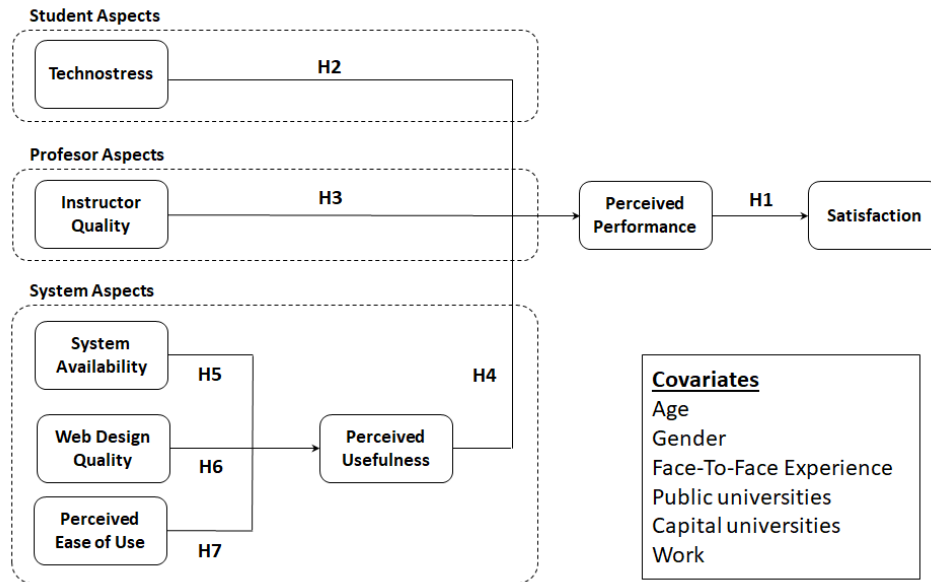

Figure 1: Research Model

Research methodology

All the variables were adapted from previous studies to ensure the reliability of the measurement instrument. Technostress was measured with one item from Jena (2015), while Instructor Quality was measured with four items from Al-Fraihat et al. (2020) and two new proposed items. In the case of the system-related variables, System Availability used four items from Parasuraman et al. (2005), while the other three variables used three items each as follows: Web Design Quality took two from Al-Fraihat et al. (2020) and one from Salloum et al. (2019), Perceived Ease of Use took its three items from Salloum et al. (2019), and Perceived Usefulness took two items from Cheng (2011) and one from Alsabawy et al. (2016). Finally, Perceived Performance was measured by three items from Cheng (2011), and Satisfaction took one item from Oghuma et al. (2015) and two items from Al-Fraihat et al. (2020). All these variables were reflective and contextualized for this study. (See Appendix 2.)

Data collection and analysis

For data collection, a survey was developed and distributed through Google Forms, a free service for surveys and collecting data. This survey was distributed in Spanish and included four sections. The first section corresponded to the informed consent to be part of the research; the second section consisted of a filter question to find out if the people who were going to participate in the survey took virtual classes during the year 2021. It should be noted that if the answer was negative in either of these two sections, the survey came to an end. The third section corresponded to the items of the proposed measurement instrument. Finally, the fourth part of the survey focused on the respondents' demographics.

A sample of 175 responses was achieved using a snowball sampling technique to find as many students as possible, obtaining responses of students from 15 Peruvian universities. Following Cohen's (1992) recommendation on sample size, and considering that three is the largest number of independent variables impacting on a dependent variable (see Figure 1), it would be necessary to have a minimum of 37 observations to detect an R2 value of at least 0.25 to achieve a statistical power of 0.8 at a significance level of 0.05 (Hair et al., 2010). Therefore, our sample size of 175 met the requirement. The demographics of the resulting surveyed group were as displayed in Table 1.

Table 1: Demographics of the Respondents

Variable	Options	Absolute Frequency	Relative Frequency
Age	Between 18 and 20	50	28.57%
	Between 21 and 23	108	61.71%
	Between 24 and 26	10	5.71%
	Over 26	7	4.00%
Gender	Male	86	49.14%
	Female	89	50.86%
Face-to-face semester before pandemic	Yes	145	82.86%
	No	30	17.14%
Current worker	Yes	88	50.29%
	No	87	49.71%
Residence before pandemic	Lima	153	87.43%
	Rest of country	22	12.57%
Nature of the university	Public	12	6.86%
	Private	163	93.14%

As for data analysis, considering that this study aims to explain the relationship between latent variables, structural equation modeling will be used (Hair et al., 2017). Smart PLS will be used as our analysis tool.

Results

The validity of the measurement model was established using construct reliability, convergent validity, and discriminant validity. To assess the reliability and convergent validity, this study used item reliability, internal consistency, and average variance extracted (AVE). The item reliability was assessed by examining each item's loading on its corresponding latent variable. It should be noted that, in the case of Instructor Quality, the items IQ1 and IQ6 were not considered because they had a loading lower than 0.7. Likewise, in the case of System Availability, items SA3 and SA4 were dropped due to their low loadings. These four items (IQ1, IQ6, SA3, and SA4) were not considered for further analysis. All the remaining item loadings were larger than the cutoff of 0.7 (see Appendix 2) suggested by Barclay et al. (1995). The internal consistency (reliability) was assessed by examining the composite reliability and Cronbach's alpha values, which ranged from 0.812 to 0.902 and from 0.613 to 0.837, respectively. (See Table 2.) Both composite reliability and Cronbach's alpha values were larger than the recommended value of 0.6 (Nunnally, 1978). This study also found all AVE values were larger than the cutoff of 0.5 (see Table 2) suggested by Hu et al. (2004). These results indicate that the measurement model is reliable and internally consistent.

Table 2: Reliability and Convergent Validity

Construct	α	CR	AVE
Web Design Quality	0.719	0.839	0.638
Instructor Quality	0.779	0.857	0.601
Perceived ease of use	0.660	0.812	0.590
Perceived performance	0.837	0.902	0.754
Perceived usefulness	0.770	0.867	0.686
System Availability	0.613	0.837	0.720
Satisfaction	0.830	0.898	0.746

Note: Technostress has not been considered as it has only one item; α = Cronbach's alpha; CR = Composite reliability; AVE = Average variance extracted

To establish discriminant validity, this study compared the correlations among the variables with the square root of the AVEs. Adequate discriminant validity is present when the square root of the AVEs is larger than the correlations among the constructs (Chin, 1998). An examination of Table 3 shows that this criterion is met. In addition, the heterotrait-monotrait ratio (HTMT) values were assessed. According to current literature, HTMT values supporting discriminant validity should be lower than 0.90 (Kline, 2011). Table 4 shows that all HTMT values are under 0.90, which further demonstrates the discriminant validity of the proposed model. Together, these tests suggest that the proposed measurement model demonstrated adequate item reliability, convergent reliability, and discriminant validity.

Table 3: Correlation Among the Constructs

Construct	WDQ	IQ	PEOU	PP	PUS	SA	SAT	TE
WDQ	**0.799**							
IQ	*0.549*	**0.775**						
PEOU	*0.624*	*0.495*	**0.768**					
PP	*0.570*	*0.426*	*0.467*	**0.868**				
PUS	*0.618*	*0.416*	*0.567*	*0.712*	**0.828**			
SA	*0.405*	*0.348*	*0.342*	*0.141*	*0.210*	**0.849**		
SAT	*0.684*	*0.483*	*0.602*	*0.725*	*0.661*	*0.261*	**0.864**	
TE	*-0.131*	*-0.146*	*-0.178*	*-0.200*	*-0.137*	*-0.017*	*-0.159*	**1.000**

Note: Numbers in bold represent the square root of the AVE, while numbers in italics represent the correlations between constructs;
WDQ = Web design quality;
IQ = Instructor quality,
PEOU = Perceived ease of use;
PP = Performance;
PUS = Perceived usefulness;
SA = System availability;
SAT = Satisfaction,
TE = Technostress

Table 4. Heterotrait-monotrait ratio (HTMT)

Construct	WDQ	IQ	PEOU	PP	PUS	SA	SAT	TE
WDQ	---							
IQ	0.737	---						
PEOU	0.874	0.657	---					
PP	0.724	0.520	0.610	---				
PUS	0.784	0.541	0.770	0.881	---			
SA	0.604	0.510	0.523	0.199	0.295	---		
SAT	0.863	0.597	0.800	0.863	0.823	0.363	---	
TE	0.173	0.158	0.234	0.217	0.153	0.073	0.177	---

Note: WDQ = Web design quality; IQ = Instructor quality, PEOU = Perceived ease of use; PP = Performance; PUS = Perceived usefulness; SA = System availability; SAT = Satisfaction; TE = Technostress

Structural model

To assess the explanatory power of the proposed structural model, this study analyzed the R2 values of the dependent variables and the paths between the variables. (See Figure 2.) These results are reported considering the effect of control variables. However, it should be highlighted that results also remain similar without control variables, supporting their robustness. The statistical significance of each path was estimated using a bootstrapping method of 5,000 subsamples as recommended by Hair et al. (2017). The proposed research model accounts for 55.9%, 45.3%, and 53.8% of the variances (R2 values) in Performance, Perceived Usefulness, and Satisfaction, respectively.
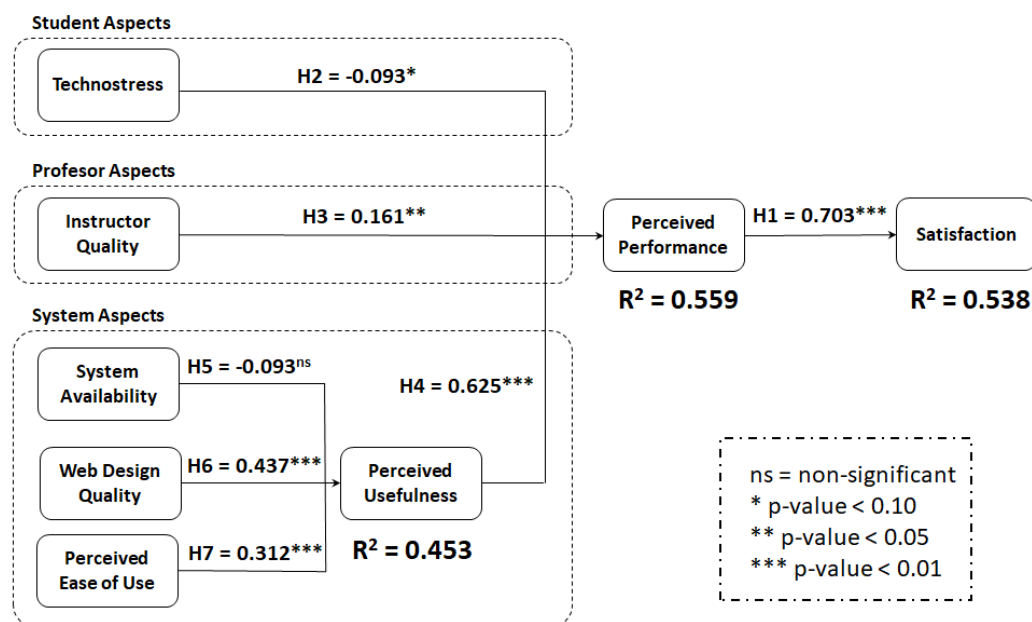

Figure 2: Structural Equation Model Assessment

The results of the path analysis indicate that Perceived Usefulness is positively affected by Web Design Quality (H6, $\beta=0.437$, p<0.000), and Perceived Ease of Use (H7, $\beta=0.312$, p<0.000). Moreover, the results show that Performance is positively affected by Instructor Quality (H3, $\beta=0.161$, p<0.010) and Perceived Usefulness (H4, $\beta=0.625$, p<0.000), and negatively affected by Technostress (H2, $\beta=-0.093$, p<0.074). This last variable is considered to be partially significant because the associated beta was significant at 10% (not 5%). Finally, the results show that Performance significantly affects Satisfaction (H1, $\beta=0.703$, p<0.000). However, the effect of System Availability on Perceived Usefulness was found to be non-significant and thus hypothesis H5 was not supported.

Discussion

The use of virtual methods, the associated platforms, and every aspect to be considered for an adequate e-learning ecosystem is becoming increasingly important today in Peru and the world at large. There is a special emphasis in terms of how students' performance can be affected by those factors. This analysis is relevant for higher education systems because of its important role in the future of the society. The main objective of this study is to assess the impact of the factors associated to students, teaching staff, and platforms. The results found empirical evidence that suggests the significant role played by instructor quality, web design quality, perceived ease of use, perceived usefulness, performance, and a partial significant role of technostress.

It should be noted that the most important factors in students' performance are those related to the system. Both the usability of the platform and the quality of the content are crucial to achieve a good learning. On the other hand, technostress shows a negative impact on performance. However, its impact is the weakest, which can be explained by the fact that offline-online migration occurred through platforms that had already been used previously by students (e.g., Zoom, Blackboard, Google Meet). Hence, in some cases this variable does not represent such a significant effect on students' performance.

Finally, the only hypothesis that was not supported was the impact of system availability on perceived usefulness. This unexpected result can be explained by the fact that most of the times when students are not able to connect to the platform are because of students' connectivity rather than platform connectivity. Thus, is the connectivity problems are not a matter of the servers supporting the platform.

Theoretical Implications

In the Literature Review section, it was found that there are not yet any studies related to a comprehensive model, with variables not related only to the systems, or to the students, or to the teaching staff, but to all of them together. A model considering all these categories together is required to better explain students' performance. Second, to the best of our knowledge, there is no study assessing students' performance in a compulsory virtual education context. Hence, the present study contributes to the literature by filling these gaps with the development of a model that could collect different actors and variables, and through empirical evidence explaining how they can affect students' performance and their satisfaction with the platform, whether positively or negatively.

Practical Implications

Based on this study's findings, recommendations to universities can be provided to improve the use of e-learning systems in similar contexts or situations, or even in a context of migration to virtuality with no associated pandemic or immediacy requirement.

First, in the case of technostress, universities can launch seminars and provide both technical and psychological help to students. Accordingly, students would not be unattended in this aspect during virtual evaluations, which in turn can provide them with options of time and tools to make the transition as smooth as possible. With respect to students' psychological state, their mood can be monitored during virtual classes. The goal is to be able to detect changes in students' behavior to support them immediately. In addition, seminars can be organized with some frequency to provide advice on how to handle the challenges of virtuality, so students may reduce their stress associated with the function of these platforms.

Second, in the case of teaching staff, institutions should consider training their teaching staff in the correct use of these platforms and other digital tools, otherwise, virtuality could have a negative effect on students' performance and their learning process. A training plan must be made before and during migration. In this way, both actors—students and teaching staff—should have all the tools and support for the learning cycle to take place. In addition, the acquired knowledge for virtual teaching can be used to keep some courses online and thus have teaching staff up-to-date in their skills for this teaching method.

Finally, universities should be able to present their content on the platform in the clearest possible way, searching for platforms that are easy to navigate without problems. As reviewed by Venkatesh and Morris (2000), it is important to increase direct user experience with the system. In this way, the user will have a perception of external control in relation to the specific environment of the system and the perceived enjoyment of using it. In terms of system availability, universities may opt for cloud-based platforms which are more stable and have potential scalability in contrast to in-house solutions.

In short, the three main actors—students, teaching staff, and systems—should be covered during planning of virtual classes. If this process is achieved satisfactorily, students will be more likely to perform better during virtual classes and assessments, with a positive impact on their performance.

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Appendix 1: Literature Review

Authors (Year)	Topic (Country)	Main Independent Variables	Comments
Al-Fraihat et al. (2020)	Factors that affect e-learning success (UK)	Technical system quality, information quality, service quality, educational system quality, support system quality, instructor quality, learner quality, perceived satisfaction, perceived usefulness, system use.	The determinants of e-learning satisfaction are technical system quality, information quality, service quality, support system quality, learner quality, instructor quality, and perceived usefulness.
Azmi et al. (2022)	University students' behavior and pervasiveness of depression due to Covid-19 (Saudi Arabia)	Stress, depression.	Stress, worry/fear of examinations, and decreased productivity were significantly associated with an increased level of depression, which could be associated to the students' performance.
Coman et al. (2020)	Online Teaching and Learning in Higher Education during Covid-19 (Romania)	E-learning platforms, benefits of e-learning.	Universities, teaching staff, and students were not prepared for the sudden shift to exclusively online learning and teaching. Teaching staff did not have the necessary technical skills and they did not manage to adapt their teaching style so rapidly.
Jena (2015)	Technostress in ICT-enabled collaborative learning environment (India)	Technostress, job performance, job satisfaction.	One of the most important variables for students in the e-learning process is technostress.
Lapitan et al. (2021)	An effective blended online teaching and learning strategy during Covid-19 (Philippines)	Online content delivery strategy, learning mechanisms (synchronous and asynchronous), assessment types and strategies.	The way in which teaching staff impart their classes could be important to the way students are able to perform.
Salloum et al. (2019)	Students' acceptance of e-learning (United Arab Emirates)	System quality, content quality, information quality, computer self-efficacy, subjective norm, perceived enjoyment, perceived accessibility, perceived ease of use, perceived usefulness, attitude towards use, behavioral intention.	System quality, content quality, information quality, perceived ease of use, and perceived usefulness are relevant factors for students' perceived performance.

Appendix 2: Survey Items

Item	Question	Loading
Technostress (TE)		
TE	I was forced by the virtual classes platform to live with very tight time schedules	N/A
System availability (SA)		
SA1	The virtual classes platform was always available for classes	0.824
SA2	The virtual classes platform started and ran immediately	0.873
SA3	The virtual classes platform did not crash	*
SA4	Pages on the virtual classes platform did not freeze after I entered a query about the content	*
Instructor quality (IQ)		
IQ1	I used the virtual classes platform as recommended by my lecturers	*
IQ2	I think lecturers' enthusiasm about using the virtual classes platform stimulated my desire to learn	0.767
IQ3	I received a prompt response to questions and concerns from my lecturers through the virtual classes platform	0.778
IQ4	Generally, my lecturers had a positive attitude to the utilization of a virtual class platform	0.738
IQ5	The material used by my lecturers was suitable for conducting virtual classes	0.817
IQ6	My lecturers were trained to teach classes virtually	*
Web design quality (WDQ)		
WDQ1	The virtual classes platform provided me with sufficient and required information	0.774
WDQ2	I perceived that the design of the virtual classes platform (for example, fonts, style, color, images, videos) was good and met quality standards	0.702
WDQ3	I believe that there is a great value in the information that I acquired from the platform used for classes	0.907
Perceived ease of use (PEOU)		
PEOU1	There was clarity and understanding in my interaction with the virtual classes platform	0.788
PEOU2	The virtual classes platform was easy for me to use	0.738
PEOU3	Interacting with the virtual classes platform did not require a lot of my mental effort	0.778
Perceived usefulness (PUS)		
PUS1	Using the virtual classes platform improved my learning performance	0.813
PUS2	I found that the virtual classes platform was useful in my learning	0.885
PUS3	Using the virtual classes platform made it easier to do my academic work	0.784
Performance (PP)		
PP1	I successfully used the virtual classes platform to improve efficiency in studies	0.893
PP2	I successfully used the virtual classes platform for my academic work	0.854
PP3	I am satisfied with the effect of using the virtual classes platform on my performance	0.857
Satisfaction (SAT)		
SAT1	How did you feel about your overall experience of using the virtual classes platform?	0.869
SAT2	The virtual classes platform satisfied my educational needs	0.867
SAT3	I enjoyed using the virtual classes platform in my study	0.856

(*) Loading was deleted because of a value lower than 0.7