Research Article

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Virtual Education and Post-Pandemic Academic Performance in University Students

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Abstract

The objective of this study was to investigate the influence of education and academic performance in the context of virtual university education. The research presents a quantitative approach, of basic type, with a descriptive causal correlational level, non-experimental and cross-sectional design, in a sample of 663 university students who participated in classes in the virtual modality. Likewise, exploratory and confirmatory analyses were used, where the results of the study reveal a positive relationship between monitoring and virtual skills in academic performance, with a β value equal to 0.392 and a p-value equal to 0.005. In addition, a more substantial positive effect was found between virtual learning resources and academic performance, with a β value equal to 0.504 and a p-value less than 0.001. In conclusion, these findings have significant implications for the design of educational policies and training programs that promote adequate support and the development of competencies in virtual environments. The learning experience can be improved by strengthening these areas and maximizing the potential of students in virtual education.

Keywords: *Performance, education, virtuality, university, COVID-19*

1. Introduction

The Covid-19 pandemic has dramatically influenced the teaching and learning of university students. In turn, only 14% of young people study in places with high poverty rates, which influences the low

learning of 59% of students in 180 countries, including those of the Latin American region (World Bank, 2021). In addition, more than 170 million students were affected by the pandemic, and they lack the necessary equipment to receive classes and adapt to virtual tools, affecting their general performance (Arriaga and Lara, 2023).

In Peru, education worsened with the pandemic, where only 66% of students did not have internet access at that time; from them, 9.9% were from rural areas only in metropolitan Lima, reflecting the reality in other departments (Vilela, Sánchez and Chau, 2021). The same thing happened with indigenous communities who did not have access to educational centers (Luján, 2022). Despite having regulations and guidelines for national education projects, they are only decorative due to their scarce application. Low budgets represent insufficient tools for university education, influencing their low performance (Huanca et al., 2020).

Likewise, 70% of university students use virtual tools regularly, and 15% stop studying due to the stress of not handling virtual tools correctly (Gonzales and Oseda, 2021). Another reality in the country is that 79% of students finish their university degree due to economic conditions and poor management of virtual tools, where most institutions lack the implementation of a management plan with exact budgets to teach the student or give them the facilities (Hernández et al., 2022).

The university population in the San Martín region represents 8.8 points below the national weight. Likewise, 54% lack connectivity and equipment to develop virtual classes, and some do not correctly manage their online tools. Most universities lack the conditions to promote good student performance (GORESAM, 2021). The students' scarce access to virtual tools is due to the low economic conditions, which hinders their academic performance.

García (2022), in his non-experimental, inferential descriptive research work, applied to a sample of 603 students, applying the survey as a technique and the questionnaire as an instrument. It concludes that students have digital communication and highly implemented virtual tools; however, there are deficiencies in the proper technology management for their classes. Likewise, it was found that the more students use digital tools, the better performance they have, indicating a significant relationship of 0.000 between both variables studied.

In this sense, Fajardo, Mantagut & Romero (2021) in their research had an objective. Establish the determinants of the academic performance of university students of Colombia's business administration (BA) program. The measurement was made through the results of state tests (Saber Pro); The sample was 143 higher-level educational institutions, totaling 28,517 students for the year 2019. Principal component analysis was used as an information processing technique; the researchers concluded that 65% of business administration students are women and 35% are men, and 75% reside in urban areas and 25% in rural areas. On the other hand, the modality of the study is given in 58% in-person, 22% at a distance, and 20% does it virtually; Therefore, there are many regional differences and gender gaps in the different competencies that make up the academic tests.

For Expósito & Marsollier (2020), in their non-experimental, descriptive, and basic work, the sample consisted of 216 students, applying the survey as a technique and the questionnaire as an instrument. They concluded that, currently, there is a modern teaching practice using educational technologies, with monitoring techniques such as the use of social networks as important and manageable educational tools for students, among the most using virtual platforms and WhatsApp that are ideal for sharing information and other programs such as zoom, meeting, or others.

In addition, Gonzales and Evaristo (2021) work was quasi-experimental and quantitative; they had a sample of 100 students, applying the survey as a technique and the questionnaire as an instrument. They conclude that, in Peru, virtual education lacks confidence regarding its effectiveness. It was observed that students who took virtual classes had less performance and more dropouts. However, it is not a determining point for students to leave the universities; it has to do more with the factors of teaching work and accompaniment.

Therefore, Quiñones, Martín, and Coloma (2021), in their analytical, descriptive-non-experimental article, had 216 students as a sample, applying the survey as a technique and the questionnaire as an instrument. They conclude that three important factors influence student

learning: style, collaborative work, and digital competence. However, virtual tools are also crucial for their use, the appropriate technological means, and the teaching styles that directly influence the student's performance in this modern world. Additionally, the students had a high level in the management of generic skills, and the teachers stopped updating and preparing themselves to have better results in strategies and teaching styles through virtual tools. In itself, there is a significant relationship between both study variables.

Moreover, Valverde and Solís (2021), in their descriptive, qualitative-non-experimental article, reviewed 29 articles from recent years, applied the review technique and the systematic review guide as an instrument, and concluded that the advancement of technology in the world has influenced teaching changes in universities such as virtual tools; These are very necessary for students, with friendly procedures that allow them to have a better performance. The only indispensable tools for this type of education are technological storage tools with the Internet, such as a laptop—computers, tablets, and telephones, among others.

2. Literature Review

In turn, theoretical aspects of the virtual education variable are presented; it is associated with technological tools that work with the Internet, which currently has to do with good teaching practices (Mondragón and Moreno, 2020). Virtual education is remote, carried out by blurring borders, times, and spaces; It is associated with using equipment and tools that work with the Internet (Cujía, 2023). Communication channels are important through virtual platforms and social networks to send classes with videoconferences, interacting synchronously and asynchronously (Gonzales, Bernad, and López, 2023).

Virtual education is associated with technocracy, using support instruments such as educational technology to carry out education from home; however, it is dissociated from socio-effective educational processes without physical contact (Núñez, 2023). Likewise, virtual education can also be hybrid after the pandemic. It consists of a mixed education where the teacher uses technology in the accompaniment, with virtual exposure teaching, content activities, and collaborative work, with their respective rubrics (Sánchez and Rodriguez, 2022). In turn, within the pedagogical approaches of virtual education, there are also constructivism, behaviorism, and cognitivism, and the modern one includes technological education (Area, Bethencourt, and Martín, 2023).

On the other hand, academic performance is of great concern in universities, which is associated with attitudinal, psychological, and contextual factors such as the quality of sleep or food that affect performance (Bustamante, Godoy, and Merellano, 2020). Other determining factors are also the migrations and culture of the students that influence their performance, and this will impact the student's adult life on their interpersonal relationships (Muñoz and Mendoza, 2023).

Moreover, the segregation of students in both urban and family strategies and the same political guidelines of the institutions (Cabrera and Bianchi, 2023). The same ones are generally linked to a social structure of different sectors and social and economic conditions that influence performance (Daza, Morón, and Batista, 2023).

For Ferrari, academic performance has specialized skills, abilities, and aptitudes for students (Fernández, 2023). The circumstances of personal experiences can affect their concentration; when they are sad, they cannot understand the classes; the emotional part is important and can have a negative or positive impact (Ledesma and Cobos, 2023).

For some students, there are external factors such as music and silence to achieve learning; it must be harmonious to avoid affecting their education. For this, distractors, including their diet, must be far away to prevent diseases that affect performance (Ortíz, Well, et al., 2023). For this, universities must design policies to generate strategies for student support, considering their sociodemographic characteristics to perform better (Grimaldo and Manzanares, 2022).

In this sense, there is the following research question: What is the relationship between virtual education and the post-pandemic academic performance of university students in 2022?

Furthermore, as a general objective: Determine the relationship between virtual education and post-pandemic academic performance of university students, 2022.

This work made it possible to find those research gaps or unresolved issues, which will serve as motivation for the development of future studies to improve knowledge in the educational area. The lack of studies in this regard prescribes the need to delve deeper into research with university students and the use of more user-friendly tools that will help improve their academic performance. Also, theories on variables and research methodology will greatly support similar research in the future.

3. Method

The research presents a quantitative approach; according to Hernández et al. (2016), this approach allows data analysis incorporating descriptive and inferential deductive and statistical methods. The research is based on a basic type study, focused on the identification of the problem based on virtual education and the academic performance of university students; Supo and Cavero (2014) indicate that the basic type of research is based on the positivist approach, thus promoting empirical research with a high level of objectivity, this originates the development of the research called quantitative, which is oriented in traditional statistical tests.

The level of research used was descriptive causal correlational; according to Caballero (2018), indicates that descriptive research works on factual realities, and its main fundamental characteristic is the presentation of the correct interpretations for the formulation of dominant conclusions, thus allowing the causal correlational type that helps to determine the influence between two variables. The research design is non-experimental and cross-sectional, for Hernandez et al. (2016), in non-experimental research is one in which the variables are not intentionally manipulated, the phenomenon is observed in its context for subsequent analysis. Similarly, cross-sectional research is characterized by describing the variables in a single period of time by collecting data at a single point in time.

4. Participants

The population is made up of 21,170 students belonging to the different professional schools of the universities (Universidad Nacional de San Martín, Universidad Peruana Unión, and Universidad César Vallejo) of the city of Tarapoto-Peru; the sample was 663 university students who answered the questionnaire applied through the use of Google Forms; the distribution was made through the academic managers of the undergraduate professional schools, the same one that was focused on the data collection, it is necessary to mention that to guarantee the transparency and randomness of the selection probabilities of each one of the students, probabilistic sampling has been used for convenience, obtaining a total of 663 students who have answered the questionnaire; and by this, all the answers obtained have been considered.

5. Instruments and Data Collection

To obtain the data, the survey has been considered as a technique and the questionnaire as an instrument. The first 6 questions were designed to collect general information such as sex, year of study, professional career, type of university, employment status, and cohabitation. In addition, a scale of ordinal structured questions has been built to collect data on virtual education and academic performance. In this context, the instruments for validating the items shown in the questionnaire to the students have been submitted to the judgment of specialists in education, psychology, and statistics. Likewise, to measure the internal consistency of the questions, Cronbach's alpha coefficient has been used, whose results exceeded the established minimums (α>0.7).

5.1 Data analysis

This research work has used various statistical techniques to examine the information, which is described below:

For the descriptive analysis, frequencies, percentages, means, and standard deviations were calculated to obtain an overview of the sample and its characteristics. On the other hand, tests such as the Kaiser-Meyer-Olkin (KMO) and Bartlett's sphericity tests were used to assess the adequacy of the data. Factor loadings were examined, and latent factors were identified. In addition, measures of absolute fit, such as the goodness-of-fit index (GFI) and root-mean-square error of approximation (RMSEA), were used, as well as measures of comparative fit, the comparative fit index (CFI) and the incremental fit index (IFI), to evaluate the fit of the theoretical model to the observed data. The structural equation model was used to evaluate the relationship between the latent variables proposed in the study for the confirmatory model and hypothesis test.

6. Results

6.1 Sociodemographic profile of the participants

Data analysis reveals important information about the different sociodemographic variables of the study. Regarding gender, it is observed that 52.34% of the participants are men, while 47.66% are women. Concerning the year of study, there is a varied distribution. Most participants are in the first year (21.57%), followed by the second year (18.85%). As the years progress, the number of participants decreases progressively, with the lowest representation in the sixth year (6.33%). These data could indicate a trend toward fewer students as they progress through their careers.

On the other hand, regarding the type of university, most participants (84.31%) study in private institutions, while the remaining 15.69% attend public universities. In addition, the careers that stand out in the number of respondents are economic sciences (32.13%) and engineering (31.37%). On the other hand, the social sciences (3.47%) and health sciences (2.87%) have less representation. Interestingly, a significant proportion of participants (26.24%) are engaged in other unspecified careers.

It is important to highlight that the majority of university students (50.53%) live with their parents; however, a significant group (16.74%) are from other cities and therefore live alone, renting rooms, and those who live with a partner (12.37%). Those who live with others (6.03%) are also present in the sample, although to a lesser extent. Regarding the employment status, it is observed that 61.84% of the participants are employed, while 38.16% do not work. This indicates that, besides studying, they are involved in some form of work.

Table 1. Study population characteristics

Variables	**Categories**	**N**	**%**
Sex	Female	316	47.66
	Male	347	52.34
Year of Study	First-year	143	21.57
	Second-year	125	18.85
	Third-year	81	12.22
	Fourth-year	92	13.88
	Fifth-year	89	13.42
	Sixth-year	42	6.33
	Seventh-year	91	13.73
Type of University	Private	559	84.31
	Public	104	15.69

Variables	Categories	N	%
Professional Career	Social Sciences	23	3.47
	Health Sciences	19	2.87
	Economic Sciences	213	32.13
	Political Sciences	26	3.92
	Engineering	208	31.37
	Others	174	26.24
Cohabitation	With their parents	335	50.53
	In couple	82	12.37
	Alone	111	16.74
	Other people	40	6.03
Employment Status	Works	410	61.84
	Does not work	253	38.16

6.2 Exploratory factor analysis

Table 2 presents the construct validation of the virtual education scale. In this process, two tests were used to assess the adequacy of the data to perform a factor analysis: the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity. Regarding the KMO, a value of 0.984 was obtained, which indicates that the data are suitable for carrying out a Kaiser (1960) factorial analysis. On the other hand, an X^2 was obtained in 20098.952 and a significance of 0.000. Likewise, the results confirm a two-dimensional structure of virtual education: virtual accompaniment and skills and virtual learning resources. In this order of ideas, a high level of reliability is observed with a composite reliability coefficient (RC) of 0.993 and an average validity extracted (AVE) of 0.934 in the dimension of Accompaniment and virtual skills. Regarding the Virtual Learning Resource dimension, there is a highly composite reliability (CR) of 0.94 and an average validity extracted (AVE) of 0.926. This indicates that the items in this factor are highly correlated and reliably measure the underlying variables.

Table 2. Exploratory analysis of the virtual education scale

ID	Items of the virtual education instrument	Factor	
		1	2
Accompaniment and virtual skills RC= 0.993; AVE= 0.934			
ACV1	Administrative processes are well-defined.	0.721	
ACV2	Communication with the teacher is active and participatory.	0.755	
ACV3	The teacher's resolution of doubts is efficient.	0.752	
ACV4	The advice platform is effective.	0.760	
ACV5	Your well-being is of the utmost importance to the university.	0.755	
ACV6	The content on the platform is useful.	0.751	
ACV7	The content on the platform is current.	0.747	
ACV8	The knowledge of the teacher is effective.	0.756	
ACV9	Access to the virtual library is optimal.	0.726	
ACV10	The contact with his colleagues is agile.	0.734	
stroke11	Cooperative work is reliable and participatory.	0.766	
Virtual learning resource RC = 0.94; AVE= 0.926			
RAV1	Platform navigation is fast.		0.719
RAV2	The usability of the platform is efficient.		0.771
RAV3	The arrangement of videos on the platform is correct.		0.746
RAV4	The connectivity of the platform is optimal.		0.762
RAV5	The design of the platform is optimal.		0.711

In that exact order, the experimental results of the academic performance scale are presented. The

KMO was 0.931, an x^2 of 4540.904, and a significance of 0.000. The construct analysis yielded a two-dimensional scale: Learning Capacities and Academic Learning; in the first dimension, a high level of reliability is observed with a composite reliability coefficient (RC) of 0.973 and an average variance extracted of 0.899. Regarding the academic learning factor, there is a moderate level of reliability with a composite reliability coefficient (RC) of 0.886 and an extracted average validity (AVE) of 0.722.

Table 3. Exploratory analysis of the academic performance scale

ID	Items of the academic performance instrument	Factor	
		1	2
Learning abilities RC= 0.973; AVE= 0.899			
CA1	Consider that you have enough knowledge to study from home.	0.850	
CA2	Participate actively with ideas to improve their academic performance.	0.842	
CA3	You consider that you can work alone.	0.824	
CA4	You consider that your teacher has been punctual in the established schedules.	0.816	
Academic learning RC= 0.886; AVE= 0.722			
AA1	Has had many errors in the assigned tasks.		0.819
AA2	Had deficiencies due to lack of knowledge in handling technological equipment.		0.691
AA3	Is very dependent on doing his job.		0.675

6.3 Confirmatory factor analysis of the instruments

When analyzing the measures of absolute fit, such as the GFI and the RMSEA, a good fit is observed in general terms. The GFI exceeds the acceptable threshold of 0.80, and the RMSEA is below the limit of 0.08. In addition, when considering the comparative adjustment measures, such as the NFI, the RFI, the CFI, the TLI, and the IFI, it is observed that all of them exceed the acceptable threshold of 0.90. These values indicate that the model has a good fit compared to alternative models and supports the validity of the proposed model concerning virtual education.

The "Academic performance" construct results show a similar pattern to the virtual education construct. Absolute fit measures, such as the GFI and RMSEA, indicate a generally good fit. Likewise, the comparative adjustment measures, such as the NFI, the RFI, the CFI, the TLI, and the IFI, also exceed the acceptable threshold of 0.90, supporting the validity of the proposed model concerning academic performance.

Table 4. Confirmatory analysis of the instruments

Absolute fit measures	Acceptable values	Virtual education	Academic performance
Chi-squared	-	432,337	41,157
P-value	< 0.05	0.000	0.000
GFI	≥0.80	0.905	0.979
RMSEA	≤0.08	0.077	0.064
NFI	> 0.90	0.979	0.991
RFI	> 0.90	0.975	0.985
CFI	> 0.90	0.984	0.994
TLI	> 0.90	0.981	0.990
IFI	> 0.90	0.984	0.994

6.4 Descriptive statistics and reliability of the instruments

The results presented show the dimensions' descriptive statistics and reliability coefficients. The averages are observed, the standard deviations (SD). In addition, a high degree of internal consistency is observed since the Cronbach reliability coefficient (α) and the McDonald reliability

coefficient (ω) are higher than the established minimums (α >0.70).

Table 5. Descriptive analysis of scale components

Variables	Mean	SD	Cronbach's α	McDonald's ω
Accompaniment and virtual competitions	3.67	1.20	0.994	0.994
Virtual learning resource	3.66	1.20	0.984	0.985
Learning abilities	3.65	1.24	0.973	0.973
Academic learning	3.28	1.22	0.888	0.888

6.5 Confirmatory model and hypothesis testing

Fit measures provide information about the degree of fit between the theoretical model and the data observed in the model analysis. These measures are essential to assess the quality of the model fit and the validity of the proposed theoretical relationships. Regarding the measures of absolute fit, such as the GFI and the RMSEA, the results show that the model reaches acceptable values. The GFI obtained is greater than 0.80, which indicates an adequate fit. Furthermore, the RMSEA exceeds the limit of 0.08, which suggests that the model has a satisfactory fit in terms of approximation error. In addition, when considering the comparative adjustment measures, such as the NFI, the RFI, the CFI, the TLI, and the IFI, it is observed that all of them exceed the acceptable threshold of 0.90. Although these measurements indicate a better fit compared to other alternative models.

Table 6. Confirmatory model fit measures

Absolute fit measure	Acceptable values	Virtual education
Chi-squared	-	914,557
P-value	< 0.05	0.000
GFI	≥0.80	0.862
RMSEA	≤0.08	0.075
NFI	> 0.90	0.965
RFI	> 0.90	0.961
IFI	> 0.90	0.973
TLI	> 0.90	0.970
CFI	> 0.90	0.973

Figure 1 shows the two hypotheses of the structural model; the first hypothesis shows a significant positive effect between monitoring and virtual skills on academic performance, with a β value equal to 0.392 and a p-value equal to 0.005. Furthermore, a more substantial positive effect was found between virtual learning resources and academic performance, with a β value equal to 0.504 and a p-value less than 0.001. These data indicate that both virtual accompaniment and skills and virtual learning resources are important factors that contribute to academic performance.

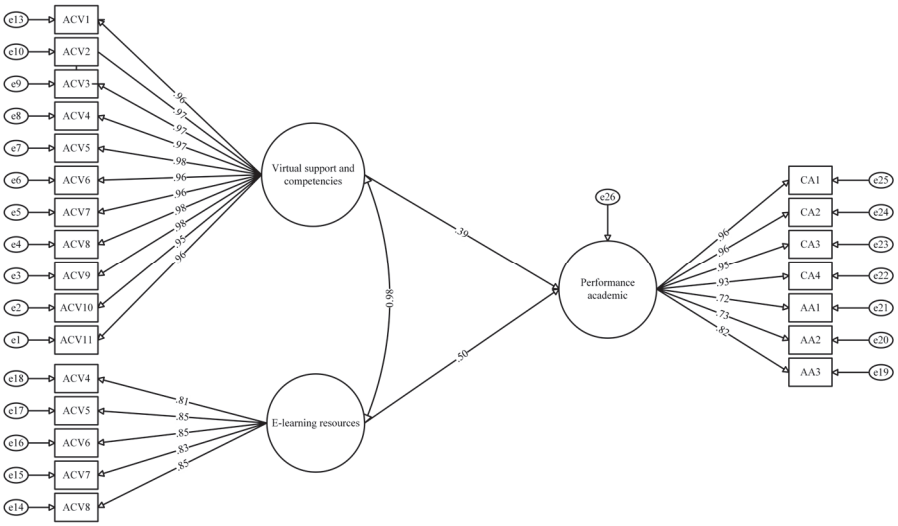

Figure 1: Confirmatory research model

7. Discussion

During the processing of the data, the results obtained from each objective set at the beginning of the investigation were analyzed, later the interpretation was made, and the relevance of the mimes was evaluated; In this sense, according to the general objective, it has been shown that there is a considerable positive correlation between the variables of virtual education and academic performance because there are many young people who live far from urban areas, where the Internet signal is medium or low, even more so in rainy seasons. Of this, it is added the difficulty of concentration inside the house; the houses are not adapted to receive a virtual class comfortably, without noise, interruptions, or without parents calling to carry out support activities. In this sense, Quiñonez et al. (2021) agree with his research when he indicates a significant relationship between both variables; Likewise, García (2022) states that students have digital communication and well-implemented virtual tools. However, there are deficiencies in management. Finally, it indicated a significant relationship of 0.000 between both variables studied.

On the other hand, the organizational commitment that the universities of Tarapoto have is in continuous improvement, which means that internal procedures and educational quality improve daily. Still, unfortunately, the dedication and discipline of young people in virtual learning teaching are not the most optimal. However, the results indicate a considerable correlation between virtual education and organizational commitment; In this context, Gonzales and Evaristo (2021) concluded that virtual education lacks confidence regarding its effectiveness in Peru. It was observed that students who took virtual classes had less performance and more dropouts. Nevertheless, studies have shown that this event has more to do with the factors of the teaching work and the accompaniment they carry out.

In this same scenario, the planning of remote work is not done, nor does it comply with the rigor required by educational quality; the results have shown a considerable correlation between virtual education and the remote work plan. Such is the case manifested by Valverde and Solis (2021) when they indicate that the advancement of technology in the world has directly influenced teaching-learning in universities through virtual tools, which are necessary today for students with friendly procedures that allow for better performance. The only indispensable tools for this type of education are technological storage tools with the Internet, such as a laptop—computers, tablets, and

telephones, among others.

Self-assessment is an essential strategy since it helps to see the state in which we find ourselves academically. Correlation studies with virtual education have shown that the relationship is positive and considerable, so it is important to self-evaluate to correct promptly and constantly. However, Expósito & Marsollier (2020) state that there is currently a modern practice that is done through the use of educational technologies that allow closer monitoring of the student; among the most used are virtual platforms and WhatsApp, which are ideal for sharing information, in addition to zoom, meetings, and others.

Finally, virtual education has come to stay and left us in our hands with multiple digital tools, applications, and social programs that allow us to conduct online evaluations and issue the results of a pass or fail. That is why the evidence shows that when the variables of virtual education and approval and execution are correlated, it was found that the relationship they have is considerably positive for Fajardo et al. (2021). Regarding virtual education, they stated that 58% study in person, 22% remotely, and 20% do so virtually. Therefore, there are many regional differences and gender gaps in the competencies that make up the academic tests.

Due to the characteristics of this research, some limitations must be pointed out. The population is made up of three universities in the San Martin Region, so it could not represent the entire university population, and the generalization of the results would imply a bias in the results. For future research, it is recommended that a study sample that includes other universities from the Peruvian coast, highlands and jungle be included. In addition, differences in academic performance should be evaluated according to gender, program of study, connectivity and conditions in which virtual classes are received.

8. Conclusions

Based on the results obtained from the data analysis, the following conclusions were reached:

Regarding the sociodemographic characteristics, the participants presented diversity in terms of sex, year of study, type of university, professional career, cohabitation, and employment status. This diversity reinforces the sample's representativeness and the results' generalizability to the target population.

Exploratory factor analysis revealed an underlying structure in the virtual education and academic performance scales, indicating that the questions used in both scales measure related constructs. Confirmatory factor analysis supported and confirmed this proposed structure, providing evidence of the scales' validity. The confirmatory model showed a significant and positive relationship between monitoring and virtual skills and academic performance. This indicates that a higher level of monitoring and virtual skills was associated with better academic performance in the participants. These findings significantly affect designing support strategies and developing competencies in virtual learning environments. Promoting effective monitoring and the development of digital skills among students is recommended to improve their academic performance in virtual environments.

The implications of this study were deduced towards university students, the importance of virtual education during the pandemic and what we were left with represents a positive valuation of the student towards technology and its role in academic performance. For future lines of research, the scope of the study can be extended and approached from the perspective of teachers or other educational agents. In addition, in other research, it can be compared with the student's or teachers' workload and academic load, and related to other variables associated with the student's field. For future studies we can consider studies that focus on the use of ICTs to improve academic performance.

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