Original Article

Categorical stress predictors in higher education students amidst remote learning in COVID-19 pandemic

Edgar E. Carpio-Vargas[1], Eliana M. Ibarra-Cabrera[2], Manuel J. Ibarra[3], Remo Choquejahua-Acero[1], Hugo D. Calderon-Vilca[4], Fred Torres-Cruz[1*]

[1]Academic Department of Statistics and Computer Engineering, Universidad Nacional del Altiplano de Puno, Puno-Perú. [2]Department of Psychology, Universidad Nacional de San Antonio Abad del Cusco Cusco, Perú. [3]Department of Informatics and Systems Engineering, Universidad Nacional Micaela Bastidas de Apurímac Abancay, Perú. [4]Department of Software Engineering, Universidad Nacional Mayor de San Marcos Lima, Perú.

Correspondence: Fred Torres-Cruz, Academic Department of Statistics and Computer Engineering, Universidad Nacional del Altiplano de Puno, Puno-Perú. ftorres@unap.edu.pe

ABSTRACT

The aim was to determine the factors that influence the development of stress in college students during nonface-to-face classes during the COVID-19 pandemic in 4 universities in southern Peru. To achieve the objectives, 570 students were sampled using Google Forms. The approach was quantitative, transactional design, and descriptive-correlational type. The instrument used to measure stress was the Perceived Stress Scale (PSS) with 10 items (dependent variable) and 21 possible stress-causing factors (independent variables). Once the information was recovered, the data were cleaned, and the reliability test obtained omega coefficients (w) of 0.86 for the PSS questionnaire and 0.82 for the stress-causing factors. The analysis was performed using descriptive statistics and categorical regression. The results show that 54.7% of the students work and study at the same time, which means that the studies are self-financed; on the other hand, they show that "they are often stressed" (47.5%), "from time to time they are stressed" (48.1%) and low percentages in very often they are stressed (3%). The stress-causing variables were 7: connection to classes from a cell phone, insufficient Internet speed, difficulties in taking exams, choppy signal, teachers' regular knowledge of ICT(Information Communication Technology), and students' regular knowledge of ICT. It is concluded that poor management of information technologies and difficulties in accessing technologies cause stress in students.

Keywords: COVID-19, Virtual classes, Stress, Nonface-to-face education, Virtual education

Introduction

In December 2019, an outbreak of a new coronavirus pneumonia called COVID-19 occurred, which was caused by the SARS-COV-2 virus, and the first cases were reported in Wuhan China [1] and began to spread in the country of origin and rapidly throughout the world. To date, 120,042,087 cases and 2,659,118 deaths [2] have been reported on March 13, 2021 (closing date of this research). The rapid growth of the contagion and the consequences of many deaths have generated various problems, including stress, anxiety, depression, and others in medical personnel and the general population [3, 4].

In Peru, as of March 16, 2020, the government ordered mandatory confinement due to the imminent risk of infection by COVID-19. This action generated many difficulties in all productive and nonproductive sectors of the country, one of the most affected by the education sector which had to implement nonface-to-face education at all levels.

In the university context, virtual classes accelerated the use of ICTs in the teaching-learning process but were also accompanied by logistical and equipment difficulties. It is pertinent to mention that the most complex difficulty that education has faced has been solving how to "evaluate" students since many teachers were

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used to doing it in a face-to-face way; thus, they had to be ingenious to use new evaluation strategies [5-7].

One of the major impacts resulting from the COVID-19 pandemic has been the profound change in the teaching-learning process. Teachers and students have moved to teaching and learning from home, with the Internet being the only means of interaction. Online interaction technologies are familiar tools for this generation, but never before have they been so widely used in mass teaching and learning activities.

All these changes have led to the discontinuation of several computer, physics, chemistry, biology, and other laboratories, despite their importance in complementing the experiential learning of students in different courses. Some institutions have seen fit to replace them with virtual laboratories or virtual computer simulations. Likewise, libraries have stopped serving students, teachers, and others and have made it feasible to serve them through the use of virtual libraries.

University teachers, who are essential agents in the teaching-learning process, found the urgent need to significantly modify and adapt their pedagogical practices.

On the other hand, university students come to be the main reason for academic life in a university; moreover, it is said that without students, a university cannot exist, and they also have questions to continue university studies in times of pandemic.

However, despite the difficulties, they had to adapt to record short videos, use simulators, use virtual laboratories, virtual classrooms, and use video conferencing, among others [8-10].

On the other hand, the unprecedented changes in educational practices and the uncertainty created by the pandemic have given rise to the discussion of issues related to people's mental health [11, 12].

Wu, *et al.*, 2009 and Sahu, (2020) indicate that stress, anxiety, and depression, exacerbated by uncertainty, the pursuit of knowledge acquisition, and the intensification of information flow, tend to increase greatly in this process, bringing negative physiological consequences for people's mental and physical health [11, 12].

Aslan and Pekince (2020) conducted a study assessing the opinions of nursing students from three universities in Turkey (Inonu, Kilis, and Bingol) on COVID-19 and their perceived stress levels [13]. A cross-sectional study was used with a sample of 662 students, and data were collected by filling out the Perceived Stress Scale (PSS) survey form. It was concluded that students perceived moderate stress but that these results were higher than those in previous years. An average of 31.69 ± 7.4 was obtained in the PSS questionnaire.

AlAteeq, Aljhani and AlEesa (2020) explored the level of perceived stress among students during the outbreak of coronavirus disease and the suspension of face-to-face teaching in Saudi Arabia [14]. The study is cross-sectional and was conducted on 367 students. They were administered Sheldon Cohen's Perceived Stress Scale Test (PSS), 55% had moderate levels of stress and 30.2% had high levels of stress.

Pérez, Gómez, Tamayo, Iparraguirre, and Besteiro (2020) conducted a study that seeks to determine the psychological manifestations in medical students during COVID-19 research under a quantitative, observational, descriptive, and transversal design in 59 medical students belonging to the Municipal Headquarters of Medical Sciences of the municipality of Gibara, Holguín province, using psychological tests [15]; the stress vulnerability test, BECK depression inventory (BDI), BECK anxiety inventory (BAI), BECK suicidal ideation scale (SIS) and Eysenck personality test (EPY) concluded that stress vulnerability as a symptom was not present in 83.0% of the students, probable and established anxiety was found in 28.8% and 18.6%, absent or minimal depression predominated in 56 students (86.4%), and only one presented suicidal ideation.

Lovón and Cisneros (2020) seek to analyze the repercussions on the mental health of students at the Pontificia Universidad Católica del Perú [16]. For this purpose, they collect the perceptions of a sample of 74 students from the Faculty of General Studies Letters. The methodology used was a mixed approach, which combines quantitative with qualitative approaches. It is concluded that the problems that cause repercussions on mental health are adaptive, i.e., temporary, and the typical conditions of students who have adequate technological resources, which help them to adapt and overcome their difficulties quickly.

Aslan and Pekince (2020) sought to assess nursing students' views on the COVID-19 pandemic and their stress levels. The research was conducted on 662 students using a cross-sectional design, and the results indicated that age, gender, and some variables related to the pandemic process affect perceived stress levels.

In this work, we consider students from four universities in Peru as a case study: Universidad Nacional Micaela Bastidas de Apurímac (UNAMBA), Universidad Nacional de San Antonio Abad del Cusco (UNSAAC), Universidad Nacional José María Arguedas (UNAJMA) and Universidad Nacional del Altiplano de Puno (UNA). We briefly describe the academic context during the pandemic which was the objective of the study.

The academic context of the Universidad Nacional Micaela Bastidas de Apurímac (UNAMBA) academic sessions in the 2020-I semester was held from July 15 to November 14, 2020, and in the 2020-II semester from December 7, 2020, to April 2, 2021. The student population enrolled in 2020-II was 3,624, and chips were acquired for all students of the 12 professional schools of the Abancay headquarters and branches. UNAMBA opted to use Google Gsuite's free educational services (Drive, Gmail, Classroom, Meet, etc.) to guarantee the relevance and security of the services. One of the difficulties for the development of the sessions is that teachers and students sometimes lost connectivity due to the low transmission signal of the data plan and that in some places they have 2G or 3G, the rugged geography of hills, valleys, and ravines of the Apurimac Region, this time was a limiting factor for good communication. On the other hand, teachers have had difficulty adapting to the new teaching context using the concepts of synchronous and asynchronous teaching, but the most notorious difficulty for most of them was "evaluation".

The National University of San Antonio Abad del Cusco (UNSAAC) planned to start the 2020-I academic semester on April 20, 2020; however, due to the difficulties caused by the

health emergency caused by COVID-19, the semester started on July 3 and ended on November 13. The 2020-II semester began on November 23 and ended on March 12, 2021; additionally, the new entrants began work on January 18 and will end on May 14, 2021. It should be noted that due to the health emergency, several students have returned to their districts and provinces where they do not have adequate internet access, and in many cases, they can only access virtual classes through their cell phones. During this period, the university made two acquisitions of connectivity devices, the first of 7343 chips to provide to students who were considered vulnerable to the health emergency and the second of 8418 modems for teachers and students, through Emergency Decree 107. Of this amount, 1265 were delivered to teachers. Despite the delivery of these supplies, students reported difficulties since this equipment had poor connectivity in some areas, making it difficult for them to attend classes.

The Universidad Nacional José María Arguedas (UNAJMA) was supposed to start the 2020-I semester on May 4, 2020; however, due to connectivity problems and poor access to virtual sessions for students, there was a 20-day pause to train students and teachers, so the semester started on May 25 and ended on September 15, 2020. The 2020-II semester began on October 19, 2020, and ended on February 15, 2021. A total of 1746 students were enrolled, and there was a dropout of 85 students. In the 2020-I semester, 1400 chips were acquired and 1300 chips were delivered to students (100 were not picked up by students); also, the office of the System for Targeting Households in Poverty and Extreme Poverty (SISFO) provided a list of beneficiaries students to provide them with computer equipment, whose delivery was made to each one in their homes approximately 600 pieces of equipment. In the 2020-II semester, an additional 120 chips were delivered only to the beneficiary students, whose list was provided by SISFO. The problem presented at the beginning of the 2020-I semester was the lack of internet connectivity since most of the students live in rural areas, and due to the geography of the province of Andahuaylas, there was no internet signal, as well as the limited number of gigabytes for their virtual classes. Finally, there were stress, visual and ergonomic problems. In the 2020-II semester, students had stress and poor ergonomic posture problems.

At the Universidad Nacional del Altiplano de Puno (UNA), the virtual academic sessions of the first semester started on June 01, 2020, and concluded on October 02, 2020, and the second semester started on October 19, 2020, and concluded on February 12, 2020. In the first semester, the Moodle platform was used, and in the second semester, the Lauracia platform was used. For the video conference sessions, different platforms were used, such as Google Meet, Jitsi, Webex, and Zoom. A university chip has been acquired for 6,000 students (approximately 30%) and a wireless modem for all teachers. Prior to the start of the remote activities, training was scheduled for teachers and students on how to use and access the different platforms mentioned above.

Regarding stress

For this study, the concepts of stress were taken from (Lazarus and Folkman), who conceptualize that stress occurs when the person values what is happening as something that exceeds the resources available to him/her and endangers his/her well-being. In addition, there is the cognitive evaluation made by the subject, and the emotional element involved in this situation is taken into account.

Another definition indicates that stress is a state of disharmony or a threat to homeostasis. The adaptive response can be specific or nonspecific (generalized). Thus, a disturbance in homeostasis results in a cascade of physiological and behavioral responses to restore the homeostatic balance idea [17].

Dr. (Bruni,2020) PAHO/WHO mental health and substance use advisor in Peru explained that "Stress is a very common response in emergency and COVID-19 situations and that some of the vulnerable groups in mental health are health workers, people infected or recovering from COVID-19, their family members and caregivers, older adults, people with mental disorders and substance use situation, people living in violence".

The Ministry of Health of the Government of El Salvador (2020) divides the symptoms into three main human responses to stress (look for a relationship with an applied questionnaire) [18]:

- At the cognitive-subjective level: worry, insecurity, difficulty in making decisions, fear, negative thoughts about oneself and about the way we act toward others, fear of losing control, difficulties in thinking, studying, and/or concentrating.
- At the physiological level: sweating, muscle tension, palpitations, tachycardia, trembling hands, gastrointestinal discomfort, dry mouth, headaches, dizziness, nausea, shivering sensation, etc.
- At the motor level: crying, smoking, excessive eating or drinking, motor restlessness, stuttering, paralysis, etc.

Given the situation we have been going through with the global health emergency, various institutions have sought to find strategies to help the population cope during this time. Both the World Health Organization and the Pan American Health Organization state that taking care of mental health and psychosocial well-being in times of emergency is as important as taking care of physical health. The current emergency could trigger mental health problems in a proportion of the population [19].

Categorical regression

Categorical regression quantifies categorical data by assigning numerical values to categories and obtaining an optimal linear regression equation for the transformed variables. Categorical regression is also known by the acronym CATREG. Ordinary linear regression analysis involves minimizing the sum of squares differences between a response (dependent) variable and a weighted combination of predictor (independent) variables. The variables are usually quantitative, with the categorical (nominal) data recoded as binary or contrast variables. As a result, the

categorical variables serve to separate groups of cases, and the technique estimates separate sets of parameters for each group. The estimated coefficients reflect how changes in the predictors affect the response.

For this reason, the objective under which this research was conducted was to determine the factors that influence the development of stress in college students in nonface-to-face classes during the COVID-19 pandemic. Knowing the influencing factors implies foreseeing the future incidence of stress in university students as well as taking into account adequate computer infrastructure since we were not prepared for this situation and many teachers and students were accommodated during the development of the pandemic.

Materials and Methods

The design under which this research was conducted is a nonexperimental design and descriptive correlational research type because it seeks the influence of the independent variables on the dependent variable (stress). The sample consisted of 570 university students enrolled during the period of social isolation due to the COVID-19 pandemic, distributed as follows: Universidad Nacional Micaela Bastidas de Apurímac (179), Universidad Nacional de San Antonio Abad del Cusco (133), Universidad Nacional José María Arguedas (133), and Universidad Nacional del Altiplano (125), all with campuses in southern Peru.

Instruments

PSS Questionnaire for measuring stress

Among the many instruments for measuring stress, the Perceived Stress Scale (PSS) of [20], which consists of 14 items in its original version and 10 items in its summarized version as **Table 1**, was selected for this research. The abridged version with 10 items was used, obtaining an omega reliability coefficient (w) of 0.82.

Table 1. Perceived Stress Scale PSS

Items	Never	Rarely	Occasionally	Frequently	Very Frequently
1. In the last month, how often have you been affected by something that happened unexpectedly?	0	1	2	3	4
2. In the past month, how often have you felt unable to control the important things in your life?	0	1	2	3	4
3. In the last month, how often have you felt nervous or stressed?	0	1	2	3	4
4. In the last month, how often have you successfully handled life's small irritating problems?	0	1	2	3	4
5. In the past month, how often have you been confident about your ability to handle your problems?	0	1	2	3	4
6. In the last month, how often have you felt that things are going well for you?	0	1	2	3	4
7. In the last month, how often have you felt that you could not cope with all the things you had to do?	0	1	2	3	4
8. In the last month, how often have you been able to control the difficulties in your life?	0	1	2	3	4
9. In the last month, how often have you felt that you had everything under control?	0	1	2	3	4
10. In the last month, how often have you felt that difficulties were piling up so much that you could not overcome them?	0	1	2	3	4

To questions 1, 2, 3, 6, 7, 9, and 10, the following scores are applied: never (0), rarely (1), occasionally (2), frequently (3), and very frequently (4). For questions 4, 5, 7, and 8, the scores are applied inversely, as follows: never (4), rarely (3), from time to time (2), frequently (1), and very frequently (0). All the scores are then added up, and the result is compared with **Table 2** to determine the value of perceived stress:

Table 2. Table to establish perceived stress levels

Score	Stress Level
0 to 10	Hardly ever or ever stressed
11 to 20	Occasionally stressed
21 to 30	Frequently stressed
31 to 40	Very frequently stressed

There are 21 preselected factors to see the influence on stress

There were 21 preselected factors that possibly influenced students' stress: 1) gender, 2) age, number of children, 3) marital status, 4) if besides studying you work, 5) way of internet connection, 6) way of internet payment, 7) if you consider sufficient the amount of GB you have monthly, 8) computer equipment to establish communication with virtual classes, 9) speed of internet uploading and downloading, 10) level of knowledge about the use of ICT tools, 11) difficulties to prepare works due to lack of internet, 12) difficulties in preparing assignments due to lack of computer, 13) difficulties in taking exams, 15) timely delivery of assignments, 16) difficulties in connecting to classes, 17) Internet online failures, 18) teacher's Internet online failures, 19) teachers' knowledge of ICT tools, 20) teachers' preparation of classes, 21) technical problems on the part of the university. The reliability of the instrument using the omega statistic (w) was 0.86.

Data analysis

Before analyzing the data, they were cleaned using free software such as the R programming language, which made it possible to detect missing data and outliers; in the factors with missing data that did not exceed 2%, information was imputed with the nearest neighbor technique. The reliability of the instruments was determined utilizing the omega coefficient (w) and construct validity using confirmatory factor analysis, obtaining valid and reliable instruments. The statistical analysis was performed by descriptive statistics using percentages and figures that allow the presentation of qualitative data. To establish the significant variables influencing stress, the categorical regression technique used for qualitative variables was used.

Procedure

To achieve the research objective, the following steps were followed:

a. First, the use of the Perceived Stress Scale instrument with 10 items was defined as a basis to understand the type of stress perceived in students during the COVID-19 pandemic (dependent variable).
b. Initially, 21 factors that can cause stress (independent variables) were established.
c. The web form was designed using Google Forms.
d. Teachers were sensitized to facilitate the application of the instruments via the web.
e. The database was cleaned using R software, and the KNN statistical technique was used to impute missing data.
f. The reliability test of the instruments was carried out with the omega statistic (ω), obtaining a coefficient of 0.86 for the Perceived Stress Scale questionnaire and 0.82 for the stress-causing factors; the validity was carried out using the descriptive and confirmatory factor analysis technique.
g. The statistical analysis was carried out using descriptive statistics, and the influential variables were selected using categorical regression because they were qualitative factors.

Results and Discussion

Stress level results

The results of the stress level of the universities under study are shown in **Figures 1a-1d**: the percentages of the perceived stress level are very similar, predominating the item "They are frequently stressed with the following percentages; UNSAAC with 68.4%, UNA 56.0%, UNAJMA 60. The item "They are occasionally stressed" shows the following percentages: UNSAAC with 29.3%, UNA 37.6%, UNAJMA with 33.8%, and UNAMBA 38.0%. The other items under study do not show significant frequencies ("rarely they are stressed and very frequently they are stressed").

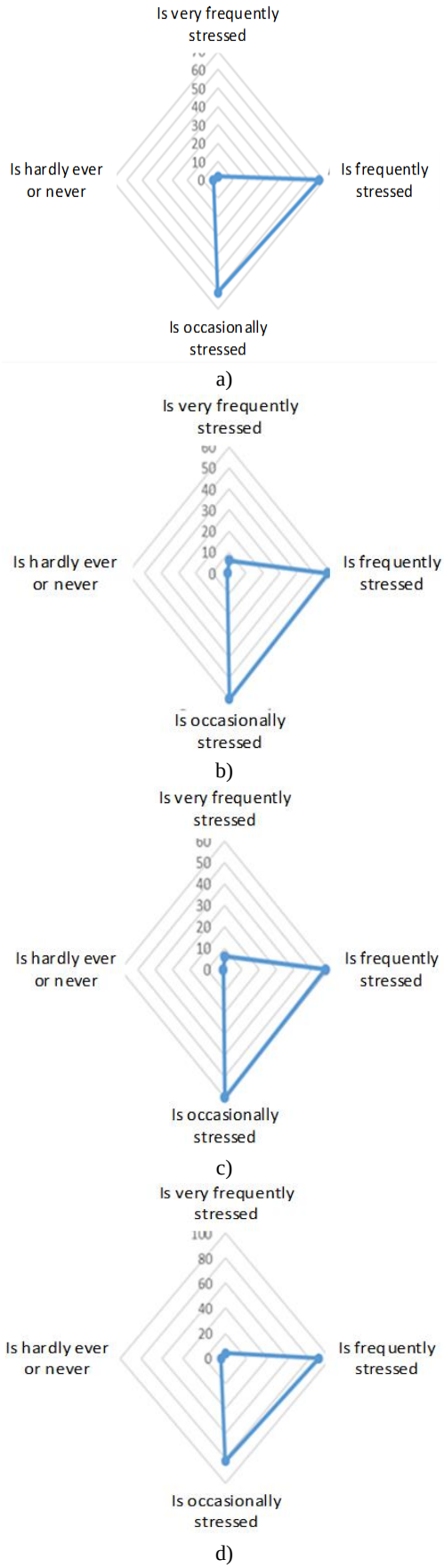

Figure 1. Stress levels of the different universities: a) stress level of UNSAAC students, b) stress level of UNA students, c) stress level of UNAJMA students, and d) stress level of UNAMBA students.

Influencing factors

Of the 21 factors preselected as influencing factors, the significant influencing factors toward stress are shown in **Table 3**. To establish the variables that determine stress in university students, a statistical technique called categorical regression was used

Table 3. Results of the categorical regression. Significant factors that determine stress in university students

	Coefficients				
	Standardized coefficients	standard error			
	Beta		gl	F	Sig.
Connecting to classes from a cell phone	-0.095	0.051	3	3.470	0.016
You consider the amount of GB sufficient	-0.013	0.048	2	0.073	0.042
The speed of upload and download	-0.028	0.193	1	0.021	0.035
Difficulty in taking my exams	-0.161	0.073	3	4.828	0.003
I listen to lectures in a choppy way	-0.150	0.091	2	2.720	0.047
You consider that the teachers do not know the ICT tools	0.164	0.077	3	4.472	0.004
Inadequate level of knowledge about the use of ICT	0.103	0.070	1	2.168	0.010

Dependent variable: Stress level with a coefficient of determination of 30% with a significant ANVA test p(0.000)< α(0.05)

If the most important variables causing stress were discriminated by the statistical technique of categorical regression, then of the 21 variables, the categorical regression determined the 7 most influential variables of stress: 1) Connection to classes from a cell phone, 2) Do you consider the amount of GB sufficient, 3) The speed of uploading and downloading, 4) Difficulties in taking my exams, 5) I listen to the classes in a choppy way, 6) They consider that teachers do not know the ICT tools and 7) Inadequate level of knowledge about the use of ICT.

The cell phone can be used as a mediator or it can facilitate learning in a limited way because it does not have technical specifications, as is the case of a computer. Likewise, economic limitations allow contracting limited internet services that directly affect students' learning since when they connect to the network, they perceive problems in taking exams, doing homework, listening to classes, and not being able to consolidate learning.

Table 4 shows the stress levels broken down comparatively by the university.

Table 4. Frequency of stress level of the different universities under study

Stress level	UNSAAC		UNA		UNAJMA		UNAMBA		Total	
	f	%	f	%	F	%	f	%	F	%
Very frequently stressed	2	1.5	6	4.8	5	3.8	4	2.2	17	3.0
Frequently stressed	67	50.4	58	46.4	57	42.9	89	49.7	271	47.5
Occasionally stressed	61	45.9	60	48	71	53.4	82	45.8	274	48.1
Hardly ever or ever stressed	3	2.3	1	0.8	0	0	4	2.2	8	1.4

The levels of stress shown by the students of the 4 universities are similar, with the items "often stressed" and "occasionally stressed" predominating.

In this regard, Lazarus and Folkman (1986) conceptualize that stress occurs when people value what is happening as something that exceeds their resources and endangers their well-being [21]. The variables that determine the level of stress in students of the universities under study are precisely linked to this concept since not having enough GB to connect, the general use of cell phones to listen to classes, the speed of uploading and downloading files, listening to classes with choppy audio, problems taking exams and doing work, and the regular knowledge of ICTs affect their interests as students and the ideal development of classes.

Stress causes, worry, insecurity, negative thinking, and mainly difficulty thinking and studying are indicated by Dr. Andrea Bruni's (2020) mental health and substance use advisor of PAHO/WHO in Peru [22]. Likewise, on stress (Reinoso and Beltrán cited in Espinosa, Hernández, Rodríguez, Chacín and Bermúdez, 2020) [23], there is an inverse tendency between academic performance and stress; that is, a lower level of academic performance corresponds to a higher stress score, and a moderate level of stress presents good or superior academic performance. For university students, they conclude that low academic performance is due to medium and high levels of stress. We agree with these authors since the factors found in the present studies, such as lack of knowledge of communication technologies and limitations in internet access, cause stress, which directly affects the academic performance of students.

On the other hand, studies previously conducted by Pericacho *et al.*, Sanchez, and Ariza. comment on the change in the way of teaching by teachers since many of them were not prepared for this sudden change, indeed, the results indicate that teachers were not prepared for the use of information and communication technologies and the use of video conferencing platforms and others, which also contributed to student stress.

Aslan, Pekince and AlAteeq *et al.* conclude in general that the level of stress is moderate and that 55% showed moderate levels of stress and 30.2% registered a high level of stress, reaching 85.2% of stressed students. The results of this study show similar results with percentages in the indicators "often stressed" (47.5%) and "occasionally stressed" (48.1%). Low percentages are observed in very often stressed (3%) and in the item rarely or never stressed (1.4%).

Alemany, Rojas, Granda, and Mingorance (2020) reveal that e-learning stress negatively affects academic self-efficacy, a result consistent with the findings that indicate a high-stress index in college students [24]; likewise, previous studies had already shown that students taking online classes had experienced negative emotions such as anxiety and stress during the COVID-19 pandemic, [25, 26]. Other studies have also shown that perfectionist concerns such as acculturative stress directly affect academic self-knowledge. In addition to the stress caused by e-learning, ShinHi Han, Ph.D., RN1, Koun Eum, Ph.D., Hee Sun Kang, and Kathleen Karsten, Ph.D., RN1 (2022), precisely the results indicate that virtual classes due to the pandemic and other factors have contributed to the development of stress in college students many times, resulting in low academic performance [27].

Vergara, Anton and Fernandez (2022) conclude that the stress caused by the pandemic caused by COVID-19 is higher in digital native teachers than in digital migrant teachers [28]. Digital migrant teachers ultimately demonstrate greater self-confidence, and this issue is very important because one of the variables found in our research is that it significantly influences the development of stress such that teachers do not know the use of technological tools, more specifically ICT tools, which has led to a significant influence on the development of stress.

On the other hand, Aslan and Pekince concluded that students perceive moderate stress but that these results were higher than in previous years, for which they used the same questionnaire of the present research (PSS). The increase in stress presented in the present research may be due to the pandemic, as indicated by Aslan and Pekince, due to the significant factors linked to the use of technologies, internet access, and the lack of economic resources to hire internet services with unlimited data plans that are necessary to conduct video conference classes and online sessions.

Conclusion

It is concluded that the COVID-19 pandemic has changed teachers' way of teaching and students' way of learning; both had to interact from home, and the only means of communication was the Internet. Teachers and students have not been prepared to start "nonface-to-face" classes, and the adaptation to them took time. On the other hand, teachers had to rethink the teaching methodology, adapting to the use of video conference platforms, virtual classrooms, and communication networks, as well as the method of evaluation.

Another important factor is that 54.7% of students work and study at the same time, which means that studies are self-financed and study time is limited, negatively affecting the learning of university students.

On the other hand, the most predominant levels of stress in university students are as follows: "They are often stressed" (47.5%) and "from time to time they are stressed" (48. 1%) and low percentages are observed in very often they are stressed (3%) and this is generated by the following variables: connection to classes from a cell phone, insufficient Giga Bits to connect to virtual classes, insufficient speed for uploading and downloading files, difficulties to take exams because the signal is repeatedly interrupted, lack of knowledge of the use of Information and Communication Technologies by teachers and students.

Finally, it is concluded that the most influential stress variables are Connection to classes from cell phones, You consider the amount of GB sufficient, The speed of uploading and downloading, Difficulty in taking my exams, Classes are choppy, you consider that teachers do not know the ICT tools and Inadequate level of knowledge about the use of ICT.

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References

1. Chen Q, Liang M, Li Y, Guo J, Fei D, Wang L, et al. Mental health care for medical staff in China during the COVID-19 outbreak. Lancet Psychiatry. 2020;7(4):e15-6. doi:10.1016/S2215-0366(20)30078-X
2. Worldometers, American Library Association (ALA). an international team of developers, researchers, and volunteers with the goal of making world statistics available in a thought-provoking and time-relevant format to a wide audience around the world. 2021. Available from: https://www.worldometers.info/coronavirus/. [Accessed: 13-Mar-2021].
3. Ozamiz-Etxebarria N, Dosil-Santamaria M, Picaza-Gorrochategui M, Idoiaga-Mondragon N. Niveles de estrés, ansiedad y depresión en la primera fase del brote del

COVID-19 en una muestra recogida en el norte de España. Cad Saúde Pública. 2020;36(4):e00054020.

4. Liu S, Yang L, Zhang C, Xiang YT, Liu Z, Hu S, et al. Online mental health services in China during the COVID-19 outbreak. Lancet Psychiatry. 2020;7(4):e17-8. doi:10.1016/S2215-0366(20)30077-8
5. Costa MJ, Carvalho-Filho M. Una nueva época para la educación médica después de la COVID-19. FEM: Rev Fund Educ Médica. 2020;23(2):55-7. Available from: https://scielo.isciii.es/scielo.php?script=sci_arttext&pid=S2014-98322020000200001
6. Avila-Ballesteros FG, González-Pérez JA. Reinvención de la educación presencial frente a Pandemia del Covid-19. Trabajo de Grado. Universidad Católica de Colombia. Facultad de Ciencias Económicas y Administrativas. Programa de Economía. Especialización en Administración Financiera. Bogotá, Colombia. 2020. Available from: https://hdl.handle.net/10983/24643
7. Martin MV, Vestfrid P. Reinventar la enseñanza en tiempos de COVID-19. InIII Jornadas sobre las Prácticas Docentes en la Universidad Pública (Edición en línea, junio de 2020) 2020. Available from: http://sedici.unlp.edu.ar/bitstream/handle/10915/105847/Documento_completo.pdf?sequence=1&isAllowed=y+
8. Pericacho M, Rosado JA, de Villanueva JP, Arbea L. Experiencias de Docencia Virtual en Facultades de Medicina Españolas durante la pandemia COVID-19 (I): Anatomía, Fisiología, Fisiopatología, Oncología. Rev Esp Educ Méd. 2020;1(1):32-9. doi:10.6018/edumed.424931
9. Sánchez S, Ariza A. Educación quirúrgica en Colombia en la era del COVID-19. Rev Colomb Cir. 2020;35(2):250-5. doi:10.30944/20117582.631
10. Puentes AY, Vargas EE, Barrera RH. Laboratorios virtuales para la enseñanza de la química: una oportunidad para avanzar. Simp Sul-Am Pesqui Ensino Ciênc. 2020;(1). Available from: https://portaleventos.uffs.edu.br/index.php/SSAPEC/issue/view/114
11. Wu P, Fang Y, Guan Z, Fan B, Kong J, Yao Z, et al. The psychological impact of the SARS epidemic on hospital employees in China: exposure, risk perception, and altruistic acceptance of risk. Can J Psychiatry. 2009;54(5):302-11. doi:10.1177/070674370905400504
12. Sahu P. Closure of universities due to coronavirus disease 2019 (COVID-19): impact on education and mental health of students and academic staff. Cureus. 2020;12(4):e7541. doi:10.7759/cureus.7541
13. Aslan H, Pekince H. Nursing students' views on the COVID-19 pandemic and their percieved stress levels. Perspect Psychiatr Care. 2021;57(2):695-701. doi:10.1111/ppc.12597
14. AlAteeq DA, Aljhani S, AlEesa D. Perceived stress among students in virtual classrooms during the COVID-19 outbreak in KSA. J Taibah Univ Med Sci. 2020;15(5):398-403. doi:10.1016/j.jtumed.2020.07.004
15. Pérez Abreu MR, Gómez Tejeda JJ, Tamayo Velázquez O, Iparraguirre Tamayo AE, Besteiro Arjona ED. Alteraciones psicológicas en estudiantes de medicina durante la pesquisa activa de la COVID-19. Medisan. 2020;24(4):537-48. Available from: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1029-30192020000400537&lng=es&tlng=es.
16. Cueva MA, Terrones SA. Repercusiones de las clases virtuales en los estudiantes universitarios en el contexto de la cuarentena por COVID-19: El caso de la PUCP. Propós represent. 2020;8(3):28. doi:10.20511/pyr2020.v8nSPE3.588
17. Chrousos GP, Gold PW. The concepts of stress and stress system disorders: overview of physical and behavioral homeostasis. Jama. 1992;267(9):1244-52.
18. Ministerio Salud El Salvador. Manejo de estres: talento humano en salud. 2020. [Online]. Available from: https://w5.salud.gob.sv/archivos/pdf/seguridad_ocupacional_2016_presentaciones/presentacion09082016/MANEJO-DEL-ESTRES-TALENTO-HUMANO-EN-SALUD.pdf
19. PAHO. Cuidado y autocuidado de la salud mental en tiempos de COVID-19. Organ Panam Salud, 2020. Available from: https://www.paho.org/es/respuesta-emergencia-por-covid-19-peru/cuidado-autocuidado-salud-mental-tiempos-covid-19
20. Cohen S, Kamarck T, Mermelstein R. Perceived stress scale. Measuring stress: A guide for health and social scientists. 1994;10:1-2. Available from: https://www.mindgarden.com/documents/PerceivedStressScale.pdf
21. Lazarus RS, Folkman S. Estrés y procesos cognitivos. Ed. Martínez-Roca; 1986. Available from: http://ftp.isdi.co.cu/Docencia/Pregrado/Dise%C3%B1o.de.Comunicaci%C3%B3n.Visual/2do.A%C3%B1o/1er.Semestre/05%20Psicolog%C3%ADa/Bibliograf%C3%ADa/4.%20Procesos%20Afectivos/BIBLIOGRAF%C3%8DA/Relaci%C3%B3n%20P.%20Afectivos%20y%20P%20Cognitivos-Estr%C3%A9s%20y%20Procesos%20Coginitivos-Richard%20Lazarus.pdf
22. Bruni A. Organizan taller sobre recomendaciones para primeros auxilios psicológicos durante la pandemia de COVID-19. Organizacion Panamericana de la Salud. 2020.
23. Espinosa-Castro J-F, Hernández-Lalinde J, Rodríguez JE, Chacín M, Bermúdez-Pirela V. Influencia del estrés sobre el rendimiento académico. Avft-Arch Venez Farmacol Ter. 2020;V39(n1):63-9. doi:10.5281/zenodo.4065032
24. Alemany-Arrebola I, Rojas-Ruiz G, Granda-Vera J, Mingorance-Estrada ÁC. Influence of COVID-19 on the perception of academic self-efficacy, state anxiety, and trait anxiety in college students. Front Psychol. 2020;11:570017. doi:10.3389/fpsyg.2020.570017

25. Fawaz M, Samaha A. E-learning: Depression, anxiety, and stress symptomatology among Lebanese university students during COVID-19 quarantine. Nurs Forum. 2021;56(1):52-7. doi:10.1111/nuf.12521
26. Gallego-Gómez JI, Campillo-Cano M, Carrión-Martínez A, Balanza S, Rodríguez-González-Moro MT, Simonelli-Muñoz AJ, et al. The COVID-19 pandemic and its impact on homebound nursing students. Int J Environ Res Public Health. 2020;17(20):7383. doi:10.3390/ijerph17207383
27. Han S, Eum K, Kang HS, Karsten K. Factors Influencing Academic Self-Efficacy Among Nursing Students During COVID-19: A Path Analysis. J Transcult Nurs. 2022;33(2):239-45. doi:10.1177/10436596211061683
28. Vergara-Rodríguez D, Antón-Sancho Á, Fernández-Arias P. Variables influencing professors' adaptation to digital learning environments during the COVID-19 pandemic. Int J Environ Res Public Health. 2022;19(6):3732. doi:10.3390/ijerph19063732