Article

Emergency Remote Education Satisfaction during COVID-19 at a Public University in Central Andes, Peru with Low Resources and Little Online Teaching Experience

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Abstract

Emergency measures to continue university activities during COVID-19 have affected student performance and satisfaction, especially in regions with scarce resources and little experience in virtual education. Online education is a new process for most universities in the interior of Peru, where digital transformation was null or incipient, affecting the learning effectiveness. The current research is based on a survey conducted in February 2021 in order to evaluate students' perception about the quality of emergency remote learning measures introduced during the pandemic in 2020. The survey was distributed through the institutional emails of students and the responses were collected anonymously, following a systematic sampling. A total of 1029 respondents representing 38 professional careers of public referent university of the Central Andes of Peru participated in this survey. The survey focused on 28 criteria linked to the didactic, technological and psycho-affective dimensions. It aimed to collect scientific evidence to propose improvements in this pedagogical transition process. Associations between the variables studied were determined with $\chi 2$ tests and Spearman correlations, and to determine the regression coefficients and Odds Ratios of the variables associated with the highest degree of satisfaction with the emergency virtual classes, logistic regression was used. Thirty percent of students showed dissatisfaction, perceiving problems in the design of class materials, feedback, e-learning support, development of practical and laboratory activities, and teaching performance; 25% were satisfied and 45% had a neutral perception. About 30% felt frustrated with their virtual classes. The highest OR for a higher degree of satisfaction fell on the impact of courses for professional training, student care services, support for online learning, and feedback mechanisms. To improve the quality of virtual learning in the post-pandemic period, the study recommends to transform the face-to-face model to a virtual or blended model, taking advantage of the variety of information, and communication to improve the quality of higher education.

Keywords

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The training of professionals for national and global development, whether face-to-face, virtual or mixed, must guarantee conditions of quality, excellence, and equal opportunities (De Metz & Bezuidenhout, 2018; World, 2020). The lack of educational quality leads to dangerous social upheavals, leaving many young people out of the educational system affecting their future (De Siqueira, 2012). The student satisfaction with their educational process must be monitored in any of the educational modalities. During the last 20 years, virtual education has experienced many teaching-learning technologies through flexible and easily accessible platforms, attempting to find the best support for students (Kumar et al., 2020; Sandybayev, 2020). This digital transformation has been maturing since the 1990s Kopp et al. (2019) and many universities have updated their educational models towards e-learning, and launched an online teaching-learning process where the teacher and students are physically and temporally separated, to develop synchronous and asynchronous learning activities (Budd et al., 2020).

The World Health Organization in early March 2020 declared that COVID-19 reached the level of a pandemic, and the entire world must adhere to preventive measures of physical distancing and quarantine. As a result, universities in more than 200 countries with more than 1.6 billion students were physically shut down (Pokhrel & Chhetri, 2021) but continued learning activities remotely (World Bank Group Education, 2020) so that professional training and learning is not interrupted (Chin et al., 2020). It was argued that this sudden change, called emergency remote teaching, should be more sustainable (Adedoyin & Soykan, 2020; Elumalai et al., 2021). It was felt that challenges experienced during the pandemic should be well explored and transformed into opportunities for continuity, sustainability, and resilience, even in the post-pandemic (Mok et al., 2021).

In order to create opportunities for continuity and sustainability, there is a need to develop educational materials, deliver instruction, evaluate and administer the program through online methods (Fry, 2001). Teachers and educational institutions ought to have a comprehensive understanding of the benefits and limitations of the Internet on academic performance. The transition from face-to-face mode to virtual mode must be strategic, establishing trust in the parties involved, especially the students. There is a need to implement a cooperative pedagogy centered on students, to use technological tools for effective learning, and understand students' problems related to online teaching.

The transition from face-to-face mode to virtual teaching continues to be a challenging task. It requires effective interaction of students, selection of a suitable platform for online teaching, and a series of tools to share texts, images, audio, videos and links for students to carry out individual and group activities with efficient communication (Özkan et al., 2020). If not, the performance of end users and their satisfaction can be directly affected. In addition, it is also necessary to facilitate students and teachers with design of audio visual materials, subject content, and complementary material for practical and simulated laboratory activities. The students also need adequate instructions, tutoring and training for navigation and online learning and completing the challenging assessments and exercises. The universities should also ensure easy accessibility and feedback mechanisms, along with IT troubleshooting support. In the absence of these factors, it could cause frustration in students, increase their dropout number and make an impact on the rate of their experience and satisfaction in online learning negatively (Kumar et al., 2020).

It is important to identify the effective factors in the degree of student satisfaction and to overcome some problems to improve the quality of e-learning training. Swan (2001) considers three factors that significantly influence student satisfaction: clarity of design, interaction with tutors, and active discussion among peers. González-Gómez et al. (2012) found that e-learning course satisfaction was influenced by content, tasks, and evaluation. The tutorial function is a relevant element for the success of e-learning solutions, as it is the student's first contact and designs the different curricular elements (content, activities, feedback, and evaluation), and can be a vulnerable link in the educational chain and of great importance for the perception of the quality and attractiveness of e-learning (De Metz & Bezuidenhout, 2018).

Therefore, the research objective of the current study was to examine how students perceive the emergency remote learning developed in the context of the COVID-19 pandemic in 2020. The study also aimed to consider various criteria linked to the didactic, technological, and psycho-affective dimensions perceived by the students in different professional careers in a leading and the largest public university in the central Andes of Peru during 2020. This is perhaps the first study in this region to add value to the existing literature on emergency remote learning. It provides useful insights to the decision-makers of this sector and the academicians to propose improvements in this pedagogical transition process.

Literature Review

- *Emergency remote education*

In the face of the health emergency caused by COVID-19 that began in March 2020, in order not to deprive students of their learning opportunities, various e-learning systems were recommended (Pokhrel & Chhetri, 2021). Various e-learning tools facilitated the development of teaching activities; however, the success of these new models depended on the level of acceptance and the use by users (Almaiah, 2018). On the adoption of e-learning, some research has been done in different countries. An empirical study carried out in Malaysia Almaiah et al. (2016) on a sample of 392 students explore the quality factors of e-learning system. The results identified a few quality indicators such as functionality, accessibility, interactivity, interface design and ease of use of the learning system, besides the quality and usefulness of the information shared. Similar findings were reported in Saudi Arabia, which identified a few success factors for the implementation of e-learning systems such as the quality of the website or the LMS, the technological options, the support of senior management, and technical awareness of e-learning by teachers (Almaiah & Man, 2016; SETYANI et al., 2021).

Salloum et al. (2019) observed that the capacity for innovation, quality, trust, and knowledge sharing are associated with better acceptance of the e-learning system by students. In this regard, Al-Gahtani (2016) identified a few factors that influenced the acceptance of e-learning by students such as lucidity, self-efficacy, and anxiety. Almaiah (2018) explored the critical factors that influenced the use of the emergency e-learning system during the COVID-19 pandemic and reported heterogeneity between universities. After interviewing students and experts in e-learning systems from six universities in Jordan and Saudi Arabia, the study identified critical factors that affected the use of the e-learning system such as technological gadgets, the system quality, and the cultural issues. The main obstacles that prevented the use of the e-learning system were found to be change management, technical problems, and financial support.

These studies opened the door for future work in other regions of the world such as Peru, to identify quality factors in their respective contexts and provide basic information for researchers and planners to design and develop online learning applications in the continuity of the pandemic and subsequent post-pandemic.

- *Low institutional resources and online teaching experience*

In developing and poorer countries, university education has been maintained for decades in the face-to-face mode, with little or no use of online tools. However, due to the health emergency caused by COVID-19, even these countries suddenly had to assume online teaching, forcing themselves for a transition from traditional face-to-face learning to online learning. Their experience of online teaching amidst constraints was totally different from other regions of the world (Abobaker et al., 2021; Marcelo García, 2001; Shah et al., 2021). The education system and educators in these countries adopted "Education in Emergency" slogan and were forced to experiment teaching through various platforms and systems which they were not prepared for (Akula & Singh, 2021; Hernawati et al., 2021; Pokhrel & Chhetri, 2021). University students from low-income areas, such as the interior parts of Peru, faced further difficulties of adapting to a new learning environment, even worse when there was no single pedagogy for online learning. To deal with such issues, students and teachers felt the domino effect of the COVID-19 pandemic. The situation was worse in the absence of organizational resources and lack of previous experience. Moreover, the Peruvian University Law had always prioritized face-to-face learning method due to the lack of resources. For this reason, these universities had little experience of online teaching and of managing virtual teaching tools that guaranteed the educational quality.

- *Impact of Online learning during the pandemic*

Different subjects and age groups required different approaches to online learning prioritizing psychoactive well-being (Doucet et al., 2020). Various studies show that the pandemic caused stress, anxiety, depression, sleep disturbances (Khoma & Vdovychyn, 2021; Lenzo et al., 2020), and an increase in psycho-affective risk factors (van der Velden et al., 2020). During emergency remote teaching many students also suffered psychological and emotional distress and were not able to productively engage in their academic pursuits and the positive practices of online homeschooling remained to be explored (Eberle & Hobrecht, 2021; Hameed & Afzal, 2021). Preventive COVID-19 pandemic measures in the educational community in Peru went on for more than two years. Recently, the Ministry of Education announced a gradual return to face-to-face classes. Eventually, it is now imperative to rescue the factors and experiences that have marked the lives of students and teachers during the contingency, so that they can adapt to this new hybrid normality.

Studies carried out during the pandemic reflect results regarding the technological dimension on the lack of knowledge of the educational use of ICT and the problems of the digital divide in developing countries, with academic and socio-emotional inequalities linked to distractions, teleworking management, and the incorporation of soft skills, such as dialogue, cooperation or caring for the other (Escudero-Nahón, 2021; Heuser, 2021) To assist the online pedagogy, several platforms are available, such as Microsoft Teams, Google Classroom, Canvas, and Blackboard, complemented with Zoom, Chat, video conferences, and OneDrive file storage.

Subedi et al. (2020) assessed the impact of e-learning during the COVID-19 pandemic and surveyed 1116 students from 13 nursing colleges in Nepal and reported that 63% of students were affected by electricity and Internet accessibility issues. Only 64% of them had Internet access and 58% used the mobile phone, finding a significant association between demographic variables with problems in academic activities. However, the study found that e-learning was a good opportunity to continue with education; but in the context of developing countries it was not fully effective unless factors affecting the e-learning process were taken into account.

In the context of the afore-mentioned review, a research gap was identified of finding an answer to the question in the contest of Peru: What are the factors of didactic, technological and psycho-affective dimensions associated with the highest degree of student satisfaction with remote emergency classes? In order to answer this question, the didactic dimensions were picked from the training process such as planning, execution, evaluation, and feedback (Aldoghan, 2021; Moreno Olivos, 2002); the technological dimension included the availability, accessibility, and training of the ICT (Prendes et al., 2020) as well as the availability of robust technology infrastructure; the psycho-affective dimension focused on the emotional well-being and included frustration and the common feeling of missing friends and socializing.

The major research objective of this study was to examine how students rated distance education in a COVID-19 emergency situation; to consider the criteria linked to the didactic, technological and psycho-affective dimensions, in the context of a largest public university in the Central Andes of Peru during the year 2020. The study also aimed to collect information on the experience of the emergency remote education domain in a region and evaluate students' experience of virtual education with scarce logistical and technological resources. This is one of the first studies in this region to adds value to the existing literature on emergency distance education and provide information for decision makers in the sector and the institution to propose improvements in this pedagogical transition process.

Method

- *Sample*

The sample consisted of 1029 students from 38 professional careers, of which 548 (53.3%) were male and 481 (56.7%) females. The sample represented 10% of the student population enrolled in the 2020-II semester, including those who were enrolled in the previous semester. Academic activities for 2020-I semester were held between May 03 and September 6, 2021 and those for the 2020-II semester were held from October 17, 2020 to February 17, 2021.

- *Research Instruments*

The main instrument of this study was a survey questionnaire which was prepared to examine the feasibility of educational technology platforms for virtual education and the perceived quality in the development of subjects. This survey questionnaire included questions on 28 criteria from the existing literature, and which students could evaluate in online learning. Some criteria were borrowed from the University System of Educational Multimodality - SUME of the University of Guanajuato in the context of distance work (Lenzo et al., 2020); while a few were extracted from a report by Kumar et al. (2020). The survey format allowed to know the experience of the students on the quality and satisfaction of emergency distance teaching during the year 2020.

The criteria evaluated in this study are described in the results section, in the item corresponding to the qualification of virtual education during the COVID-19 pandemic. In general, the answers considered scores from 1 to 5, being 1 Very Bad to 5 Very Good; in some cases, the scores corresponded to Strongly Disagree to Strongly Agree. Cronbach's Alpha value for the 28 items of the survey was 0.95 and the values for each item were between 0.94 and 0.96, values that indicate a high reliability of the survey.

- *Procedure*

A descriptive cross-sectional on-line survey was carried out in February 2021 at the largest and oldest university in central Peru, considered by the University Law as a national benchmark university. It is located in Huancayo city, Junín region. The survey was distributed through the institutional emails of the students and the responses were collected anonymously, following a systematic sampling. A total 1029 valid online survey responses were successfully completed. The study complied with the Helsinki ethical guidelines, and the students gave their informed consent to voluntarily participate in the survey and the privacy and confidentiality of the information was respected.

- *Data analysis*

The respondents' data were transferred from MS Excel to SPSS 23 for its descriptive and relational statistical processing in order to demonstrate the attitude of the survey participants with the quality of their studies in the context of the COVID-19 pandemic. Socio-demographic characteristics were shown in percentage values; quantitative variables considered mean values, standard deviation and range. The levels of satisfaction were evaluated by means of a Likert scale, with graphs showing the percentage and relative frequencies of the findings. The associations between the variables studied were determined using $\chi2$ tests with a confidence level of 95%, Spearman correlations. To estimate the regression coefficients and Odds Ratio regarding the higher degree of student satisfaction with their virtual emergency classes, the logistic regression method was used.

Results

- *General characteristics of the evaluated students and enrollment*

The 1029 students surveyed were between 18-37 years of age (22.50 ± 2.82 years). Only 25 students (2.4%) were cohabiting and 1004 (97.6%) were single; 779 students (75.7%) depended financially on their parents and the rest had their own income. The students surveyed were from the 38 professional careers that the university offered, registering the highest number of surveys in Mechanical Engineering students (8.1%), followed by Economics (5.8%), Business Administration, (5.9%), Zootechnics (5.3%), Agronomy (4.9%), Chemical Engineering (4.1%), Industrial Chemical Engineering (4.1%), Food Industries (4%), Architecture (3.8%), Electrical Engineering (3.7%), Accounting (3.6%), Environmental Chemical Engineering (3.6%), Metallurgy and Materials (3.2%), Civil Engineering (3.1%), Anthropology (3.1%), Forest and Environmental Sciences (3%), Nursing (3%), Sociology (2.9%), Mining Engineering (2.4%), Human Medicine (2.3%), Social Work (2.3%), Mathematics (2.1%), Systems Engineering (2%) and Communication Sciences (2%).

Regarding the place of residence, due to the COVID-19 health emergency and the suspension of face-to-face activities, 21% (N=213) had left their residence in districts close to the university and returned to their areas of origin located even in other regions from where they received their classes. Before the pandemic, 87.5% (N=900) of those surveyed lived in Huancayo province and 12.4% (N=129) in other nearby provinces. However, during the pandemic 64.3% (N=662) remained in Huancayo province, and 35.7% (N=367) were from other provinces where they faced the greatest difficulties in accessing the network. In this case, 36% (N=370) of students received a cell phone with unlimited Internet service and 64% (N=659) did not receive this support and assumed their own technology costs to support their virtual classes.

The number of enrolled students had a sharp decrease in the 2020-II semester, with a clear recovery for 2021-I (Table 1). If the number of enrolled in semester 2018-I (100%) is taken as a basis, for semester 2020-II, enrollment was reduced by 7.8%. For the 2020-II semester, students registered their enrollment after the quarantine measures, social distancing and adverse effects caused by the COVID-19 pandemic, registering a further significant decrease in student enrollment.

Table 1: *Number of students enrolled before and during the pandemic*

Academic semester	Enrolled students	Percentage	Percentage difference
2018-I	11160	100.0*	-
2018-II	11148	99.9	-0.1
2019-I	11466	102.7	2.7
2019-II	11361	101.8	1.8
2020-I	11213	100.5	0.5
2020-II	10294	92.2	-7.8
2021-I	11005	98.6	-1,4

* The percentages have been determined considering the 2018-I semester as a base.

- *Students' qualification and satisfaction grade of emergency remote education*
  For 28 criteria evaluated in this study (Table 2), the greatest concern of the students regarding the classes which developed during the pandemic, was the poor and deficient development of practical and laboratory activities (25.9 + 28.5 = 54.4%), permanent Internet accessibility (16.9 + 26.4 = 43.3%), personal equipment & technology (11.2 + 25-6 = 36.8%), motivation level (8.6 + 24.8 = 33.4%), training and tutoring (10.8 + 20.4 = 31.2%), physical space availability at home for virtual learning (9.4 + 21.6 = 31%), learner services (9.2 + 21.7 = 30.9%) and design of materials for classes (8.1 + 22.2 = 20.3%).

Table 2. *Rating of virtual education during the COVID-19 pandemic*

Item	Qualification grade: n (%)				
	Very deficient	Deficient	Regular	Good	Very good
Meaningful interactivity	52 (5.1)	159 (15.5)	550 (53.4)	236 (22.9)	32 (3.1)
Design of materials	83 (8.1)	228 (22.2)	462 (44.9)	234 (22.7)	22 (2.1)
Motivation level	88 (8.6)	255 (24.8)	455 (44.2)	207 (20.1)	24 (2.3)
Assessments & exercises	46 (4.5)	171 (16.6)	541 (52.6)	235 (22.8)	36 (3.5)
Feedback mechanisms	63 (6.1)	202 (19.6)	505 (49.1)	225 (21.9)	34 (3.3)
Relevance of content	33 (3.2)	140 (13.6)	488 (47.4)	328 (31.9)	40 (3.9)
Number of topics per classes	42 (4.1)	134 (13.0)	473 (46.0)	313 (30.4)	67 (6.5)
Adequate use of audio-visual elements	62 (6.0)	200 (19.4)	462 (44.9)	256 (24.9)	49 (4.8)
Use of complementary materials	33 (3.2)	127 (12.3)	406 (39.5)	372 (36.2)	91 (8.8)
Easy navigation on the virtual platform	56 (5.4)	196 (19.0)	449 (43.6)	286 (27.8)	42 (4.1)
Previous instructions for courses development	47 (4.6)	165 (16.0)	453 (44.0)	322 (31.3)	42 (4.1)
Online learning support	79 (7.7)	222 (21.6)	459 (44.6)	238 (23.1)	31 (3.0)
Permanent Internet accessibility	174 (16.9)	272 (26.4)	349 (33.9)	192 (18.7)	42 (4.1)
Personal equipment & technology	115 (11.2)	263 (25.6)	430 (41.8)	192 (18.7)	29 (2.8)
Online learning experience qualification	80 (7.8)	192 (18.7)	515 (50.0)	219 (21.3)	23 (2.2)
Learner services (Chat, E-mail, WhatsApp)	95 (9.2)	223 (21.7)	461 (44.8)	216 (21.0)	34 (3.3)
Adequate distribution of subjects	29 (2.8)	115 (11.2)	512 (49.8)	339 (32.9)	34 (3.3)
Adequate class time	64 (6.2)	141 (13.7)	423 (41.1)	328 (31.9)	71 (7.1)
Physical space availability for classes	97 (9.4)	222 (21.6)	433 (42.1)	225 (21.9)	52 (5.1)
Training and tutoring	111 (10.8)	210 (20.4)	451 (43.8)	222 (21.6)	35 (3.4)
Practices & laboratory	267 (25.9)	293 (28.5)	333 (32.4)	124 (12.1)	12 (1.2)
Time for learning activities	75 (7.3)	199 (19.3)	512 (49.8)	212 (20.6)	31 (3.0)
Collaborative work among students	78 (7.6)	193 (18.2)	450 (43.7)	263 (25.6)	45 (4.4)
Impact courses on professional training	57 (5.5)	147 (14.39	495 (48.1)	288 (28.0)	42 (4.1)
Teaching performance in online teaching	49 (4.8)	158 (15.4)	472 (45.9)	292 (28.4)	58 (5.6)
Satisfaction rating with online classes	113 (11.0)	197 (19.1)	463 (45.0)	227 (22.1)	29 (2.8)
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Frustration	155 (15.1)	143 (13.9)	239 (23.2)	245 (23.8)	247 (24.0)
Common sentiment: missing friends & socializing	35 (3.4)	79 (7.7)	270 (26.2)	298 (29.0)	347 (33.7)

The situation caused students to have 30.1% dissatisfaction with the emergency virtual academic activities developed during the pandemic, and the most worrying factor was the high level of frustration (23.8 + 24.0 = 47.8%) which, in some cases, made students think to drop out of online studies. They also had a common feeling of missing friends and working together in face-to-face classes before the pandemic (29.0 + 33.7 = 62.7%).

The comparison between the criteria of the study with the accumulated percentage of the degree of satisfaction "good" and "very good" is depicted in Table 3.

Table 3. *Relationship between the evaluated criteria and the very good satisfaction degree*

Very good satisfaction rating with online classes vs:	Very poor	Deficient	Regular	Good	Very good	χ^2 P-value	R (P-value)
Meaningful interactivity	0.0	0.0	20.7	48.3	31.0	0.000	0.473 (0.000)
Design of materials	0.0	3.4	20.7	41.4	34.5	0.000	0.587 (0.000)
Motivation level	0.0	3.4	17.2	62.1	17.2	0.000	0.537 (0.000)
Assessments & exercises	0.0	0.0	13.8	62.1	24.1	0.000	0.534 (0.000)
Feedback mechanisms	0.0	0.0	17.2	41.4	41.4	0.000	0.560 (0.000)
Relevance of content	0.0	0.0	13.8	51.7	34.5	0.000	0.552 (0.000)
Number of topics per class	0.0	0.0	17.2	37.9	44.8	0.000	0.574 (0.000)
Adequate use of audio-visual elements	0.0	0.0	13.8	37.9	48.2	0.000	0.634 (0.000)
Use of complementary materials	0.0	0.0	10.3	27.6	62.1	0.000	0.561 (0.000)
Easy navigation on the virtual platform	0.0	3.4	6.9	55.2	34.5	0.000	0.588 (0.000)
Previous instructions for courses development	0.0	0.0	13.8	48.3	37.9	0.000	0.624 (0.000)
Online learning support	0.0	0.0	10.3	51.7	37.9	0.000	0.594 (0.000)
Permanent Internet accessibility	3.4	17.2	24.1	24.1	31.0	0.000	0.372 (0.000)
Personal equipment & technology	0.0	17.2	24.1	34.5	24.1	0.000	0.407 (0.000)
Online learning experience qualification	0.0	3.4	17.2	41.4	37.9	0.000	0.679 (0.000)
Learner services (Chat, E-mail, WhatsApp)	0.0	0.0	10.3	37.9	51.7	0.000	0.539 (0.000)
Adequate distribution of subjects	0.0	3.4	0.0	55.2	41.4	0.000	0.594 (0.000)
Adequate class time	0.0	6.9	10.3	37.9	44.8	0.000	0.520 (0.000)
Physical space availability for classes	3.4	3.4	13.8	51.7	27.6	0.000	0.437 (0.000)
Training & tutoring	0.0	0.0	20.7	48.3	31.0	0.000	0.532 (0.000)
Practices & laboratory	3.4	13.8	31.0	37.9	13.8	0.000	0.494 (0.000)
Time for learning activities	0.0	3.4	27.6	31.0	37.9	0.000	0.555 (0.000)
Collaborative work among students	0.0	3.4	17.2	41.1	37.9	0.000	0.569 (0.000)
Impact courses on professional training	0.0	0.0	6.9	55.2	37.9	0.000	0.682 (0.000)
Teaching performance in online teaching	0.0	0.0	17.2	37.9	55.8	0.000	0.614 (0.000)
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	χ^2 P-value	R (P-value)
Frustration	48.3	10.3	17.2	10.3	13.8	0.000	-0.252 (0.000)
Common sentiment: missing friends & socializing	3.4	10.3	6.9	17.2	62.1	0.000	0.115 (0.000)

The 10 criteria which were most influenced included adequate distribution of class topics (55.2 + 41.4 = 96.6%), teaching performance (37.9 + 55.8 = 93.7%), impact of the courses on professional training (55.2 + 37.9 = 93.1%), use of complementary materials (27.6 + 62.1 = 89.7%), ease of navigation on the learning platform (55.2 + 34.5 = 89.7%), support for online learning (51.7 + 37.9 = 89.6%), communication services (37.9 + 51.7 = 89.6%), content relevance of the classes (51.7 + 34.5 = 86.2%), and previous instructions given by the teacher for the development of the classes (48.3 + 37.9 = 86.2%).

Among the issues related to psychological aspects, the common feeling of missing friends and socializing was closely linked to good and very good degree of satisfaction in remote emergency classes during the pandemic (17.2 + 62.1 = 70.3%). Frustration was closely associated with very poor and deficient satisfaction (48.3 + 10.3 = 58.6%). Of regression coefficients of all predictor variables considered in the study, there were 9 that registered statistical significance except for 18 of them. Although they had an association with the highest degree of satisfaction, the P-value of the regression coefficient did not register statistical significance (P> 0.05). The highest OR (Exp B) values for a higher satisfaction degree fell on the impact of courses for professional training, student care services, online support, and feedback mechanisms (Table 4).

Table 4. *Regression coefficients and OR of the predictor variables regarding a very poor satisfaction compared to a high level of student satisfaction in emergency online classes*

		Confidence interval for OR, 95%		
	B	Lower	Odds Ratio	Upper
Very poor satisfaction vs. very high satisfaction				
Intersection	-47.004**			
Impact courses on professional training	2.879**	5.141	17.794	61.583
Learner services (Chat, E.mail, WhatsApp)	2.113**	2.278	8.270	30.026
Online learning support	1.666*	1.217	5.289	22.981
Feedback mechanisms	1.632**	1.496	5.113	17.480
Design of materials	1.378**	1.432	3.967	10.988
Practices & laboratory	1.361**	1.748	3.900	8.702
Adequate distribution of subjects	1.216*	0.798	3.374	14.261
Adequate use of audio-visual elements	1.062	0.781	2.892	10.709
Online learning experience	1.023	0.792	2.782	9.777
Meaningful interactivity	0.881	0.796	2.413	7.321
Adecuate class time	0.643	0.702	1.902	5.158
Permanent Internet accessibility	0.404	0.679	1.498	3.306
Physical space availability for classes	0.401	0.586	1.493	3.804
Training & tutoring	0.305	0.521	1.357	3.534
Collaborative work among students	0.206	0.420	1.229	3.594
Motivation level	0.164	0.391	1.178	3.549
Easy navigation on the virtual platform	0.114	0.333	1.120	3.768
Use of complementary materials	0.033	0.271	1.034	3.938
Time for learning activities	-0.016	0.331	0.984	2.927
Previous instructions for courses development	-0.103	0.186	0.902	4.389
Assessments & exercises	-0.121	0.286	0.886	2.746
Number of topics per classes	-0.169	0.215	0.845	3.324
Relevance of content	-0.220	0.196	0.802	3.281
Teaching performance in online teaching	-0.308	0.187	0.735	2.894
Personal equipment & technology	-0.884	0.146	0.413	1.167
Psychological aspects:				
Frustration	-0.821**	0.264	0.440	0.733
Common sentiment: missing friends and socializing	-0.383	0.333	0.682	1.399

Cox & Snell R^2= 0.65 (Cox y Snell), 0.75 (Nagelkerke). Modelo X^2= 1087.98 (P<0.001). *P<0.05; ** P<0.01

With the regression coefficients obtained from the previous table, the parameters that showed a highly significant effect (P <0.01) on the Very High degree of satisfaction were estimated. This model included 8 variables with high OR values (Table 5).

Table 5. *Estimation of parameters on the degree of satisfaction very good compared to very poor satisfaction*

		Confidence interval for OR, 95%		
	B	Lower	Odds Ratio	Upper
Very poor satisfaction vs. very high satisfaction				
Intersection	-42.745**			
Impact courses on professional training (IC)	3.289**	9.160	26.820	78.524
Learner services (LS)	2.400**	3.944	11.020	30.789
Design of materials (DM)	1.986**	2.919	7.284	18.177
Feedback mechanisms (FM)	1.655**	1.984	5.234	13.810
Adequate distribution of subjects (ADS)	1.613**	1.500	5.017	16.783
Online learning support (OLS)	1.476**	1.662	4.377	11.520
Practices & laboratory (PL)	1.332**	1.921	3.790	7.576
Frustration (F)	-0.735**	0.306	0.479	0.757

Cox & Snell R^2= 0.65 (Cox y Snell), 0.70 (Nagelkerke). Modelo X^2= 1087.98 (P<0.001). ** P<0.01

According to the ORs, it was observed that the impact of the courses for professional training and the services of attention to the students were the most important so that the students could have a very good degree of satisfaction. An adequate design of materials, feedback mechanisms, adequate distribution of class topics, support for online learning, development of practices and laboratory activities should also be considered. The frustration of students in the development of remote emergency classes also negatively affected the degree of satisfaction.

The Aiken and Schwarz's index shows that this model with 8 descriptors had a good fit (P <0.01). The Pearson goodness of fit table and the Deviation indicate a p-value of 1.0, which indicates that the predicted values of the model do not differ from the observed values, demonstrating a good fit of the model. The Cox-Snell (0.65) and Nagelkerke (0.70) pseudo-R squared values are similar and high. Taking the value of the Nagelkerke correction, we see that the final model explains 70% of the change from very poor satisfaction to very good satisfaction. Additionally, the likelihood ratio indicated the importance of the predictors in the model.

Discussion

The online education experience has been new to this region of the world, where university education had always been face-to-face, with some virtual academic support in the years prior to the COVID-19 pandemic, specifically in the search for scientific information from Scopus, Springer, Proquest, and other databases. The COVID-19 emergence coincided with the fourth industrial revolution, characterized by information, communication and virtual learning technologies (Agbehadji et al., 2020), widely accessible in developed countries (Adly et al., 2020), with poor and developing countries being the most affected (Mukhra et al., 2020), where most students still preferred face-to-face teaching and had a negative impact of online education (Aung & Khaing).

Digitization process in higher education in developing countries, which would normally take several years, was realized in a few days during the COVID-19 pandemic. It proved to be a disruptive process, with a number of obstacles related to the use of technological devices, tools, pace, skills and other factors (Kopp et al., 2019), as perceived in the present study. In the university sampled for this study, the digital infrastructure was weak, with unequal access to connectivity and lack of knowledge necessary for its use, especially among students of rural origin. This resulted in a decrease in the enrolment rate in the second academic semester of 2020 (Figure 1), a percentage that at the national level was 12% and at the end of 2020 reached 16% (UNESCO, 2020; MINEDU, 2020; SUNEDU, 2020). This situation was aggravated by the fact that in Peru only 21% of young people managed to enroll in a university, while in developed countries it was 40% (Manco & Salazar, 2015)). In Peru only 7.8% of the population living in poverty and extreme poverty had access to higher education (INEI, 2014), which translated into persistent poverty (Manco & Salazar, 2015). During the COVID-19 pandemic, more than 147,000 low-income students at public universities received free internet service, external modems or mobile chips (Emergency Decree N°107-2020, Diario Oficial El Peruano, 2020 (Doucet et al., 2020; Hassan et al., 2021). The university involved in this study, considered by the University Law among the 12 leading universities in the country, distributed cell phones with Internet service to 1,500 low-income students (19% of all those enrolled.

For 2021-I semester (Supreme Decree N°002-2021-MINEDU, (Peruano, 2020, 2021), teachers were also provided modems with unlimited internet. The students registered in the household in situations of poverty, vulnerability or exclusion were given chips with unlimited internet service. However, it was important to consider that this university had maintained a face-to-face educational model for more than 60 years and the sudden change to remote emergency classes caused a lot of uncertainty, affecting student satisfaction (Table 2). The university was not prepared to assume the immediate change to emergency remote teaching. It faced problems in the virtual migration process, while universities in other latitudes, with greater experience in distance education, responded better in the transition process during the pandemic (Altwaijry et al., 2021). In our case, the inclusion of technological tools that facilitate digital integration such as virtual reality, augmented reality, artificial intelligence, holograms, and adaptive learning, were practically null, a result that had also been identified in other latitudes (Adedoyin & Soykan, 2020; Alhasan & Hasaneen, 2021; Altwaijry et al., 2021; Chen et al., 2021; Ma et al., 2021; Mukhra et al., 2020).

At the university studied, the migration was limited to the delivery of instruction and the use of synchronous conferencing tools and a platform used primarily as a repository for class and supplementary materials in Word, PDF, PPT, and Internet URL formats. It showed little implementation of virtual pedagogy mechanisms, and students received their classes on mobile devices, laptops or tablets, similar to that reported in other studies. These findings are consistent with a few other studies (Altwaijry et al., 2021; Sun et al., 2020; Vargo et al., 2021).

In the current study on emergency remote classes, students identified restricted access to the internet and personal equipment as the main technological limitations. In addition, poor development of practical and laboratory activities was methodological limitations, which resulted in demotivation and showed a high level of dissatisfaction with virtual classes. Although students born during the digital period are called digital natives, many do not have the expected skills (Bennett et al., 2008), especially in developing countries such as Peru, and mainly in those who come from rural areas, where migration is slower due to inadequate access and quality of the Internet. Similar results are reported al the Sultan Qaboos University, Oman where student satisfaction with their online classes was 25%, a percentage linked to the type and level of online interaction with their instructors, the quality and clarity of the recorded lectures, teaching methods and materials for e-learning (Eberle & Hobrecht, 2021).

In the current study, the criteria that registered the highest correlations with "Very Good" satisfaction of the students with respect to their online classes were having courses with an impact on professional training, adequate use of audio-visual elements, prior instructions for courses development, and teacher performance for online teaching, whose correlation coefficients were greater than 0.6 (P <0.01) (Table 3). The limited impact of online courses during the pandemic may be due to the fact that the subjects were not transformed to virtual education and the educational model continued to be face-to-face and caused a series of frustrations in the students, which did not occur in other latitudes where effective impacts were reported to persist in the post-pandemic era (Succar et al., 2022).

Our results that online learning performance was affected by the absence of face-to-face relationship between students and with their teachers agree with the observations of (Joshi et al., 2020). The courses too had a number of shortcomings, as identified in other studies (Alhasan & Hasaneen, 2021), where migration was not assisted, as Adedoyin and Soykan (2020) recommended. However, one aspect to note was that teachers personally were trained in the use of synchronous and asynchronous tools for online teaching during the COVID-19 pandemic (Besser et al., 2020; Cavanaugh & DeWeese, 2020). Students also improved their digital competencies and had partial support from tutors (Kumar et al., 2020).

Of the 27 variables associated with a high level of satisfaction with the remote emergency classes developed during the year 2020 (Table 4), 8 had the highest OR and showed a highly significant effect on satisfaction Very Good (Table 5) and should be reinforced to improve the educational process (Cerdas-Montano et al., 2020). Results similar to the present study have been reported by Owusu-Fordjour et al. (2020) in Ghana, which observed that students cannot study effectively from home, which makes the online learning system ineffective due to limited Internet access and lack of technical knowledge in the use of technological devices, digital libraries and imaging systems (Zamora et al.).

Teacher performance in online teaching was another factor that influenced the degree of student satisfaction, so the teacher must be properly trained in the use of teaching platforms, online tools, and assessment online (Getange, 2016; Ma et al., 2021). Teachers tried to quickly transform courses into virtual learning formats, without having had previous experiences, and thus continued with the development of their classes (Succar et al., 2022). Another problem in emergency remote learning is the frustration to the sudden change to virtual studies, result also observed by Vargo et al. (2021) on personal feelings linked to professional burnout, anxiety, and mental health (Zheng et al., 2020), and students with strong personalities cope better with psychological stress (Brzozowski & Cucculelli, 2016). Distraction due to noise outside the classroom and student demotivation due to the monotony of classes hinder online learning and cause low student satisfaction (Chang et al., 2008), suggesting the intensification of debates, forums, tasks, and gamification to promote interactivity (Shea & Bidjerano, 2010; Succar et al., 2022; Zamora et al.; Zydney et al., 2012).

Other studies have reported that students of lower socioeconomic status with obsolete technological devices have experienced frequent technical problems for online learning and have not been able to adapt to virtual formats (Altwaijry et al., 2021), causing a high level of frustration (Adedoyin & Soykan, 2020). This emotional exhaustion plus low motivation has a significant correlation with satisfaction (Freudenberger, 1975; Maslach et al., 2001), an aspect that is also evident in our study, recommending providing psychological support to students with a higher risk of depression and stress (Scull et al., 2020; Vargo et al., 2021).

Regarding the different parameters associated with a high level of student satisfaction with the emergency remote classes developed during 2020 (Table 4), the 8 parameters that have the highest Odds Ratio and that show a highly significant effect on the degree of satisfaction Very Good (Table 5), it is suggested to improve the educational process, through collaborative work, integrating pedagogical leadership and the experience of each teacher. In this prolonged pandemic, new skills and abilities must be learned and developed (Cerdas-Montano et al., 2020). The current study also shows that the limitations of digital technology caused students to show high dissatisfaction with the remote academic work developed, a result similar to those reported in other latitudes (Bond et al., 2018; Ramsetty & Adams, 2020), which should strengthen the digital system (Keesara et al., 2020).

The results of this study agree with the observations of (Yekefallah et al., 2021; Yun & Min, 2021), who indicated that student satisfaction with e-learning was linked to the dimensions of teaching and learning, flexibility and suitability and workload among students. (Hassan et al., 2021), when evaluating the satisfaction of university students with their virtual classes in the COVID-19 pandemic, observed that workload and technical support explained 62% of the variation in negative academic self-perceptions associated with lowest levels of satisfaction, adopting emerging media such as virtual worlds, Internet of things, blogs, wikis and video sharing, and synchronous software with audio and video, which are dynamic, flexible and easy to use (Chen et al., 2021; Uppal et al., 2018).

There are other studies that indicate that the level of satisfaction was related to online education services, motivation, and course level (Leszczyński et al., 2018; Yun & Min, 2021). These findings have given the opportunity to evaluate areas where there had been main deficiencies during remote emergency classes from the perception of students, showing that the public university in the Center of Peru was not prepared for online teaching. This necessitates developing plans of and improvement to use the resources more efficiently, considering the students' perceptions to adjust the blended model that is planned to be implemented in 2022.

Conclusions, Recommendations and Implications

Emergency remote education, in the first year of the COVID-19 pandemic, raised concerns that affected learning and student satisfaction with technical and educational quality. The parameter estimation model on Very Good satisfaction with respect to Very Bad, considered a few determinants such as the impact of the courses for professional training, the attention given to the student, the adequate design of materials, the feedback mechanisms, the distribution of class topics, the support for online learning, and the development of practices and laboratory activities; all linked to learning and knowledge technologies.

Student frustration was a factor that negatively affected the satisfaction of emergency remote classes, evidencing the complexity of virtual studies without previous institutional experience. The risk that the COVID-19 crisis would exacerbate existing inequalities was something that the government must quickly address through properly budgeted and funded contingency plans, as this crisis offered an opportunity for university higher

education to readjust its educational model. Regarding limitations and implications, the study adopted a quantitative method by using an online platform to easily distribute survey questionnaires to all students enrolled in the 2022-II semester; however, we recognize it as a limitation that some living in areas without adequate Internet access were unable to respond to the survey.

The data, after careful cleaning and analysis, offered useful information to understand important aspects related to digital technology, the design and the development of classes associated with the degree of satisfaction from the perspective of students during the first year of pandemic. The findings on student attitudes to remote COVID-19 emergency study provided useful information to understand the problems and propose effective improvements in educational quality.

This research suggests that teachers should adapt their subjects to the virtual model and communicate more with their students and vice versa through various informal channels (instant messaging, online chat groups, audio calls, private video calls) in parallel with formal channels (online platforms, e-mail, forum), and motivate students to actively participate in online classes. Our findings lead to reflection and redesign of university education policies, providing a larger budget to guarantee connectivity and transition to virtual pedagogy, training teachers and students in this type of teaching modality.

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Declaration of Competing Interest

The authors declare that they have no competing interests.

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