Research Article https://doi.org/10.12973/ijem.9.1.41

International Journal of Educational Methodology
Volume 9, Issue 1, 41 - 51.
ISSN: 2469-9632
https://www.ijem.com/

Students' Learning Perception in Engineering, Health and Education During Emergency Remote Education in Chile

Verónica Villarroel*
Universidad del Desarrollo, CHILE

Alvaro González
Universidad de Magallanes, CHILE

Received: July 28, 2022 ▪ Revised: November 24, 2022 ▪ Accepted: December 27, 2022

Abstract: Higher education institutions around the world had to implement an emergency remote education (ERE) modality due to the COVID-19 pandemic. This study aimed to determine the individual and relational factors that affect the perception of learning in engineering, education, and health students during emergency distance education. Through a quantitative, non-experimental, and correlational study, an online survey was administered to a sample of 929 higher education students regarding their ERE experience. They were surveyed regarding their perceived learning, empathy, classroom interaction, self-regulation of learning, positive agency, student engagement, learning approaches, and use of digital resources. Data was analyzed using quantitative methods, namely correlations, comparisons of means and a linear regression analysis. Education students showed a more positive perception of learning, used a deep learning approach, and rated more positively the empathy shown by their professors and the possibilities for class participation than other students. Engineering students had the lowest scores on perceived learning and on almost all other variables. In general, students with a better perception of learning presented a higher engagement in their studies and a lower use of surface learning approach.

Keywords: *COVID-19, higher education, internet, pandemic, remote education.*

To cite this article: Villarroel, V., & González, A. (2023). Students' learning perception in engineering, health and education during emergency remote education in Chile. *International Journal of Educational Methodology*, *9*(1), 41-51. https://doi.org/10.12973/ijem.9.1.41

Introduction

Due to the pandemic, in March 2020, higher education institutions (HEIs) around the world faced one of the most important challenges in their history: closing their facilities as a preventive measure against COVID-19 (Hodges et al., 2020; UNESCO International Institute for Higher Education in Latin America and the Caribbean, 2020). Universities shifted the teaching-learning process to an emergency remote mode (ERE), facilitated by Information and Communication Technologies (ICT), through e-learning (Abbasi et al., 2020; Ali, 2020; Hodges et al., 2020; Pardo & Cobo, 2020; Soni, 2020).

This change comes in a context of uncertainty and anxiety (Kirshner, 2021), when as a society we were faced with long confinements, reports of high virus contagiousness and associated deaths. It was also developed as a momentary solution to the health crisis (Hamid et al., 2020), with no prior experience or expertise for teaching in a digital environment (Lassoued et al., 2020; Pardo & Cobo, 2020). However, this ERE lasted much longer than initially anticipated, sparking researchers' interest in understanding and evaluating its development.

Research on the ERE has moved from characterizing its functioning in the pandemic (Ali, 2020; Gewin, 2020; Hamid et al., 2020) to identifying key aspects for learning (Almutairi et al., 2021; Chatziralli et al., 2021; Schneider & Council, 2021). Early studies showed students' difficulties with electricity, connectivity and personal electronic devices (Olum et al., 2020) and how the use of the mobile phone, which was the most commonly used device, hindered the distance learning process (Hamid et al., 2020). The physical environment was also not optimal for ERE (Lassoued et al., 2020), with people spending more time than allocated and at non-standard times (Heng & Sol, 2020; Soni, 2020). In addition, it was found that the most used tools were: a) videoconferencing platforms for conducting synchronous classes: MS Teams, Google G Suite, Zoom, Skype, Smart Class (Abbasi et al., 2020; Hamid et al., 2020), b) interactive educational platforms: Moodle, Intranet (Lassoued et al., 2020), c) social networks: Whatsapp, Youtube, Twitter, Facebook and Instagram (Heng & Sol, 2020).

* **Corresponding author:**
Verónica Villarroel, Facultad de Psicología, Universidad del Desarrollo, Ainavillo 456, Concepción, Chile. ✉ vvillarroel@udd.cl

Students were not proficient in handling technology and platforms for online learning as expected and teachers felt overwhelmed, which affected their mental health and increased anxiety towards digital learning environments (Ali, 2020). In addition, teacher-student and student-student interaction in the virtual classroom was significantly lower than in the face-to-face mode (Carolan et al., 2020; Soni, 2020).

These initial results were probably due to the limited experience and preparation for implementing ERE. The urgency led HEIs and their professors to move face-to-face education to the virtual environment without changing the instructional design of the pedagogical process (Carolan et al., 2020), even though we know that different rules apply in digital environments (Hamid et al., 2020). For example, research has shown that online education requires detailed planning of each session and the design of good study materials (Kim, 2020; Pardo & Cobo, 2020). As well as the need to limit synchronous classes because, they generated burnout (Gewin, 2020).

For this same reason, studies suggested the need to allocate more time to teachers to create content and much less to deliver synchronous sessions, which is exactly what did not happen. During the ERE, lecture recordings were longer than the prescribed session, and students reported that they exceeded their attention span (Ali, 2020). This undermined teacher and student motivation (Almutairi et al., 2021; Lassoued et al., 2020; Mavengere et al., 2021; Zhao et al., 2020).

Over time, there was growing evidence pointing to the need to adjust the emergency education process. On the one hand, the need to enhance instances of face-to-face interaction between students and teacher-student became evident (Chatziralli et al., 2021; Lobos et al., 2022). On the other hand, implementing effective assessment and feedback processes that support student learning and minimise the potential for cheating and deception (Almutairi et al., 2021; Schneider & Council, 2021).

However, studies still did not answer the most important question, namely whether students were learning what they were supposed to learn. It was questioned and criticized that ERE could train in competences, considering that the graduate profiles of university degrees implied the development of knowledge, skills and attitudes, which are difficult to address and assess in virtual environments (Chatziralli et al., 2021; Mukhtar et al., 2020; Schneider & Council, 2021). For example, it has been found that online learning was not sufficient to ensure that teaching, nursing, dermatology and ocular medicine students acquired the necessary set of discipline-specific competences (Chatziralli et al., 2021; Schneider & Council, 2021).

Considering these elements, it is important to progress in the study of undergraduate students' perception of learning in ERE, and to compare the learning experience among students from different undergraduate programs in Chile. It is known that the profiles of health and engineering students are different, from sociodemographic variables to study habits (López-Angulo et al., 2020; Méndez, 2016), so it is interesting to know how distance ERE has worked for their learning. Thus, this study aimed to determine the individual and relational factors that influence the perception of learning in engineering, healthcare and education students, analyzing whether there are differences between disciplines.

Personal variables of students, known for their impact on learning in face-to-face education, such as self-regulation (Gutierrez de Blume, 2021; Panadero et al., 2021), strategic learning (Barrón & Llimpe, 2017) and self-efficacy (Martínez & Medina, 2019) were studied. It was hypothesized that the presence of these variables can facilitate learning in ERE contexts. Likewise, relational variables typical of teacher-student interaction were analyzed, understanding that research in distance education considers them to be key to foster student motivation and learning (Chatziralli et al., 2021; Lobos et al., 2022). The relevance is that this was analyzed in the context of pandemic education and in students with academic profiles that may be different according to the disciplinary area of the degree they are studying, which is a contribution and enriches current research in ERE.

Methodology

Research Design

This research corresponds to a quantitative study with a non-experimental, cross-sectional and correlational design (Hernández et al., 2010). The aim was to compare the perception of learning among engineering, health and education Chilean students, determining differences between individual and relational factors involved in the experience of ERE and the experience of learning.

Sample and Data Collection

929 university students in engineering, health, and education programs participated in this study. They belonged to 34 Chilean universities of different sizes, dependencies, geographical and cultural contexts, as well as years of accreditation (Muñoz & Blanco, 2013). 29.9% of them were studying engineering (n= 278), 36.2% were studying health (n= 336), and 33.9% were studying education (n= 315). In turn, 31.2% of the students surveyed were men (n= 290), while 67.7% were women (n= 629). 1.1% of the students (n= 10) identified with another gender. 75.4% of participants were between 18 and 23 years old. Finally, 48.7% of the students were in the first or second year of their programs, while 51.3% were in the third year of their program or onwards.

The data were collected in 13 regions of the national territory, where there were co-researchers who were part of the team of this study. Each co-researcher managed the dissemination of the online questionnaire in the study house to which he or she belonged. Research ethics were followed in this data collection process, and the survey was anonymous, confidential and voluntary. University students agreed to participate by signing an informed consent form.

The research team collected comprehensive data from 2020 to 2022 from both teachers and students. The co-researchers are grouped into smaller teams for the analysis of the data collected. In this case, this article refers to a sample of data taken in early 2021, the second year of ERE in pandemic.

Instruments

An online questionnaire was used in this study, containing questions related to socio-demographic variables, and Likert-type scales referring to different topics associated with the remote teaching-learning process during the pandemic. The total questionnaire consisted of 95 items, 90% of which were closed-ended. All scales that were part of the questionnaire were administered at one time, and the Likert-type response options were 1 to 5 points for 80% of the scales. The research analyses 75 of the 95 items that are part of this online survey.

The scales discussed in this article are part of a broader general questionnaire applied to students, which also contains other scales not mentioned here. However, response bias was controlled to some extent by a methodological separation, which consisted of establishing a physical separation between the predictor variable (in this case perceived learning) and the criterion measures of the questionnaire. As stated by Podsakoff et al. (2012), methodological separation is appropriate when the questionnaire is of sufficient length to separate the measures. This can decrease method bias by increasing the difficulty of responding stylistically, removing the salience of any contextually provided retrieval cues and/or reducing the respondent's ability to use earlier responses to fill in gaps in recall or use earlier responses to answer later questions.

Ten variables were selected (Perceived Learning, Self-regulation of Learning, Sense of Agency, Student Engagement, Surface Learning, Deep Learning, Strategic Learning, Empathy, Classroom Interaction, Use of Digital Resources), seven of which were measured through five authors' scales, validated by their creators; three of them were also validated for the Chilean context. The remaining three were measured through reagents created for this purpose. Validity and reliability indices are reported below. The variables measured through author's scales are presented below:

Perceived Learning Scale (PLS). This scale was developed by Rovai et al. (2008) and validated in Chile by Herrera Seda (2016). The PLS consists of statements related to the knowledge, skills and attitudes that students have developed from their participation in a subject. Include a set of items in which students are asked whether: a) they consider they are learning adequately in their classes, b) they feel that what they learn in their classes is useful for their future profession and c) they can demonstrate to others what they have learned to do. The following are examples of questions in this dimension: I can show others what I have learned to do in these subjects; I feel that I can think in a more complex way as a result of the subjects I have taken.

Inventory of Self-regulation of Learning Processes IPAA (Rosário et al., 2007). Instrument validated in Chile by Bruna et al. (2017), which asks students how they generate appropriate learning strategies necessary to achieve their academic goals. The following are examples of questions in this dimension: I establish specific academic goals for the subject; I keep and analyse the corrections of written assignments or partial tests, to see where I made a mistake and to know what I should change to improve.

Sense of Agency Scale developed by Tapal et al. (2017). A scale assesses students' ability to make decisions and their sense of control over their actions. The following are examples of questions in this dimension: The things I do depend exclusively on my will; I am fully responsible for all the results of my actions.

Student Engagement Scale. An instrument developed by Schaufeli et al. (2002) that measures positive and satisfied mood, characterised by vigour, dedication and absorption in academic tasks in higher education. The following are examples of questions in this dimension: I am enthusiastic about my studies; I feel happy when I study hard.

Approaches to Learning Questionnaire (SPQ). Questionnaire created by Biggs et al. (2001), which asks about superficial, deep and strategic approaches to learning. Deep learning relates to students' practices of critical analysis of knowledge, integration of prior knowledge, understanding and its long-term retention, making use of cognitive skills of analysis and synthesis. Superficial learning, on the other hand, is a tendency of the learner to memorise information as isolated facts, without connection to previous experiences or to the general context. The central goal is to retain facts in order to pass the assessment. Strategic learning is described as a third form of learning strategy in which the learner tries to achieve high marks, using either deep or shallow learning strategies, as required by the subject and the teacher. SPQ was validated in Chile by González et al. (2011). Examples of questions for each dimension are presented below:

- Superficial learning: I have often had trouble making sense of the things I have to remember; Many of the things I have learned remain in my mind as unrelated ideas.

- Deep learning: When I read new material, I try to relate it to what I already know about the subject; I try to relate what I have learned in one course to what I have learned in other courses.
- Strategic learning: I organise my study time carefully to make the most of it; I carefully prioritise my time to make sure I have enough time for everything I have to do.

The following three variables: empathy, classroom interaction and use of digital resources, were measured using scales developed for this study. Their construction was based on the literature review, considering key aspects of ERE. For each variable, the result of the "eigenvalues" of the principal component analysis is reported, which in all cases shows the presence of a dominant factor in each scale.

Empathy: related to the interest and concern shown by teachers for their students in the context of distance learning. The following are examples of questions in this dimension: In the distance classes, the teachers showed interest in knowing how my family and I are doing in the context of the current pandemic; The teachers took a few minutes at the beginning of the classes to ask us how we have been in this period of confinement.

The principal components analysis shows that the first eigenvalue is 3.24 and the rest is below 0.70, demonstrating the existence of a latent factor in this scale.

Classroom interaction: a set of items asking about the space and opportunities teachers create for students to participate and interact in online classes. The following are examples of questions in this dimension: Online classes allowed me to dialogue with the teachers; In online classes, the teacher provided a space to listen to classmates' opinions.

The principal component analysis shows that the first eigenvalue is 2.47 and the rest is below 0.8, which demonstrates the existence of a latent factor in this scale.

Use of digital resources: a scale designed to find out how often students use different digital resources in their learning process, such as video lectures, digital books, databases, websites and applications, among others. The following are examples of questions in this dimension: Have you used books in digital format for your courses; Do you collaborate with your classmates in group work related to your courses through tools such as Google Drive, Dropbox or others? The principal component analysis shows that the first eigenvalue is 2.89 and the rest is below 1.0, which demonstrates the existence of a latent factor in this scale.

Table 1 presents the number of items considered in each of the variables included in this study and the reliability of the scales through Cronbach's alpha. The reliability of the scales was adequate for all variables, with a mean of α=.81, although less robust in the case of the variables "classroom interaction" (α=.69) and "use of digital resources (α=.61)." The variable "student engagement" presented the highest reliability (α=.91).

Table 1. Reliability Analysis of the Variables

Variable	Items	Alfa
Perceived learning	12	.869
Empathy	5	.858
Classroom interaction	4	.696
Self-regulation of learning	12	.859
Positive agency	5	.798
Student engagement	17	.916
Surface learning	4	.802
Deep learning	4	.830
Strategic learning	4	.879
Use of digital resources	8	.614

Procedure

The data collection process was conducted online. The students, all of whom were of legal age. The instrument was entirely answered by 1782 students, of which we retained 929 for this study, as these were the students enrolled in programs related to engineering, health, and education, respectively.

Data Analysis

All analyses were performed using the SPSS software (version 22). Before performing the correlation analyses, the scatter plots between the variables were analyzed. The analysis of these plots did not reveal any non-linear relationships or the presence of values that could be influential. Before the comparison between the three groups of students, the box plots were analyzed. This analysis did not reveal the presence of outliers or markedly non-normal distributions between the groups. Finally, the analysis of the residuals of the multiple linear regression model did not reveal any anomalies that could call into question the results of this analysis.

Reliability indicators were first established for all variables (see Table 1). The second stage of data analysis consisted of generating correlations between variables (see Table 2). The third stage of the analysis compares students studying engineering, health, and education concerning each variable (see Tables 3 to 9). Finally, a linear regression analysis was performed to understand the incidence of the different independent variables introduced in the successive stepwise regression models on the dependent variable "perceived learning" (see Table 10).

Findings / Results

Correlations Between Variables

As a preliminary data analysis, the variables were correlated with each other. Table 2 summarizes the results of these correlations.

Table 2. Correlations Between Variables

	PA	EM	IN	AR	AG	CO	AS	AP	AE	RD
PL	1									
EM	.494**	1								
CI	.513**	.547**	1							
SR	.549**	.258**	.279**	1						
PA	.419**	.210**	.273**	.358**	1					
SE	.693**	.398**	.414**	.644**	.420**	1				
SL	-.440**	-.273**	-.313**	-.285**	-.260**	-.413**	1			
DL	.533**	.309**	.305**	.509**	.284**	.585**	-.328**	1		
ST	.504**	.186**	.229**	.665**	.311**	.577**	-.237**	.357**	1	
DR	.282**	.130**	.153**	.346**	.192**	.295**	-.112**	.341**	.256**	1

*Note 1: **p<.01*

Note 2: PL= Perceived learning; EM= Empathy; CI= Classroom interaction; SR= Self-regulation of learning; PA=Positive agency; SE= Student Engagement; SL= Surface Learning; DL= Deep Learning; ST= Strategic Learning; DR= Use of digital resources

As can be seen in Table 2, all the variables were correlated with each other. In this analysis, the negative correlation between the variable "superficial learning" and all the other variables stood out. This is especially relevant in the case of perceived learning (r= -.440) and student engagement (r= -.413). In other words, those students who reported being more satisfied with their learning process and more committed to their studies were also those who used the superficial learning approach to a lesser extent. Conversely, there was a high correlation between perceived learning and the deep (r= .533) and strategic (r= .504) learning approaches, respectively.

It is worth noting that the strongest correlations originated between perceived learning and student engagement (r=.693), strategic learning, and self-regulation of learning (r=.665), as well as between this last variable and student engagement (r=.644). On the other hand, student engagement was strongly correlated with self-regulation of learning, as we saw, and was highly associated with students' adoption of deep (r=.585) and strategic (r=.577) learning approaches, respectively.

Finally, it should be noted that student engagement was also significantly correlated with the empathy teachers show with their students (r= .398) and with the opportunities for interactions and participation in class (r= .414). As expected, teacher-dependent variables such as empathy and opportunities for classroom interactions are found to be highly correlated with each other (r= .547).

Comparison of Variables Among Students Studying Engineering, Health, and Education.

When contrasting the different variables analyzed, there were significant differences between students in the areas of engineering, health, and education in all variables, at a significance level of p<.001, except for "positive agency," "self-regulation of learning," and "strategic learning." The perceived learning variable showed three well-differentiated sets (see Table 3). Thus, students from the education area perceived more learning during the pandemic. Engineering and health students followed them, respectively. As previously indicated, there were no significant differences among the students of the different areas of knowledge surveyed concerning the strategic learning approach. However, there were substantial differences in the deep learning (see Table 4) and surface learning approaches (see Table 5).

Table 3. Means and Homogeneous Subsets for Perceived Learning

Area	N	F1	F2	F3
Engineering	283	3,0568		
Health	241		3,2106	
Education	293			3,3865

Table 4. Means and Homogeneous Subsets for Deep Learning

Area	N	F1	F2
Engineering	256	37.852	
Health	316	38.600	
Education	295		40.339

Table 5. Means and Homogeneous Subsets for Surface Learning

Area	N	F1	F2
Education	296	29.164	
Engineering	258	30.669	30.669
Health	318		31.171

From the tables above, it can be observed that students in the education area indicated that they used the deep learning approach more frequently than their peers did in the engineering and health areas. Quite consistently, the same education students reported using the surface learning approach less regularly than their peers did in the other areas.

Contrary to expectations, students in the engineering area indicated the lowest proportion of use of varied digital resources for their learning process (see Table 6). Students in the areas of health and education formed a homogeneous subset.

Table 6. Means and Homogeneous Subsets for Use of Digital Resources

Area	N	F1	F2
Engineering	253	3,7297	
Health	310		3,9544
Education	293		4,0068

Regarding the student commitment variable (see Table 7), once again, education students declared themselves more strongly committed to their studies than their peers in other areas, these differences being significant with students in the engineering area. Finally, it should be noted that, as in the case of the strategic learning approach, there were also no significant differences between the students of the different areas of knowledge surveyed on the variables of self-regulation and positive agency.

Table 7. Means and Homogeneous Subsets for Student Engagement

Area	N	F1	F2
Engineering	256	31.307	
Health	311	31.901	31.901
Education	289		32.911

Factors Associated with the Work of Academics and the Conditions of the ERE

When comparing the students in the various areas concerning their evaluation of the empathy shown by professors towards students (see Table 8), as well as the possibilities of interaction and participation in classes in a remote teaching mode (see Table 9), it was found that the students of the education area were those who evaluated these dimensions most positively. In contrast, the lowest scores were found among engineering students. Lastly, we proceeded to perform a linear regression analysis, with all the students in the sample, to understand the incidence of the different independent variables, on the dependent variable "perceived learning" (see Table 10).

Table 8. Means and Homogeneous Subsets for Empathy

Area	N	F1	F2	F3
Engineering	278	27.460		
Health	336		29.321	
Education	315			33.295

Table 9. Means and Homogeneous Subsets for Classroom Interaction

Area	N	F1	F2
Engineering	278	31.574	
Health	336	31.890	
Education	315		33.675

Table 10. Regression Models for the Variable "Perceived Learning"

Model	Variables	R^2	B^a	SE	$Beta^b$	t
1	Student engagement	.476	.385(**)	.039	.349	9.971
2	Student engagement + Classroom interaction	.547	.077(*)	.032	.071	2.439
3	Student engagement + Classroom interaction + Empathy	.564	.100(**)	.026	.110	3.760
4	Student engagement + Classroom interaction + Empathy + Strategic learning	.579	.135(**)	.023	.170	5.867
5	Student engagement + Classroom interaction + Empathy + Strategic learning + Deep learning	.592	.298(**)	.031	.277	9.468

[a]: Non-standardized regression coefficient
[b]: Standardized regression coefficient
*: $p < .05$; **: $p < .001$

These results indicated that the most relevant variable to explain students' perceived learning was their willingness to study, effort, dedication, and involvement in their studies. Nevertheless, this individual variable was associated with two relational variables, classroom interaction, and empathy, for which the teacher is responsible. In other words, students' perceived learning was also explained by the opportunities teachers generate for students to participate and interact in online classes, as well as by the interest and concern shown by teachers towards their students in remote courses. Finally, although the variables of strategic learning and deep learning were significant, does not have the greatest standardized impact on explaining perceived learning. It should be noted that when regressions were performed by area of study, the results were very similar. The two most potent predictor variables were student engagement and interaction have the greatest standardized impact on explaining perceived learning. Which ones explained, in all cases, a considerable percentage of the "perceived learning" variable, 44.6% for the health area, 57.3% for the education area, and 60% for the engineering area. On the other hand, empathy was a significant predictor variable for education and engineering but not for health, where positive agency explained part of the perceived learning.

Discussion

This study investigated students' perceptions of their learning during ERE in the first year of the COVID-19 pandemic. The aim was to analyse the personal and relational variables that explained a positive perception of learning, and to determine differences between students' perceptions of learning and their perceptions of learning. The first studies on ERE in Latin America sought to characterize the experience of students and teachers, considering Internet access, physical and technological resources, but did not ask about the quality of learning achieved by students or the personal and relational variables involved in that learning. This article is a contribution along these lines.

Do Chilean university students perceive that they have learned in ERE? We can answer this question; at least by pointing out that, in general, they perceive that they have learned above average (above 3 points, on a scale of 1 to 5). Data also shows that there are individual variables such as the students' commitment to their learning as well as their disposition to deep learning that influence their perception of learning. The higher the score on these personal variables, the higher the perception of learning. On the other hand, at the level of relational variables, the empathy that the student perceives in the teacher and the bond with him/her also positively influences his/her perception of learning.

Results suggests that students with a better perception of learning in ERE also evidenced high engagement in their studies and lower use of the surface learning approach, which is consistent with the research of Barrón and Llimpe (2017) and Martínez and Medina (2019). Likewise, student engagement appeared strongly correlated with self-regulation of learning and adopting deep and strategic learning approaches, in line with Panadero et al. (2021).

Regarding the research question related to the differences in perceptions and learning experiences of students from different disciplinary areas, it was found that students in education programs perceived they had achieved more significant learning during the ERE period and indicated using the deep learning approach more frequently, which is in line with López-Angulo et al. (2020). They were followed by engineering students' and health students' programs, who indicated a lower perception of learning, confirming the findings of Méndez (2016).

When comparing the students of the different areas concerning their perception of empathy shown by the professors during the pandemic, as well as the possibilities of interaction and participation in classes in remote teaching mode, it was found that students of the education area were those who valued these dimensions more positively. In contrast, the lowest scores were found among engineering students. A possible explanation is related to the "pedagogy" of teachers in these disciplinary areas since teachers in education are involved and committed to more constructivist teaching practices that, in general, favor the protagonism and participation of students, as stated in studies by Bolaño-Muñoz (2020) and Castellanos et al., (2018).

Although the most relevant variable that explained students' perceived learning was related to their willingness to study, try, dedicate themselves, and be involved with their studies, there were also two relational variables of interest, namely class interaction and empathy responsibility of the teacher. In the regression models, it was observed that student commitment, class interaction, and teacher empathy explained 56.4% of the students' perceived learning. That is, the perceived learning by students was also defined by the opportunities generated by teachers for students to participate and interact in online classes, as well as by the interest and concern shown by teachers towards students, in the context of remote courses. This reinforces the need to implement instances of intentional dialogic interaction in online teaching and to establish a positive bond between teacher and students, as proposed by Carolan et al. (2020), Lassoued et al. (2020), and Soni (2020).

Virtual education is here to stay, not only in crisis situations, but in normality. Distance education has great advantages in terms of coverage and reach, and is a very useful tool for higher education. In the wake of the pandemic, a precedent has been set for its use, and research is needed to tap its true potential. There is a need for further exploration of pedagogical competencies, the competencies of the students themselves, student-student and teacher-student interaction, and curricular content that promotes quality learning.

Conclusion

In synthesis, the possibilities of success in ERE were more significant because students have individual factors that promote and direct their learning, such as commitment and willingness to learn deeply and strategically. Relational factors that depend on teachers were also strongly relevant, such as promoting participation and dialogue with and among students and the empathy and affective bonding they show, especially in crises.

Recommendations

For researchers, it is important to continue studying the impact of emergency remote education (ERE) on student learning during pandemic years, considering the change from the beginning to the end of COVID-19 (2020-2022). These measurements should consider the set of variables that allow for a systemic understanding of the ERE and virtual education phenomenon. They should evaluate contextual aspects and basic conditions for remote education, but also personal variables of students and teachers, variables of the educational process of the virtual classroom and of the educational institution. Through longitudinal, contextual, pedagogical and personal measurements, it will be possible to estimate the evolution of ERE and determine the factors that allow the development of a quality remote educational process.

For practitioners, it is important that teachers and curriculum management teams in universities are aware of the impact of variables such as engagement and deep learning strategies. It is well known that students develop their competences and cognitive skills in interaction with others (teachers, peers, families), so the pedagogical strategies we use in class, and what we ask them to do with their peers, need to be oriented towards critical thinking, analysis, problem solving and decision making. Commitment to learning is also related to the empathy shown by the teacher when teaching, especially in times of uncertainty. Therefore, the teacher's persona needs to integrate pedagogical competence and socio-emotional skills that allow him/her to establish a bond with his/her students.

Limitations

Regarding the limitations of this study, we presented cross-sectional results through data collection performed during the first year of the pandemic. Therefore, it is necessary to analyze the evolution of the data during the year 2021. On the other hand, the sampling was developed for convenience. Although it reached several students, it is not a representative national population sample.

Acknowledgements

This project was made possible thanks to funding granted by the COVID-UDD 2020-2021 project of the Universidad del Desarrollo.

Authorship Contribution Statement

Villarroel: Concept and design, data acquisition, drafting manuscript, critical revision of manuscript, securing funding, editing/reviewing, supervision, final approval. González: Design, analysis, writing, critical revision of manuscript.

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