

Validation of an Instrument to Measure Students' Perceptions of Online Learning

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Abstract—In the context of the COVID-19 global pandemic and the health measures derived from it, emergency online learning (EOL) became the only possible alternative to be able to continue the training process in the university context. The general objective of the present research is to know the perceptions and evaluations of students at a Chilean public university about the "emergency" online learning process that occurred in the context of the COVID-19 pandemic. Based on several previous works related to online learning (OL), an instrument (questionnaire) was developed and implemented with the participation of 117 students. The research is quantitative-descriptive and had the following specific objectives: (1) To determine the attitude of university students towards EOL; (2) To characterize the learning experience of students in online modality; (3) To know about the available resources of students for EOL; and (4) To validate the developed questionnaire through a factor structure analysis. In general, the results show that students are proficient in the aspects related to self-management of learning, but have a low level of motivation for EOL and suffer a deficit in aspects related to interaction with others (teachers and peers). These results provide a first approximation of Chilean students' perceptions of EOL and allow us to identify several aspects that should be improved by professors and university authorities. This research was financially supported by the German Academic Exchange Service (DAAD) as part of the project "Praxispartnerschaften zwischen Hochschulen und Unternehmen in Deutschland und in Entwicklungsländern ab 2017" (Project Nr. 57334905).

Keywords—students' perceptions about online learning, emergency online learning, university students, online learning in Chile

1 Introduction

For a long time, online learning (OL) was reserved for a particular group of learners: mostly older people with multiple family, work, financial and other responsibilities. These students benefited from the opportunities offered by this type of educational modality compared to traditional face-to-face education [1, 2]. Expectations for the design

and implementation of comprehensive online university education programs have been held back for a long time in a number of countries due to the prevalence and preference for face-to-face learning (FFL) [4]. However, the emergence of COVID-19 not only generated health problems, but also affected social structures and caused various problems in the field of education [2,3,5].

In this context, as is well known, face-to-face courses were suspended as a preventive health measure, and "emergency e-learning" or "emergency online learning" (EOL) became the optimal alternative to continue the educational process. Every elementary form of EOL uses a mix of information and communication technologies (ICT) [6-7] for the design and implementation of university training programs, which were not originally planned for OL [6, 9, 10]. However, this resulted in new conditions for educational institutions for which their protagonists (students, teaching staff, faculty and academic authorities, etc.) were not necessarily prepared and equipped. It is clear that many students and lecturers had no previous experience in OL, nor did many universities have the necessary technical equipment to offer EOL quickly and efficiently to all students and faculty [7, 8, 13, 14]. In most cases, the outcome of OL in the emergency context has had its strengths and weaknesses, but it has also demonstrated the commitment of higher institutions (and their faculty members) to students and the quality of their education process [9-15].

The general objective of the present research was to know the perceptions and evaluations of students at a Chilean public university about the "emergency" online learning process that occurred in the context of the COVID-19 pandemic. Based on several previous works related to online learning (OL), an instrument (questionnaire) was developed and implemented with the participation of 117 students. The research is quantitative-descriptive and had the following specific objectives: (1) To determine the attitude of university students towards EOL; (2) To characterize the learning experience of students in online modality; (3) To know about the available resources of students for EOL; and (4) To validate the developed questionnaire through a factor structure analysis. In general, the results show that students are proficient in the aspects related to self-management of learning, but have a low level of motivation for EOL and suffer a deficit in aspects related to interaction with others (teachers and peers).

2 Literature review

2.1 Online learning and "emergency online learning"

OL can be defined as an educational experience in which students and teachers are separated in time and space [16]. According to Watts, this interaction can occur synchronously or asynchronously, on a variety of online platforms and with a variety of technological resources [17]. Platforms for OL, whether they simply provide communication between learners and (humanoid) instructors (as in a text messenger or discussion forum), or are fully digital (such as an online library with learning videos and interactive learning programs), or are a hybrid form (like interactive learning programs with humanoid online tutors): They generally provide the ability for asynchronous use

of resources for instructional partners. Students and instructors can submit input at any time and react to it at any time. Learning videos and learning programs can also be accessed at any time and from any location. This aspect offers the convenience of free time management and is especially essential for instructors, considering the widely separated time zones of participating students. The synchronous interaction corresponds as far as possible to the mode of typical face-to-face teaching. The extension of an OL-platform with synchronous components enables the integration of highly interactive learning phases and is essential for the realization of examination situations.

Bozkurt et. al.[9] and Hodges et. al. [12] caution against confusing OL (didactically designed and well planned with adequate technological infrastructure for online teaching-learning processes), with the rapid and temporary adaptations in platforms and information and communication technologies made to continue educational training in the extraordinary context of the COVID-19 pandemic [9, 12]. Several authors argue that confusing OL (conceived as such for the university training) with online learning in emergency contexts (hereafter EOL), could have a long-term detrimental effect on the former, as both students and faculty (who prior to the pandemic had little or no previous experience with OL) are likely to assume that OL is a poor substitute for FFL, thereby also crystallising beliefs about the inferior quality of OL compared to FFL. [9, 12, 13, 15].

From the site of the academic staff, different factors influence the use and integration of technologies in learning process (FFL or OL). In 1999, Ertmer presented the “Barrier to technology integration model”, which described factors as ‘barriers’ that hinder how and how much teachers integrate technology at teaching learning process [18]. According to Ertmer’s model there are two types of barriers: (1) external barriers to teachers, also called first-order barriers (as institutional culture and vision, access to technology, and professional development opportunities); and (2) internal barriers to teachers, also called second-order barriers (as value beliefs and ability for integrating technology as teaching-learning) [18, 19, 43].

Another important aspect of the discussion about learning modality (FFL, OL or EOL) is its design and delivery to learners. Thompson and Copeland [19] argue that a redesign of training courses based on EOL (which prioritises students' accessibility to learning material) will ensure that more disadvantaged students succeed in the "online" context. Equally important is the fact that this redesign can help alleviate students' anxiety caused by the sudden life changes brought about by this pandemic, including the abrupt shift from FFL to EOL. In this regard, several authors have highlighted the need for educational institutions to prioritise the physical, mental and psychological well-being of their students and teachers over the need to teach the compulsory curriculum [12, 20, 21].

It should be emphasized that studies show a strong correlation between students' attitudes toward OL and EOL and their socioeconomic conditions, and here, in particular, students from better socioeconomic backgrounds express more satisfaction about EOL than their disadvantaged peers [12, 22]. Specifically, Bozkurt and Sharma [12], and Zhang et al. [22] evidence a variety of barriers that may impede effective delivery of online education, including the lack of preparation of most educational institutions' elements, faculty and students in OL domains. Other factors that negatively affect EOL

would be: Inequalities in access and availability of infrastructure for online learning, possession of the necessary technology (computers, software, etc.) and facilities with internet connectivity [22-23]; the inadequate psychological, social and academic support provided to students [12, 22]; and the unfavourable home environment that makes online education difficult for many students [23]. Certainly, the presence (or absence) of one or more of these aspects may have an impact on increasing inequalities in access to education [8, 21], but it may also negatively influence students' perceptions of EOL, and may also create barriers and predispositions towards OL in the future [9, 12].

2.2 Online learning in Chilean university context

The Chilean higher education system is characterized by a high degree of privately funded and non-governmental institutions, which leads to a great institutional diversity, but also to a strong competition between study centers, which is carried out in the field of study programs and educational services [14, 24, 25]. In relation to OL in the university context, Chile does not yet have a specific regulatory framework for OL (as FFL does), nor specific criteria and mechanisms for regulating the quality of this modality [25, 26]. In general terms, until before the pandemic, the valuation of OL at the university level was low due to doubts about its quality and the real level of learning achieved by students [25]. Although there are no official statistics from the Chilean Ministry of Education or any other state agency about online university education, in 2019 it was estimated that there were around 23 higher education centres (including universities, professional institutes and technical training centres), with an enrolment of around 35 thousand students [25]. However, as early as 2010, there is literature indicating that 1.6% of higher education provision in Chile was in the form of OL [26]. Until the COVID-19 global pandemic, OL was strongly characterised by its complementary role to FFL. A common example of this was the use of educational platforms such as Moodle [41] as a repository of resources and study material available to students, the use of discussion forums (or other individual and collective participation activities) and spaces for notifications about various course activities [25]. The evaluation process usually consists of partial evaluations (assignments and/or application work) that are carried out on the virtual platform, and the final exam, which takes place in the face-to-face mode.

On the other hand, it was noted that in some universities, the OL modality already existed, as the entire teaching and learning process and evaluations were carried out through the virtual platform. In 2015, a detailed analysis of all 60 Chilean universities¹ was presented based on publicly available information by Araya-Castillo [27]. The analysis showed that all 60 universities already used a virtual learning platform (LMS – Learning Management System) but only 14 universities offered online training programs: 6 were public universities, 5 were private, and 3 were private universities with government support or funding (6 of these universities are headquartered in the city of Santiago; 2 of them also operate in the city of Santiago, 2 of them also operate with

¹ The number of Chilean universities in 2018 was 61[42].

another campus in another city). Until that time, only 6 universities offered undergraduate programs, but in the particular form of continuity of previous studies [27].

The health interventions resulting from the pandemic have greatly changed this reality, and to remain active, universities have had to quickly develop and implement EOL for their students. As in several countries, the Chilean university experience shows that EOL decisions are based on the use of video conferencing software (e.g. Microsoft Teams and Zoom), educational platforms (e.g. Moodle and Educandus) and a variety of ICT resources and other platforms [6, 25]. However, the pandemic has also highlighted the gaps and inequalities among Chilean students in relation to access to the Internet, to the technologies needed for OL (computers, software, among others), and the socio-economic reality of those students who were "pre-pared" for OL and those who were not [28]. Therefore, it is important to know the students' perception of the EOL and the personal and educational processes it has entailed.

3 Validating an instrument to measure the university students' perceptions about the online learning process

3.1 Research questions and methodology

The general objective of this research are to develop and validate an instrument (questionnaire) and to know about the perceptions and evaluations that university students have about the "emergency" online learning process that occurred in the context of the COVID-19 pandemic in Chile. The specific objectives of the research are:

1. To know the students' readiness towards EOL;
2. To characterize the students' learning experience in the online modality;
3. To find out what resources are available to students for EOL; and
4. To validate the developed questionnaire through a factorial structure analysis.

To address these objectives, three main categories were developed based on specific literature on OL, from which the questions (items) for students were derived (see Table 1). Regarding to the development and validation of a research instrument, this study is quantitative-descriptive (more details in 3.4). Since the data were obtained at a specific point in time (online survey), it is also a non-experimental, cross-sectional descriptive research [36].

3.2 Population and sample

The subject of this study is a group of students from an engineering faculty of a Chilean university. To respond to the main study goal (develop and validate an instrument), the sample selected is non-probabilistic. The students belong to different year groups with study starts from the year 2013. This instrument was applied in the winter semester of 2020/2021. A total of 121 students participated in the survey, but only 117

were considered valid in the data analysis (117 fully completed questionnaires). Regarding gender, 7.70% of the sample were female (9) and 92.30% were male (108). The distribution of students in the study was such that 3.40% of students entered in 2013 (4), 9.40% in 2014 (11), 8.54% in 2015 (10), 11.11% in 2016 (13), 12.82% in 2017 (15), 14.54% in 2018 (17), 18.80% in 2019 (22) and 21.36% in 2020 (25).

3.3 Instrument

Based on specific literature on OL, the authors of this proposal developed a questionnaire to explore "the perceptions and assessments that university students have about the EOL process in the context of the COVID-19 pandemic in Chile". The instrument consists of 24 items rated on a 5-point Likert scale (1 applies for "strongly disagree" and 5 for "strongly agree"). These items are grouped into 3 dimensions/factors derived from the literature presented in Table 1.

Table 1. Structure for the construction of instrument dimensions and items

Dimension/ Factors	Items	References
F1: Readiness towards EOL	1 – 8 (8 in total)	22, 23, 30
F2: Characterization of EOL experience	9 – 20 (12 in total)	30, 31, 32
F3: Resources for EOL	21 – 24 (4 in total)	23, 30, 32

3.4 Data collection and analysis procedure

The instrument was applied during November 2020, using the Google questionnaire tool. Students received an email, inviting them to participate and answer the survey. Each student completed the online questionnaire anonymously, considering ethical aspects according to Chilean social science research criteria. The study material initially consisted of 121 surveys. However, 117 questionnaires were considered valid, as they were fully completed. Based on this information, students' perceptions of how highly they rated various aspects of their OL experience were analyzed. To respond to the first three specific objectives of the research (see above), the responses to each item were analyzed through a descriptive analysis that considered average and standard deviation, and additionally, the homogeneity and coherence of each of the items with the corrected item-total correlations. Concerning the fourth specific objective (validation of the instrument), two procedures were carried out: first, the adequacy of the factorial structure was analyzed by performing an exploratory factor analysis with maximum likelihood and full-scale Varimax rotation methods. Then, the internal consistency of the full scale and sub-scales was analyzed using Cronbach's alpha. All statistical analyses were carried out using SPSS software.

4 Results

Concerning the reliability of the instrument, it can be noted that the Cronbach's Alpha index for all items (24) is .891 which indicates a high consistency [35]. Table 2 shows the results related to the reliability of each factor/dimension. The dimensions "EOL readiness (F1)" and "Characterization of EOL experience" (F2) register high consistency, while "EOL resources" (F3) register moderate consistency [35].

Table 2. Descriptive analysis of the scales

Factors	Cronbach alpha	Number of items
F1	.85	8
F2	.86	12
F3	.75	4

4.1 Statistical descriptive analysis

Table 3 presents the 24 items that make up each of the factors proposed in the instrument, the mean the homogeneity index (IT-Cr = Corrected item-total correlations) and the percentages of responses in degrees of agreement for each of the items: low (1 to 2), medium (3) and high (4 to 5) levels.

Table 3. Descriptive analysis of the scales

Factors	Items	\bar{x}	S.D	IT- Cr	Low 1-2	Med. 3	High 4-5
F1: Readiness towards EOL	Q1. Readiness level for online learning.	3.13	1.11	.725	27.4%	37.6%	35%
	Q2. Motivation level to learn online.	2.49	1.25	.54	52.1%	23.9%	23.9%
	Q3. Level of mastery of strategies and resources for autonomous learning.	3.4	0.97	.538	17.1%	37.6%	45.3%
	Q4. Usefulness of the time flexibility offered by online learning.	3.42	1.25	.444	23.9%	26.5%	49.6%
	Q5. Usefulness of the space flexibility offered by online learning.	3.13	1.34	.581	31.6%	27.4%	41%
	Q6. Facilitation of the interactions with the teacher through online learning	1.95	1.12	.52	71.8%	16.2%	12%
	Q7. Facilitation of the interactions with other students through online learning.	1.95	1.13	.409	73.5%	14.5%	12%
	Q8. Facilitation of group activities through online learning.	2.21	1.22	.389	60.7%	24.8%	14.5%
F2: Characterization of EOL experience	Q9. Identification of own learning strategies (memory, exercising, analysis, and reflection, summarising, etc.).	3.8	0.90	.517	5.1%	31.6%	63.2%
	Q10. Identification of own learning style (verbal, logical-mathematical, auditory, bodily, visual, interpersonal, individual, or a combination of the above).	3.94	0.84	.473	6%	20.5%	73.5%

	Q11. Identification of the most effective times to study.	3.94	0.99	.574	8.5%	17.9%	73.5%
	Q12. Identification of the most effective times for doing university work.	3.87	1.01	.623	10.3%	16.2%	73.5%
	Q13. Identification of the duration of the own concentration times.	3.75	1.04	.514	11.1%	28.2%	60.7%
	Q14. Ability to establish a systematic daily work and study schedule.	2.73	1.29	.428	46.2%	22.2%	31.6%
	Q15. Planning own work and study week online.	3.11	1.27	.478	29.1%	35%	35.9%
	Q16. Ability to search for relevant information on the internet.	3.96	1.01	.403	8.5%	22.2%	69.2%
	Q17. Ability to organize the information found.	3.81	0.97	.497	9.4%	24.8%	65.8%
	Q18. Ability to distinguish between relevant and irrelevant information.	3.96	0.89	.462	6%	21.4%	72.6%
	Q19. Level of proactivity in responding to new online learning tasks.	3.5	1.06	.484	15.4%	33.3%	51.3%
	Q20. Level of responsibility for the own learning process in the online format compared to face-to-face.	3.2	1.26	.274	29.1%	28.2%	42.7%
F3: Resources for EOL	Q21. Permanent availability of a computer for the online lessons.	4.16	1.22	.369	13.7%	13.7%	72.6%
	Q22. Availability of all software required for online learning.	3.32	1.36	.328	29.9%	20.5%	49.6%
	Q23. Availability of internet access for the online lessons.	3.77	1.29	.44	18.8%	17.1%	64.1%
	Q24. Availability of a place (at home) to work and study without distractions.	3.38	1.52	.448	28.2%	18.8%	53%

Note: N is equal for all (117) and 23 of the items reach the minimum (1) and maximum (5) value, except for item 10, where the minimum value (2). \bar{x} = Mean; S.D. = Standard Deviation; IT-Cr= Corrected item-total correlations.

In general, for all items there is sufficient *variability*, as almost all items have reached the minimum and maximum values available, except for item Q10 whose minimum value is 2. Regarding the homogeneity index, a positive item/total corrected correlation is observed for all items, with values between .274 and .725, indicating that all items contribute in the same sense to the measurement of the questionnaire. Of the 24 items, there is only one value < 0.3 (item Q20).

Regarding the "Readiness towards EOL" [22, 23, 30] of the students, the flexibility of time offered by OL is perceived as useful (49.6%) and to a lesser extent the flexibility of space offered by this type of learning (41%). They recognise that they are proactive in responding to new EOL tasks (50%) but with less significantly that they feel more responsible for the teaching-learning process in the online format (41.3%), and also that only 23.9% feel motivated to teach online. Specifically with regard to motivation and readiness for EOL: 52.1% feel low motivation and 65% of the participants feel medium and low prepared for EOL.

In relation to the "Characterization of EOL experience" [30, 31, 32] the students claim to know their learning style (73.5%), the times when they are most effective at

doing university work (73.5%) and the length of their concentration time (60.7%). The students also recognise that they know how to search for relevant information on the Internet (69.2%) and how to distinguish between relevant and irrelevant information (72.6%), as well as how to organise the information they find (65.8%). To a lesser but equally significant, learners recognise that they are proactive in responding to new OL tasks (51.3%) and recognise that they feel more responsibility for their own learning process in the online format (42.7%). In this dimension, the items with the lowest scores are the statements referring to planning the work and study week online (35.6%) and having a systematic work and study schedule (31.6%).

Regarding the “Resources for EOL” [23, 30, 32] the participants considered having a computer permanently available for online classes (72.6%) and access to the internet (64.1%). However, when the middle and low percentages are added together, 47% of participants report difficulties in having a place at home where they can work concentrate, and 50.4% do not have all the necessary software for EOL.

4.2 Factorial structure analysis

In order to evaluate the structure of the questionnaire from the scores of the items that compose it, exploratory factor analysis was applied for the complete scale that seeks to find out the students' perceptions regarding the use of ICTs. The factor analysis was carried out with principal component extraction and subsequent Varimax rotation with Kaiser [38].

Pre-existing works on OL and EOL by Blankenship and Atkinson [31], Hung et. al. [32], Parkes et. al. [23] and Smith [30], show that in order to investigate university students' perceptions of OL, aspects such as “self-management of learning”, “motivation for learning”, “possession and self-efficacy in the use of technological resources”, “interaction with other actors in the learning community”, among others, must be considered. Based on this, the initial instrument consisted of 3 scales (dimensions/factors) with a total of 24 items. The first scale refers to "Readiness for EOL" (items 1-8); the second, "Characterization of the EOL experience" (items 9-20); the third, "Resources for EOL" (items 21-24).

For the exploratory factor analysis, values lower than .30 are suppressed so that the results do not show values of factor loadings lower than this value and to make it clearer which are the most important loadings and which are not, [38, 39]. The sample adequacy measures indicate that the factor analysis is relevant given the correct KMO index of the scale (0.791). A level > 0.75 is estimated to be correct [39]. In order to assess the applicability of the factor analysis of the entire scale, Bartlett's test of sphericity was performed, obtaining a significance index of 0.001, a value that allows the implementation of a factor analysis [40]. The next step corresponded to an iterative process of factor analysis, where items with weak factor loadings or with loadings that saturated in more than one factor were eliminated. The items eliminated from the factor analysis scale were: 3, 15, 19, 20 (four in total).

Table 4 presents the consolidated factor structure after eliminating the mentioned items (3, 15, 19, 20). The result of the exploratory factor analysis shows that the 20

items entered are grouped into 5 factors. The Kaiser rule provides a factor structure with five factors that explain 66.15% of the total variance.

Table 4. Exploratory factor structure

Items	Factors				
	1	2	3	4	5
11	.807				
12	.744				
10	.660				
14	.652				
13	.632				
9	.599				
4		.837			
5		.709			
1		.650			
2		.646			
21			.806		
22			.773		
24			.681		
23			.598		
17				.853	
18				.842	
16				.828	
7					.861
8					.833
6					.607

A first factor refers to "Self-management learning skills" and explains 15.92% of the total variance and is made up of six items (9, 10, 11, 12, 13, 14). A second factor is made up of 4 items (1, 2, 4, 5) that refer to "Readiness for OL" and explains 14.19% of the total variance. The third factor refers to "Resources for OL" and is made up of items 21, 22, 23 and 24 which explain 12.83% of the variance. The fourth factor refers to the "Skills and strategies of the student for EOL" and this explains 12.18% of the variance (items 16, 17, 18). And finally, the fifth factor refers to "Interaction with others during OL" and includes three items (6, 7 and 8) which explain 11.03% of the variance.

Cronbach's alpha measure for the full scale is .879 (high consistency) for 20 [36]. The alpha coefficients for each of the extracted factors are presented in Table 5.

Table 5. Statistical reliability analysis for the new factor structure

Factors	Cronbach's alpha	No. of elements
F1	.83	6
F2	.79	3
F3	.82	8
F4	.86	3
F5	.73	4

These results show that the instrument applied with a structure based on the criteria of previous research distributed in three dimensions ("Readiness towards OL", "Characterization of the OL experience" and "Resources for OL"), should be regrouped into 5 dimensions. The dimension "Resources for OL" (F3) remains unchanged. The dimension "Readiness towards OL" (F2) is maintained, but with fewer items than initially proposed, as a new dimension called "Interaction with others during OL" (F5) is derived from it. The dimension that was originally called "Characterization of the ALE experience" was the one with the most of changes, as it gives rise to two dimensions that can be better specified as: "Self-management learning skills" (F1) and "Skills and strategies for OL" (F4).

5 Discussion and conclusion

This research was carried out in the midst of the process of adapting to the conditions generated by the COVID-19 pandemic. Aware of the challenges facing EOL and concerned about the training process of university students, the general objective of this research are to develop and validate an instrument (questionnaire) and to know about the perceptions and evaluations that university students have about the "emergency" online learning process that occurred in the context of the COVID-19 pandemic in Chile. In the specialized literature a strong correlation between students' attitudes toward OL and EOL and their socioeconomic conditions can be distinguished, and here, in particular, students from better socioeconomic backgrounds express more satisfaction about EOL than their disadvantaged peers [12, 22]. Specifically, Bozkurt and Sharma [12], and Zhang et al. [22] evidence a variety of barriers that may impede effective delivery of online education, including the lack of preparation of most educational institutions' elements, faculty and students in OL domains. Some of this correlations were identified during the study, but not conclusively (the sample was non-probabilistic).

Based on the works of Blankenship and Atkinson [31], Hung et. al. [32], Parkes et. al. [23] and Smith [30] (among other authors) regarding AL, an instrument (questionnaire) was developed and implemented through an online tool, with the participation of 117 students. The specific objectives of the research were: (i) to know the students' readiness towards EOL; (ii) to characterise the students' learning experience in the online modality; (iii) to find out about the resources available to students for EOL; and (iv) to validate the developed questionnaire through a factorial structure analysis.

In relation to the reliability of the instrument it can be noted that the Cronbach's Alpha index across all items (24) is .891 indicating high consistency [35, 36]. The findings of the research related to the specific objectives are (among others):

1. Students perceive flexibility of time as useful, but to a lesser extent flexibility of space.
2. Low motivation and low preparation for OL was recognized.
3. All aspects that are directly related to interaction with others (teachers and peers) were low rated.
4. The students claim to know their learning style, the times when they are most effective at doing university work and the length of their concentration time.
5. All students also recognise that they know how to search for relevant information on the Internet and how to distinguish between relevant and irrelevant information.
6. The items referring to planning the work and study week online and having a systematic work and study schedule are rated extremely low.
7. Students considered having a computer permanently available for online classes and access to the internet. However, 47% of participants say they have difficulty having a place at home to work in a focused manner and that they do not have all the software they need for EOL. %).

According to this information, it is possible to infer that there is a family factor (and maybe also an economic factor) that could produce some difficulties to face this change in the learning modality. It is possible to refer to factors specific to the household, such as, for instance, having technological devices with sufficient internet connectivity for the family members or spatial issues, such as an exclusive space for study [12, 22].

8. Regarding to the factorial structure analysis of the questionnaire, the analysis showed that the instrument should be regrouped into 5 dimensions. The dimension "Resources for OL" remains unchanged from the initial instrument. The dimension "Readiness towards OL" was maintained, but with fewer items than initially proposed, as a new dimension called "Interaction with others during OL" was derived from it. The dimension that was originally called "Characterization of the ALE experience" was the one with the most of changes, as it gives rise to two dimensions that can be better specified as: "Self-management learning skills" and "Skills and strategies for OL".

Thanks to the factor analysis, it is possible to identify that there are still variables that would be useful to add in a future instrument that deals with these issues in depth. In this sense, it could be interesting to study what is the infrastructure available for study (at home), what are the dynamics within this space, whether they facilitate or promote concentration, respect, and silence, etc. On the other hand, there are high percentages of agreement in those variables that evaluate the characteristics of the students and the potential for OL (Factor 1), where it is evident that the students have all the tools for this process to be integrated quickly, as they not only use ICTs several hours a day but also know how to use them for educational purposes.

In this sense, students are able to discriminate the information they find, to support academic studies through them and to recognize the potential of OL (they recognize

that the length of their concentration time has improved, that their work and study timetable has been strengthened and that they plan their work and study week better). However, the theory has also pointed out how important motivational aspects are in the successful integration of this type of learning [30-32].

As a limitation of the present research, both the size and the characteristics of the sample (117 students from an engineering faculty) should be taken into account. Future studies should consider the (larger) sample size and probability sampling techniques, including participants from other faculties and universities as the object of study.

The results obtained are a first approximation of OL and the perceptions that Chilean students have of it in times of a global pandemic. They allow us to identify various aspects of the OL experience in the Chilean educational context, their reality and new challenges. The next step for the authors of this article will be to make theoretical adjustments and strengthen the research instrument for its subsequent new implementation.

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