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Case study: An exploratory-descriptive study on the engineering students' perceptions about online assessment during the COVID-19

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Abstract : To ensure high-quality educational processes, more educational research should be developed about student experiences during the COVID-19 pandemic. Furthermore, the student's perception about distance learning education (under the current situation) could be used as input for instructors and educational institutions to guide their distance learning process. The primary aim of this research is to explore engineering undergraduate student's perceptions about the online assessment methods during the COVID-19 age. This paper presents an exploratory-descriptive study based on content and quantitative analysis tools. The main findings of this research concern the factors perceived as the main differences between the face-to-face and online assessment by a group of engineering students during the current pandemic. These factors are: teaching presence, self-efficacy, autonomy, teamwork, and coherence between assessment and class. Furthermore, in the analyzed state-of-the-art, the last three factors have not been reported. These results will be used to guide the improvement of future online assessment methods in our engineering school.

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Keywords: Assessment's methods; COVID-19; Distance Learning; On-line Learning.

1. Introduction

The situation caused by the COVID-19 pandemic forced governmental actions, such as temporary closure of the schools and universities around the world in more than 109 countries (Mahaye, 2020; Syed, Kandakatla, Yadav, & Himasagarika, (2021)). In Colombia, the government decreed a strict quarantine in April 2020, which force the migration from face-to-face to distance lectures by the educational institutions (Ruka, 2020; Sanchez & Ariza, 2020). This abrupt change implied a rapid adaptation process of the educational institutions world-wide (Mahaye, 2020; Syed, Kandakatla, Yadav, & Himasagarika, (2021)). Furthermore, professors and students had to face several pedagogical, technical, financial, or organizational obstacles (Ruka, 2020; Lassoued, Alhendawi, & Bashitialshaaer, 2020; Syed, Kandakatla, Yadav, & Himasagarika, (2021)). Furthermore, some institutions introduce Information and Communication Technologies (ICTs) on a larger scale under the distance learning paradigm (Ruka, 2020; Sanchez & Ariza, 2020;). For instance, in local Universities in Colombia (e.g., Pontificia Universidad Javeriana), both postgraduate and undergraduate courses change from face-to-face to virtual classes, supported by a learning management system (e.g.,

Blackboard or teams software) and other open software tools (e.g., Open Broadcaster Software). Distance learning has impacted not only universities but also elementary schools in Colombia, for instance, the Instituto Alberto Merani implemented ICT tools (i.e., Moodle and Zoom software) to guarantee the access to virtual classes for all their students. This fact has also transcended to educational institutions world-wide as is the case of the, institutions with a very well-known trajectory in the design and implementation of online courses (e.g., Massachusetts Institute of Technology and the Harvard University), which increase their distance learning offer. In this research, we follow the distance learning concept discussed by Lassoued et al. (2020), which define distance learning as an "interactive learning between a teacher and a student that takes place outside the walls of the educational institution, so that information and knowledge from its sources reach the student through technical means and electronic media.". In this sense, it is very similar to the online learning concept adopted by (Mahaye, 2020; Girik, 2020). We considered both definitions as equal in this paper.

In the COVID-19 age, some works have studied several aspects involved in the distance (or online) learning process (Mahaye, 2020; Lassoued et al. 2020; Girik, 2020; Chick et al. 2020; Kaur, Garg, & Kaur, 2021; Piyatamrong, Derrick, & Nyamapfene, 2021; Saripudin, Sumarto, Juanda, Abdullah, & Ana, 2020; Kaur, Garg, & Kaur (2021)). Mahaye (2020) explored the applicability of some distance learning tools to overcome the restrictions associated with the pandemic. The author exposes that distance learning could be effectively implemented only in a digitally developed society. Lassoued et al. (2020) used an exploratory-descriptive methodology to explore the students' perception of the transition to distance learning. Their results indicate that the professors and students faced many obstacles, which could be categorized as self-imposed (e.g., students had to learn to be more autonomous in their learning process) and external obstacles (e.g., the institutions had to develop pedagogical tools to support learning process). Girik (2020) researched about the learners' perception of online learning during a COVID-19 pandemic using a semi-structured interview and a qualitative method. The author found that the adopted distance process has a significant impact on student performance, they also found that online learning is perceived by the learners as a good option during the pandemic. Furthermore, the author found "good" practices perceived by the students as the insertion of voice notes to give instructions in the material implemented by the lecturer in the online learning process. In addition, the author discussed some obstacles of online learning, such as the availability of free internet access, financial issues, and free online learning applications. George (2020) presented the exploration of a classroom-based methodology for distance teaching of digital logic course to engineering students during the pandemic. In this research, the author evaluated the students` performance and found that the proposed methodology increases their performance. Kaur, Garg, & Kaur (2021) explored the student's perceptions about the quality of engineering education through online platforms. The authors used the notions of knowledge gain, concept clarity, assessment, and satisfaction. They concluded that students prefer regular teaching (i.e., the instructor teaches in front of them). Finally, Chick et al. (2020) explored the distance learning (forced by the pandemic) of eminently experiential environments such as the training processes of medical residents. These authors proposed a methodology based on flipped classroom, online practice questions, teleconferencing, telemedicine clinics, procedural simulation, and surgical videos. However, the author did not evaluate its impact on students' performances.

Due to the pandemic and during the first semester of 2020 our engineering school changed from face-to-face to distance classes. However, the pedagogical and educational methodology remained the same. On the one hand, this abrupt change implied a rapid adaptation process for faculty instructors. They had to reconsider their teaching methods and become proficient in the use of ICTs. On the other hand, students had to learn to be more autonomous in their learning process because many of the contents` lectures were asynchronously delivered, and they had to manage their learning process. Also, peer collaboration facilitated student learning and social interaction between peers. Moreover, summative assessments became a key factor in students' satisfaction with their online learning experience. Furthermore, in the routine student`s evaluation of academic processes, they raised criticisms and questions about assessing tools, such as lack of coherence between assessment and class, very complex assigned tasks, and overwork. These critics were focalized on the assessment tools used in the Dynamic Systems Analysis course, which is a second-year course of the electronic engineering program. To understand the educational context, the course's

instructors looked for literature about student's preferences and acceptance of distance assessments under the conditions associated with the COVID-19 pandemic. However, to the best knowledge of the authors, this topic has not been still explored during the COVID-19 pandemic.

Previous research has explored this topic in the pre-pandemic reality (Chyung, Moll, & Berg, 2010; Jimenez et al, 2020; Obando, Palechor, & Arana, 2018a; Shea & Bidjerano, 2010; Khan & Khan, 2019; Cazan & Indreica, 2014). Chyung et al. (2010) approached the role of intrinsic goal orientation, self-efficacy, and e-learning practice in an introductory online engineering class following a quantitative method. They found that higher levels of intrinsic goal orientation and self-efficacy are associated with higher academic achievement. Jimenez et al. (2020) explored the motivation role in math class under face-to-face and blended class. They found that students in face-to-face learning programs had a statistically higher level of interest. Obando et al. (2018a) analyzed teaching presence in a blended learning university course. They found a significant relationship between student satisfaction and presence learning. Moreover, they found that teaching presence was an essential condition for effective online learning environments. Shea and Bidjerano, (2010) examined the relationship between learner self-efficacy and performance in online environments. The authors suggest that learner presence (i.e., self-efficacy and other cognitive, behavioral, and motivational constructs) supports the learner's self-regulation. Khan and Khan (2019) found that students' acceptance increases if the transition from presence to online is gradual. Cazan and Indreica (2014) analyzed the differences between online and traditional assessments using validated questionnaires and a quantitative methodology. The authors concluded that there are no differences in academic performance between the assessment modalities. However, the online students reported higher levels of anxiety and lower levels of self-efficacy.

Considering our engineering school context under the current pandemic, an exploratory-descriptive study about the students' perception of assessment was developed. Its descriptors are summarized below:

· Objectives: This research aims to explore the factors involved in the distance learning assessment under the current pandemic, considering the points of view of professors and students in an engineering school of a Latin American university.

· Research Question: What are the factors involved in the distance learning assessment during the current pandemic from the point of view of engineering students and instructors.

· Methods: This research uses a mixed methodology based on content and quantitative analysis. We applied the content analysis technique to some reflective activities developed by the students and instructors about its assessment experiences (both face-to-face and online) during the pandemic. In addition, the content analysis was applied to semi-structured interviews of the course. From the results, we developed two surveys about the assessment student`s experiences, which results were analyzed using quantitative analysis.

· Population: Students of electronics engineering program at our engineering school during the first semester of 2020.

· Research Limitations: The used sample was limited to three classes of the same course at the electronic engineering program, which means the 13.33% of the total active students of this program (i.e., 475 persons).

· Results: We identify relevant factors perceived as the main differences between the face-to-face and online assessment experiences, which are: teaching presence, self-efficacy, autonomy, teamwork, and coherence between assessment and class.

· Conclusions: The situation of the COVID-19 pandemic is not a factor perceived by the students as a significant difference between their face-to-face and online assessment experiences. However, we found an indirect relationship between the pandemic condition and assessment students' experiences, which is evidenced in some semi-structured interviews and analyzed reports fragments. Moreover, we identified some factors not reported in the analyzed literature perceived by the students as significant in their assessment experiences during the pandemic (Chyung et al, 2010; Jimenez et al, 2020; Obando et al, 2018a; Khan & Khan, 2019; Cazan & Indreica, 2014; Obando, Palechor, & Arana, 2018b), which are teamwork and coherence between assessment and class.

2. Exploratory Procedures

This study applies a mixed research methodology based on a quantitative analysis and content analysis techniques. This approach allows finding general trends and particular details of the context (Bonilla & Sehk, 2005; Raigada, 2002). In particular, This research used the content analysis concept defined by Bonilla & Sehk, (2005), who conceived this tool as the set of analysis-procedures applied to communication-products that allow processing of relevant data on the individuals and their social and contextual conditions. The quantitative analysis was developed using a non-validated instrument constructed for the particular context (based on exhaustive content analysis of reflective tasks and semi-structured interviews). This instrument could be used instead of a universally validated instrument (e.g., scale or psychometric tests) because this research does not attempt to measure some categories of the population. Furthermore, its main objective is to explore and to describe the different perceptions to categorize them.

Following an exploratory-descriptive approach and to explore students' perception about their learning assessment experiences during the first semester of 2020, a few reflective tasks related with face-to-face and online experiences (i.e., synchronous or asynchronous) were applied to engineering students. These students' tasks were: 1) A reflection essay on the evaluation methods, 2) Two lists made by the students with disciplinary and non-disciplinary topics, which were perceived by them as related to its assessing experiences, 3) A short video of reflection on evaluation methods during the pandemic. These tasks were volunteer, submitted by the 36,5% of the sample (i.e., 63 students of the Dynamic Systems Analysis course, which is a second-year course of the electronic engineering program of our university). These students were 68% male, and 31% female. Moreover, two semi-structured interviews were developed with the course instructors about their learning assessment experiences during the pandemic.

The context analysis technique based on deductive and inductive categories was applied to the communicative products (i.e., reflective tasks and semi-structured interviews transcriptions). The deductive categories were defined from the conceptual framework (i.e., the analyzed state-of-the-art) and the inductive ones were defined based on the systematic exploration of the communicative products. As a result, the content analysis allowed defining five inductive and four deductive categories, which are: Autonomy (A), Teamwork (TW), Work under Pressure (WP), Coherence between assessment and Class (AC), Academic Self-efficacy (AS), Teaching Presence (TP), Motivation (M), Participation (PA), Internet Access (IA).

To identify the perception of the students regarding the possible different characteristics between online and face-to-face assessment during the pandemic, and based on the categories found in the content analysis, one descriptive survey (Díaz, 2017) were implemented on the Microsoft Forms®. This survey was split into two questionnaires, named as Face-to-Face Assessment Instrument (FAI) and the Online Assessment Instrument (OAI) with 26 and 29 questions, respectively. In the developed questionnaires, the most used question type was the Likert scale of Agreement/Disagreement, which is illustrated in Fig. 1. On that Likert scale, questions with positive and negative logic were placed. In positive logic, the statement used the same logic of the evidence found in the content analysis. In negative logic, the statement used the inverse logic of the evidence. These two approaches are exemplified in Table I. The list of all agreement/disagreement Likert questions along with their logic were summarized in Appendix A. These questions were mapped to a numerical scale, which is summarized in Table II.

The numerical results were quantitatively analyzed by the Percentage of Agreement or Disagreement (PAD). The PAD of a question was defined as the average value of all students' responses to the question using the numerical scale discussed before, which was multiplied by 100 (question with positive logic) or -100 (question with negative logic). Furthermore, the PAD of a category was defined as the average value of the questions PADs of the category. In the other queries, the frequency Likert scale and single-response selection questions were used. These question types were illustrated in Fig. 2 and Fig. 3.

Table 1:
Example of the logic agreement/disagreement questions

Logic	Evidence	Statement
Positive	"After taking the virtual exam, I realized that I had to study in a different way"	The experience of taking the course virtual exams, made me reflect on my preparation strategies for the exam.
Negative	"The time was not enough for me in the virtual exam"	"The adverse time conditions in the face-to-face exams were greater than those in the virtual exams"

Table 2:
Mapping of the agreement/disagreement likert scale

Logic	Strongly disagree	Disagree	Agree	Strongly agree
Agree	-1	-0.5	0.5	1

Fig. 1: Example of a question with an agreement/disagreement Likert scale.

Fig. 2: Example of a question with a frequency Likert scale.

Fig. 3. Multiple choice question example.

3. Content Analysis Results

From the content analysis of both the students' reflexive tasks and semi-structured interviews applied to the course instructors, we obtained five deductive and four inductive categories, which were listed in Tables III and IV, respectively. From these categories, two instruments were developed (OAI and FAI), the structure of these instruments was summarized in Table V. In addition, in Table VI, the two control questions developed for the surveys were listed.

Table 3 :
Deductive categories found in the content analysis

Source	Category	Definition
Chyung et al (2010)	Academic Self-efficacy (AS)	Recognition of one's own capacities to organize and implement the required courses of action that will produce certain achievements or results.
Obando et al (2018b)	Teaching Presence (TP)	The design, facilitation and orientation of cognitive and social processes, in order to obtain educational results.
Villalpando et al (2020)	Motivation (M)	The degree to which students strive to achieve the academic goals they perceive as useful and meaningful.
Sfard (2008)	Participation (PA)	The process of becoming part of a learning community through class intervention and preparation.
Andersson and Grönlund (2009)	Internet Access (IA)	Having physical access to a communication device and an Internet connection, the reliability of the connection and everything you need to access the full range of content needed to develop a virtual class.

Table 4:
Inductive categories found in content the analysis

Category		Source or Definition or Evidence
Autonomy (A)	Source	Mentioned in 73.91% of the activities
	Definition	Ability to deliberate, be aware, be informed, make choices and take responsibility for action.
	Evidence	Text fragments of the activities: "It is the ability of a person to investigate, learn and make decisions, independent of others." "Fulfill own duties without being reminded by somebody."
Teamwork (TW)	Source	Mentioned in 65.22 % of the activities and in the semi-structured interview with the instructors.
	Definition	Personal readiness and disposition to carry-out activities with peers to achieve common objectives, exchanging information, assuming responsibility, and solving difficulties that arise.
	Evidence	Text fragments of the activities: "To understand the strengths of each member of the group and take advantage of the most of them, to obtain a better performance facing a test, and then to assign activities to each member consistent with the above mentioned".
Work under pressure (WP)	Source	Mentioned in 82.61% of the activities.
	Definition	Ability to work under adverse circumstances and maintain satisfactory levels of effectiveness and compliance
	Evidence	Text fragments of the activities: "It is the abi lity of each individual to perform an activity." "Knowing how to control cognitive abilities correctly when it is working on a stipulated time."
Coherence between assessment and class (AC)	Source	Mentioned in 65.22 % of the activities and in the interview with the instructors.
	Definition	The relationship between evaluative and lectures practices.
	Evidence	Text fragments from the interview: "We all have had a hard time moving from face-to-face modality to virtual modality. Students are unhappy because t hey perceive less quality classes and expect easy exams"

Table 5 :
Structure of perception assessment instruments details

Instrument or Scale	Category								
	AS	TP	M	PA	IA	A	TW	WP	AC
Number of questions in OAI	2	2	4	4	3	3	2	5	2
Number of questions in FAI	2	2	4	4	0	3	2	5	2
Frequency Likert				X					
Agreement/Disagreement Likert	X	X	X			X	X	X	X
Multiple choice					X				

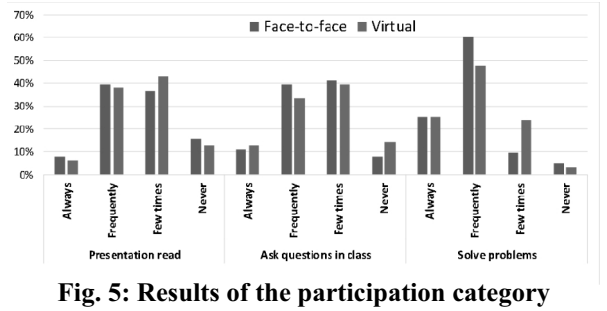

Fig. 5: Results of the participation category related with class participation.

Table 6 :
Control questions used in surveys.

Identifier	Instrument	Question text
P17	FAI y OAI	Adverse time conditions in face-to-face exams were greater than virtual exams.
P19	FAI y OAI	The experience of performing face-to-face exams made me feel high levels of anxiety.

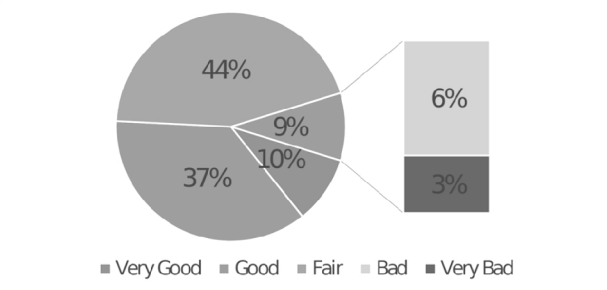

Fig. 4 : Perception of the of Internet Access quality

All the students of the sample (i.e., 63 persons) responded the survey, they are between 18 and 24 years old. The 26.98 %, 71.43 %, and 1.59 % were female, male, and another gender, respectively.

A. Internet access

Regarding internet access (IA), the 92% of the participants had a device to take online classes, and 80% had internet access. Their perception about the IA quality is shown in Fig. 4.

B. Participation

The participation category results were illustrated in Fig. 5 and Fig. 6. Considering these results, the students perceived their participation as frequent and infrequent regarding class preparing activities (e.g., solving the workshops and reading the presentations) and asynchronous online interactions (e.g., forums, short videos, and chat), respectively. Furthermore, there are no differences in the perception of PA category related with class participation between the online and face-to-face modalities, except for the solve problem task, in which more frequent participation was perceived in the face-to-face modality.

C. Quantitative analysis of the rest categories

The agreement/disagreement Likert questions were grouped by categories (see detailed in Appendix A). The analysis of these categories was developed using the PAD concept (explained in the section II). The category PADs were calculated in each instrument (OAI and FAI, which were named as online and Face-to-Face in Figures). The category PADs results were summarized in Fig. 7. These results are coherent with the content analysis because many calculated PADs were positive. This numerical result means that the perception measured quantitatively with the PAD corresponds to the same logic found in the evidence of the content analysis. This trend was valid for all questions, except for questions P9 and P3 of the OAI instrument, with a calculated PAD of -10% and -2% respectively. The calculated PAD difference of the control questions (i.e., P17 and P19) was a maximum value of 10%, therefore the negative values of the PAD (i.e., P9 and P3) could be explained by the instrument error.

To identify the categories perceived by the students as the main differences between their face-to-face and online assessment experiences, the PADs differences of each category were calculated as the mean value of the questions PAD differences of the category. These average values were summarized in Fig 7. Furthermore, the categories with a PAD difference more than 10% (i.e., the estimated error of the instrument) are illustrated comparatively in Fig. 8. These categories (ordered from the highest to the lowest impact in the students` perception) are: teaching presence, teamwork, self-efficacy, autonomy, and coherence between the evaluation and the class

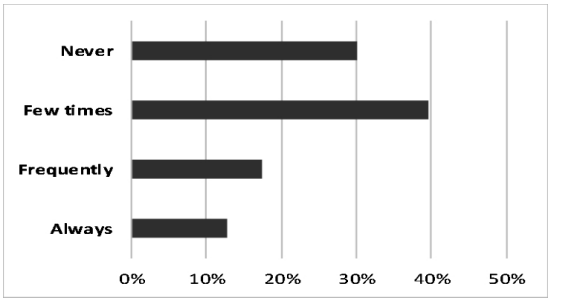

Fig. 6 : Results of the PA category related with the use of asynchronous media.

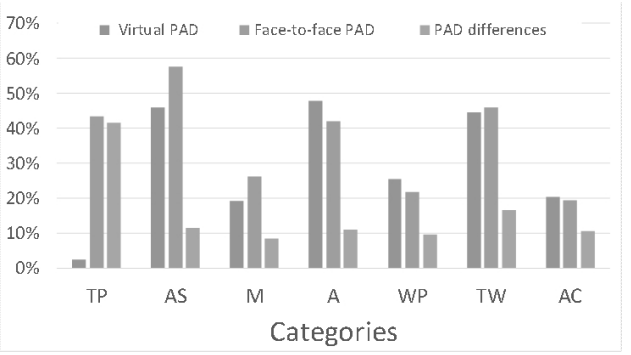

Fig. 7 : Category results and its differences

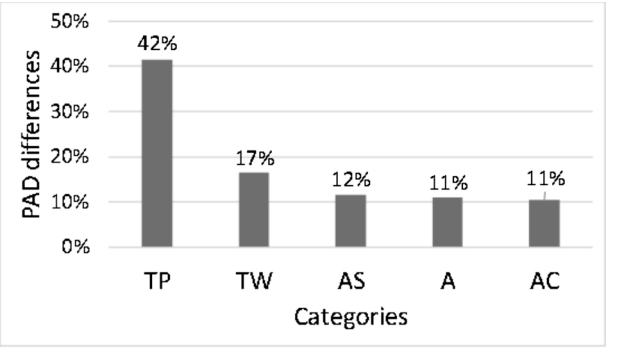

Fig. 8 : Categories with the highest impact in the students` perception

5. Discussion

A. Internet access

The 80% of the students had computers with an internet connection, so this factor did not represent an obstacle to access classes in online mode. This may be related to the private nature of the university and the financial resources of its students. However, the other students (i.e., 20%) had limited their chances of achieving good results in the online model and generated inequality among students. The perception on this topic is exemplified in table VIII through fragments transcribed from the content analysis of the reflective tasks carried out by the students.

B. Participation

The students perceived that they did more frequently its assigned out-class problems in the face-to-face learning process. Furthermore, the decrease in their participation in this task could be linked with the task evaluation method because they perceived the online quizzes as easier than the face-to-face ones. Furthermore, in the online environment, students mentioned that it was easy to find the answer to the evaluations on the internet. Regarding this aspect, the interviewed instructors agreed that student's performance in online quizzes was in general good because they usually had ethical misconducts by interacting with their peers during the individual evaluation activities. Examples of these perceptions are shown in table VIII. Additionally, it was found that the perception of students regarding the use of asynchronous tools available in online education platforms was scarce. This may be related to the students' perception that in the online environment, the work related to the lectures increase under the pandemic. Therefore, they gave priority to the activities linked to the final grade. The above is exemplified in table VIII through fragments transcribed from the content analysis of the reflective tasks carried out by the students.

Table 7 :
Fragments transcribed related to ia and pa

Cat.	Fragments	Actor
IA	"On the other hand, being a tool that needs internet access, for some people who do not have stable access, or they simply do not have fixed internet access, it is very difficult to complete this test, worth almost 50% of the total grade, it is not something that can be despised".	Student
IA	" Not everyone has a good internet connection and the same teams to develop an online exam at the same level".	Student
IA	"I am part of the program. . . and although they told us that they were going to help us with the Internet issue, the only thing they told us was that they were going to recharge us 14 USD in an account so that we have data on our cell phone. But, even so, many of my classmates cannot even access classes at any time, and some (very few) do not have a computer.".	Student
IA	"The faculty did make an effort to try to help the boys, they asked us to identify students who missed a lot of online classes, but after identifying them it was difficult to contact some of them to offer the faculty support".	Instructor
PA	"It was easier to find the answer to the evaluations without developing the exercises".	Student
PA	"In the end, it seemed to me that the boys cheated in the online quizzes, they got good grades, but they didn't participate in the solution ... other teachers showed me that it was easy to cheat on this type of platforms".	Instructor
PA	"It is not a joke to say that many teachers due to the situation are saturating students with many files to read and perform, due to the issue of autonomy".	Student
PA	"In my case, it was necessary to take the time from other assigned work of other classes to develop the exam, this time was vital for achieving a good exam result. However, this effort affected my grade in the other classes."	Student
PA	Although the exam is created according to the time established for its development, it can be considered that it was a bit extensive since it was not taken into account that the student has to answer for other subjects and could not be devoted all the time.".	Student

C. Quantitative analysis of the rest categories

Of the nine categories found in the content analysis, seven categories were analyzed quantitatively. Considering the survey results, only five of them were perceived by the students as the main differences between its face-to-face and online assessment experiences. A brief discussion about student's perceptions of these categories is presented below.

· Teaching presence (TP): The students perceived the physical presence of the instructor in the assessment as more comfortable. One of the reasons is because they consider that face-to-face communication (with the instructor) during the assessment helps them to increase their knowledge (in the assessed topics). This was evidenced in the high difference in the PADs of questions P9 and P3, and in the content analysis. Examples of these perceptions are summarized in table IX.

· Teamwork (TW): The students perceived peer collaboration during the assessments (online and face-to-face) as a tool, which helps them consolidate their knowledge and helps to increase their confidence in obtaining a successful result. However, the peer collaboration interaction was perceived as more important in face-to-face than in online assessment to strength their knowledge. This is evidenced in the value of the PAD difference of the question P4 (in both instruments). The perception on this topic is exemplified in table IX. Additionally, the PAD difference found in P14 question showed that the peer collaboration was perceived as more important in face-to-face than in online assessment to increase the confidence in obtaining a successful result. Examples of these perceptions are summarized in table IX.

· Academic Self-efficacy (AS): Considering the category PAD difference, its definition, and its PAD related question, the students perceived that the two assessment types (especially the face-to-face one) contributed to identify aspects necessary to obtain good academic results, such as study techniques, attitudes, and academic skills.

· Autonomy (A): Considering the category PAD difference, its definition, and its related PAD question, the students perceive that the strategies required to prepare the online and face-to-face assessments are different.

· Coherence between the Assessment and the Class (AC): Considering the category PAD difference, its definition, and its related PAD question, the students perceive that in an online environment the assessments were less complex than in a face-to-face environment.

B. Perception of conditions associated with the COVID-19

Only a few mentions regarding the COVID-19 pandemic were found in the content analysis. The students' perception of the pandemic effects involved in their learning process was grouped in two dimensions. The first dimension is related to the abrupt change from face-to-face to online educational process because the pandemic. The second one is related to the increase and decrease of their anxiety and motivation, respectively. These dimensions are exemplified in the fragments showed in table X.

Table 8 :
Fragments transcribed related to tp and tw categories

Cat.	Fragments	Actor
IA	"On the other hand, being a tool that needs internet access, for some people who do not have stable access, or they simply do not have fixed internet access, it is very difficult to complete this test, worth almost 50% of the total grade, it is not something that can be despised".	Student
IA	" Not everyone has a good internet connection and the same teams to develop an online exam at the same level".	Student
IA	"I am part of the program. . . and although they told us that they were going to help us with the Internet issue, the only thing they told us was that they were going to recharge us 14 USD in an account so that we have data on our cell phone. But, even so, many of my classmates cannot even access classes at any time, and some (very few) do not have a computer.".	Student
IA	"The faculty did make an effort to try to help the boys, they asked us to identify students who missed a lot of online classes, but after identifying them it was difficult to contact some of them to offer the faculty support".	Instructor
PA	"It was easier to find the answer to the evaluations without developing the exercises".	Student
PA	"In the end, it seemed to me that the boys cheated in the online quizzes, they got good grades, but they didn't participate in the solution ... other teachers showed me that it was easy to cheat on this type of platforms".	Instructor
PA	"It is not a joke to say that many teachers due to the situation are saturating students with many files to read and perform, due to the issue of autonomy".	Student
PA	"In my case, it was necessary to take the time from other assigned work of other classes to develop the exam, this time was vital for achieving a good exam result. However, this effort affected my grade in the other classes."	Student
PA	Although the exam is created according to the time established for its development, it can be considered that it was a bit extensive since it was not taken into account that the student has to answer for other subjects and could not be devoted all the time.".	Student

Table 9: Fragments transcribed related to the COVID-19 Pandemic

Fragments	Actor
". . . the learning methods were very different, initially normally with face-to-face classes, but with the arrival of the coronavirus, the work changed a lot. . . This affected learning because now the environment was different, there were more distractions, it was more difficult to pay attention in class. And clearly, this affected evaluation times.".	Student
The sudden change to a new education methodology which we must quickly adapt. The need of attending to our elderly relatives. Also, to maintain the motivation which we started from the beginning of the semester, which has decreased considerably due to various reasons, such as extra occupations, the social confinement, etc.".	Student
"In my case, th is on-line method has generated many stressful situations and has reduced my desire to learn in a significant way, each day involves a new and increasingly stronger challenge, where I have to fight with myself to be able to go through this last trail with a lot of strength and motivation".	Student
"I can also say that this current situation has not been the same for everyone, each one has handled it in their own way. . . being in the same place all the time without being used to this. . . having a greater academic and emotional load, have been factors that are reflected in the academic performance of each student".	Student

Table 10 : Comparison by categories with a brief state-of-the-art.

Study\Cat.	Category								
	TP	TW	AS	A	AC	WP	M	P	IA
This Work	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Chyung et al (2010)	No	No	No	Yes	No	No	No	No	No
Cazan and Indreica (2014)	No	Yes	No	Yes	No	No	No	No	No
Khan and Khan (2019)	No	Yes	No	No	No	No	No	No	No
Jimenez et al (2020)	No	No	No	Yes	Yes	No	Yes	No	No
Obando et al (2018b)	Yes	No	No	No	No	No	No	Yes	No
Shea and Bidjerano (2010)	Yes	No	No	Yes	No	No	No	No	No

*Yes, it means that this category was analyzed in the study.
**No, it means that this category was not analyzed in the study.

Table 11 : Comparison by categories with a brief state-of-the-art.

Study	Analysis	Instruments	Val. Tools	Population	Analyzed Dimension
This work	Mixed	Survey	No	Undergraduate	Students' perceptions of face-to-face and virtual assessment methods during the COVID-19 pandemic.
Chyung et al (2010)	Quantitative	Questionnaires	Yes	Undergraduate	The role of intrinsic orientation and self -efficacy in virtua l learning.
Cazan and Indreica (2014)	Quantitative	Questionnaires	Yes	Under	Differences between online and traditional assessment.
Khan and Khan (2019)	Qualitative	Focus groups	No	Under	Preferences and acceptance of online assessments.
Jimenez et al (2020)	Quantitative	Questionnaires	Yes	High School	Motivation towards mathematics in mixed and face -to-face modality.
Obando et al (2018b)	Qualitative	Data and texts	No	Under	Teaching presence in a university course with blended learning modality.
Shea and Bidjerano (2010)	Quantitative	Questionnaires	Yes	Online Students	Statistical Relationship between student self - efficacy measures and their grades.

F. Comparative analysis with a brief State of the Art.

Our work is compared in Tables XI and XII with some other studies with populations and dimensions related to this research. Furthermore, Table XI summarizes the categories explored by the analyzed literature regarding assessment. Considering these tables, our research explored multiple assessment dimensions under the pandemic context. Our results complement and partially confirm some results reported in the literature and can be used to guide the implementation of future assessment methods during the pandemic.

6. Conclusions

The main findings of this research concern the factors perceived as the main differences between the face-to-face and online assessment by a group of engineering students during the current pandemic. These factors are: teaching presence, self-efficacy, autonomy, teamwork, and coherence between assessment and class. Although conditions associated with the COVID-19 pandemic affected students and could influence their assessment perception, they did not perceive the pandemic as a factor that directly influences their assessments processes. However, students perceived its effect as an indirect impact on their motivation. We summarized below other findings of our research, in which we identify an improvement opportunity.

· Teaching presence was the factor perceived by students as the main difference between face-to-face and online assessment. Therefore, our recommendation is to incorporate cognitive and

affective aspects related to teaching presence (e.g., student autonomy, collaborative work, interaction spaces between instructors and students) in the online evaluation. In particular, we recommend the instructor's presence during the online assessment using ICT tools such as chat.

· On one hand, the students perceive teamwork (especially in online assessments) as significant support for cognitive and emotional levels. On the other hand, the instructors perceive teamwork as a useful tool for reducing fraud and increasing students' self-efficacy. Consequently, our recommendation is to promote team assessments and collaborative assessments in the program curriculum.

· In the online environments, students perceived self-efficacy and autonomy as factors impacting their evaluation performance. Thus, promoting assessments, projects, and challenges that involve a gradual increment in complexity could increase the student's perceived self-efficacy and independence.

· According to the students' perception and to increase their participation, it is necessary to adjust the dedication time of the asynchronous online activities to the one defined by the academic credits in the program curriculum. Therefore, our recommendation is to explore in this course and other ones the validity of this perception and, if necessary, redistribute the academic activities consistent with the program curriculum.

7. Future Work

In the next academic period, we will apply the OAI and FAI instruments (developed in this research) to evaluate the students' perception evolution using a new assessment approach guided by the findings summarized in this paper. In addition, following the same methodology, we will explore the students' perception of others courses dynamics, such as the real impact of the course in the development of the curriculum soft skills.

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Appendix

In this appendix, the questions analyzed quantitatively in this research are summarized below in Tables A and B.

Table A
List Of First Ten Questions Analyzed Quantitatively.

ID	Cat.	Logic	Question text
P1	A	Positive	The experience of taking the course virtual exams, made me reflect on my preparation strategies for the exam.
		Positive	The experience of taking the course's face-to-face exams made me reflect on my preparation strategies for the exam.
P2	AS	Positive	The experience of taking the virtual exams allowed me to identify the aspects (study techniques, attitudes, skills) that I must maintain to obtain good results in this course.
		Positive	The experience of taking face-to-face exams allowed me to identify the aspects (study techniques, attitudes, skills) that I must maintain to obtain good results in this course.
P3	TP	Negative	During the virtual exams, my communication with the teacher helped me to increase my knowledge about the assessed topics.
		Positive	During the face-to-face exams, my communication with the teacher helped me to increase my knowledge about the assessed topics.
P4	TW	Positive	Working with my classmates during the virtual exams helped me to consolidate my knowledge about the assessed topics.
		Positive	Working with my classmates during the face-to-face exams helped me to consolidate my knowledge about the assessed topics.
P5	M	Positive	The experience of taking the virtual exams seemed useful to my academic training.
		Positive	The experience of taking the face-to-face exams seemed useful to my academic training.
P6	AC	Positive	To solve the virtual exams successfully, a great intellectual effort was necessary because the knowledge built in the virtual class was insufficient.
		Negative	To solve the face-to-face exams successfully, a great intellectual effort was necessary because the knowledge built in the face-to-face class was insufficient.
P7	WP	Positive	The experience of taking the virtual exams, made me feel that I can work under adverse time conditions while efficiency is maintained.
		Positive	The experience of taking the face-to-face exams, made me feel that I can work under adverse time conditions while efficiency is maintained.
P8	M	Positive	I was motivated to present the virtual exams because I liked the topics that were assessed.
		Positive	I was motivated to present the face-to-face exams because I liked the topics that were assessed.
P9	TP	Negative	During the virtual exams, I felt comfortable with the virtual presence of the teacher.
		Positive	During the face-to-face exams, I felt comfortable with the physical presence of the teacher.
P10	A	Positive	Strategies for preparing virtual exams are different from preparing face-to-face exams
		Positive	Strategies for preparing face-to-face exams are different from preparing virtual exams.

Table B
List Of Last Ten Questions Analyzed Quantitatively.

ID	Cat.	Logic	Question text
P11	M	Positive	The experience of taking virtual exams, made me more confident in my skills as an electronic engineering student.
		Positive	The experience of taking face-to-face exams, made me more confident in my skills as an electronic engineering student.
P12	WP	Positive	The experience of taking virtual exams, made me feel that I can work under adverse conditions for activities overload, maintaining efficiency.
		Positive	The experience of taking face-to-face exams, made me feel that I can work under adverse conditions for activities overload, maintaining efficiency.
P13	A	Positive	The experience of taking the virtual exams of the course, made me reflect on my strategies for taking exam.
		Positive	The experience of taking the course's face-to-face exams made me reflect on my strategies for taking exam.
P14	TW	Positive	Working with my classmates during the virtual exams made me feel more confident about a successful outcome.
		Positive	Working with my classmates during the face-to-face exams made me feel more confident about successful outcome.
P15	AC	Negative	Knowledge developed in virtual classes are deep and must be assessed with complex virtual exams.
		Negative	Knowledge developed the face-to-face classes are deep and must be assessed with complex face-to-face exams.
P16	AS	Positive	The experience of taking the virtual exams allowed me to identify aspects (study techniques, attitudes, skills) that I must change to obtain good results in this course.
		Positive	The experience of taking face-to-face exams allowed me to identify aspects (study techniques, attitudes, skills) that I must change to obtain good results in this course.
P17	WP	Negative	The adverse time conditions in the face-to-face exams were greater than virtual exams.
		Negative	The adverse time conditions in the face-to-face exams were greater than virtual exams.
P18	M	Positive	I was motivated to present the virtual exams because I like the virtual assessment methodology.
		Positive	I was motivated to present the face-to-face exams because I like the face-to-face assessment methodology.
P19	WP	Positive	The experience of taking face-to-face exams made me feel high levels of anxiety.
		Positive	The experience of taking face-to-face exams made me feel high levels of anxiety
P20	WP	Positive	The adverse time conditions of activities overload in the virtual exams were greater than face-to-face exams.
		Negative	The adverse conditions of activities overload in the face-to-face exams were greater than virtual exams.