LESSONS LEARNED FROM EMERGENCY REMOTE LEARNING IN LIGHT OF THE ACADEMIC COMMUNITIES OF ENGAGEMENT (ACE) FRAMEWORK

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ARTICLE

LESSONS LEARNED FROM EMERGENCY REMOTE LEARNING IN LIGHT OF THE ACADEMIC COMMUNITIES OF ENGAGEMENT (ACE) FRAMEWORK

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ABSTRACT: During the COVID-19 pandemic, higher education institutions needed to adopt a different learning format from in-person classes. One of the alternatives was the so-called Emergency Remote Learning (ERL), transforming traditional in-person teaching into synchronous remote instruction. This study aims to gain insights into online learning best practices based on a Brazilian university survey in which students periodically responded to an open-ended question about their experience with ERL over a determined period. Data was collected at different times during the first year of the pandemic and encompassed more than 19,000 responses. Students' responses to the open-ended question were analyzed using the Academic Communities of Engagement (ACE) framework. Analyzing student perceptions of the ERL period allowed for reflection on relevant aspects of students' emotional, cognitive, and behavioral engagement, with potential applications in synchronous or asynchronous online teaching contexts. Students associated remote learning with online modalities, expressing exhaustion and difficulties managing studies, work, and family. Negative comments regarding technology, methodology, and instructors affected cognitive, emotional, and behavioral dimensions. The data underscores that online synchronous activities necessitate accessible technology, specific strategies, and methods that foster collaboration to build engagement. This article gives insights for implementing remote teaching experiences aimed at student learning and satisfaction.

Keywords: Emergency remote learning, online learning, academic communities of engagement, higher education, COVID-19.

LIÇÕES APRENDIDAS COM O ENSINO REMOTO EMERGENCIAL À LUZ DA ESTRUTURA DAS COMUNIDADES ACADÊMICAS DE ENGAJAMENTO (ACE)

RESUMO: Durante a pandemia de COVID-19, as instituições de ensino superior precisaram adotar um formato de aprendizado diferente das aulas presenciais. Uma das alternativas foi o chamado Ensino Remoto Emergencial (ERL), transformando o ensino presencial tradicional em ensino remoto síncrono. Este estudo tem como objetivo obter informações sobre as melhores práticas de aprendizagem online com base nas respostas de estudantes de uma universidade brasileira a uma pergunta aberta, aplicada periodicamente em uma pesquisa online, sobre sua experiência com o ERL durante o primeiro ano da pandemia. Os dados foram coletados em diferentes momentos do ano, tendo sido coletadas mais de 19.000 respostas. As respostas à pergunta aberta foram analisadas usando a estrutura das Comunidades Acadêmicas de Engajamento (ACE). A análise das percepções dos estudantes sobre o período de ERL permitiu realizar uma reflexão sobre aspectos relevantes do envolvimento emocional, cognitivo e comportamental dos alunos, com potenciais aplicações em contextos de ensino online síncronos ou assíncronos. Os estudantes associaram o ensino remoto às modalidades online, expressando exaustão e dificuldades de gestão de estudos, trabalho e família. Comentários negativos sobre tecnologia, metodologia e professores afetaram as dimensões cognitiva, emocional e comportamental. Os dados ressaltam que as atividades síncronas online exigem tecnologia acessível, estratégias específicas e métodos que promovam a colaboração para criar engajamento. Este artigo fornece contribuições sobre estratégias para a implementação de experiências de ensino remoto que objetivem o aprendizado e a satisfação dos estudantes.

Palavras-chave: Ensino remoto emergencial, aprendizagem online, comunidades acadêmicas de engajamento, ensino superior, COVID-19.

LECCIONES APRENDIDAS DE LA ENSEÑANZA REMOTA DE EMERGENCIA A LA LUZ DEL MARCO DE LAS COMUNIDADES ACADÉMICAS DE COMPROMISO (ACE)

RESÚMEN: Durante la pandemia de COVID-19, las instituciones de educación superior tuvieron que adoptar un formato de aprendizaje diferente al de las clases presenciales. Una de las alternativas fue la llamada Enseñanza Remota de Emergencia (ERL), que transformó la enseñanza presencial tradicional en instrucción remota sincrónica. Este estudio tiene como objetivo obtener información sobre las mejores prácticas de aprendizaje en línea a partir de una encuesta en la que estudiantes de una universidad brasileña respondieron periódicamente a una pregunta abierta sobre su experiencia con ERL durante un período determinado. Los datos se recopilaron en diferentes momentos durante el primer año de la pandemia y abarcaron más de 19.000 respuestas. Las respuestas de los estudiantes a la pregunta abierta se analizaron utilizando el marco de las Comunidades Académicas de Compromiso (ACE). El análisis de las percepciones sobre el período de ERL permitió reflexionar sobre aspectos relevantes del compromiso emocional, cognitivo y conductual de los estudiantes, con posibles aplicaciones en contextos de enseñanza en línea sincrónicos o asincrónicos. Los estudiantes asociaron el aprendizaje remoto con modalidades en línea, expresando agotamiento y dificultades para manejar los estudios, el trabajo y la familia. Los comentarios negativos sobre la tecnología, la metodología y los instructores afectaron las dimensiones cognitivas, emocionales y conductuales. Los datos subrayan que las actividades sincrónicas en línea requieren tecnología accesible, estrategias específicas y métodos que fomenten la colaboración para generar compromiso. Este artículo proporciona contribución significativa sobre la implementación de la enseñanza remota dirigida al aprendizaje y la satisfacción de los estudiantes.

Palabras clave: Enseñanza remota de emergencia, aprendizaje en línea, comunidades académicas de compromiso, educación superior, COVID-19.

INTRODUCTION

In March 2020, Brazil faced, like most of the world, the onset of the COVID-19 pandemic, leading to widespread quarantine measures. Consequently, traditional in-person university classes became unfeasible. Many institutions swiftly transitioned to remote learning with video conferencing, marking the beginning of Emergency Remote Learning (ERL). On March 17th, 2020, in response to the nationwide suspension of in-person classes, the Brazilian University where the present study was conducted promptly shifted to remote instruction. This transformation required professors and students to utilize web conferencing technologies effectively and adapt teaching methodologies while devising novel methods for assessing students within the digital realm. The collaborative efforts of a task force involving the University's administration facilitated this transition. The institutional Teaching and Learning Center swiftly delivered online workshops to faculty, focusing on web conference tools, teaching, and assessment practices in the remote context. Additionally, the University provided hundreds of laptops to students in need and extended internet access to those without connectivity. Over several months, educators conducted synchronous online classes from their respective homes.

A questionnaire was regularly given every two to four weeks throughout an academic year to track students' evolving perspectives during these transformative changes. It aimed to gather feedback on their satisfaction with the remote learning experience. According to their satisfaction, they should assign scores to the experience from one to five stars and be encouraged to answer an open question to justify their score. We gathered over 19000 responses, and the students freely shared their thoughts about the ERL experience.

This material might shed light on the trajectory and effectiveness of ERL, providing insights into best practices for future online learning initiatives. Therefore, we were compelled to examine how students' perceptions of ERL evolved systematically. To do this, we relied on the Academic Communities of Engagement (ACE) framework, proposed by Borup et al. (2020a), as it has been valuable in identifying engagement indicators and facilitators or barriers.

Remote, online, or hybrid instruction has become an increasingly prevalent reality in the field of education, driven by technological advancements and the need for adaptation in the face of exceptional circumstances, as exemplified by the COVID-19 pandemic (Hollis & Was, 2016; Natarajan & Joseph, 2022; Suryaningsih, 2021). However, Emergency Remote Learning (ERL), adopted during the pandemic, differs in interaction and intention from E-learning, distance learning, online learning, virtual learning, and blended learning, as it comprises remote synchronous interactions (Tulaskar & Turunen, 2022). While ERL offers benefits and opportunities in moments of crisis, it also presents significant challenges, particularly concerning student engagement (Maraqa et al., 2022; Tulaskar & Turunen, 2022).

Student engagement is a crucial factor for educational success and is intricately linked to students' motivation, participation, and academic performance in educational activities (Ahshan, 2021; Borup, 2016; Kuh, 2003; Wester et al., 2021). The interaction between students and teachers is crucial for effective online learning (Banna et al., 2015). The way this interaction takes place underwent significant changes during the COVID-19 pandemic. Despite ERL being essentially synchronous and acknowledging the effectiveness of video interactions in building relationships (Borup et al., 2012; Falloon, 2011), students tend to establish stronger connections in face-to-face settings, positively impacting their academic engagement (Spring et al., 2023).

A primary concern in online and remote learning is the need for more meaningful interaction between students and teachers and among students (social presence). This interaction is essential for establishing a sense of connection and community, which can positively impact student engagement. The absence of physical contact during remote instruction can hinder the creation of a stimulating learning environment (instructor's feedback and peer collaboration) and affect student motivation (Means & Neisler, 2021). According to Natarajan and Joseph (2022), perceived levels of student engagement and social presence are significantly correlated with overall satisfaction in the online environment.

Furthermore, remote and online learning present challenges related to students' self-discipline and self-management; as Means et al. (2013) mention, online learning requires self-regulation skills such as goal setting, time management, and the ability to self-direct. Physical structure and direct supervision can lead to procrastination and a lack of student commitment, positively impacting their engagement.

Another challenge is adapting teaching strategies to the online environment. Educators must rethink their pedagogical practices and adopt approaches that stimulate active participation and student engagement in the virtual setting. Translating in-person activities to the online format requires careful adjustments, considering the characteristics and possibilities of the available technological tools. In the case of remote instruction during COVID-19, teaching practices such as personal messages to students about their performance and metacognition-related activities were shown to impact student satisfaction positively (Means & Neisler, 2021).

To better understand student engagement indicators and facilitators, Borup et al. (2020a) have proposed the Academic Communities of Engagement (ACE) framework, which defines academic engagement as the energy invested by the student in developing course learning outcomes (Borup et al., 2020b; Halverson & Graham, 2019). Recognizing that engagement is situational and varies across learning experiences, it is essential to assess it within the context of learning experiences rather than institutionally (Halverson & Graham, 2019; Kahu, 2013). As Borup et al. (2020b) indicated, the engagement emphasized in the ACE framework pertains specifically to students' active participation in academic learning activities, distinct from a broader institutional perspective. The ACE framework is divided into three student engagement indicators, affective, behavioral, and cognitive, in a complex construct influenced by various factors (Martin & Borup, 2022). Behavioral engagement pertains to students' participation in academic or social activities; cognitive engagement is defined by the student's ability to grasp new ideas and master intellectually challenging skills; and emotional engagement includes emotional reactions, both positive and negative, towards peers, teachers, and oneself (Fredricks et al., 2004).

The ACE framework was found to be a good tool in the identification of support elements for affective, cognitive, and behavioral engagement provided by course communities at a high school and a junior high during COVID-19 (Borup et al., 2020a) and in the University online and blended learning context (Tuiloma et al., 2022). It was also a base for an evaluation instrument designed to examine the quality of institutional student support provided by a Colombian University (Graham et al., 2023). Spricigo et al. (2023) also employed the ACE framework to investigate obstacles and facilitators to student engagement in online courses at a Brazilian university. Spring et al. (2023) utilized the ACE framework in a Transition To Online program, which focused on adult learners unable to participate in traditional paths toward higher education. The authors employed social network analysis to understand the support offered in their academic communities of engagement: online course community, in-person course community, and their community of family and friends. They analyzed students' perceptions of engagement and enjoyment in online courses and in-person gathering sessions and the strength of emotional and academic support from the three communities.

This article, which focused on the learning experience with ERL at a Brazilian university, proposed using ACE framework indicators and facilitators of engagement as the coding basis to categorize students' responses to a periodically posed open-ended question. This question, presented during the COVID-19 pandemic, asked them to comment on their learning experience in the last week with ERL. The results can help understand the challenges faced by the University and the students during a year-long ERL. Eventually, this should lead us to devise innovative approaches for online or blended instruction (Clum et al., 2022), which is particularly relevant as educational scenarios are continuously evolving, along with the possibility of new events that ask for teaching methods and institutional support. More specifically, we aim to answer the following research questions:

(1) How did students' comments refer to indicators and facilitators/barriers of engagement over time?

(2) How did student sentiments (positive and negative) relate to affective, behavioral, and cognitive engagement?

(3) What facilitators/barriers to engagement did students most frequently refer to?

(4) What are the associations between indicators and facilitators/barriers to good ERL experiences in students' comments?

METHOD

This qualitative longitudinal case study was conducted in a Brazilian higher education institution during the COVID-19 pandemic. Below, we describe the research setting, data collection, and analysis procedures.

Research Setting

The higher education institution has more than 70 on-site undergraduate programs, with approximately 25.000 enrolled students. In March 2020, after two weeks of on-campus classes, the lockdown determined the beginning of the remote classes. Four days of online workshops were offered to instrumentalize faculty using web conference tools. After two weeks of the ERL, the institution administration applied a satisfaction questionnaire to all students. So, we obtained the data for this work from a database containing responses to the surveys originally applied for decision-making during the COVID-19 crisis. Data storage and sharing, in addition to the anonymity of respondents, follows the Brazilian General Personal Data Protection Law (Law No. 13709/2018). The Research Ethics Committee authorized the research (registration number 51954121.3.0000.0020).

Data Collection

The surveys were administered to all students enrolled in on-site undergraduate programs throughout the two academic semesters of 2020 at ten different intervals, from March 23rd to November 9th (refer to Table 1). The survey asked students to assess their learning experience for the week by assigning a rating of 1 to 5 stars on a scale. Furthermore, they could provide additional insights by including a comment with their response. The survey was conducted using an online form (Pergamum Analysis Software, APC, Brazil). Participation was voluntary and anonymous, with no mandatory questions included in the survey.

The responses were stored in a proprietary institutional database with restricted access and then were shared with the authors as Microsoft Excel© files via Microsoft Sharepoint©.

Data Analysis

This study analyzed only the open-ended qualitative data. Initially, the four researchers created a codebook based on the analysis of some quotes. Then, to improve the trustworthiness of the coding, each researcher used the codebook to code a sample of 100 quotes independently. Differences in coding were discussed until there was an agreement of at least 70% among the researchers, and additions to the original codebook were made.

Besides the three indicators of the ACE framework, we have defined categories that could grasp other factors impacting engagement, i.e., facilitators/barriers. According to long-time engagement researchers (Skinner et al., 2008) distinguish facilitators/barriers from indicators in this way: "Indicators refer to the features that belong inside the construct of engagement proper, whereas facilitators are the causal factors (outside of the construct) that are hypothesized to influence engagement."

Each comment was classified as positive or negative if it manifested satisfaction or dissatisfaction. The engagement indicators of the ACE framework (Borup et al., 2020b) were employed to classify the comments into three categories: affective, cognitive, and behavioral. We created five additional categories to classify comments that were potential facilitators or barriers to academic engagement (Borup et al., 2020b): professor, technology, institution, physical health, and activity

overload. Positive comments were considered engagement facilitators, while negative ones were considered barriers. Some categories had subcategories, as shown in Table 1, which presents the emergent categories and subcategories coded with Atlas.ti© version 9 (ATLAS.ti Scientific Software Development GmbH, Berlin). Description and examples of each coding are given in the Results section.

Table 1 – Coding categories.

Type	Category	Subcategory
ACE Indicator of Engagement	Affective	-
	Behavioral	-
	Cognitive	-
Facilitator/Barrier to Engagement	Professor	Attitude
		Methodology
		Organization
		Technological preparation
		Others
	Technology	Connection
		Tools-Platform
		Recording
	Institution	Criticism/suggestion
		Financial
		Recognition
	Health	-
	Activity Overload	-

For the analysis, we divided the academic year into three periods: the initial, intermediate, and final, according to Table 2. The initial period corresponded to the beginning of the first academic semester. The intermediate and final periods corresponded to the end of the first and second academic semesters of 2020. The database underwent a filtration process based on response validity. Responses lacking any intelligible comments, those carrying unmeaningful content, neutral or ambiguous, were excluded, such as: "*Nothing to declare*,"; "*Slow*,"; "*Excellent!*"; "*Internet.*"

Table 2 - Periods of analysis with the respective number of answers.

Period	Date range	Total Answers	Encoded answers
Initial	23rd – 30th March 2020	23712	3339
Intermediate	4th May – 15th June 2020	12296	845
Final	5th October – 9th November 2020	27794	2430

RESULTS

The findings are structured in alignment with the research questions, as delineated in the following sections.

Temporal trends in student comments categorization

This section will present findings on the first research question: How did students' comments refer to indicators and facilitators/barriers of engagement over time? It is essential to understand if students' spontaneous comments about their perceptions of ERL bring sentiments of affective, behavioral, or cognitive engagement or facilitators/barriers to engagement. Table 3 presents the definitions and examples of the code categories applied to classify the comments. Since ERL changed as the academic community experienced it, we also analyze what changed in students' comments over the first pandemic year.

Table 3 – Main Coding Description and Examples.

Type	Category	Description	Examples
ACE Indicator of Engagement	Affective	The student mentions joy, sadness, anxiety, frustration, confidence, interest, disinterest, boredom, and pleasure. The student mentions something about mental health, such as experiencing depression or anxiety.	It is convenient to be able to stay at home. I like the classes. I do not like the classes. Lack of motivation for distance learning. Exhausting; too much time in front of the computer.
	Behavioral	The student mentions participation, meeting deadlines, following instructions or procedures, time dedicated to tasks, self-regulation, and study organization. Note: It also addresses the state of the environment where they carry out their activities and how this may or may not hinder them.	I have much difficulty studying through distance learning. Study routine: It is difficult to maintain a study routine at home. Little time for studying.
	Cognitive	The student mentions whether they are learning, understanding, enjoying, and able to ask questions. They also address attention, absorption, concentration, persistence in learning, and the use of cognitive or metacognitive strategies (inquiring, exploring, taking notes, and checking comprehension). The student expresses concern about the practical classes and their impact on learning. The student expresses confusion or concern about the assessment methods.	I cannot learn anything. It is difficult to concentrate in online classes. I have difficulty in remote classes that should be practical. I cannot concentrate and memorize the content covered in remote practical classes. I am having difficulty with online assessments.
Facilitator/Barrier to Engagement	Professor	The student mentions the professor, whether for criticisms, suggestions, or compliments regarding their organization, methodology, or even technological preparation.	Professors dedicate themselves to the maximum to ensure that classes continue, even in this scenario. One of my professors does not record the classes!
	Technology	The student mentions something related to technology: connection, class recording, or the institution's LMS.	I cannot participate in the classes; my connection is terrible. The LMS keeps freezing during several classes.
	Institution	The student mentions the institution, whether involving financial aspects such as tuition fees or criticisms, suggestions, compliments, and recognition regarding adapting classes during social isolation.	The University deserves congratulations for everything it is doing for us. We want lower tuition fees!
	Health	The student mentions physical health issues.	Sitting in front of the computer gives me a lot of back pain. All-day classes give me headaches.
	Activity Overload	The student reports that they are overwhelmed with activities.	There is so much to do; I cannot live and do activities. I am tired of so much work.

First, regarding the nature of the comments, we observed that negative comments consistently outweighed the positive ones (Table 4). Positive comments were more prevalent during the initial period, declined drastically during the intermediate, and grew again in the last period. Secondly, when comparing the frequency of engagement indicators to the presence of facilitators/barriers in students' comments across all periods, it became evident that facilitators/barriers were consistently more prevalent in the comments than engagement indicators (Figure 1). The numbers include both positive and negative comments. However, it is noteworthy that the proportion of comments containing engagement indicators exhibited a noticeable increase during the final survey period.

Figure 2 illustrates the aggregate count of negative and positive comments within each coding category across the initial, intermediate, and final survey cycles. Notably, the initial survey period exhibited a substantial concentration of comments in the Technology and Professor categories, a trend that diminished in subsequent periods. Meanwhile, comments within the Health category demonstrated an increase in the last survey period and a noticeable rise in mentions of activity overload. The following sections will present additional data to gain a more comprehensive understanding of these findings.

Table 4 - Distribution of Negative and Positive Comments in Each Survey Period ("n" is the number of coded comments).

Survey period	Negative comments (%)	Positive comments (%)
Initial (n = 3339)	77.1	22.9
Intermediate (n = 845)	91.4	8.6
Final (n = 2430)	70.2	29.8

Figure 1 – Number of Comments Categorized as Engagement Indicators or Facilitators/Barriers of Engagement over Time.

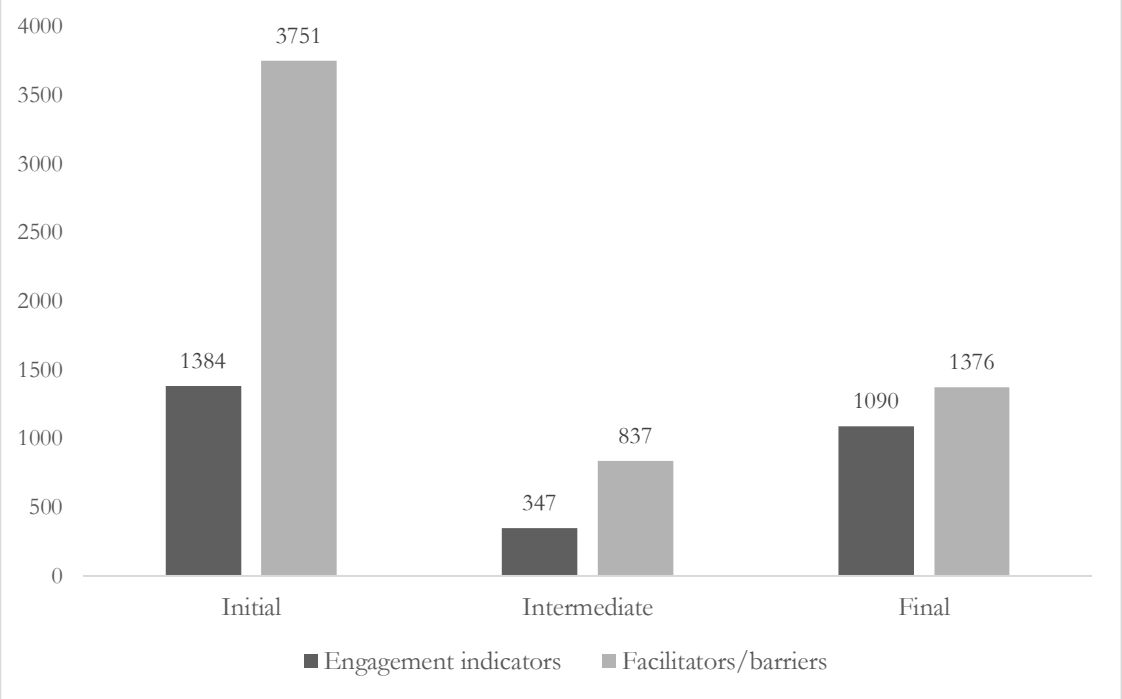
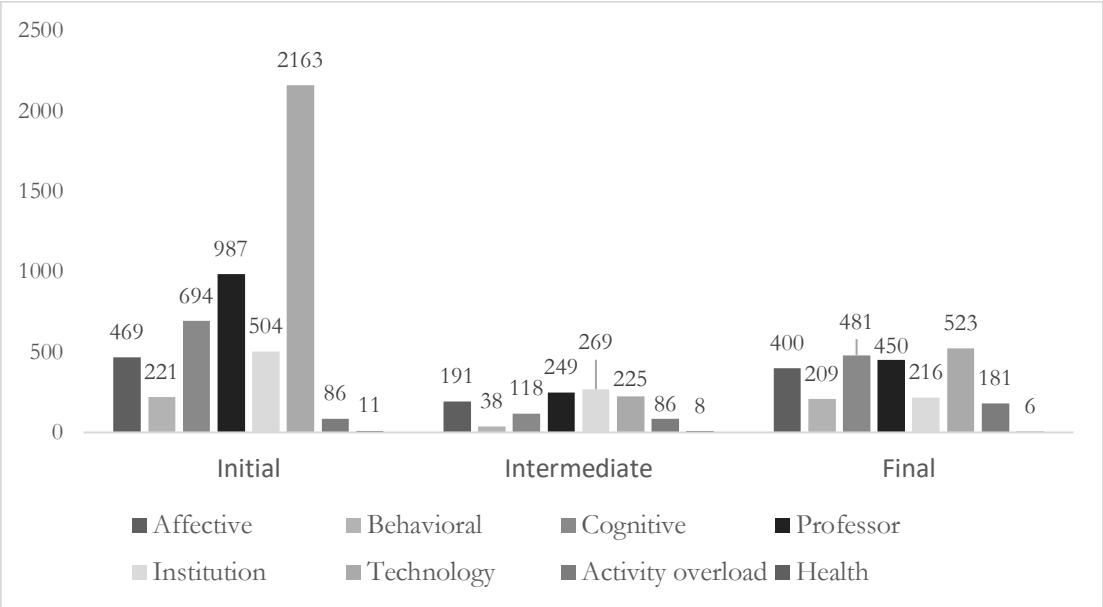


Figure 2 – Number of Comments in each Category over Time.



Engagement Indicators – Affective, Behavioral and Cognitive

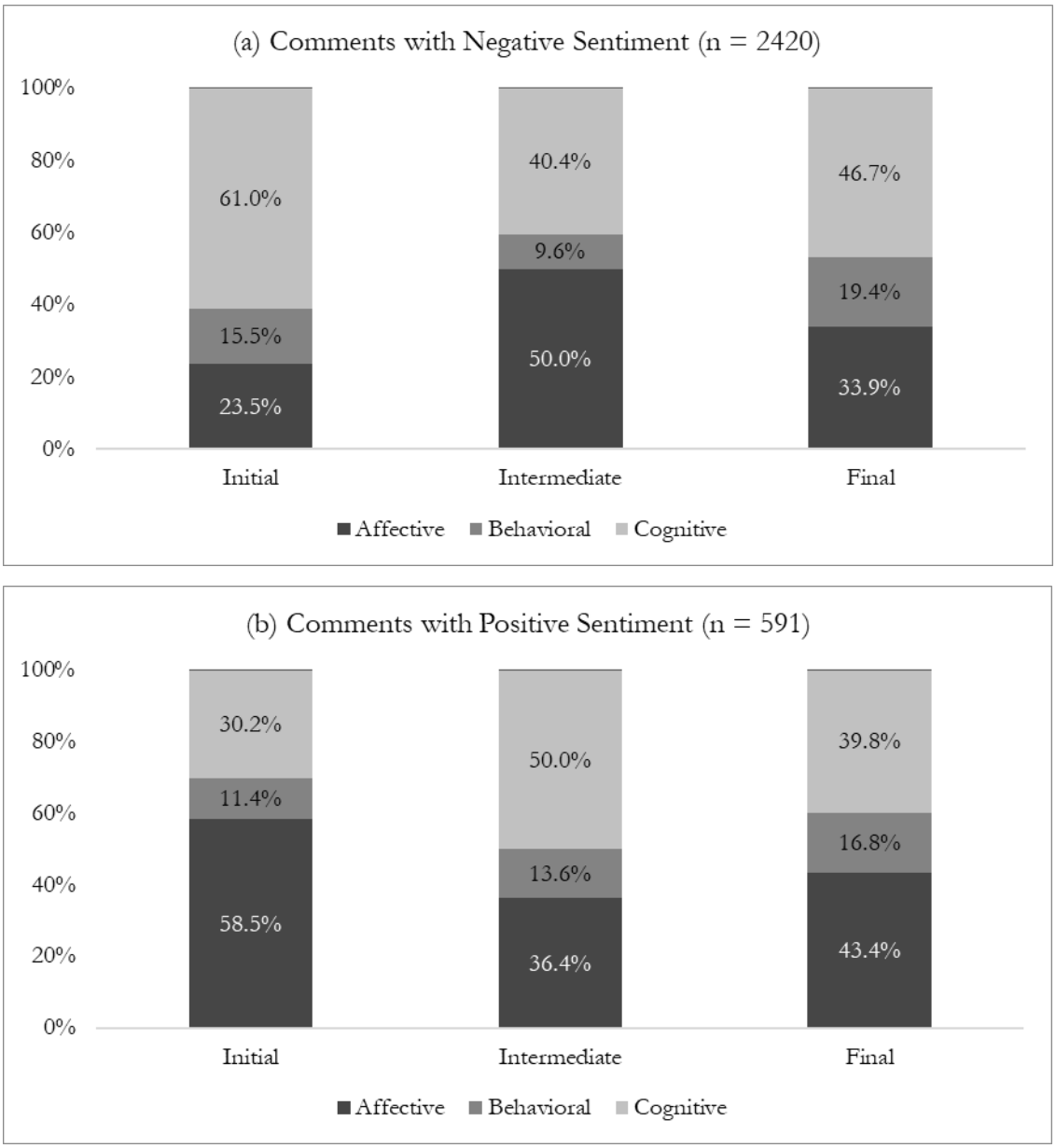
This section presents findings on the second research question: How did student sentiments (positive and negative) relate to affective, behavioral, and cognitive engagement? We observed that many students spontaneously self-reported sentiments towards the ERL that reflect their academic engagement, and those comments could be coded under the categories of Affective, Behavioral, and Cognitive (Table 3). Figures 3(a) and (b) depict the frequency of positive and negative comments within each category of the ACE engagement dimensions.

Figure 3a illustrates that comments categorized in the cognitive category were consistently more prevalent than the other engagement dimensions, regardless of the survey period. Most of these comments underscored that the online classes resulted in poorer learning outcomes than in-person classes. The following quotes reflect this sentiment: "*The online classes did not provide me with effective learning.*"; "*Unfortunately, my performance and enthusiasm have significantly declined.*"; "*Nothing compares to in-person classes; even though the teaching method is just as good, we do not have the same level of interaction as in a classroom. Personally, I find that I can acquire more knowledge in face-to-face classes.*"

In the intermediate period, negative comments categorized as Affective emerged as the most prevalent within the engagement indicators (Figure 3(a)). Students expressed exhaustion during that period, as reflected in the following quotes: "*I am feeling extremely demotivated, and I am even considering giving up on the course... I am exhausted, and it seems like the content is no longer engaging me or sparking my interest.*"; "*Physically and emotionally exhausted due to classes, I wake up at 7 a.m. every day, turn on my laptop, attend classes, have lunch, return to the laptop for team meetings, and continue until around 11 p.m. I take a shower, and the cycle repeats. I have no time for rest or leisure, hardly spend time with my family, and no time for household chores. My sister, who is also a student at this University, is in the same situation. Consequently, it overwhelms my parents, who are also working from home, and creates an unpleasant environment at home.*"

Fewer students expressed positive or negative Behavioral aspects of their engagement in their comments (Figure 3(a, b), so the Affective and Cognitive categories remained the most prevalent throughout the survey periods. The following quotes illustrate comments categorized as Behavioral, in which students expressed their behavior towards the remote classes: "So far, I have been able to attend all the classes and submit all the assignments."; "I have been able to make better use of my time and dedicate myself even more to university so that I currently do not need to leave work early on exam days or endure traffic to get to the college, which causes immense physical and mental exhaustion."

Figure 3 – Distribution of (a) negative and (b) positive comments within the Categories of Engagement Indicators.

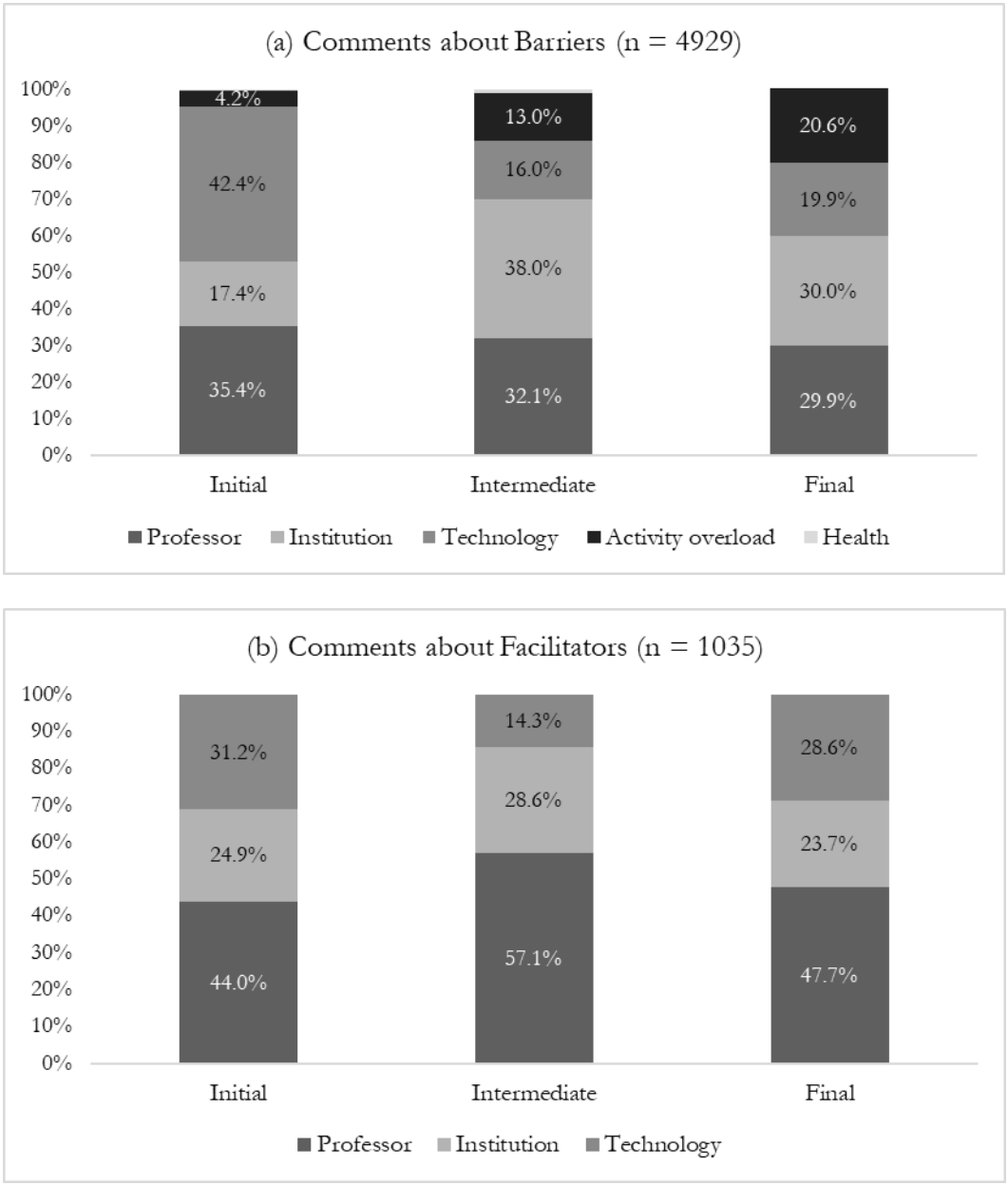


Facilitators/Barriers to Engagement

This section codifies students' comments regarding factors that helped or hindered their learning experience during ERL to answer the third research question: What facilitators/barriers to engagement did students most frequently refer to?

Figures 4(a) and 4(b) illustrate the frequency of comments across survey periods within the barriers and facilitators main categories (Table 3): most comments regarding facilitators or barriers to engagement were coded under Professor, Institution, and Technology. From Figure 4(a), we depict that technology appeared as the prevalent barrier in the initial survey cycles, but its relative importance dropped afterward, giving rise to complaints regarding the institution. Most engagement facilitators were coded under Professor, demonstrating the importance of professors' actions to good ERL experiences (Figure 4(b)). The subsequent subsections will delve into more detailed discussions of the findings within each category.

Figure 4 – Frequency of Comments in the (a) Barriers and (b) Facilitators Categories.



Professor

Figures 5(a) and (b) show how the comments coded in the main code Professor were distributed under five subcategories: methodology, organization, attitude, technological preparation, and others (Table 5).

Table 5 - Subcategories of the Main Code Professor.

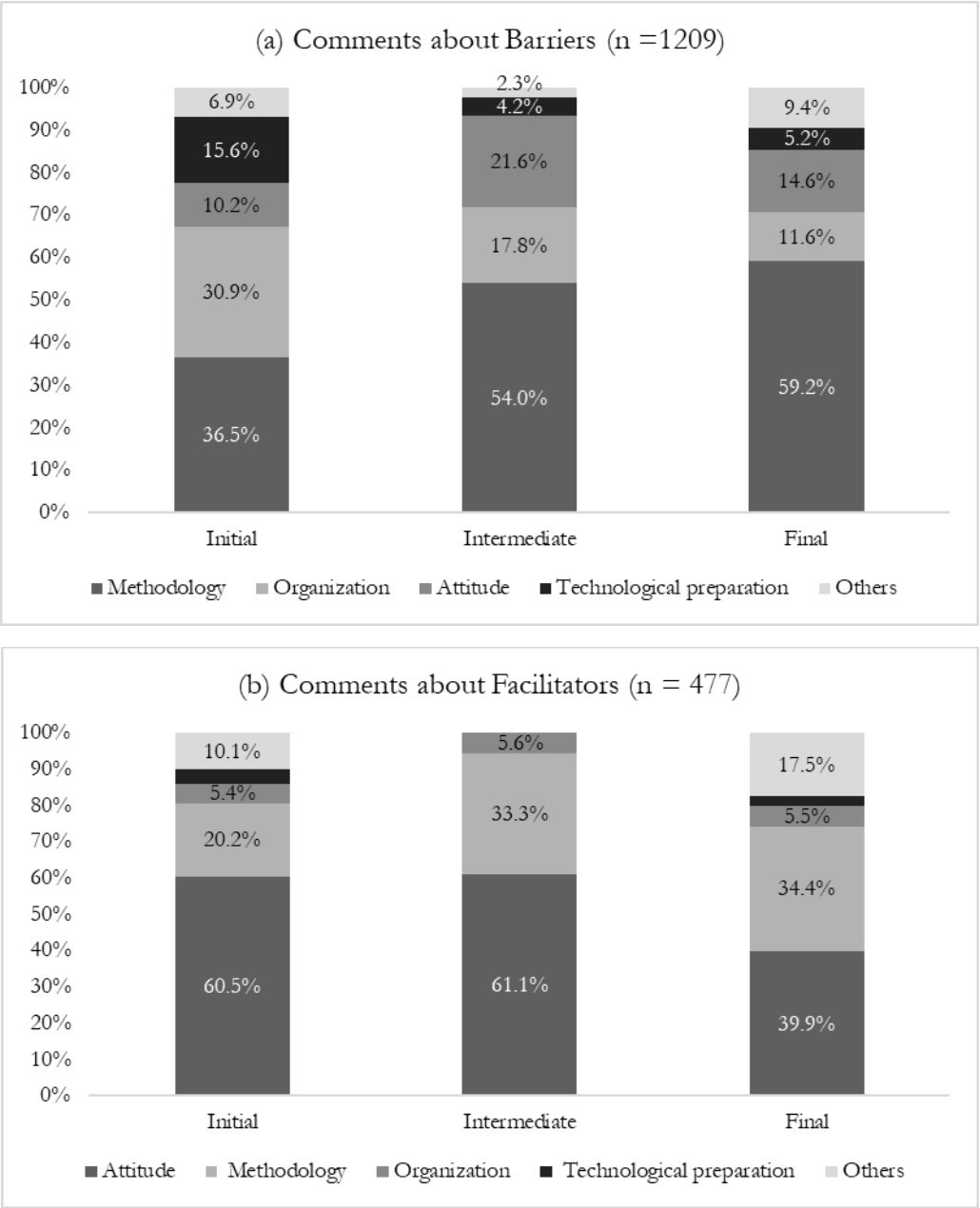
Type	Category	Subcategory	Description	Examples
Facilitator/Barrier to Engagement	Professor	Attitude	For example, the student may express recognition, gratitude, or dissatisfaction with the Professor's attitude by praising or criticizing their efforts.	The professors seem not to communicate; they just send various activities that bring no knowledge.

			The professors are doing their best to teach us.
	Methodology	The student mentions didactics, strategies for remote teaching, the use of group work, interaction strategies with students and among peers, and assessment strategies.	The online classes are being well taught, but there are still many uncertainties on the part of the professors.
	Organization	The student mentions how the professor organizes classes and how he/she uses the platforms to organize materials, recordings, assessments, etc.	Some professors have not yet fully provided the course syllabus. The professor organized the activities very well in the LMS.
	Technological preparation	The students expressed their opinions on whether the professor can use technology in remote classes and how well or badly the professor is prepared to use technological tools in remote classes.	Professors lack practice with the platforms. The Professor does not know how to use the LMS.
	Others	Comments about professors that do not fit into the other subcategories.	

Negative comments regarding the methodologies employed by professors during remote classes increased over time and constituted the most frequent complaint within the professor dimension, as exemplified by the following quote: "*Professors lack the didactics for conducting remote classes; they spend much time speaking without providing sufficient opportunities or encouragement for student interaction.*" However, positive comments concerning teachers' methodologies have also been raised over time and are represented by the following quote: "*Teachers demonstrated commitment and concern for learning, utilizing new methods.*"

Throughout the pandemic, the Teaching and Learning Center offered mandatory workshops to faculty members, focusing on best practices in remote teaching, including student engagement in remote classes. The collective effort of faculty development and the experience gained by professors over time may account for the increase in positive comments. However, negative comments remained prevalent. Complaints about professors' organization and technological readiness decreased as time passed, likely attributed to the accumulated experience and the impact of numerous hours of faculty development workshops conducted by the institution. Most positive comments about professors are within the Attitude subcategory. In most of them, students acknowledged the considerable efforts made by their professors, as demonstrated by the following quote: "*Teachers are putting in tremendous effort to deliver the best possible lessons.*"

Figure 5 – Subcategories of Comments Regarding Professors: (a) Barriers and (b) Facilitators.



Technology

Table 6 presents the description and examples of the subcategories of the leading code Technology: connection, recording, and tool/platform. In Figures 6(a) and (b), the percentage distribution of technology-related comments is divided into those three subcategories. Figure 6(a) focuses on barriers, while Figure 6(b) centers on engagement facilitators in ERL experiences.

Most technology-related complaints during the initial survey cycles focused on tool/platform and connection issues. As soon as remote classes began, not all students had access to personal computers, and many of them reported problems with an internet connection or with the web conferencing tool and the learning management system, as demonstrated by the following quotes: "*We frequently encounter connection problems, audio freezes, and dropped calls*."; "*The learning management system is slow, and we cannot join the class when multiple students are connected simultaneously*." In their comments, students also asked professors to record all classes: "*It would be beneficial to have classes recorded since not all students have a reliable internet connection, and some may not even have a suitable study environment*."

Table 6 – Subcategories of the Main Code Technology.

Type	Category	Subcategory	Description	Examples
Facilitator/Barrier to Engagement	Technology	Connection	The student reports on the quality of the internet connection, such as speed and reliability.	The signal loss was a hindrance. There is a fluctuation in quality during class hours and continuous drops, including from the instructors.
		Tools-Platform	The student mentions the audio, video, virtual learning environment, videoconferencing quality, usability, and number of tools or systems they have to cope with.	The LMS is not working. I am missing all the classes. The system still has many bugs.
		Recording	The student reports that they cannot access recorded classes or that there are no recorded classes to watch.	There is no recording. The classes are being recorded, so if we have any doubts, we can review the class.

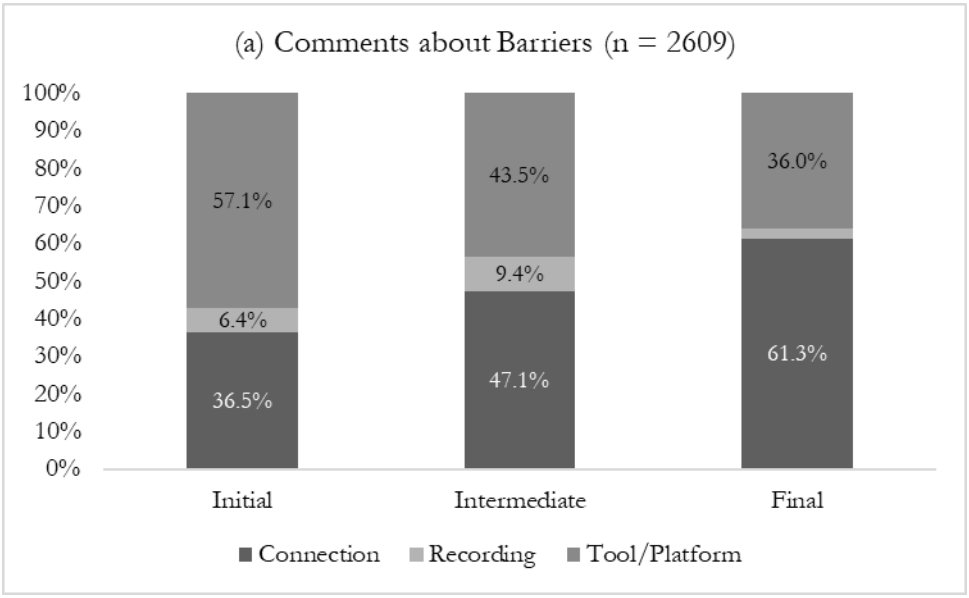
Institution

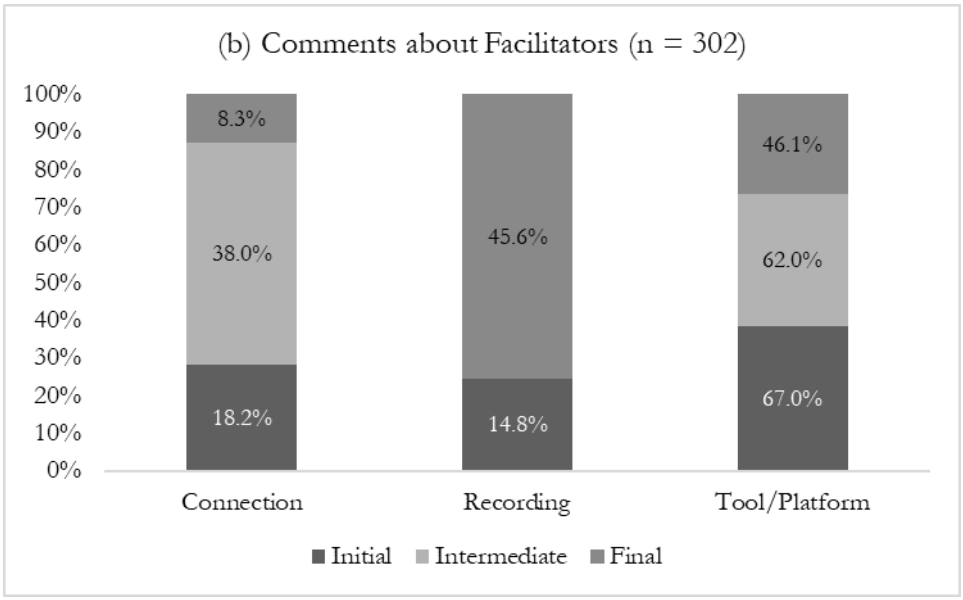
The code Institution had three subcategories: criticism or suggestion, financial, and recognition (Table 7). Negative comments regarding institutional issues were more prevalent than positive ones during the initial and final survey cycles. During those periods, many students recognized the positive efforts made by the institution to keep the classes running, exemplified by the following quotes: "*The university's efficiency in adapting the system and availability for student support is highly commendable*."; "*I am thankful. This University provides significant support to its students during this public calamity, whether through remote classes or online study materials.".* However, negative comments increased in the intermediate period, accounting for 22.1%, surpassing the percentage of positive comments (20.9%). Many students voiced their concerns regarding tuition fees during this period, arguing that remote classes should be priced lower.

Table 7 – Subcategories of the Leading Code Institution.

Type	Category	Subcategory	Description	Examples
Facilitator/Barrier to Engagement	Institution	Criticism or suggestion	The student provides suggestions or criticism at the institutional level by giving examples of what works/does not work or expressing ideas for improvement.	They should simulate the classroom by showing slides and giving time to copy. They need to improve Zoom and Teams for video calls with interpreters. I am deaf.
		Financial	The student mentions financial issues such as tuition fees and a reduction in income.	Where is the reduction in tuition fees? I am paying TOO MUCH for a service that the University is not providing (in-person classes).
		Recognition	The student expresses gratitude to the institution or recognizes its effort to maintain the classes.	Thank you for the support; congratulations on the excellent work! Congratulations to the University for supporting and encouraging the students!

Figure 6 – Subcategories of Comments Regarding Technology: (a) Barriers and (b) Facilitators.





Activity Overload and Health Issues

Complaints about activity overload increased from the beginning to the end of the survey periods. Towards the end of the year, activity overload became a significant concern among students' negative comments. The following quote exemplifies these complaints: "*This semester is much more demanding than the previous one. More activities are to be done now, including summative tasks, attendance-related activities, and text readings. Additionally, most of the assignments and assessments are group work, which makes it even more challenging since you become somewhat dependent on others for the progress of the work. I have been feeling overwhelmed by this and being confined at home since the beginning of the quarantine adds a significant amount of stress. I am unable to focus during classes and frequently feel tired.*"

Only a few comments about physical health problems were received throughout the survey cycles, most of which were related to remote classes and the pandemic situation, as exemplified by the following quotes: "*Remote classes have been highly successful, but they have taken a toll on my physical well-being, especially my eyes and back.*"; "*I experience headaches from spending so much time in front of the screen.*"; "*Visual fatigue is a significant hindrance.*"

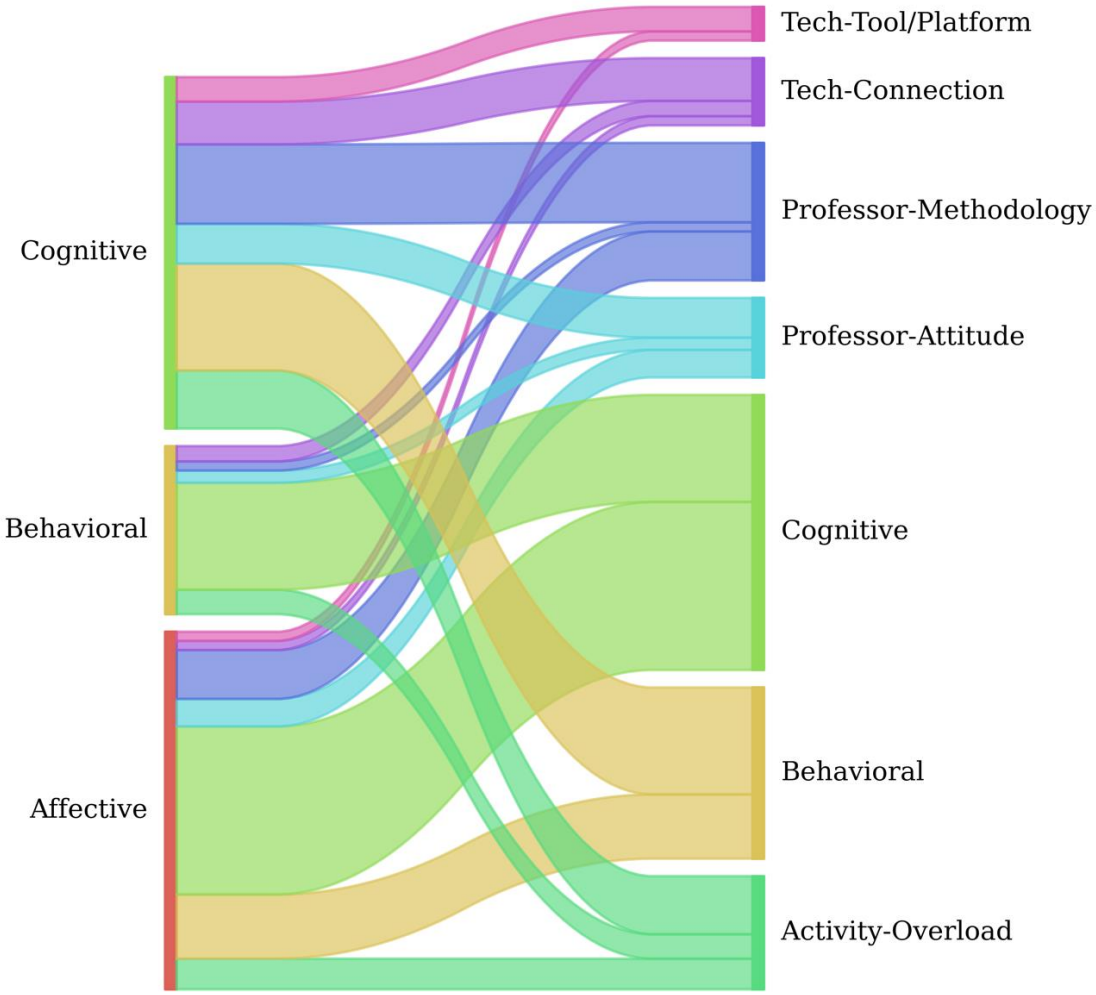
Co-occurrence of Codes

We investigated the co-occurrence of categories within the same comment, whether positive or negative, to identify patterns of categories frequently appearing together in students' free speech and answer the fourth research question: What are the associations between indicators and facilitators/barriers to good ERL experiences in students' comments?

It is important to note that student comments do not always explicitly establish cause-and-effect relationships, as exemplified in the following quote: "*Unfortunately, my performance and enthusiasm decreased considerably.*". This comment was categorized under the codes Affective and Cognitive due to the expressions of "enthusiasm" and "performance", respectively. However, in another example, the student established a causal relationship between anxiety (Affective) and his learning (Cognitive): "*I had more difficulty understanding some subjects; I believe that the anxiety crisis contributed to it*."

Figure 7 illustrates the frequency of co-occurrences between pairs of categories, encompassing both positive and negative comments. The mapping of these co-occurrences considered whether the comments established a causal relationship.

Figure 7 – Frequency of Co-occurrences between Pairs of Categories (the line thickness represents the volume of comments in which the categories at each end appear together).



We can observe that comments in the Affective category often appeared in association with comments in the Cognitive category, as illustrated in the previous examples, where students mentioned concentration or learning while also expressing feelings of sadness or stress. Co-occurrences of ACE engagement indicator categories frequently occurred among themselves, exemplified in the following co-occurrence between Behavioral and Cognitive: "*Because it is tough for me to wake up early and attend classes on the computer. I feel I do not wake up or absorb the content*."

The following quote is an example of a comment with a co-occurrence among Affective, Cognitive, and Professor-Methodology that shows a cause-consequence: "*The dynamics of the classes are not good; I feel unmotivated to attend classes every day, I am not learning, and I am frustrated with this.*"

Co-occurrences between the categories of engagement indicators and facilitators/barriers occurred more frequently in the Cognitive category. Table 8 exemplifies how the students established connections between facilitators/barriers and engagement indicators.

Table 8 – Examples of quotes illustrating co-occurrences of the Cognitive category with other categories.

Co-occurrences	Quotes
Cognitive AND Technology-Connection	"The connection was terrible, making learning difficult, and motivation was shallow."
Cognitive AND Professor-Attitude	"It is difficult to pay attention, and there are not many stimuli from a significant number of teachers."
Cognitive AND Professor-Methodology	"I gave a 5-star rating because the classes, even though they are online, are of high quality and provide a learning experience like in-person classes. The teachers are very didactic, and the students are now well-prepared for remote classes."
Cognitive AND Activity Overload	"[] There are more assignments to be done because now we have summative assessments and attendance activities in addition to the required readings. Furthermore, most of the assignments/evaluations are group work, which makes it even more difficult because you become somewhat dependent on others to progress with the work. I have been feeling overwhelmed because of this[...]. I am having trouble focusing on classes and often feel tired."

DISCUSSION

This work is intended to explore students' responses regarding their experience with ERL during COVID-19 for a whole year at a Brazilian higher education institution in light of the Academic Communities of Engagement (ACE) framework. Understanding the factors influencing students' experience with ERL would help shape future online learning experiences. The data were collected at different periods spread across the first year of the pandemic and encompassed many responses, providing a highly representative picture of student's perceptions.

The students' responses to an open-ended question were coded using the ACE engagement indicator dimensions (affective, behavioral, and cognitive) and other codes reflecting possible facilitators or barriers for a good ERL experience (Professor, institutional matters, technology, health, and activity overload). Throughout this discussion, we will compare with other studies that surveyed students' self-reported perspectives during ERL during the pandemic.

ERL facilitators and barriers: temporal trends

Notably, the students gave more negative comments than positive ones in all three survey cycles, but the nature of comments varied in relative proportions throughout the academic year. At the beginning of ERL, technology was a big issue (Figure 4 (a)). Many students reported challenges such as unstable or slow internet connections at home, limited smartphone data plans, or multiple household members participating in web conferences. However, these complaints decreased from the

intermediate to the final periods, and the number of positive comments in the Technology category increased. During that period, the institution implemented various measures, including distributing computers and providing internet access to students. From this finding, we learn that courses that take place wholly or partially online must initially address students' access to technology. In the post-pandemic period, where remote work and study have become more prevalent, several family members might need to share the household space and technological resources simultaneously.

The preparedness of professors for synchronous online activities was also important, being responsible for about one-third of comments steadily in all three periods (Figure 4(a)). While acknowledging the efforts of professors in conducting classes during the pandemic, comments from several students made it clear that the teaching strategies of many professors needed to be more suitable for the context of remote classes. Over time, students complained less about the professors' organization or technological preparation and complained more frequently about the teaching methodology (Figure 5(a)) and activity overload (Figure 2). Many professors conducted their classes as long lectures with slides, increasing the time of video exposure. This strategy contributed to boredom, fatigue, lack of class participation, and difficulty concentrating, which may have been further affected by the excessive comfort of being at home, a factor reported by Tulaskar and Turunen (2022) in a similar study with students from India and Finland. Keeping students consistently engaged with assignments is crucial to ensure active participation in remote classes. It helps prevent disengagement and maximizes their interaction with the Professor, allowing them ample opportunities to ask questions and tackle more complex tasks. On the other hand, there was also an increasing recognition of professors' capacity to adopt new methodologies (Figure 5(b)). The pedagogical training of faculty in the University varies significantly, which can explain the wide range of engagement strategies observed among faculty during ERL, as well as the comments from students, ranging from praise to criticism.

The institutional Teaching and Learning Center (TLC) offers an essential faculty development 12-hour program regularly, including three workshops on competency-based teaching, learning-focused course design, and assessment of learning. Before the pandemic, only 58.7% of faculty had completed that program. Across the pandemic year, the TLC organized online synchronous workshops covering topics such as teaching methodology, lesson planning, assessment of learning, and educational technologies. They also formed communities of practice aiming at improving engagement and assessment in remote classes. In 2020, when ERL began, 89 professional development events for faculty were held, each with an average duration of 2 hours, and they had 3753 subscriptions among a community of 1439 professors. In the second semester of 2020, an asynchronous workshop titled "Planning Engaging Experiences that Promote Effective Learning" was offered, with a training duration of 8 hours, aimed at making remote classes more engaging. The first edition of the workshop had 681 participants (47.3% of the professors).

Despite this vast effort to instrumentalize professors, students commonly reported about professors delivering lectures throughout the entire synchronous remote class, which, coupled with the comfort of being at home, hindered concentration, similar to what was reported in the studies by Tulaskar and Turunen (2022). Even though the initiatives of the TLC during 2020 reached practically all faculty, teaching online requires a very different course design approach than what professors accustomed to exclusively in-person teaching are used to (Keengwe & Kidd, 2010). However, due to financial constraints, no additional work hours were allocated to the professors during the ERL. Therefore, faculty members already involved in online education before the pandemic may have found it easier to adapt their in-person classes to the ERL (Su et al., 2024).

At the end of the mid-term research period, the institution requested student attendance registration in synchronous classes by submitting assignments to promote study habits and attention during synchronous sessions. However, instead of conducting engagement activities during synchronous meetings, many professors assigned additional out-of-class activities, contributing to the perception of overload mentioned in students' comments, especially in the later survey cycles. In the research by Tulaskar and Turunen (2022), students themselves suggested that synchronous time should be used for active learning, leaving theory for asynchronous moments.

Although fewer comments on behavioral engagement were collected in the present study, students who provided feedback reported difficulties maintaining a study routine at home. Similar complaints were found in a perception study with undergraduate online students at a Brazilian higher education institution (Spricigo et al., 2023).

We observed, therefore, that in-person meetings, strategically scheduled and conducted by the Professor, are crucial for students to establish a study routine. Many students requested that remote classes be recorded, which may have aided their studies or encouraged procrastination. Some students got a job during the pandemic and started watching all recorded classes outside the regular class hours. Active learning and flipped classroom concepts during remote classes keep students more engaged, preventing them from skipping synchronous sessions even with class recordings available. For example, since the recordings do not include interaction in group activities, students would not trade the synchronous moment for the recording (Venton & Pompano, 2021). The same authors reported that students engaged more in general chemistry college classes and attended synchronous classes when pre-recorded lectures were made available and synchronous classes were conducted using active learning. The same researchers reported that professors who pre-recorded their lectures and transformed synchronous classes into question-and-answer sessions failed to engage students. Online courses, therefore, should adopt the best practice of establishing study routines with students, guiding them in developing autonomous behavior regarding their learning.

Engagement indicators

The students' comments about ERL could be categorized within the engagement dimensions of the ACE framework, as they discussed emotional energy, behaviors, and mental energy related to their learning experiences. While the ACE framework was initially developed for online and blended learning, it also proved applicable to the current ERL scenario. The cognitive dimension was highlighted in 40 to 60% of the comments, the affective dimension in 23 to 50%, and finally, the behavioral dimension was mentioned in 9 to 20% of the comments.

Considering the affective dimension, students showed differing opinions about ERL classes. Some adapted well and appreciated the convenience of studying at home, while others missed in-person classes and found the ERL teaching inferior and tiring. Some students also expressed concerns about the pandemic and its emotional impact, including financial and family issues. The lack of in-person interaction and the need to attend classes via computer were frequently mentioned challenges. Wester et al. (2021) surveyed the impact of ERL on STEM students' engagement at American universities and concluded that there was a decline in emotional engagement, leading to a stagnation of cognitive engagement compared to pre-pandemic data. They observed increased anxiety and a decreased positive attitude toward science education. Shin and Hickey (2021) found that during the pandemic, U.S. college students needed more significant socio-emotional support, referred to by the authors as Tender Love Caring (TLC), as inequities were exacerbated during that time, and students experienced a lack of motivation and learning difficulties.

In cognitive terms, students from the present study also expressed divergent opinions about the quality of ERL. Some mentioned preferring in-person classes and missing the interaction and classroom environment. Several considered remote teaching inferior to in-person teaching, especially in courses with many practical activities, such as those in health and architecture areas, criticizing the institution for adopting ERL while maintaining the same tuition fees. Although many students expressed gratitude to the institution for not canceling classes and praised the increased freedom and time-saving aspects of remote classes (as also noted by students from India, according to Tulaskar & Turunen (2022)), negative comments related to affective engagement demonstrated how dependent many students are on the physical presence of the teacher to perceive their learning, as teaching presence is one of the most relevant factors for student engagement with learning (Khlaif et al., 2021; Su et al., 2024). According to Chiu (2022), the perception of connection with the teacher and peers was the main predictor of behavioral, affective, and agentic engagement in a case study conducted with

middle school students during the ERL. Online courses should incorporate occasional synchronous or in-person sessions to consolidate learning and give students a sense of self-efficacy.

Less frequently, students made spontaneous comments about behavioral aspects during ERL; therefore, fewer comments were categorized under the behavioral code. This code gathered mentions of students' adaptation to remote classes regarding study organization and attitudes. The ERL experience varied among students, with some adapting well and enjoying the benefits of flexibility and convenience, while others struggled to organize their study routine, often linking this difficulty to overlapping study, work, and family responsibilities. Espinosa (2021) states that self-report questionnaires are less accurate than observation for assessing behavioral engagement.

For the sake of comparison, Tulaskar and Turunen (2022) reported that students adjusted to ERL but needed to accept it thoroughly, and the perception of learning quality declined over time. Among the significant challenges faced by Indian students, as reported in that study, were poor internet connectivity and distractions (social media, noise, interruptions by family members). On the other hand, Finnish students complained more about the lack of interaction with peers. Indian students spent more time in synchronous classes than Finnish students, which was positively associated with greater boredom. Like India, in the educational institution described in this study, 100% of in-person classes were converted into synchronous online sessions, and the nature of comments from Indian students coincided with those of the Brazilian institution students described in this research.

Co-occurrences of codes

The analysis of categories of co-occurrences in students' comments showed that few established cause-and-effect relationships between barriers or facilitators to their learning. The open-ended question used in this survey did not explicitly ask students to establish this relationship, and most did not do so spontaneously. Nevertheless, it can be observed that several comments categorized within the engagement dimensions of the ACE framework presented the co-occurrence of other categories, mainly teacher-methodology, teacher-attitude, technology-connection, technology-tools/platform, and activity overload. Students need to understand their cognition and the barriers and facilitators to their learning to benefit from methodological changes implemented by the teacher.

CONCLUSION

Based on surveys regarding ERL experiences at a Brazilian university, this study identified relevant aspects to consider when designing hybrid learning experiences in higher education. Students' comments could be successfully coded under the ACE framework engagement indicators and other codes representing facilitators/barriers for engagement. Throughout the entire research period, most comments presented negative sentiments regarding the ERL experience, and students made more comments about facilitators/barriers to engagement than they mentioned indicators of their engagement in remote classes. Regarding the comments classified under the ACE engagement indicator's codes, the analysis revealed a prevalence of cognitive-related comments throughout the survey periods, indicating dissatisfaction with online learning outcomes compared to in-person classes. Particularly, students expressed concerns about diminished learning effectiveness. In the case reported in this research, students wrongly associated ERL with the online learning modality, which in Brazil has a reputation for leading to lower learning outcomes. They expressed negative comments in the affective dimension, demonstrating exhaustion from the routine of classes and work during the pandemic. Study, work, and family merged into the same space, making it challenging to establish boundaries between them and generating a perception of overload. During the intermediate period, affective-related comments emerged as predominant, reflecting students' exhaustion and demotivation due to the demanding schedule of remote classes and decreased enthusiasm.

In the behavioral dimension, some students adapted to ERL, learning to organize their routines even without receiving instructions. However, another portion continued to complain, mentioning the difficulty of balancing studies, family, work, and leisure. Even with adaptation, the student body did not come to like ERL more over time.

Regarding facilitators/barriers that students most frequently referred to, students consistently provided more barriers than facilitators across all survey cycles. The nature of these comments varied over time, with initial challenges surrounding technology access diminishing as institutional measures were implemented. However, concerns regarding professors' preparedness and teaching methodologies persisted, indicating a need for ongoing faculty development and adaptation to remote teaching strategies. Despite institutional efforts to support faculty through training initiatives, students reported continued struggles with maintaining engagement, particularly concerning activity overload and difficulties establishing study routines at home. Strategies such as active learning and strategic scheduling of synchronous sessions were highlighted as effective means to enhance student engagement in remote classes, emphasizing the importance of fostering autonomous learning behaviors in online education environments.

When considering associations between indicators and facilitators/barriers to good ERL experiences in students' comments, we highlight that negative comments in the Technology and Professor categories possibly indicate causes for the negative comments in the ACE framework engagement dimensions, as students attributed negative aspects of the cognitive, affective, and behavioral dimensions to difficulties with technology and the lack of proper organization or teaching methodology on the part of the teachers.

Many of the aspects raised in this case study have also been reported by other researchers in different global contexts, showing similarities. So, facilitators and barriers to student engagement in teaching activities involving synchronous online moments are similar across various contexts worldwide. The use of synchronous online activities in teaching requires suitable technology for both students and professors, as well as teaching methodologies that lead to student engagement in meaningful activities when they can collaborate with their peers and professors, creating a community of engagement.

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Author 1 – Supervision, formal analysis, article writing – first draft, analysis, edition, and review.
Author 2 – Formal analysis, article writing – first draft.
Author 3 – Formal analysis, article writing – first draft.
Author 4 – Coordination, formal analysis, methodology, article writing – first draft, edition, and review.
Author 5 – Conceptualization, methodology, article writing – analysis and review.

DECLARATION OF CONFLICTING INTERESTS

The authors declare that there is no conflict of interest.

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- The authors declare that the preparation of the manuscript followed the ethical norms of scientific communication.
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