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A Systemic Analysis of the Impacts of the Covid-19 Pandemic on the Studies of Brazilian Graduate Students: An Exploratory Study

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This article presents the findings related to an exploratory study of the systemic impacts of the covid-19 pandemic on the studies of graduate students of Brazil. It was sent a survey to 38 students who attended a University of São Paulo graduate course during the first semester of 2021. An exploratory sequential mixed method approach was followed. Quantitative and qualitative data was collected using questionnaires. The quantitative data was analyzed through descriptive statistics. The qualitative data was examined following a language processing method. The insights gained from both kinds of data were connected using a causal loop diagram. It was found that home confinement was the factor that created the main barriers to learning. In addition, digital fatigue, inadequate teaching strategies and the limitation of video conferencing tools also impacted negatively on learning. On the other hand, the pandemic also brought learning opportunities: the students took advantage of courses, webinars and conferences offered during the pandemic. In addition, the students developed new IT and communication skills.

Keywords: covid-19 pandemic, impacts on learning, systemic analysis, graduate students, learning

INTRODUCTION

The context

In the years prior to the pandemic, the majority of Faculty of Education of University of São Paulo (thereafter FEUSP) graduate courses were offered on campus, in face-to-face mode. Usually, the number of students who attended each course was small, generally below 20. The majority of the class was composed of students from University of São Paulo, with a few graduate students from other universities. Due to the Covid-19 pandemic, the courses were offered online. This brought the opportunity for graduate students from all over the country to enroll in FEUSP courses. In 2021, we offered an online Research Methodology course. Forty-five students from 27 faculties in 10 Universities in seven states of Brazil (Appendix A) enrolled in this course. During our synchronous meetings, they let us know that many of them were suffering diverse problems due to the pandemic. Some of them pointed out that the pandemic also brought new learning opportunities. Therefore, we decided to develop research in order to have a better understanding of how the Covid pandemic impacted their studies. We wanted to understand its systemic impacts of the pandemic on the students' studies, unveiling the dynamics the drove the learning processes that occurred during the pandemic.

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Theoretical review

Well-conducted face-to-face courses allow students to interact with the teacher in a simple and direct way (Gherheș et al.,2021). More than that, such classes can foster social relationships between participants (Bali & Liu, 2018; Yau & Tang, 2020) and facilitate the development of group activities (Liu et al.,2021). Face-to-face courses may also allow for collaborative learning (Satriani,2022).

Teachers may use several educational approaches in face-to-face courses, including project-based learning (Arantes do Amaral & Fregni, 2021), problem-based learning (Leavy et al.,2022), simulation-based learning (Yan et al.,2022), community-based learning (Arantes do Amaral, 2019) and a flipped classroom (Polat & Karabatak, 2022). Moreover, teachers can also combine different educational approaches. Scholars have pointed out the advantages of combining project-based learning and community-based learning approaches (Arantes do Amaral & Lino dos Santos, 2018; Arantes do Amaral, 2019). Researchers also point out the benefits of a combination of simulation-based learning and problem-based learning (Arantes do Amaral & Fregni, 2021).

Online courses also have their advantages. Scholars emphasize the fact that online courses can be flexible (Müller & Mildenberger, 2021), allowing self-paced learning (Rosar & Weidlich, 2022) and place independency (Wege et al., 2022). However, researchers (Dumford & Miller, 2018) also note that the quality of the interactions in online courses may be lower than in face-to-face courses. Academics have stressed the importance of scaffolding online courses in order to foster students' interaction and collaboration (Cortázar et al., 2022). Online courses can also make use of the same educational approaches used in face-to-face courses, such as project-based learning (Yuliansyah & Ayu, 2021), problem-based learning (Haslam & Nielsen, 2021), simulation-based learning (Boffelli et al., 2021), community-based learning (Iyengar & Shin, 2020) and a flipped classroom (Tang et al., 2020). Researchers observed that the learning may be similar in face-to-face and online courses (Binmohsen & Abrahams, 2022).

The Covid-19 pandemic brought several challenges to teachers since they had to rapidly adapt their teaching approach (Daniel, 2020). Prior to the pandemic, several teachers were not used to teaching in an online environment (Robosa et al., 2021). Therefore, they had to learn different teaching strategies and educate themselves in how to use different collaborative IT tools (Ortiz, 2020).

The students also had to adapt to study and work under lockdown. Researchers reported that social isolation led to the diminishment of students' interaction (Elmer et al., 2020) along with increased loneliness and depression (Kapasia et al., 2020). Other studies (Sifat, 2020; Spanemberg et al., 2020) have demonstrated that students also became more stressed and anxious due to the impact of the news about the evolution of the pandemic. In addition, studies also showed that students faced problems related to the inadequacy of their learning environment at home (Kapasia et al., 2020) and internet connection problems (Means & Neisler, 2021). Although several articles have described the negative impacts of the pandemic on students, it appears that there is still a lack of articles that analyse not only the negative consequences, but also the opportunities that the pandemic brought.

The systemic analysis of the Covid-19 pandemic can be understood as the study of the dynamics that emerged during the pandemic. Recently, researchers (Desa & Jia, 2022; Rahmandad & Sterman, 2022) have used system dynamics modelling tools in order to have a broad understanding the impacts of the Covid-19 on the society. One useful tool to understand the impacts is the causal loop diagram (Stankov et al., 2021) a visual image that allows to represent the feedback loops present in the system (Waterlander et al., 2021). There are two kinds of feedback loops (Richardson, 2020): the positive feedback loops (the structure that leads to growth) and negative feedback loops (structure responsible for the stability, leading to the reduction of the force of the positive feedback loops). The interaction of the feedback loops determines the pattern of behavior of a system (such as exponential growth,

decay, stability and oscillation). Causal loop diagrams have been used to represent the dynamics of the Covid-19 pandemic (Bradley et al., 2020).

Our purpose was to identify the feedback loops that drove the learning processes in a graduate course in Brazil. We wanted to figure out the dynamics behind the motivation to learn, the dynamics that created learning opportunities and the dynamics that harmed the learning.

Systemic analysis is used to understand a particular system. However, the dynamics present in a particular system can be present in similar systems. For example, the dynamics that drove the studies of the graduate students in one course in Sao Paulo, Brazil can bring insights that can be useful to understand the dynamics that drove graduate courses in all over the country or even in similar countries.

Even though there are articles that describe the general dynamics of the Covid-19 pandemic (Sharif et al. ,2022), it seems there is still a lack of information of the systemic impacts on the studies of graduate students in Brazil. This research aims to fulfill this gap. Our research question then became: What were the systemic impacts of the Covid-19 pandemic on the studies of FEUSP' graduate students?

METHOD

We followed an exploratory sequential mixed method approach (Creswell, 2017). First, we collected quantitative data by means of a questionnaire with 20 close-ended questions (Appendix B, tables B1 and B2). After analyzing the students' answers, we collected qualitative data by means of another questionnaire with four open-ended questions (Appendix B, table B3). The goal of the second questionnaire was to obtain more information that could help us to have a broader comprehension of the issues analyzed. Finally, we connected the insights gained by the quantitative and qualitative data by means of a systemic analysis (Arantes do Amaral et al., 2020), making use of a system dynamic modeling tool, a causal loop diagram.

The participants

Thirty-eight students participated in this research. They were graduate students from 27 faculties of 10 Universities located in 7 states of Brazil (Appendix A). There were 12 PhD students (7 female and 5 male) and 26 MSc students (17 female and 9 male). The youngest student was 23, and the oldest was 58. The average age was 36.

Data collection

The first questionnaire had 20 close ended questions (Appendix B). We collected data using the five-point Likert scale. The first ten questions had the goal of measuring the problems the pandemic brought to the students (Appendix B, Table B1). We collected information about home confinement, digital fatigue, the impact of media coverage, job workload, the grief they may have experienced as a result of losing a family member or friend to Covid, social isolation, learning environment, IT problems, and schedule conflicts. The second set of questions were related to the learning processes (Appendix B, Table B2). We asked questions about learning opportunities, the quality of the online courses, the flexibility that the online courses offered, the development of students' IT and communication skills, their efforts to study prior to class, the depth of learning they experienced, their self-discipline in studying, their economic situation, and their interaction with the teachers. The first questionnaire was sent two weeks prior to the end of the course.

The second questionnaire had four open-ended questions (Appendix B, Table B3). It was delivered to the students one week after the first questionnaire in order to gather further information about how the

pandemic impacted the students' studies, what were the educational opportunities that emerged during the pandemic, the quality of the students' learning environment and the students' study discipline.

Data analysis

The quantitative data was analyzed using a divergent stacked chart. This chart was used to present the results of the data collected using a five-point Likert scale. It presented the percentage of the answers of each Likert item.

The qualitative data was analyzed using the Language Processing Method (Graham et al., 2001), following three steps. First, the phrases were decomposed into small parts, each part containing only one simple concept or idea. After that, the parts were gathered in groups based on the similarity of their meanings. In sequence, we created recurrent themes (thereafter RT), themes that synthesized the main ideas of each group.

Following that, we combined the insights gained by the quantitative and qualitative data by means of a causal loop diagram (thereafter CLD), a system dynamic modeling tool that is used to describe the structure of a system (Meadows, 2008), to visualize how the components of a system are interconnected and interrelated (Senge, 2014). This modeling tool facilitates the understanding of how the findings of quantitative data connect with the findings of qualitative data (Arantes do Amaral & Santos, 2018).

Reliability and validity

We measured the reliability of our questionnaire by means of Cronbach´s alpha (thereafter CA), a metric (or a coefficient of reliability) that can be used for measuring the internal consistency of a Likert scale (Tavakol & Dennick, 2011). The CA, which ranges from zero to one, measures the correlation of a set of items that form a specific group (Bland & Altman, 1997). In our study, we collected two sets of data, one related to the learning problems that Covid-19 pandemic brought (Appendix B, Table B1) and the other related to the learning processes (Appendix B, Table B2). The values of the CA were 0.82 and 0.813 respectively, indicating that the questionnaire is reliable (Hair Jr. et al., 2006).

FINDINGS

Results from quantitative data

The diverging stacked chart (Figure 1) shows the survey results from the 10 first questions of the questionnaire (Appendix B, Table B1). The answers followed a five-point Likert Scale (1-Totally disagree, 2-Disagree 3-Neither agree, nor disagree, 4-Agree, 5-Totally agree). The data was separated into three categories. The middle of the chart shows the percentage of the answers "Neither agree, nor Disagree" (grey color). The right part of the chart shows the sum of the percentage of answers "Agree" (light green color) and "Totally agree" (dark green). The left part of the chart shows the sum of the percentage of answers "Disagree" (light brown) and "Totally disagree" (dark brown). The diverging stacked chart (Figure 2) shows the survey results from the second set of questions of the questionnaire (Appendix B, Table B1).

The quantitative data (figure 1) showed that the majority of the students experienced digital fatigue (89%), grief (74%) and social isolation (68%). More than that, many of them also had scheduling conflicts (66%) and suffered from job and course workload (66%). The data also revealed that they were impacted by the news about the pandemic (66%) and suffered as a result of home confinement (63%). In addition, 61% of the students reported that they did not study properly because they had to support their children and/or family members (61%). Many students reported that they had IT problems (45%) and problems related to their learning environment (32%).

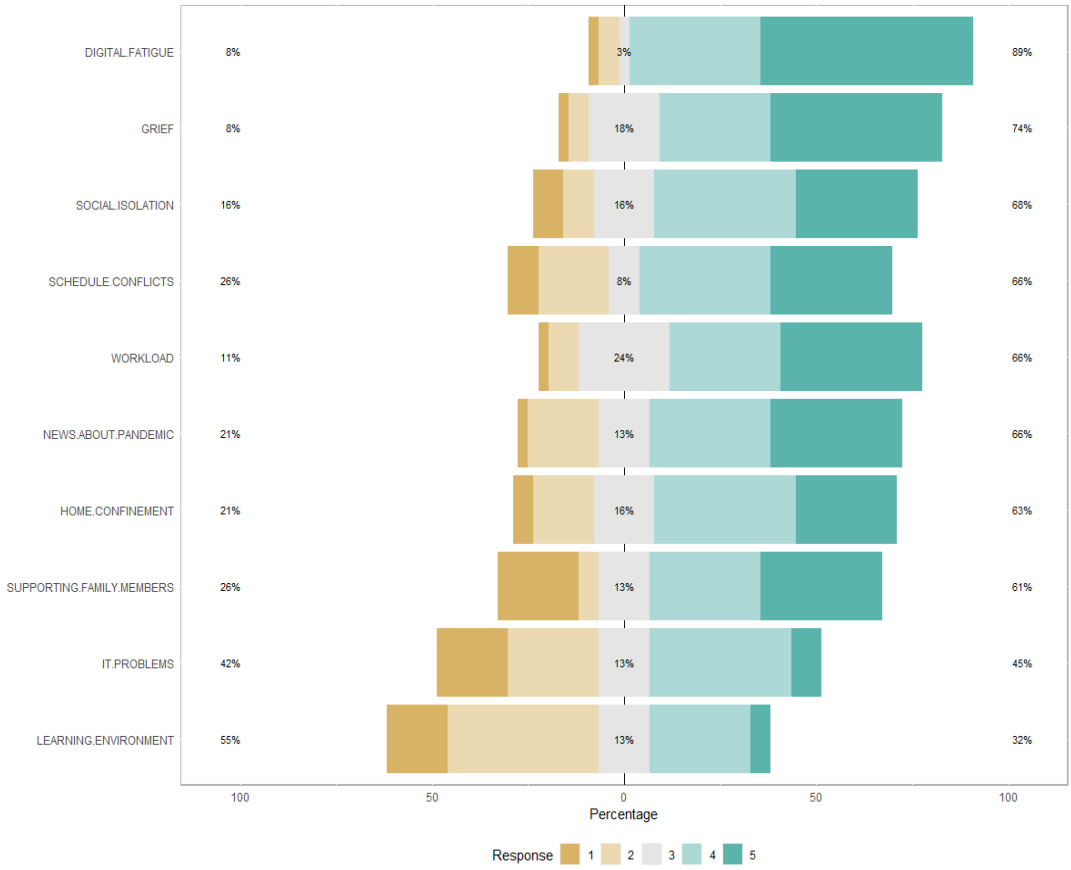

Figure 1
Results from the 10 first questions of the questionnaire (Appendix B, Table B1).

However, the pandemic also brought opportunities. The quantitative data revealed (figure 2) that all students improved their IT skills. In addition, 95% of the students acknowledged that they had learning opportunities. The data also revealed that 95% of the students reported that home confinement allowed them to save money (mostly related to the transportation costs). Moreover, the majority of the students (89%) improved their communications skills. In relation to the learning experience, 71 % of the students acknowledged that online courses were flexible, allowing them to study at their own pace. The data also revealed that 55% of the students considered online courses to be as good as face-to-face courses.

The data also revealed (figure 2) that while 53% of the students were able to study prior to the online classes, 47% did not have the necessary self-discipline to do so. In addition, 50% of the students acknowledge that online courses did not allow deep learning. Moreover, 63% of the students reported that online courses did not allow good interaction with teachers.

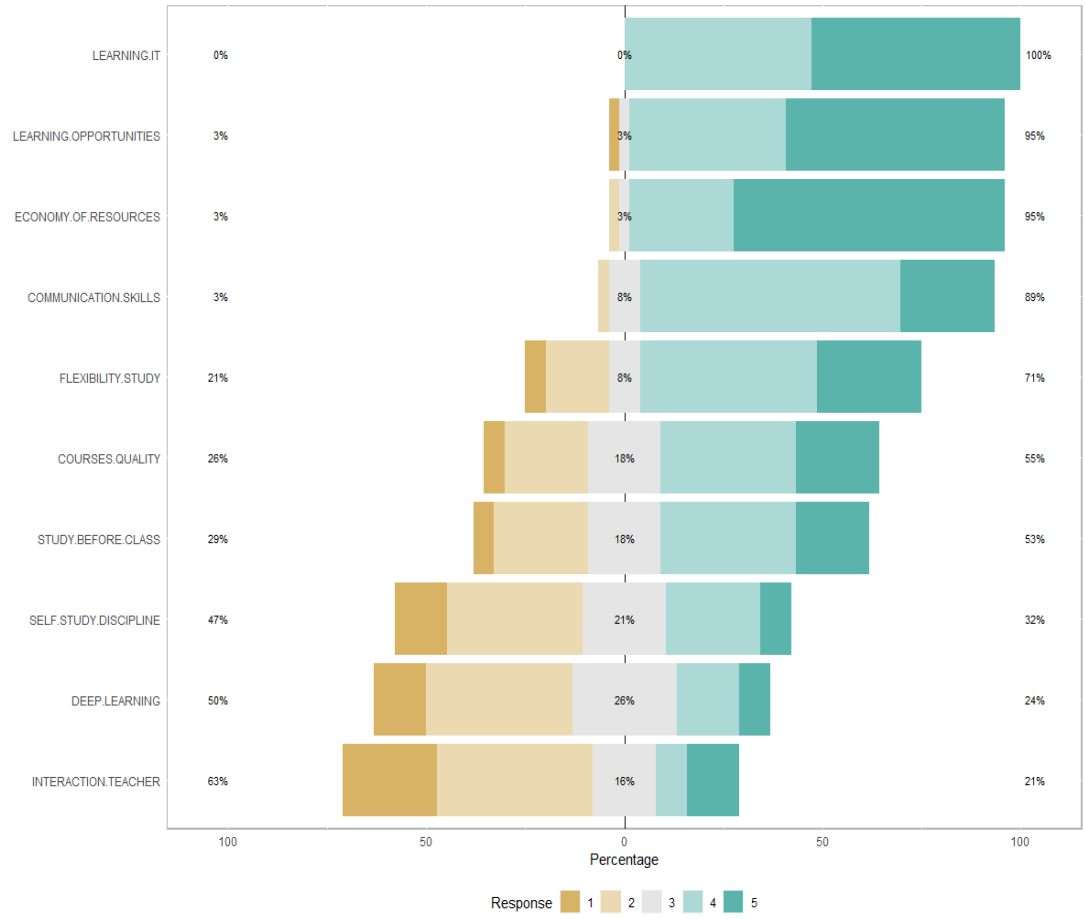

Figure 2
Results from the second set of 10 questions (Appendix B Table B2)

Results from qualitative data

Ten recurrent themes emerged from the analysis of the qualitative data. Six themes related to the problems that the pandemic brought to the students (table 1) and four themes related to the learning opportunities (table 2).

Recurrent themes related to the problems that pandemic brought

RT1: Home confinement impacted negatively on learning

The students' answers allowed us to understand that to study at home during the lockdown was challenging: families had to abruptly change their routines and habits. The students reported that this change led to an increase in household chores, since all family members shared the same space all the time. Moreover, the students also were involved in time-consuming activities such as caring for elders and family members who contracted Covid and supporting their own children's online learning. The data also revealed that the family members frequently interrupted their studies, including the online synchronous activities. Some students reported that every now and then they wasted time with

distractors such as social networks and news, losing focus on their studies. The data also revealed that the confinement caused social isolation.

RT2: Inadequate learning environment impacted negatively on learning

The answers led us to understand that several students did not have adequate study space in their homes. In addition, many students faced IT problems, including bad internet connection. Other students reported that they had to share their computers with other family members. Many students reported that noise from neighbors also disturbed their studies.

RT3: Lack of effort to learn impacted negatively on learning

The data revealed that many students lacked self-discipline, not studying prior to the online meetings.

RT4: The students' mental health problems impacted negatively on learning

The qualitative data also revealed that the social isolation led to an increase in stress. Stress was also aggravated by the anguish and suffering caused by the loss of family members. The bombardment of negative news by the media also contributed to the stress. The data revealed that some students developed emotional disorders.

RT5: Problems related to the online courses impacted negatively on learning

The answers allowed us to understand that some problems were related to the way that the courses were designed and delivered. The data revealed that the instructional design of some courses was not promoting deep learning. Additionally, students reported the limitations of video conferencing tools, making the interaction between the students and teachers difficult.

RT6: Digital fatigue impacted negatively on learning

The data revealed that several students reported that the course workload and the job workload increased during the pandemic, causing digital stress and fatigue.

Table 1
The problems that the pandemic brought to the students

	Recurrent theme	Dimensions
RT1	Home confinement impacted negatively on learning	● Change in daily routine and habits ● Household chores ● Caring for someone at home ● Supporting their own children's learning ● Social isolation ● Scheduling conflicts ● Frequent interruptions ● Distractions ● Lack of focus
RT2	Inadequate learning environment impacted negatively on learning	● Lack of study space ● IT problems ● Problems sharing resources ● Neighbour noise
RT3	Lack of effort to learn impacted negatively on learning	● Studying prior to class ● Self-discipline to study
RT4	The students' mental health problems impacted negatively on learning	● Stress caused by social isolation ● Anguish and suffering caused by loss ● of family members ● Stress caused by negative news ● Emotional disorders
RT5	Problems related to the online courses impacted negatively on learning	● Limitations of video conferencing tools ● Lack of interaction among the participants ● Poor teaching methods ● Failure to promote deep learning
RT6	Digital stress impacted negatively on learning	● Digital fatigue ● Course workload ● Job workload

Recurrent themes related to the learning opportunities that emerged during the pandemic

RT7: Online learning opportunities increased during the pandemic.

The students let us understand that the pandemic also brought new learning opportunities, such as the opportunity to attend online courses offered by graduate programs from all over the country, and the opportunity to learn by participating in webinars and conferences.

RT8: Students saved time and money through online learning.

The data led us to understand that the home confinement also allowed the students to economize in areas such as transportation (most of them related to the commuting costs and time spent on traffic).

RT9: The students developed their IT and communication skills.

The students let us understand that in order to attend online courses the students developed IT and communication skills, since they have to learn how to use different communication software.

RT10: Learning motivates the students to learn even further.

The students' answers let us understand that the more the students learned in online courses, the more motivated they became to seek new learning opportunities.

DISCUSSION

We created a causal loop diagram (thereafter CLD) in order to connect the insights gained from the analysis of the quantitative and qualitative data (figure 3).

The home confinement brought problems such as changes in daily routines and habits, increase in household chores, scheduling conflicts, and interruptions (figure 3, top left corner). In addition, the students also reported that they also had to assist family members (doing activities such as supporting children's learning or caring for elders). All these problems contributed to a reduction in the time that student could devote to their studies. The house confinement also contributed to the increase of the number of distractions, making the students lose focus. These findings are in accordance with the findings of other researchers, who pointed out the problems that the home confinement brought (Pronzato & Di Fraia, 2021). It is also in accordance with researchers who have pointed out that self-discipline has a direct impact on learning (Muksin & Makhsin, 2021).

Moreover, home confinement also contributed to an increase in social isolation and the time spent on online activities. The social isolation (figure 3, bottom left corner) led to an increase in stress and emotional disorders. This finding is in accordance with the findings of other scholars (Ammar et al., 2020; Banerjee & Rai, 2020; Wang et al., 2020) who have pointed out the negative impacts of social isolation. The time spent on online activities contributed to the increase of digital fatigue. This finding aligned with the findings of other scholars who have pointed out the negative impacts of social isolation and digital fatigue on learning (Nadler, 2020).

The data revealed that other factors also led to an increase in stress as a result of the deaths of loved ones and the ongoing media coverage about the pandemics. This is in accordance with other researchers (Aslam et al., 2020) who also have pointed out the negative impacts of the media coverage of the pandemic and the impacts of the losses on students (Sirrine et al., 2021).

The participation in online courses also contributed to the increase in digital fatigue, consequently increasing stress, which in turn led to a reduction in the motivation to learn (this is a negative feedback loop, represented in CLD as Video call fatigue).

The CLD also shows unexpected positive outcomes of the pandemic. During the pandemic, there was a multiplication of learning opportunities (webinars, conferences, courses). This finding is aligned with the findings of other researchers, who pointed out that e-learning opportunities increased during the pandemic (Radha et al., 2020). The more the students took advantage of these opportunities, the more they learned (positive feedback loop, New opportunities to learn) and the more motivated they became to participate in online courses, contributing to a further increase in learning (positive feedback loop, Learning motivates to learn).

The participation in online courses forced the students to become familiar with IT tools (such as Google Meets and Zoom), which lead to development of new skills (positive feedback loop Developing new skills). This finding is in accord with the findings of other researchers who also pointed that one positive after effect of the pandemic was development of the communication skills (Julka-Anderson, 2020). It is also interesting to notice that the positive feedback loop 'Learning motivates to learn' is counteracted by the negative feedback loop Video call fatigue. This finding aligned with the findings of system dynamics experts (Meadows, 2008; Senge, 2014), who pointed out that the development of positive feedback loops led to the appearance of negative feedback loops that

oppose them. This finding is also in line with findings of other researchers (Sharma et al., 2021), who have studied the impact of digital fatigue.

The analysis of the data let us understand that not all students had an adequate learning environment in their homes. Several students reported that they faced IT problems (such as lack of reliable internet connection). Others reported that they lived in small, crowded apartments, while others pointed out that neighbourhood noise disturbed their learning. Therefore, the sum of all these problems (IT problems, inadequate space to study, neighborhood noise) impacted the quality of the learning environment, which impacted negatively on learning (top right side of figure 3). This finding is in accordance with the findings of other researchers, who have pointed out that the quality of the learning environment in computer-mediated communication impacts the learning (Marani et al., 2020). Added to this, the students also reported that sometimes the course quality was poor. They reported that, in some courses, the teacher did not use an effective teaching strategy. In addition, many students pointed out that the limitations of the video conferencing tools made the interaction between the participants difficult. Therefore, we may conjecture that the sum of these problems impacted the course quality, thus impacting the learning (figure 3, top right corner). This finding is aligned with similar findings of other researchers (Nambiar, 2020), who pointed out that poorly structured courses impacted learning. Finally, we may also affirm that several students lacked the self-discipline to study, making the learning less effective (figure 3, feedback loop Effort to learn).

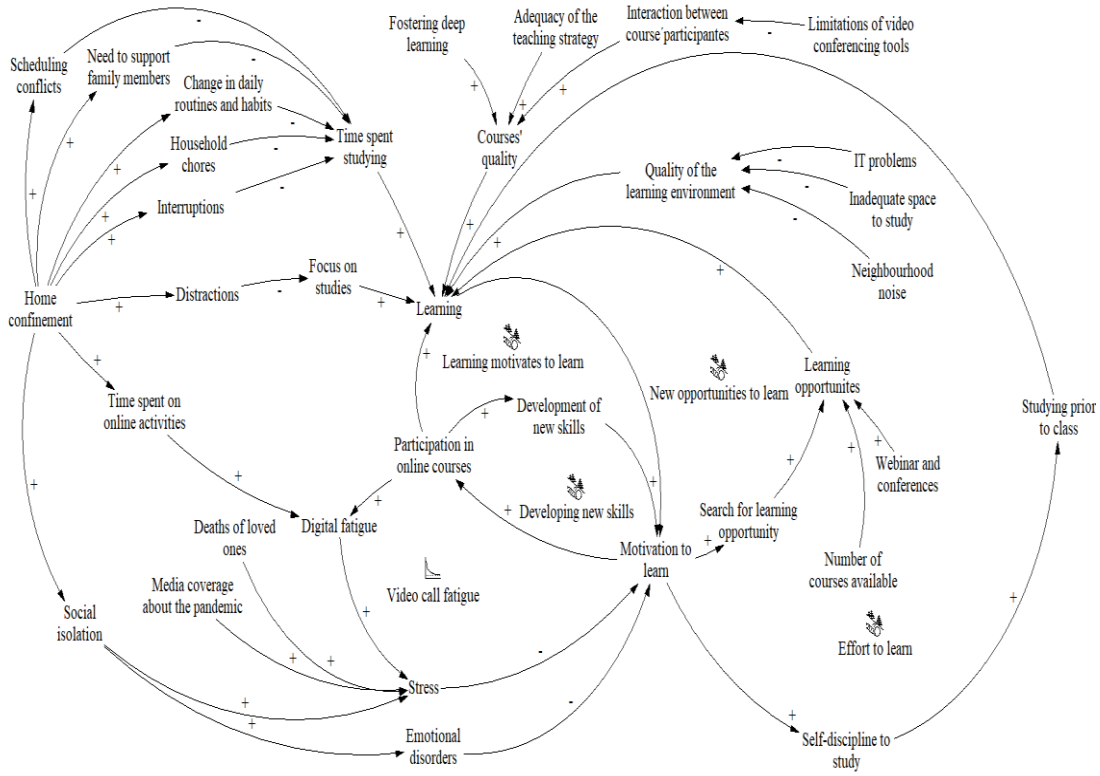

Figure 3. This figure presents the causal loop diagram (CLD), a system dynamic modeling tool. This CLD helps to connect the quantitative and qualitative findings, showing the variables and feedback loops.

CONCLUSIONS

What can be learned from this experience?

Returning to our research question (What were the systemic impacts of the Covid-19 pandemic on the studies of FEUSP' graduate students?) based on the evidence here presented we may affirm that:

Home confinement was the factor that created the main barriers to learning: the distractions made the students lose focus. The household chores, schedule conflicts, the change in daily routines, and the need to support family members reduced the time available to study. The lack of adequate space, IT problems, and neighborhood noise made learning difficult. The social isolation contributed to an increase in stress and emotional disorders.

In addition, the digital fatigue, the inadequate teaching strategies and the limitation of video conferencing tools also impacted negatively on learning.

The pandemic also brought learning opportunities and economy of resources: the students took advantage of several courses, webinars and conferences that were offered during the pandemic. Moreover, the students developed new IT and communication skills. In addition, the students saved time and money (related to transportation to and from the university).

LIMITATIONS

Our study was based on data gathered from only 38 students. Moreover, the group of students were not selected randomly (Sampieri et al., 2013). However, since the students were from 27 universities in 7 different States of Brazil, we may speculate that our conclusions can be applied in a broader context. Finally, we may say that the systemic analysis was based on a causal loop diagram, which is a model which, like all models, has limitations in that they are simplified representations of the real-world. Nevertheless, the model allowed us to have a clearer understanding of the main impacts that the pandemic brought to the students.

We speculate that the merit of this research was provide an integrated view of not only the problems that the pandemic created to the students, but also the opportunities that it brought.

In order to improve the research, we intend to accomplish a more detailed study, involving this time inferential statistics methods and a larger population sample in order to have an even better understanding of the systemic impacts of the pandemic on the students' learning.

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APPENDIX A

Table 1
The States where each University is located and the number of students per University

University	State	Number of Students
University of São Paulo (Faculty of Administration)	São Paulo	1
University of São Paulo (Faculty of Physical Education)	São Paulo	4
Federal University of São Carlos (Faculty of Operations Management)	São Paulo	1
University of São Paulo (Faculty of Philosophy, Language and Human Science)	São Paulo	4
Federal University of Ouro Preto (Faculty of Education)	Minas Gerais	1
University of São Paulo (Faculty of Medicine Veterinary and Zootechny)	São Paulo	3
State University of São Paulo (Faculty of Agronomy)	São Paulo	1
University of São Paulo (Faculty of Philosophy, Sciences and Letters of Ribeirão Preto)	São Paulo	2
University of São Paulo (Institute of Psychology)	São Paulo	1
University of São Paulo (Faculty of Public Health)	São Paulo	1
University of São Paulo (Faculty of Pharmaceutical Sciences of Ribeirão Preto)	São Paulo	1
State University of Paraná (Faculty of Arts)	Paraná	1
Federal University of Santa Catarina (Faculty of Education)	Santa Catarina	1
State University of Rio de Janeiro (Faculty of Education of Baixada Fluminense)	Rio de Janeiro	1
Federal University of São Carlos (Faculty of Education, Sorocaba Campus)	São Paulo	1
University of São Paulo (Institute of Physics)	São Paulo	1
University of São Paulo (Institute of Biosciences)	São Paulo	1
University of São Paulo (Nursery School)	São Paulo	3
University of São Paulo (Institute oif Geosciences)	São Paulo	1
University of São Paulo (Faculty of Education)	São Paulo	3
Federal University of São Paulo (Faculty of Social Service and Political Sciences)	São Paulo	2
University of São Paulo (Faculty of Letters)	São Paulo	1
University of São Paulo (Faculty of Education, Campus of Ribeirão Preto)	São Paulo	2
State University of Southwest of Bahia (Faculty of Education)	Bahia	2

Federal University of Ceará (Faculty of Education)	Ceará	1
University of São Paulo (School of Arts and Communication)	São Paulo	1
University of São Paulo (Institute of Astronomy, Geophysics and Atmospheric Sciences)	São Paulo	2

APPENDIX B

Table B1 presents the 10 questions* about the learning problems that Covid-19 pandemic brought to the students. The observed indicators were used in the diverging stacked chart (Figure 1)

Table B1
The questions about the problems and the observed indicators

Close-ended Questions	Observed indicator
1.Staying at home most of the time is bad for my mental health, negatively impacting my studies	Home.Confinement
2.Accessing electronic devices for many hours makes me fatigued (digital fatigue), negatively impacting my studies	Digital.Fatigue
3.Following the news about the pandemic makes me tense and worried, negatively impacting my studies	News.about.Pandemic
4.The job workload and course workload increased during the pandemic, negatively impacting my studies	Workload
5.The death or illness of family/friends has brought me sadness and anguish, negatively impacting my studies	Grief
6.Social isolation makes me anxious, negatively impacting my studies	Social.Isolation
7. My home study environment is not suitable, negatively impacting my studies	Learning.Environment
8. Technology problems (internet connection, computer problems, etc) have negatively impacted my study	IT.Problems
9.I have had conflicting schedules (class, work, housework) which negatively impacts my studies	Schedule.Conflicts
10. I have not studied properly because I have to support my children and/or family members.	Supporting.Families.Members

Table B2 presents the 10 questions about the learning processes. The observed indicators were used in the diverging stacked chart (Figure 2)

Table B2
The questions about learning processes and the observed indicators

Close-ended Questions	Observed indicator
1. Compulsory move to distance education brought new educational opportunities.	Learning.Opportunities
2. Compulsory move to distance education (due to the pandemic) made me realize that online courses can be as good as face-to-face courses.	Course.Quality
3. Compulsory move to distance education (due to the pandemic) gave me more flexibility to study.	Flexibility.Study

4. Compulsory move to distance education (due to the pandemic) made me learn to use new computational tools.	Learning.IT
5. Compulsory move to distance education (due to the pandemic) made me develop communication/collaboration skills in virtual environments.	Communications.Skills
6. Compulsory move to distance education (due to the pandemic) makes me have to study before class, making the synchronous class more productive.	Study.Before.Class
7. Compulsory move to distance education (due to the pandemic) made me learn in greater depth.	Deep.Learning
8. Compulsory move to distance education (due to the pandemic) made me develop a discipline of study.	Self.Study.Discipline
9. Compulsory move to distance education (due to the pandemic) made me save money.	Economy.of.Resources
10. Compulsory move to distance education (due to the pandemic) made me interact more with my colleagues and teachers.	Interaction.Teacher

*The possible answers for each-closed ended questions were: 1.Strongly disagree 2. Disagree

3. Neither agree nor disagree 4. Agree 5. Strongly agree

Table B3

This table presents the open-ended questions, created in order to understand the impacts of the pandemic on the students' lives and on their learning.

1. Please explain how the pandemic has impacted your life (e.g. housework, child care, remote work, loss of family/friends etc.) and how it has impacted your studies.
2. Please detail what educational opportunities have arisen for you as a result of the pandemic.
3. Please let me know about the problems that you have had with the learning environment.
4. What challenges impacted your learning in the online courses that you took during the pandemic (e.g. discipline of self-study, studying prior to the class, interaction with professors/colleagues)?