https://doi.org/10.18222/eae.v34.9043

DIFFICULTIES MET BY UNICAMP STUDENTS IN THE TRANSITION TO REMOTE LEARNING

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ABSTRACT

This paper conducts an exploratory analysis of data collected from a survey with Brazilian students at Universidade Estadual de Campinas (Unicamp) about the difficulties observed in the transition from in-person to remote learning due to the Covid-19 pandemic. We conducted bibliographic research and applied exploratory factor analysis (EFA) to responses from 1,776 students. Our goal was to obtain a model that explains most of the variance in the data. Upon analyzing the EFA results, two groups of difficulties stood out: those related to course planning and those related to access and the provision of adequate infrastructure for remote learning. These findings can contribute to higher education institutions' institutional plans. Importantly, we are not inferring a prevalence of difficulties, but rather emphasizing that university stakeholders should actively analyze and explore these challenges.

KEYWORDS PRESENTIAL TEACHING • REMOTE TEACHING • HIGHER EDUCATION • COVID-19.

HOW TO CITE:

Serafim, M. P., Dibbern, T. A., Cristofoletti, E. C., Rampasso, I. S., Anholon, R., Silva, D. da, Leal, W., Filho, & Atvars, T. D. Z. (2023). Difficulties met by Unicamp students in the transition to remote learning. *Estudos em Avaliação Educacional*, *34*, Article e09043. https://doi.org/10.18222/eae.v34.9043

DIFICULDADES ENCONTRADAS POR ALUNOS DA UNICAMP NA TRANSIÇÃO PARA O ENSINO REMOTO

RESUMO

Neste artigo, realiza-se uma análise exploratória de dados coletados em uma pesquisa aplicada a estudantes brasileiros da Universidade Estadual de Campinas (Unicamp) sobre as dificuldades observadas na transição do ensino presencial para o remoto devido à pandemia de covid-19. Conduzimos uma pesquisa bibliográfica e aplicamos a análise fatorial exploratória (AFE) às respostas de 1.776 estudantes, buscando obter um modelo que explicasse a maior parte da variação dos dados. Analisando os resultados da aplicação da AFE, destacam-se dois grupos de dificuldades: as relacionadas ao planejamento do curso e as relacionadas ao acesso e à disponibilização de infraestrutura adequada para o ensino remoto. Essas reflexões podem contribuir para os planos institucionais das instituições de ensino superior. É interessante salientar que não estamos inferindo uma prevalência de dificuldades, mas apontando que essas dificuldades devem ser analisadas e exploradas pelos *stakeholders* (partes interessadas) universitários.

PALAVRAS-CHAVE ENSINO PRESENCIAL • ENSINO REMOTO • EDUCAÇÃO SUPERIOR • COVID-19.

DIFICULTADES QUE ENCONTRARON ESTUDIANTES DE UNICAMP EN LA TRANSICIÓN A LA ENSEÑANZA REMOTA

RESUMEN

En este artículo se realiza un análisis exploratorio de datos recogidos en una investigación aplicada a estudiantes brasileños de la Universidade Estadual de Campinas (Unicamp) sobre las dificultades observadas en la transición de la educación presencial a la remota debido a la pandemia de covid-19. Llevamos a cabo una investigación bibliográfica y aplicamos el análisis factorial exploratorio (AFE) a las respuestas de 1.776 estudiantes, buscando obtener un modelo que explicase la mayor parte de la variación de los datos. Al analizar los resultados de la aplicación de AFE, se destacan dos grupos de dificultades: las relacionadas a la planificación del curso y las vinculadas al acceso y a la puesta a disposición de una infraestructura adecuada a la educación remota. Tales reflexiones pueden contribuir para los planes institucionales de las instituciones de educación superior. Es interesante subrayar que no estamos infiriendo una prevalencia de dificultades, sino señalando que dichas dificultades deben ser analizadas y exploradas por los *stakeholders* (partes interesadas) universitarios.

PALABRAS CLAVE ENSEÑANZA PRESENCIAL • ENSEÑANZA REMOTA • EDUCACIÓN SUPERIOR • COVID-19.

Received on: SEPTEMBER 29, 2021
Approved for publication on: JULY 3, 2023

INTRODUCTION

The emergence of the Covid-19 pandemic has impacted heavily and disruptively the dynamics of various institution and organizations, with implications for the economy, politics, education, sociability and the routine of people in most countries of the world (McKibbin & Fernando, 2020; Roth, 2021; Anholon et al., 2021).

Higher education institutions (HEI) were not exempt from these effects. According to Marinoni et al. (2020), until the beginning of May 2020, it was observed that schools and HEI remained closed in 177 countries, affecting more than 1.2 billion students. Indeed, HEI were compelled to implement a series of measures in response to this new reality. This primarily involved interrupting in-person activities and adopting remote learning strategies through online learning or e-learning (Comisión Económica para América Latina y el Caribe [Cepal], 2020; Toader et al., 2021; United Nations Educational, Scientific and Cultural Organization [Unesco], 2020a, 2020b).

As outlined in the Unesco report (2021), one year into the pandemic, three key agendas for education are emerging: i. discussions about reopening schools and the necessary support for this process; ii. the mitigation of problems arising from emergency adaptations in teaching and learning; and iii. the acceleration of the so-called "digital transformation" in education and higher education.

In light of this, it can be said that the adoption of remote learning has brought about a range of impacts on teaching and learning processes. It has also accelerated trends in the adoption of digital technologies in higher education, even into a potential post-pandemic scenario (Benavides et al., 2020; Toader et al., 2021; Ali, 2020; Alzahrani et al., 2021).

Given this context, it is necessary to understand the process of adopting remote learning in the various contexts where it has been implemented. This process has posed challenges to the management of HEI, educators and students, largely due to its disruptive nature. For instance, the study Affouneh et al. (2021) highlights a critical aspect: the transition from in-person activities to remote learning had stressful and overwhelming effects on students and faculty members. This was followed by an adaptation process, although a sense of dissatisfaction persisted.0

Therefore, this discussion has sparked numerous debates, primarily concerning the difficulties and inequalities observed in teaching and learning dynamics. The literature generally highlights some of these issues, including the following: psychological problems such as stress and increased workloads; pedagogical challenges (teaching-learning relationship) from the use of digital distance learning tools; and structural issues within HEI which affect both professors and students, particularly inequality in accessing the technological resources necessary for students (Ali, 2020; Appolloni et al., 2021; Cabero-Almenara

& Llorente-Cejudo, 2020; Paudel, 2021; Watermeyer et al., 2020; Yang, 2020; Zawacki-Richter, 2021; Salcedo-Lagos et al., 2021).

In a report titled "The impact of Covid-19 on higher education: A review of emerging evidence" by the European Commission (Farnell et al., 2021), it is analyzed that the emergency adoption of remote education for most surveyed students resulted in increased workloads and a sense that learning was somewhat hindered in the new context. Some students reported increased feelings of anxiety, frustration and anger, among others. The report also identifies issues related to the challenges of adapting to new tools and the difficulty that some students face in accessing the tools and resources necessary for online teaching. From a social impact perspective, the report emphasizes the challenge faced by HEI in ensuring equitable access, providing adequate training, and creating a diversity-inclusive environment.

In the analytical report from the International Institute for Higher Education in Latin America and the Caribbean (Iesalc) (2020), it is argued that one of the primary challenges in adopting remote learning was the transition from face-to-face activities to a context of social distancing (closed campuses). This transition created a climate of uncertainty for students, with immediate impacts on their daily routines, financial situation, learning continuity, and international mobility. In other words, the disruptive nature of, and the uncertainty about the short, medium, and long-term consequences of the pandemic have resulted in psychological issues, challenges in learning, difficulties in accessing resources and infrastructure, and disruptions in the routines and lives of students.

Considering the above, the aim of this paper is to conduct an exploratory analysis of data obtained through a survey administered to Brazilian students affiliated with the Universidade Estadual de Campinas (Unicamp) about the difficulties met during the transition from in-person to remote learning activities, within the context of the Covid-19 pandemic. We submitted the responses from 1,776 students on 12 different types of difficulties to exploratory factor analysis in order to understand the data structure and obtain a model that explains most of the data variance.

Before presenting the article's structure, it essential to provide a brief description of Unicamp's characteristics. Unicamp is one of the public universities in the state of São Paulo, established in 1966. In addition to its main campus in Campinas, Unicamp has two other campuses in Limeira and Piracicaba. Regarding its legal status, though subordinate to the state government, it possesses didactic-scientific, administrative, financial and property management autonomy. Its primary funding comes from public sources, particularly the Treasury of the State of São Paulo, as well as national and international development institutions.

Unicamp comprises 24 teaching and research schools and 23 interdisciplinary research centers. These entities are responsible for providing undergraduate, graduate, and outreach and extension courses, as well as conducting research and outreach and extension projects. Moreover, Unicamp operates two technical colleges (one in Campinas and another in Limeira), and manages a sophisticated health complex, with two large hospital units on the Campinas campus. Presently, approximately 50,000 people study and/or work on the three campuses. Despite being a relatively young institution, Unicamp has established a robust tradition in teaching, research and engagement with society. It accounts for over 8% of academic research in Brazil, 12% of national graduate studies, and maintains its position as the leading Brazilian university in terms of patents and number of papers published per capita annually in journals. The university has approximately 34,000 students enrolled in 66 undergraduate courses and 153 graduate programs. Before the pandemic, it averaged 2,000 theses and dissertations defended annually, and 99% of its professors hold a doctoral degree.

In 2017, the University Council approved new admission methods to expand social inclusion at Unicamp. Alongside the traditional Unicamp admission exam, the university joined the Exame Nacional do Ensino Médio [National High School Exam] (ENEM), particularly for ethnic-racial quotas, and allocated admission exam slots for indigenous and Olympic students. As a result of these measures, according to the Comissão Permanente para os Vestibulares da Unicamp [Unicamp Admission Exam Commission] (Comvest), in 2022, 42.1% of the admitted students came from public schools, and 30% of the enrolled students self-identified as Black or brown.

To achieve the goals outlined in this paper, it is organized into three sections, along with this expanded introduction and concluding remarks. The first section presents the methodological procedures employed in conducting this research. Subsequently, the results obtained from the applied survey are presented and examined for outliers through the Mahalanobis distance, and then submitted to exploratory factor analysis. Finally, the third section aims to discuss the findings based on the literature review conducted.

METHODOLOGICAL PROCEDURES

As previously highlighted, the primary objective of this study is to understand the structure of the collected data, i.e., this structure is more relevant for the study than the intensity of difficulties. Thus, we went through the following sequential steps: first, we conducted a bibliographic research to establish a theoretical foundation (step 1); next, we analyzed the Unicamp Observatory, a public database (step 2); we identified outliers using the Mahalanobis distance (step 3); we developed a

model via exploratory factor analysis (EFA) (step 4); subsequently, we discussed the results within the context of the existing literature on the subject (step 5); and we established our conclusions (step 6).

The theoretical foundation obtained from the bibliographic research was presented in the previous section. The data for analysis was collected from the Unicamp Observatory, specifically from the database containing students' perceptions on the transition from in-person classes to remote learning. After examining its contents, we selected question 7 to have its responses used in the study. This question focuses on students' perceptions about their difficulty adapting to remote learning. In the original database, question 7 had 14 items. However, since two items centered-on internships, which not all students were doing or were required to do, we excluded them. We proceeded with the analysis of the remaining 12 items:

D1 = Availability of equipment (computer, access to texts or course materials, etc.);

D2 = Availability of internet access;

D3 = Appropriate space for activities;

D4 = Personal mastery of digital technologies;

D5 = Mastery of digital technologies by professors;

D6 = Activities and class dynamics;

D7 = Evaluation methods;

D8 = Access to remote platforms;

D9 = Interaction with other students;

D10 = New planning of the course(s) and class preparation;

D11 = Excess of courses;

D12 = Number of students in the class.

Respondents who did not answer all 12 items were excluded. The answers were recorded on a scale from A1 (indicating little difficulty) to A5 (indicating a high level of difficulty). A6, A7 and A8 corresponded to "I don't know", "I prefer not to answer", and "Not applicable", respectively. For the statistical analysis, student responses were coded as 1 for A1, 2 for A2, 3 for A3, 4 for A4, and 5 for A5. Respondents with one or more A6, A7 and A8 answers were removed from the dataset. In the end, a database with 1,776 respondents was used for the next step, which involved the analysis of outliers. To achieve this, we applied the Mahalanobis distance, a technique which, according to Tabachnick and Fidell (2013), considers the distance between the centroid of variables' means and each case. The χ^2 distribution was used in its calculation. After eliminating the outliers, we conducted the EFA.

In this analysis, we considered guidelines provided by Fávero et al. (2009), Hair et al. (2009) and Malhotra (2012), and performed the following steps using SPSS software. We chose principal component analysis as the extraction method and used the varimax orthogonal rotation method. To validate the model, we considered the following criteria: the Kaiser-Meyer-Olkin (KMO) index should be greater than 0.60; the Bartlett's sphericity test should have a significance level below 5%; the measure of sampling adequacy (MSA) values should be higher than 0.50, as well as the variables' communality values. In the generated model, only eigenvalues greater than 1 were considered, and the first components, whose number is fixed, should explain at least 60% of the variance. Subsequently, in the analysis of the rotated component matrix, we examined the factors identified with the matrix structure and named and interpreted them based on the literature related to the topic.

RESULTS

Outliers identification

As previously mentioned, following the removal of respondents with missing answers, we had a remaining sample of 1,776 students. This sample was employed for the elimination of outliers. Utilizing the Mahalanobis distance, we identified 18 outliers (with probability values lower than 0.001), and we subsequently removed their records from the sample. The Mahalanobis distance values and their respective probabilities are presented in Table 1.

TABLE 1
Mahalanobis distance and its probability

OUTLIER	MAHALANOBIS DISTANCE	PROBABILITY	OUTLIER	MAHALANOBIS DISTANCE	PROBABILITY	OUTLIER	MAHALANOBIS DISTANCE	PROBABILITY
1	57.15733	0.00000	7	39.59441	0.00008	13	35.15256	0.00044
2	49.92569	0.00000	8	38.60835	0.00012	14	34.81155	0.0005
3	44.54228	0.00001	9	37.7349	0.00017	15	34.22627	0.00062
4	41.06821	0.00005	10	37.20664	0.00021	16	34.17008	0.00063
5	40.23521	0.00007	11	35.82014	0.00035	17	33.92088	0.00069
6	39.61068	0.00008	12	35.75161	0.00036	18	33.91926	0.00069

Source: Authors' elaboration.

Exploratory factor analysis (EFA)

After removing the outliers, we proceeded with the exploratory factor analysis (EFA) using SPSS software, following the guidelines outlined in section "Methodological procedures". However, the initial application of EFA was not validated due to the variables D4, D5, D9, and D12 having communality values lower than 0.5. Consequently, these variables were excluded from the input set, and EFA was performed again. This second attempt was validated, with all criteria being met as presented below.

The KMO index showed a value of 0.881, exceeding 0.6, as indicated in the literature (Fávero et al., 2009). The Bartlett's sphericity test displayed a significance level of 0.000, below 0.05, as emphasized by Malhotra (2012). All MSA values exceeded 0.50, as did variables' commonality values, which were above 0.5 (Hair et al., 2009). The analysis of the total variance explained can be found in Table 2, where two components presented eigenvalues greater than 1 (Hair et al., 2009). Together, they explain 66.77% of the total variance (51.305% and 15.472%, respectively). Finally, Table 3 shows the variables allocated to each of the two components. This is because D6, D7, D10 and D11 had high correlations with the first component, while D1, D2, D3 and D8 had high correlations with the second component.

TABLE 2
Extraction method: Principal component analysis

COMPONENT	TOTAL VARIANCE EXPLAINED								
	Initial eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	4.104	51.305	51.305	4.104	51.305	51.305	2.809	35.112	35.112
2	1.238	15.472	66.777	1.238	15.472	66.777	2.533	31.665	66.777
3	0.569	7.114	73.891						
4	0.535	6.682	80.573						
5	0.410	5.125	85.698						
6	0.401	5.015	90.713						
7	0.378	4.725	95.438						
8	0.365	4.562	100.000						

Source: Authors' elaboration.

TABLE 3
Rotation method: Varimax with Kaiser normalization

VARIABLES	COMPONENTS	
	1	2
D1		0.831
D2		0.856
D3		0.585
D6	0.801	
D7	0.769	
D8		0.76
D10	0.751	
D11	0.827	

Source: Authors' elaboration.

Upon considering the two factors identified in the structure of the rotated component matrix, an analysis was conducted to name these factors based on their variables. Factor 1 was designated as "Course planning" as all its variables were related to the planning stage: D6 (activities and class dynamics), D7 (evaluation methods), D10 (new planning of course(s) and class preparation), and D11 (excess of courses). Factor 2, on the other hand, was designated as "Infrastructure" due to the difficulties associated with it: D1 (availability of equipment – computers and access to texts or course materials), D2 (availability of internet access), D3 (appropriate space for activities), and D8 (access to remote platforms).

Following the analysis of the EFA results, it is necessary to present the frequency distribution of each variable. As observed in Table 4, within factor 2, most of the responses indicate lower levels of difficulty (levels 1 and 2), whereas in factor 1, though the distinctions are less pronounced, we can see a greater number of responses indicating higher levels of difficulty (levels 3, 4 and 5).

TABLE 4
EFA results: Variables' frequency distribution according to factor

LEVELS	FACTOR							
	1 – Course planning				2 – Infrastructure			
	D6	D7	D10	D11	D1	D2	D3	D8
1	12.7%	16.4%	13.4%		51.5%	50.9%	29.6%	48.7%
2	15.9%	17.6%	11.6%		18.9%	21.7%	18.3%	25.5%
3	28.0%	27.3%	20.0%		14.8%	15.1%	19.6%	16.7%
4	23.7%	19.5%	19.3%		9.0%	8.0%	14.5%	6.3%
5	19.6%	19.2%	35.7%		5.8%	4.3%	18.0%	2.8%

Source: Authors' elaboration.

DISCUSSIONS

The results obtained from the exploratory factor analysis provide evidence that certain difficulties experienced by students require exploration, understanding and action from HEI leaders. This is especially crucial as we still have a longer period of "transiency" in remote education. Covid-19 will become endemic, and we will live with it in various regions for several years (Phillips, 2021).

To offer guidance to HEI leaders, we have categorized these difficulties into two main groups: 1) those associated with the absence of, or weaknesses in course planning; and 2) the challenges stemming from the lack of adequate infrastructure. It is important to clarify that we are not suggesting a prevalence of these difficulties, but rather emphasizing that they should be analyzed and explored in institutional planning.

In an effort to understand the transition from in-person to remote learning and the associated adaptation difficulties, the Unicamp survey inquired about the degree of difficulty encountered when shifting some activities to remote learning. Challenges related to course planning were more evident. The incorporation of remote teaching-learning activities and dynamics, and new assessment methods, including various formats, led to a perception of overload which was felt as an excess of courses. The number of subjects did not increase compared to in-person learning. That is, the number of subjects has not changed, which underscores a critical aspect deserving further exploration: the online curriculum cannot be a mere replication of the face-to-face curriculum. Intangible factors such as high exposure to technology and reduced human interaction can impact student fatigue and performance (Joshi et al., 2020).

Hodges et al. (2020) emphasize the distinction between well-planned online learning experiences and courses adapted to remote learning in response to the pandemic. They underscore that high-quality online teaching and learning require meticulous planning that aligns with a comprehensive teaching-learning project. Other studies, such as those by Bozkurt and Sharma (2020) and Vlachopoulos (2020), also highlight that the absence of a careful process of adaptation to online education during the pandemic resulted in the rejection of the adopted models, which the authors interpreted as emergency remote learning.

Careful planning is essential, including the development of a minimum infrastructure plan that aligns with HEI's online education project. The infrastructure-related challenges identified by Unicamp students encompass issues like the availability of equipment (computers, access to texts and teaching materials), access to the internet and remote platforms, and suitable study spaces at home. These challenges are more pronounced among students with some degree of socioeconomic vulnerability. Examining the Chinese context, Zhong (2020) shows

the impact of students' social vulnerability on organizational responsiveness and on students' ability to actively participate in the teaching-learning process through digital means.

In recent years, Unicamp has expanded its social inclusion policy, adopting ethnic-racial quotas and specific scores for public school students, who have a more vulnerable socioeconomic profile. This measure brought an additional challenge during the transition to remote learning, which was addressed through the provision of computers and internet chips. While this measure has limited social reach, as it only serves students without any infrastructure, we know that many students face severe limitations in their infrastructure, which also affects their learning process.

The HEI's emergency plan was a response to the challenges imposed by the pandemic on everyone. As an emergency measure, its primary goal was to mitigate the impact of social distancing by providing the necessary conditions for students to attend classes taught via online platforms. It was recognized that the effort to provide computers and internet chips would not suffice to address the challenges that accompanied remote teaching. It is worth emphasizing that Unicamp was already aware that the impact of remote teaching would be multifaceted, and that it would become evident during social distancing, but even more so during the transition back to in-person teaching, which took place in March 2022.

Initially, the measures to resume in-person learning were focused on compliance with health protocols, providing socializing environments with the necessary spacing, and requiring proof of vaccination from the academic community. However, what we found was: a sense of apathy among students and professors; the lack of a sense of belonging among students, who were formally part of the university but still unfamiliar with it; a high prevalence of mental health-related issues; limited social interactions, and difficulties monitoring/retaining didactic contents. In response, Unicamp implemented three crucial strategies: 1) monitoring of students' mental health; 2) introducing mentorship and tutorship disciplines to monitor students; 3) organizing various cultural and extension activities for both the internal and external community. After one semester of resumption of in-person learning, we are only now beginning to witness a more active, joyful and present community at the campuses.

FINAL REMARKS

Epidemiological predictions indicate that SARS-CoV-2 is still far from being eradicated. In fact, a report published in *Nature* highlights that approximately 90% of the immunologists, infectious disease researchers and virologists interviewed,

who work with SARS-CoV-2, anticipate that the disease will become endemic, and that we will live with it in various regions for several years to come (Phillips, 2021).

If these forecasts are confirmed, then the next few years will still be affected by periods of social distancing and lockdowns. Consequently, alternation between in-person and remote teaching will remain a reality. As such, it is necessary to advance in comprehending and addressing the difficulties faced by students during remote education. Understanding the process of adoption of remote learning across different contexts, its inherent challenges, and its implications and difficulties for HEI managers, professors and students is essential.

The primary goal of this paper is to draw attention to the difficulties experienced by students during the transition from in-person to remote learning. It is worth emphasizing that the method employed, exploratory factor analysis, is aimed at stressing that certain reported difficulties deserve the attention of HEI administrators. This paper does not claim that these difficulties predominate over others; rather, it underscores that they need to be further investigated, explored and analyzed in the institutional plans of HEI. We encourage other researchers to use the reflections presented here as a starting point for more complex studies on the difficulties addressed in this paper.

ACKNOWLEDGMENTS

This study was supported by the Fundação de Amparo à Pesquisa do Estado de São Paulo (Fapesp) – process n. 2021/03864-2; Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), through grants 307536/2018-1, 305442/2018-0 and 311738/2022-2; by Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (Capes) – funding code 001, process n. 88887.464433/2019-00.

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NOTE: The authors Milena Pavan Serafim, Rosley Anholon, Izabela Rampasso, Thais Aparecida Dibbern and Evandro Coggo Cristofoletti participated in the research design and in the entire writing process. The authors Dirceu da Silva, Rosley Anholon and Walter Leal Filho performed the entire statistical analysis and validation. The author Teresa Dib Zambon Atvars participated in the final reading and in providing the Unicamp survey data. All authors participated in the final review and contributed passages to the text of this article.