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EXPLORING DISTANCE LEARNING IN HIGHER EDUCATION: SATISFACTION AND INSIGHTS FROM MEXICO, SAUDI ARABIA, ROMANIA, TURKEY

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Abstract. Education, notably higher education, faced a significant challenge during the last period. Our data exploratory study aims to provide insights into the key factors that define students' Distance Learning (DL) in the current period. Based on the main findings, we justify our bold proposition for the current era of distance and blended learning in Higher Education. Our research study aims to understand cultural and national differences in four countries: Mexico, Saudi Arabia, Turkey and Romania. It contributes to the theory of DL with a model of six hermeneutic factors for the satisfaction of using the DL method. It investigated and confirmed the capacity of the components to explain 60% of the DL satisfaction variance. Our research study also emphasized the interpretation of the essential findings and the drafting of bold propositions for the DL practice, emphasising academic environments. We identified significant areas of improvement, and we suggested the orchestration of combined efforts. Our research promotes the strategic deployment of DL in the current context as a resilient strategy of institutions for high-impact training and targeting of huge audiences, with emphasis on the deployment of new tools and teaching methods customized for a new, unique value proposition of the DL.

Keywords: distance learning, technology, satisfaction, principal component analysis, COVID-19, higher education.

JEL Classification: M41, C83, L20.

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1. Introduction

Education, notably higher education, faced a significant challenge during the last period. It faced an unexpected but very complex context, as higher education plays a courageous role in the social responsibility of each community. The disruption of education could generate future threats to societies. Higher education institutions have focused on technical, organizational, and pedagogical aspects to identify rapid responses for the transition from traditional to distance learning (DL), to ensure the continuity of the educational process, and to provide high-quality education (Bojović et al., 2020; Mravik et al., 2023), ensuring equity, transparency, and legal certainty in the DL process. Encouraging per-

sonalized learning, improving assessment methods, and increasing faculty engagement support the transition to digital and hybrid learning environments (García-Peñalvo et al., 2020; Rahiman & Kodidal, 2024).

The pandemic revealed an increased need to create a new educational model, highlighting the weaknesses of the traditional one and the need for urgent action using available resources. For a limited period, it created a full transition to DL, and it increased the need for an enhanced package of tools and methods. Murphy (2020) argued that the de-securitization of face-to-face education is imperative for the future possibility of emancipatory learning (traditional, hybrid, or online).

There is a common understanding that DL objectives guarantee and improve access to education opportunities for a more significant part of the population to counterbalance the decreasing university-age population and provide graduates capable of responding to the labor market requirements. The creation, dissemination, and use of information are changing rapidly. As a result, not only has the higher education sector changed in terms of methods, technology, and content, but also the labor market requirements have also changed. Education prepares people to succeed in the labor market. However, to successfully cope with all the new realities, individuals need experience utilizing new forms of communication, work, or study to increase productivity, achieve sustainable progress and target resilience (Dede & Lewis, 1995; Salas-Pilco et al., 2022; Abulibdeh et al., 2024). The effectiveness of higher education can be properly assessed by evaluating how well students are equipped with the skills needed for a knowledge-based and digital society.

As technologies continuously evolve, our focus will be on the satisfaction of the educational process under the rapid transition to distance education. Concerning student satisfaction from online courses, many studies (Bolliger & Martindale, 2004; Swan, 2001; Zheng & Xiao, 2024) point out the importance of effective course design, instructor interaction, and student engagement in enhancing satisfaction and learning outcomes in DL education. Furthermore, we need to focus on the fundamental assumptions about education and the design of emerging opportunities under the current conditions; the online learning used as a measure of social distancing for reducing the spread of viruses is not new, being considered as a contingency plan also during the A(H1N1) flu from 2009 (Dede, 1996). The importance of our study lies in the assessment of the potential effect of DL, along with its implications and benefits, as center pillar for researchers and policymakers. This focus aims to design new coordinates for the educational process, considering the experiential situation we have all encountered. Understanding the long-term impact and refining educational strategies will be crucial for creating a more resilient and effective learning environment.

Under these circumstances, our paper aims to evaluate the perception of satisfaction and comfort in using online tools compared to traditional methods for students. We seek to identify how online learning is perceived based on the methods designed, adapted, delivered and managed during the pandemic. Also, our analysis will delve into the impact on overall learning outcomes, the effectiveness of engagement strategies, and the potential for integrating successful elements of DL into future traditional educational processes.

The rest of the paper is structured as follows: the next part presents the theoretical framework on the factors affecting DL satisfaction, section three presents the research methodology of our paper, section four investigates the results, and the last parts discuss the implications of our key findings and present the conclusions.

2. Literature review

Distance education was initially used to describe the access to education for those geographically separated. Before the advent of digital technology, distance education was used as basic correspondence through postal service by Pitman's postal system in the 1840s. As computers were used in delivering and accessing information, the term was defined as delivering instructional materials, using print and emerging electronic media to produce distributed learning opportunities (Moore, 1990; Dede, 1996). Although distance education and DL refer to the distance in time or place, they are mentioned to be different, as the first refers to the activity and the second to the ability to learn at a distance (King et al., 2001; Volery & Lord, 2000). E-learning is described as accessible using technical tools and instructional methods, delivered via the Internet, Intranet, or CD-ROM (Nichols, 2003; Benson, 2002; Clark, 2002). Online learning refers mainly to the technology environment and its context (Lowenthal et al., 2009). It is considered a recent type of DL that improves access to educational opportunities (Conrad, 2002). Even more recently, distance education/learning, online education, distributed learning, or e-learning are often used as interchanged terms without meaningful differences (Moore et al., 2011). In response to the need for social distancing during the COVID-19 pandemic, the term DL was used more often than the other concepts (OECD, 2020; European Commission, 2021; UNICEF Regional Office for South Asia, 2020).

The wide spread of information and communications technologies and the digital transformation reshaped the traditional approaches to activities in many areas of the economy and society (e-commerce, e-government, e-business, e-health, etc.). The growing demand for education driven by the rapid changes in the labor market resulting from the digital revolution and the widespread access to the Internet has led to the adaptation of educational programs to the new requirements of the information and communications era (Klaus & Changchit, 2014; Zou et al., 2022), highlighting the essential role of digital tools in transforming information into knowledge through effective pedagogical practices (Boltsi et al., 2024). Furthermore, globalisation drove changes in education towards adopting global perspectives in a knowledge-based world (Lam, 2010; Mittelmeier & Yang, 2022) and distance learning, driven by technological advancements, has increased educational accessibility and flexibility. However, globalization presents challenges that require understanding the factors influencing students' engagement with distance learning, such as trust or social influence (Hameed et al., 2024). Electronic educational technology for learning is considered the cornerstone of building an inclusive knowledge-based society (Tolmachev et al., 2022). Interactions across the Internet and advances in computer-supported learning led to the increased use of other types of learning, available regardless of space or time (Masalimova et al., 2022).

DL is considered a strategy to improve education outcomes in the current global circumstances. It is also a strategy to cope with the increasing pressure to reduce human and infrastructure costs by reducing school-based facility costs (by using home spaces) and salary costs (by transferring some teaching activities to digital tools or reusing teaching materials once they were provided as recorded courses, by providing education to a large number of students) (Liu et al., 2022). DL widens access to education for all (especially for those in areas where traditional enrolment is difficult) and provides active learning and individualized teaching methods based on performance and preferences (Georgakopoulos et al., 2023). These are essential in fostering greater satisfaction with the educational process for students and professors. Particularly for students, it could improve the enrolment rates, generate higher efficiency of the learning process, and increase motivation. For teaching staff, DL

could provide better time management by focusing on high-value activities, better results in learning processes for students by using new personalized methods of teaching, and better use of teaching time during courses as a result of the possibility of providing courses for consulting before lectures (Bakia et al., 2012; Benabbes et al., 2023). Digital technologies can require a higher workload for professors than they have traditionally conceived (Burns, 2020; Rahimi & Oh, 2024).

DL changed how information was delivered and brought greater flexibility to both students and professors (Tseng, 2020). Their capacity to integrate different learning tools (emails, chats, forums, online assignments or quizzes, etc.) was higher as the Internet was increasingly accessible. They use synchronous and asynchronous communication depending on the method, the needs of learners, and the flexibility of both students and professors in terms of time and place (Pituch & Lee, 2006; Harlow, 2024). Self-regulated efforts and flexibility variables significantly affect satisfaction (Turan et al., 2022; Sato et al., 2024). Also, DL better matches the needs of students and professors when they have conflicting schedules and are geographically dispersed (Pituch & Lee, 2006).

Xiao et al. (2020) considered investing in new education delivery types critical for institutions. The most important indicators of assessing the cost-effectiveness of learning are the satisfaction and experience of students. The higher education sector needs further investment, redirected from physical assets to human capital. The pandemic revealed that some administrative investments and staff categories are less critical than investments in adequate technologies and human capital. The lack of further financial support for infrastructure development will weaken the implementation of new technologies (Qiao et al., 2021; Ashri et al., 2020) in a sector already at risk due to the decline of the university-age population.

The information and technology infrastructure are the engine of the DL process (Sahin et al., 2024). It has long been emphasized that the focus should be on creating learning-centred environments supported by technology (Petrides, 2002). The COVID-19 pandemic accelerated the integration of technology and digital tools in education, particularly in higher education. Sprenger and Schwaninger (2021) compared digital learning technologies and found that distance education based on the classroom response system had the highest level of acceptance, followed by e-lectures. Williamson et al. (2020) focused on the shift to online and digital education formats, considering that education and educational technology have become frontline emergency services, stressing that digital connectivity and people's ability to access and endowment with skills to use technology effectively and safely are essential to achieve educational goals. Also, the willingness or motivation of the teaching staff to adapt their methods was a critical variable in last period. The motivation of students, along with the lack of collaboration and internet connectivity, were highlighted by other authors (Segbenya et al., 2022) as challenges for students in this process. Also, DL is perceived as safer and less stressful, especially during a pandemic (Masalimova et al., 2022). These variables are essential for increasing the comfort of DL tools and the participants' perceived satisfaction.

König et al. (2020) found that ICT tools and digital skills are essential in adapting to DL during pandemic. Almaiah et al. (2020) concluded that the main challenges facing DL extend beyond the infrastructure issue to include technical, managerial, and course content issues with potential effects on both the comfort and satisfaction of participants in the educational process.

Another critical aspect of the literature is the importance of accepting DL systems (e-learning) to claim their benefits (Van Raaij & Schepers, 2008). Marek et al. (2021) conducted a

worldwide survey to explore the experience after passing DL during the COVID-19 pandemic. They found, as expected, that those with experience with DL before the pandemic were more comfortable with the short-notice transition. Nevertheless, a higher workload and stress were experienced compared to traditional face-to-face learning. By contrast, Johnson et al. (2020) found that the transition to DL, regardless of existing or not previous experience, required new teaching methods and assignment changes, which may imply a lower expected volume of work for students.

An increase in satisfaction by using DL tools is supported by its capacity to promote a peer-to-peer learning approach, to support group cohesiveness, trust, and a sense of belonging to a community, even if it will have to manage different learning styles and cultural attitudes in an environment with increasing need of personalized education (Amemado & Manca, 2017; Contrino et al., 2024). Other relevant studies highlighted benefits in terms of convenience and portability (not required physical attendance, advantages of asynchronous methods, etc.), cost and selection (wide range of possibilities for education), flexibility (Motiwalla & Tello, 2000), higher dropout rates than in traditional education as a result of low entry and exit barriers (Borrella et al., 2022). Compared to this perspective, studies delivered before the pandemic did not show significant differences between online and traditional face-to-face learning in terms of knowledge retention and student research results, highlighting that the content delivered is more important than the modality of content delivery (Brown & Park, 2016), while other studies showed higher student achievement in the case of blended or DL (Al-Qahtani et al., 2013).

Despite the key factors that affect DL satisfaction (Figure 1), inequalities or vulnerabilities for some groups/countries greatly affected the continuity and efficiency of the educational process, even more so in times of rapid changes.

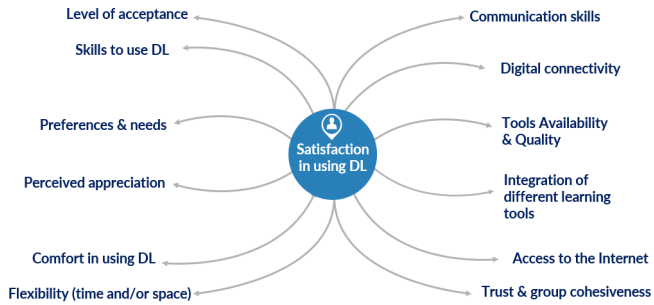

Figure 1. Key factors that affect satisfaction in DL (source: the authors)

The assessment of 'being comfortable using DL tools' should be based on the prerequisite that the digital space changed from an amenity to a necessity. Researching inequalities across many domains of life, some authors (Blundell et al., 2020; Bartolic et al., 2022) stated that the current crisis will exacerbate some pre-existing inequalities in the long run.

Beaunoyer et al. (2020) explored digital inequities that potentiate the vulnerability in the new context when digital space becomes the main (or one of the only remaining) vectors for many activities, including education. Iivari et al. (2020) also considered that many kinds of digital divide prevail in many countries and will affect the future of young generations, highlighting the need for extensive digital transformation of education to meet the needs of a digitalized future.

The role of DL systems is essential in promoting education and knowledge acquisition that drive both economic development and sustainability efforts, as presented in relevant studies (Kyriakopoulos et al., 2020; Kyriakopoulos, 2021; Drosos et al., 2021). Those studies also underscore the role of educational institutions in cultivating skills and behaviors aligned with environmental and economic progress.

3. Methodology

Our exploratory study aims to provide insights into the key factors defining students' DL Satisfaction during COVID-19. The main research objective is to deploy data exploratory analysis to understand hermeneutic factors for DL satisfaction. One additional research objective is to use the main findings to justify a bold proposition for the post-COVID era of distance and blended learning in Higher Education. Also, our research study aims to understand, with the given limitation, cultural and national differences in four countries: Mexico, Saudi Arabia, Turkey and Romania.

Our research is organized around three main research questions:

Research Question 1: How can an exploratory (data) analysis reveal the key factors affecting DL satisfaction during COVID-19?

Research Question 2: How can applied Principal Component Analysis further lead to the analysis of hermeneutic factors for DL satisfaction and insights by exploiting sample data from DL in Romania, Turkey, Mexico, and Saudi Arabia during the COVID-19 pandemic?

Research Question 3: What are the critical implications of the main findings for post-COVID-19 DL and Blended Learning in Higher Education?

We sent an electronic questionnaire via email to university students in all four countries. After receiving the completed questionnaires, we randomly selected 40 students from each country (with the randbetween function of MS Excel) and created the final sample of 160 students. The current study aims to locate the critical factors associated with DL satisfaction and discover differences between the countries. For this purpose, we first factor analyzed the questionnaire, and afterwards, we applied linear regression by setting satisfaction from DL as the dependent variable. We constructed separate OLS (Ordinary Least Squares) models for the four countries. The analysis is performed via SPSS v20. In the next section 4, we summarize the key findings of our analysis on the critical determinants of satisfaction from DL. These findings are further discussed and interpreted in Section 5 to synthesize the critical implications for bold contributions for DL and blended learning in the post-COVID-19 era in higher education institutions.

In our effort to deploy an exploratory (data) research analysis of Key factors affecting DL satisfaction during COVID-19, we deployed three diverse and integrated statistical and data mining methods (Figure 2):

- We deployed Kaiser–Meyer–Olkin (KMO) and Bartlett test of sphericity on Questionnaire;
- We utilized factor analysis over our questionnaire, and we discovered six significant factors;
- We applied linear regression by setting satisfaction from DL as the dependent variable;
- We exploited the sophisticated factor analysis findings for DL insights by using the variance of the DL satisfaction, and we approximated the hermeneutic capacity of each factor to justify the degree of DL satisfaction;

- We constructed separate OLS models for Turkey, Saudi Arabia, Mexico and Romania, and we concluded on the most significant hermeneutic factors of the DL. satisfaction for each country.

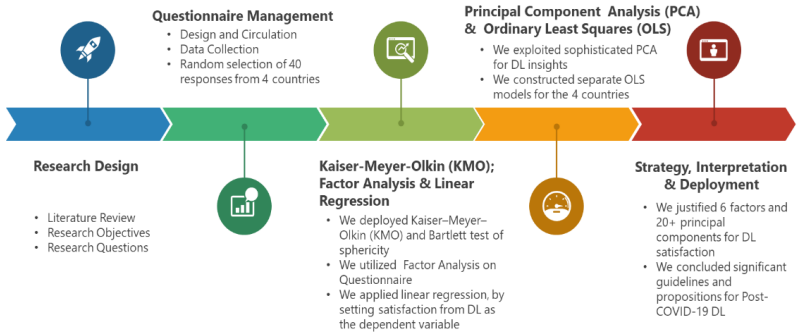

Figure 2. Our integrated research approach (source: the authors)

This sequence of exploratory data analysis is summarized in the next subsections.

4. Results

4.1. Factor analysis

The questionnaire was initially factor analyzed. The Kaiser–Meyer–Olkin (KMO) and Bartlett test of sphericity both returned very satisfactory values (KMO = 0.815, Bartlett's Test. Sig = 0.000). Thus, our sample is suitable for factor analysis. Table 1 provides additional insights for the factorial analysis of our data. As evident, 25 items/components associated with the questionnaire we designed have been analysed and tested for their capacity to justify the variance.

According to the rotated component matrix the questions correctly match the theory we presented. We categorized the components for each identified factor (six according to Eigenvalues >1). The first two factors explain almost 40% of the total variance of DL satisfaction of our respondents in our research study with its given limitations that will be communicated in the Discussion section.

Table 1. Total variance explained

Component	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	6.574	26.296	26.296	6.574	26.296	26.296	3.861	15.442	15.442
2	3.291	13.163	39.459	3.291	13.163	39.459	3.734	14.937	30.379
3	1.741	6.965	46.424	1.741	6.965	46.424	2.382	9.528	39.907
4	1.267	5.069	51.493	1.267	5.069	51.493	2.142	8.567	48.474
5	1.125	4.499	55.992	1.125	4.499	55.992	1.485	5.941	54.415
6	1.073	4.292	60.284	1.073	4.292	60.284	1.467	5.869	60.284

End of Table 1

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
7	.967	3.870	64.153						
8	.925	3.700	67.854						
9	.835	3.339	71.193						
10	.778	3.114	74.306						
11	.726	2.903	77.209						
12	.704	2.815	80.024						
13	.603	2.413	82.438						
14	.590	2.362	84.799						
15	.532	2.130	86.929						
16	.486	1.945	88.874						
17	.418	1.673	90.547						
18	.400	1.602	92.148						
19	.374	1.495	93.643						
20	.364	1.455	95.098						
21	.327	1.307	96.405						
22	.279	1.117	97.522						
23	.259	1.035	98.557						
24	.200	.801	99.358						
25	.161	.642	100.000						

Note: Extraction Method: Principal Component Analysis.

More specifically, the factors can be interpreted as follows (Figure 3):

- Factor Score 1: Lack of group cohesiveness: Factor related to the DL team and feeling of belonging to a class facilitated by online means;
- Factor Score 2: Appreciation of DL teaching methods: Factor that incorporates a new paradigm for enhanced engagement and active learning;
- Factor Score 3: Technology availability: Technology Availability related to tools and services implementing efficient and effective DL scenarios of exploitation;

Figure 3. The six factors identified for DL satisfaction (source: the authors)

- Factor Score 4: Infrastructures: Factor Related to the availability of sustainable infrastructure for DL in the institution;
- Factor Score 5: Institutional Commitment to DL: Related to the institution and administration's commitment to fully support the DL process;
- Factor Score 6: Trust in DL: Factor related to the psychological conditions and motivation to deploy DL.

4.2. Liner regression analysis and ordinary least squares (OLS)

After deployment of the six factors relevant to DL satisfaction, we deepen their study in the context of the diverse data for the four countries by conducting a stepwise regression analysis to understand the factors influencing satisfaction from DL in Turkey, Mexico, Romania and Saudi Arabia. The stepwise procedure systematically evaluates the inclusion and exclusion of predictors, selecting those that contribute most significantly to the model. This methodology (stepwise regression) emphasizes the relevance and significance of the specific factors for each country. This way, we streamline the model by including only the most impactful predictors to understand satisfaction in the DL environment better.

4.2.1. Analysis for Turkey

Using the previous six identified variables, we applied a linear regression model (stepwise) for Turkey's case concerning DL satisfaction. Results are presented in Table 2 and 3.

Table 2. Applied linear regression model (stepwise) for the case of Turkey

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.560[a]	.314	.289	16.286
2	.691[b]	.477	.439	14.476

Notes: a. Predictors: (Constant), REGR factor score. b. Predictors: (Constant), REGR factor score 1, REGR factor score 2.

After conducting a stepwise regression analysis to understand the factors influencing satisfaction from DL in Turkey, we identified two factors: Factor 1: Lack of group cohesiveness and Factor 2: Appreciation of DL teaching methods, as the most relevant predictors for explaining satisfaction. These two factors have a statistically significant impact on the satisfaction from DL.

Table 3. Applied linear regression model (stepwise) for the case of Turkey/coefficients (a, b)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	53.585	2.980		17.984	.000
	REGR factor score 1	–11.832	3.306	–.560	–3.579	.001
2	(Constant)	52.884	2.659		19.887	.000
	REGR factor score 1	–11.642	2.939	–.551	–3.961	.000
	REGR factor score 2	9.053	3.116	.404	2.906	.007

Notes: a. Dependent Variable: From 1 to 100 how much are you satisfied of the e-learning support in COVID-19 pandemic? b. Selecting only cases for which Which is your Country? = Other.

The negative coefficients for Factor 1, Lack of group cohesiveness, underscore its detrimental impact on satisfaction with DL. A unit increase in Factor 1 is associated with a decrease in DL satisfaction by approximately 11.8 to 11.6 units, as indicated by Models 1 and 2, respectively (Table 3). This suggests a critical area for improvement in fostering collaborative environments within DL.

The introduction of Factor 2: Appreciation of DL teaching methods in Model 2 brings a positive perspective. A unit increase in this factor is associated with an increase in satisfaction by approximately 9.1 units. This highlights the significance of effective teaching methods in enhancing satisfaction levels among Turkish distance learners.

4.2.2. Analysis for Saudi Arabia

We used the same methodology for Saudi Arabia, and we get the results presented in Tables 4 and 5.

Table 4. Applied linear regression model (stepwise) for the case of Saudi Arabia

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.486[a]	.236	.204	27.136

Note: a. Predictors: (Constant). REGR factor score 3.

The stepwise regression, designed to select the most impactful predictors, identified a single factor that demonstrated a statistically significant influence on satisfaction on DL in Saudi Arabia. This focused approach allows us to point out the specific factor important in understanding satisfaction in the Saudi Arabian DL landscape: Factor 3: Technology availability.

Table 5. Applied linear regression model (stepwise) for the case of Saudi Arabia/Coefficients (a, b)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	63.294	5.328		11.879	.000
	REGR factor score 3	13.094	4.807	.486	2.724	.012

Notes: a. Dependent Variable: From 1 to 100 how much are you satisfied of the e-learning support in COVID-19 pandemic? b. Selecting only cases for which Which is your Country? = Saudi Arabia.

4.2.3. Analysis for Mexico

The stepwise regression results for Mexico are presented in Tables 6 and 7.

Table 6. Applied linear regression model (stepwise) for the case of Mexico

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.370[a]	.137	.111	15.433

Note: a. Predictors: (Constant). REGR factor score 2.

Factor 2, Appreciation of DL Teaching Methods, was a significant predictor with a statistically significant influence on satisfaction with DL. It highlights the importance of instructional approaches in shaping satisfaction among Mexican distance learners.

Table 7. Applied linear regression model (stepwise) for the case of Mexico/coefficients (a, b)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	65.703	2.692		24.407	.000
	REGR factor score 2	6.090	2.626	.370	2.319	.027

Notes: a. Dependent Variable: From 1 to 100 how much are you satisfied of the e-learning support in COVID-19 pandemic? b. Selecting only cases for which Which is your Country? = Mexico.

4.2.4. Analysis for Romania

Concerning Romania, we get the following results presented in Tables 8 and 9.

Table 8. Applied linear regression model (stepwise) for the case of Romania

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.760[a]	.578	.562	15.142
2	.820[b]	.673	.648	13.580

Note: a. Predictors: (Constant). REGR factor score 2. b. Predictors: (Constant). REGR factor score 2. REGR factor score 4.

The stepwise regression analysis for Romania highlighted two factors, Factor 2: Appreciation of DL Teaching Methods and Factor 4: Infrastructures, with statistically significant impact. They recognise the importance of teaching methods and infrastructural support in shaping the DL experience for Romanian students.

Table 9. Applied linear regression model (stepwise) for the case of Romania/coefficients (a, b)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	55.788	3.284		16.986	.000
	REGR factor score 2	23.053	3.793	.760	6.078	.000
2	(Constant)	55.680	2.946		18.902	.000
	REGR factor score 2	20.769	3.501	.685	5.932	.000
	REGR factor score 4	8.307	3.020	.318	2.751	.011

Notes: a. Dependent Variable: From 1 to 100. how much are you satisfied with the e-learning support in the COVID-19 pandemic? b. Selecting only cases for which Which is your Country? = Romania.

Summarizing the findings per factor we have the following presentation in order of importance according to the criterion of the highest standardized coefficient (showing the impact on the dependent variable of satisfaction):

1) Appreciation of the DL methods (Factor 2): The includes the appreciation, comfort in using DL and acceptance of DL teaching methods and is the most important factor since it appears in three of the four countries we analyzed: Mexico, Romania and Turkey. Furthermore, in the relevant statistical models, it has the highest standardized coefficient (in absolute value) for Mexico and Romania.
2) Lack of group cohesiveness (Factor 1): This factor includes the sense of being isolated from the class, colleagues and the academic environment and is the most important factor for the case of Turkey.

3) Technology availability (Factor 3): This factor includes the availability of technology to students to access DL tools and is the most important factor for the case of Saudi Arabia.
4) Infrastructures (Factor 4): This factor includes the availability of appropriate infrastructures for the DL methods and is statistically significant for the case of Romania.

5. Discussion

5.1. Key findings

Our research was organized into three main research questions.

The 1st Research Question seeks to explore how an exploratory analysis can reveal the key factors influencing DL satisfaction during COVID-19.

In Figure 3, we provided a graphical overview of the first significant finding of our research study. By deploying data exploratory analysis, we concluded that six meaningful factors are related to the satisfaction of using DL.

These factors are: Lack of group cohesiveness (1), Appreciation of DL teaching methods (2). Technology availability (3), DL Infrastructure (4), Institutional Commitment to DL (5) and Trust in DL (6).

Our 2nd Research Question focuses on how applied factor analysis can lead to an examination of hermeneutic factors for DL satisfaction and insights, utilizing sample data from DL usage in Romania, Turkey, Mexico, and Saudi Arabia during the COVID-19 pandemic.

Our analysis concluded that 21 components are sufficient parameters for justifying 60% of the variance related to DL satisfaction during COVID-19.

Additionally, we investigated statistically significant associations of DL satisfaction with sample data for each of the four countries. According to our methodological approach, the factors that are related to DL satisfaction collectively for all four countries are the following:

- Factor 1: Lack of group cohesiveness;
- Factor 2: Appreciation of DL teaching methods;
- Factor 3: Technology availability;
- Factor 4: Infrastructures.

On the other side, two factors have not been detected as statistically significant for DL satisfaction in the four countries of our analysis: Factor Score 5: Institutional Commitment to DL, and Factor Score 6: Trust in DL (Figure 4).

	MEXICO	SAUDI ARABIA	ROMANIA	TURKEY
Factor 1: Lack of group cohesiveness				✓
Factor 2: Appreciation of DL teaching methods	✓		✓	✓
Factor 3: Technology availability		✓		
Factor Score 4: Infrastructures			✓	
Factor 5: Institutional Commitment to DL				
Factor 6: Trust in DL				

Figure 4. Factors confirmed as statistically significant for DL Satisfaction in each country (source: the authors)

Especially factor 2, Appreciation of DL teaching methods, is statistically significant in 3 of the four countries of our analysis: Turkey, Mexico and Romania. Furthermore, each of the countries has a different focus. For example, Saudi Arabia is more interested in technology and Romania in infrastructure. Even each country has unique needs to improve DL satisfaction, the teaching methods must be prioritized.

5.2. Interpretation and implications of key findings and propositions

The 3rd Research Question is related to the critical implications of the main findings for post-COVID-19 DL and Blended Learning in Higher Education.

The first implication of our research study is to utilize the key findings for designing DL and Blended Learning courses in the post-COVID area.

According to our research, Factor 1, Group cohesiveness, explained 26.30% of the total variance of DL satisfaction. A straightforward interpretation of this finding is that post-COVID-19 DL programs and courses should consider the components of factor 1 as significant targets (Isolation, Discomfort, Lack of communication skills building during DL, Disconnection from Physical Academic Space, feeling of missing class and colleagues, Community Feeling).

In our analysis of the components integrated into Factor 1, the following propositions emerge are significant findings from our research:

- The deployment of active learning strategies and collaborative learning around team-based technology-enhanced scenarios can significantly increase DL satisfaction by eliminating factors like discomfort, disconnection from physical academic space, feeling of missing class and colleagues.
- The DL strategy and the E-learning and Instructional Design specialists need to synergistically identify new modes of interaction, class participation, and team-based instruction for the DL experience.
- DL strategy in the current era needs to promote learning strategies for DL aiming to develop new communication skills and also exploratory scenarios for knowledge acquisition and skills development;
- In the case of Blended Learning, this must be considered a bold enrichment and complementary approach to DL aiming to manage the six components of Factor 1 effectively.

Factor 2, Teaching Methods, and its components (Confidence for DL effectiveness, Learner-orientation of DL, DL as a means to target large student audiences in the future, Enrichment of Teaching methods with DL tools, Successful adoption of DL, Positive perception of DL by faculty, Sufficient Skills Mastering) was recognized as a common ground for most of the countries in our study.

Our research reveals a significant level of appreciation for DL teaching methods. The respondents of our survey confirm that the learning outcomes of the DL are high. From this point of view, our study confirms that DL is a substantial and meaningful learning mode that must be supported effectively in modern institutions. Our propositions related to the main findings related to this factor are:

- Respondents have a high confidence in the DL's effectiveness. Higher Education institutions have to capitalize on this and must efficiently support the DL mode with innovative ideas, sufficient resources and experts capable of designing and delivering effectively the DL component to their institutions;

- At an institution-wide scale and context, there must be a clear and robust DL Learning/ Teaching strategy aiming to unify the efforts and to provide compliance standards and DL execution strategies;
- Students' and faculty's positive perception of DL upon conditions indicates the way forward. In the current era, higher education institutions have to design student-oriented and faculty-friendly DL services and infrastructures;
- It is imperative for universities and colleges to develop standards for the DL equivalent of traditional learning since DL is more consuming in terms of preparation, implementation and feedback;
- The DL in the post-COVID-19 era can also be considered a robust, resilient and sustainable means and medium for targeting large audiences of students and learners. Thus, DL can support massive open online courses (MOOCs) and define new market segments for institutions;
- The new generation of students is tech-savvy; thus, there is a clear understanding that most of them can use advanced and sophisticated DL tools. For example, the recent arrival of Open AI and Generative AI tools such as Chat GPT, Bard, Grok, should be considered opportunities and not threats for DL academic environments.

For the 3rd factor identified in our research Technology Availability, and its components (Internet Connectivity, DL long term strategy, Accessibility/Access to Higher Education), high-quality internet connectivity is a critical prerequisite for DL success and satisfaction. Our key propositions related to this factor are summarized below:

- Higher Education institutions must support internet connectivity and the quality of the Internet for students and learners involved in DL. They should also provide incentives for equipment acquisition;
- The DL strategy of universities should adopt a long-term strategy. The rapid changes and the arrival of new DL technologies that are considered catalysts, such as Artificial Intelligence, Metaverse, etc., must be integrated into the DL strategy. Also, issues related to GDPR (data privacy and protection) are significant aspects of a long-term DL strategy.

Concerning country-focused findings:

The most relevant model for Turkey includes two factors (Factors 1 and 2) that are statistically significant. Those are the Lack of group cohesiveness and the Appreciation of DL Teaching Methods. Turkey puts emphasis on the anthropocentric approach to education. Our findings provide actionable insights for professors, higher education institutions, and policymakers aiming to improve the satisfaction of DL participants in Turkey. Addressing issues related to group cohesiveness and emphasizing effective teaching methods can contribute to a more positive and enriching DL experience in Turkey.

For Saudi Arabia, the positive coefficient of Factor 3 highlights that accessible and reliable technology plays a crucial role in shaping the overall DL experience (Table 5). Given the cultural and educational dynamics of Saudi Arabia, where technological advancements are rapidly transforming the economy and society and, particularly, the educational landscape, the significance of Technology Availability cannot be contested. Our finding serves as a foundation for targeted interventions. Initiatives that enhance Technology availability should be prioritised to enrich the DL experience and satisfaction in Saudi Arabia. Investing in technology, ensuring access to devices, and reliable internet connectivity is vital in this context. Targeted training programs can optimise available technologies, finally contributing to higher DL satisfaction.

For Romania, we identified a positive coefficient for Factor 2: Appreciation of DL Teaching Methods that reflect its beneficial impact on satisfaction on DL. A unit increase in Factor 2 is associated with an increase in DL satisfaction by approximately 23 to 20.7 units as indicated by Models 1 and 2 respectively (Table 9). This suggests the need to focus on innovation in teaching, for active learning methods and, respectively, for a student-centred approach in higher education in Romania. Extending the model by including Factor 4: Infrastructure in Model 2 created a more comprehensive picture of the factors influencing satisfaction on DL. In Romania, higher education institutions should focus on shaping an environment that encourages appreciation for new and innovative teaching methods merged with a reliable infrastructure, which are key components of enhancing student satisfaction in DL.

For Mexico, the positive coefficient highlights the role that the value and the perception of teaching methods play in shaping satisfaction (Table 7). This finding aligns with Mexico's cultural and educational aspects, where the appreciation of effective teaching methodologies is an integrated part of the learning experience. Higher education institutions in Mexico need to recognize the contribution of teaching methods in increasing satisfaction from DL. Investments in professional development for teaching staff, using innovative and active teaching approaches, and asking student feedback can enhance Appreciation of DL Teaching Methods.

6. Conclusions, implications and future works

6.1. Contribution to the theory of DL

Our research study offers insights about the deployment of DL during COVID-19 times. It deployed sophisticated exploratory research data methods and concluded with a model of six hermeneutic factors for satisfaction by the DL method. Furthermore, it investigated and confirmed further the capacity of 21 components to explain the 60% of the DL satisfaction variance. Last but not least, we analyzed the different attitudes and perceptions of respondents from four countries: Mexico, Saudi Arabia, Romania, and Turkey, and we directly associated four of the six factors identified as statistically significant.

In another direction, our research instrument can also be reused by another researcher to investigate the phenomenon of satisfaction by the deployment of DL in academia in their local or national contexts. The dataset also deployed in this exploratory research (data) analysis can be accessible upon request from the research team for further analysis. We are also happy to communicate our research strategy as a promising strategy/practice that other researchers can reuse and follow in the near future.

The combined use of diverse statistical tests and data mining methods, including Kaiser–Meyer–Olkin (KMO) and Bartlett test of sphericity; Factor Analysis on Questionnaire; Linear regression by setting satisfaction from DL as the dependent variable; sophisticated applied Principal Component Analysis for DL insights by analyzing the explainability of the variance of the DL satisfaction and the approximation of the hermeneutic capacity of each factor to justify the degree of DL satisfaction; development of separate OLS (Ordinary Least Squares) models for Turkey, Saudi Arabia, Mexico and Romania; can be seen as a robust research data analysis strategies for the same of similar phenomena.

6.2. Contribution to practice

Our research study emphasized the interpretation of the essential findings and the drafting of bold propositions for the DL practice, emphasizing academic environments. We identified significant areas of improvement and suggested the orchestration of combined efforts for most of the 21 components of our 6-factor model for DL satisfaction. As a bold proposition, our research promotes the strategic deployment of DL in post-COVID-19 times as a resilient strategy of institutions for high-impact training and targeting of huge audiences with emphasis on the deployment of new tools and teaching methods customized for a new, unique value proposition of the DL.

6.3. Limitations

Our study adhered to rigorous scientific practices and employed robust exploratory data analysis techniques. Its limitations arise from our dataset. We collected responses from university students in four countries via an electronic questionnaire, randomly selecting 40 students from each country to form our final sample of 160. While this approach has its merits, it also imposes constraints on the generalizability of our findings. However, it should be noted that our methodology is a valid scientific approach. We encourage fellow researchers to replicate our methods with larger sample sizes. In a pilot run, doubling the sample had no significant impact on critical findings.

6.4. Future research

Our research has a robust data set with diverse components. In this research work, we focused on the determinants of DL satisfaction and its hermeneutic factors and components. One of the most significant challenges is delivering additional analysis to identify clusters of students and faculty regarding meaningful DL quality features. This issue will be our priority for future research. One more direction is related to the integration of qualitative research, e.g. focus group or Delphi method for comparing the key factors revealed in this study with factors and items agenda from a group of diverse stakeholders of the DL research domain, e.g. faculty, students, administrators, researcher, trainers, DL software providers, policymakers, government officer.

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