VERONICA CAMPIAN, DAN-CRISTIAN DABIJA,
ELENA-MĂDĂLINA VĂTĂMĂNESCU,
GANDOLFO DOMINICI

Teaching staff's role in enhancing students' future intended use of e-learning management systems

This article examines how teaching staff's involvement influences the effectiveness of e-learning management systems and students' future intentions to use those platforms. Following an online survey of 250 students, structural equation modeling was performed to analyze the relationships between teaching staff's involvement, knowledge exchange, and students' future intentions to use e-learning platforms. The model explained more than 65% of the variance in future use intention and nearly 60% of the variance in knowledge exchange. In validating the proposed model, the findings confirm the critical role of teaching staff's involvement in fostering knowledge exchange and shaping students' long-term intentions to use e-learning platforms. Educators and institutions can leverage the findings to enhance e-learning systems by fostering greater engagement among teaching staff, improving knowledge exchange, and sustaining students' commitment to using those platforms.

Keywords: *e-learning platform, knowledge exchange, future use intention, e-learning management system, user-friendliness, teaching staff*

Author Information

Veronica Campian, Babeș-Bolyai University of Cluj-Napoca
https://orcid.org/0000-0002-1647-9250

Dan-Cristian Dabija,* Babeș-Bolyai University of Cluj-Napoca; Academy of Romanian Scientists, Bucharest
https://orcid.org/0000-0002-8265-175X

Elena-Mădălina Vătămănescu, National University of Political Studies and Public Administration
https://orcid.org/0000-0002-9397-0385

Gandolfo Dominici, University of Palermo
https://orcid.org/0000-0002-9061-318X

***** Corresponding author

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1. Introduction

The rapid onset of the COVID-19 pandemic prompted a sudden shift toward e-learning that forced educational institutions to quickly innovate and adjust to new conditions. In turn, changes in the online teaching and learning process became necessary (Vătămănescu et al. 2023). Students who were directly impacted have since been challenged to demonstrate their inclination to utilize e-learning platforms in order to attain their individual ambitions and educational aims, particularly when being physically present on campus was restricted, if not impossible (Nikou and Maslov 2021). In the so-called new normal, education has assumed a hybrid form in which both students and teachers drew from their knowledge, experiences, and use of online tools during the pandemic (Pishchukhina, Gordieieva and Rainer 2024), all of which facilitated their use of different online learning platforms as well (Csorba and Dabija 2024; Mineshima-Lowe et al. 2023).

In the past few years, e-learning has emerged as a marker of significant innovation and progress in education (Martínez-Cerdá, Torrent-Sellens and González-González 2020), one that offers students comfort, lower costs, and a high degree of flexibility (Salloum et al. 2019). Among the other advantages of e-learning is student autonomy during the teaching–learning process and new forms of peer interaction (Valencia-Arias et al. 2019). Online teaching has not only engendered fundamental transformations in education but also changed how teaching and educational communication are envisioned (Deshwal, Trivedi and Himanshi 2017; Fülöp et al. 2022).

The implementation of e-learning in higher education institutions has facilitated synchronous and asynchronous teaching–learning activities between teachers and students, along with the identification of the tools necessary for students to do so and the fulfillment of their desires related to learning (Fülöp et al. 2023). At universities in particular, e-learning has emerged as one of the most developed, important directions for strategic development (Gros and García-Peñalvo 2023; Nugroho, Setyorini and Novitasari 2019), because it facilitates students' access to education regardless of their location.

Nevertheless, the efficacy of implementing e-learning depends heavily on the way in which education is conducted online, the disposition and engagement of instructional personnel, their endeavors to offer guidance and furnish feedback to learners, the approach employed in delivering online activities, and their capacity to inspire students to enroll in online courses (Cholyshkina et al. 2024; Keržič et al. 2021). Universities, for example, should provide students with applications that are easy to use as well as support and motivate students and teachers to use e-learning facilities and tools to optimize their performance (Abbad 2021). The success of any e-learning system also depends on the degree of acceptance among users, be they students, teachers, or administrative staff (Elneel et al. 2023). In that context, students' satisfaction is fundamental, given its identified role in learning efficiency due to boosting the use and acceptance of technology on which teaching–learning through e-learning systems is based (Navimipour and Zareie 2015). It may also catalyze knowledge sharing among peers.

Among the COVID-19 pandemic's unprecedented effects, it greatly influenced the application of the technology acceptance model at universities (Bamufleh et al. 2020). Briefly described, the technology acceptance model predicts how users accept and use technology based on two specific factors: perceived usefulness and perceived ease of use. During the pandemic, students and teachers gained robust experience with using online digital learning technology while being dependent upon it. Amid the sudden shift to remote learning, universities and students had to adapt swiftly (Djokic et al. 2024; Petchamé et al. 2023), and universities in particular had to ensure that their digital learning technology was user-friendly enough to facilitate smooth transitions to the new normal. To that end, significant effort was put into improving such technology's perceived ease of use. Meanwhile, the technology's perceived usefulness also had to be actively stimulated due to the abrupt and necessary transition to online learning. In the process, universities also had to improve and expand their digital infrastructure in order to support heavy digital traffic and the intensified reliance on technology. Ensuring digital infrastructure's performance not only involved smooth functioning but also making students perceive technology as being reliable and necessary (Mihai et al. 2024; Petchamé et al. 2023). Because those issues impact stakeholders to different extents depending on the university's infrastructure, preparedness, and digital literacy, investigating students' intention to use e-learning platforms in the future based on teaching staff's involvement, the digital platforms available, their user-friendliness, and students' propensity toward knowledge exchange is a worthwhile endeavor.

Against that background, this article probes students' perceptions across diverse faculties within the same university. It also investigates how the institution has actively fostered knowledge exchange by engaging teaching staff in e-learning. Beyond that, it delves into students' perspectives on their capacity to learn and assimilate information through e-learning. Last, taking a forward-looking approach, it examines students' future intentions to embrace digital platforms in the new normal and the ever-evolving landscape of education technology.

As presented in this article, we conducted a study in one of Romania's most complex universities as a representative example of higher education in Eastern Europe. The university was able to rapidly respond to the challenges posed by the COVID-19 pandemic by transitioning to an exclusively online learning and teaching environment. Thus, in the postpandemic period, many of the experiences and best practices gained were further developed. E-learning, facilitated through diverse platforms incorporating robust learning management systems (LMSs), emerged as a pivotal aspect, one that offered users several options. Our findings stem from a questionnaire-based survey with 250 students conducted in late 2024, data from which were processed and analyzed in structural equation modeling (SEM) involving partial least squares.

As for the novelty of our findings, whereas past studies have examined the COVID-19 pandemic's impact on teaching and learning and the measures imposed as a result, including the immediate and complete closure of educational institutions to allow social distancing (Bamufleh et al. 2020; Petchamé et al. 2023), our research returns students to the fore as the chief stakeholders of education and, in turn, the changes brought about in the new normal. Our findings emphasize students'

perceptions of how the university and teaching staff managed to deliver and share knowledge in the new normal and their perceived capitalization of the online infrastructure and resources to actively support peer-to-peer knowledge exchange. Students' learning experiences improved due to both their perceptions of the inherent, sometimes tangible benefits of using e-learning platforms and their sense of social presence. In turn, their strategic use of LMSs also motivated them to increase their efforts in pursuing higher education.

In the remainder of this article, we first review relevant literature, elaborate our hypotheses, and present our conceptual model. Next, we describe our methodology and data analysis using SEM, after which we detail and interpret our results. In conclusion, we present our study's theoretical and practical contributions and its limitations.

2. Literature review and hypotheses development

The term *e-learning* describes various digital learning environments (Giannakos, Mikalef and Pappas 2021) involving not only computer-assisted teaching but also interactive learning (Lara, Aljawarneh and Pamplona 2020). E-learning requires various tools and multimedia technology to produce and improve the quality of educational materials and thus contribute to the acquisition and sedimentation of participants' knowledge (Navimipour and Zareie 2015). A major advantage of e-learning is that the time and location of the teaching–learning process becomes exceptionally flexible and adaptable. Although e-learning facilitates an increase in the quality of education in many ways, it is deficient in practical activities, and its major shortcoming is a lack of interpersonal interaction (Maatuk et al. 2022).

Today's teaching–learning processes seldom occur without e-learning systems. Among the teaching–learning platforms most frequently used by educational institutions are Blackboard, Canvas, Teams, and Moodle (Cramarenco, Burcă-Voicu and Dabija 2023), which support and improve innovative teaching–learning processes for students and other stakeholders, including teachers and staff. Depending on their characteristics and functionalities (Giannakos, Mikalef and Pappas 2021) e-learning systems can be categorized as computer-based training, web-based e-learning, and LMSs (Nugroho, Setyorini and Novitasari 2019, 83), the latter of which are especially widespread, highly regarded, and greatly appreciated. LMSs host virtual classes in which a teacher or teaching staff manages a course, which allows the collaboration and active involvement of participants (Giannakos, Mikalef and Pappas 2021). A particularly well-known open-source LMS is Moodle, which occupies approximately 50% of the global e-LMS market and boasts approximately 155,000 active sites registered in 239 countries (Moodle 2024). e-LMSs also provide forums that facilitate interactions and exchanges between teachers and students. Perhaps above all, e-LMSs afford a high level of flexibility due to being accessible almost entirely regardless of place or time, which stakeholders generally find to be highly valuable (Elneel et al. 2023).

Before the COVID-19 pandemic, teaching–learning in higher education occurred almost exclusively in a face-to-face format, often accompanied and/or supported

by digital platforms (Daumiller et al. 2021; Szabó et al. 2022), especially in blended learning or massive open online courses (Cramarenco, Burcă-Voicu and Dabija 2023). In response to the global shutdown of face-to-face teaching and learning at the beginning of the health crisis, a rapid transition from traditional teaching–learning methods to e-learning occurred that resulted in a profound transformation in the communication and interaction dynamics between the teaching staff and course participants (Kulikowski, Przytuła and Sułkowski 2022). The abrupt shift posed unforeseen challenges and marked a significant departure from established educational norms. Faced with unprecedented challenges, educators and students had no choice but to urgently adapt to the new educational landscape.

To achieve their personal goals and educational objectives, students directly affected by emergent developments demonstrated their willingness to use e-learning platforms in the new normal of the postpandemic period, especially having gained ample experience during the pandemic (Castro 2023). In general, success in implementing e-learning largely depends on whether education is entirely online or hybrid, the teaching staff's attitude and involvement, their efforts in guiding students and providing them feedback, the ways that they teach online activities, and their ability to motivate students to take online courses (Keržič et al. 2021). Along those lines, we first hypothesized that:

H_1: Teaching staff's involvement positively influences e-LMSs.
H_2: Teaching staff's involvement positively influences e-learning platforms.
H_3: Teaching staff's involvement positively influences the user-friendliness of e-learning platforms.
H_4: Teaching staff's involvement positively influences the exchange of knowledge on e-learning platforms.

Universities represent a favorable framework for digital and sustainable development given their educational strategies, implementation of teaching–learning activities, and well-defined educational measures and tactics, all of which offer students and stakeholders relevant models to follow (Fülöp et al. 2022). Therefore, e-learning platforms are user-friendly environments that are regarded as sustainable in education due to facilitating new possibilities for learning and innovation (Dabija et al. 2023; Donath, Mircea and Rozman 2020). Such green e-learning platforms have reduced CO2 emissions caused by the transport of students to campus (Aghamolaei and Fallahpour 2023). E-learning is also a paper-free learning method, which helps to reduce the manufacture of cellulose, a major source of air pollution, and does not require physical textbooks; instead, e-books can be accessed from electronic libraries, downloaded, and updated by the publishers as necessary (Amarneh et al. 2021). Thus, we additionally hypothesized that:

H_5: Green e-learning platforms positively impact e-LMSs.
H_6: Green e-learning platforms positively impact the user-friendliness of e-learning platforms.
H_7: Green e-learning platforms positively impact future use intention.

In general, LMSs facilitate the intertwining of classical teaching techniques with digital learning, thereby offering students personalized e-learning opportunities (Gligorea et al. 2023). Moodle is the most popular, widely accepted open-source LMS in educational institutions, organizations, and society at large (Altinpulluk and Kesim 2021; Dominek et al. 2023). In fact, considering students' performance via LMSs, scholars (Bessadok, Abouzinadah and Rabie 2023) have recently recommended using Moodle, for it confers exceptionally strong results. Owing to its functionalities, Moodle can facilitate the learning process in various ways (Gamage, Ayres and Behrend 2022). It supports teachers' creativity in developing educational materials, allows the creation of quizzes and multiple-choice questions, offers automatic scoring, and facilitates feedback. A user's positive experience and ease of use with e-learning systems both drive students' satisfaction and largely determine their degree of acceptance of the platform (Miya and Govender 2022). For those reasons, we added the following hypotheses as well:

H_9: The user-friendliness of e-learning platforms positively influences knowledge exchange through them.

H_{10}: The user-friendliness of e-learning platforms positively influences future use intention.

Although interactions in e-learning systems do not take place in real time in a formal context, they nevertheless allow students to share knowledge gained with peers through a socialization process (Muhisn et al. 2019). Thus, the acquisition, exchange, and sharing of knowledge and the collaboration between interested parties are essential elements in e-learning that stimulate not only learning but also the creativity of participants (Abdekhoda, Pourrasmi and Ranjbaran 2023; Mutale 2025). Whereas *knowledge acquisition* describes the acquisition and development of new knowledge based on existing information, *knowledge sharing* involves sharing knowledge, skills, and/or experiences with others (Dabija et al. 2024; Vătămănescu et al. 2023).

Given the added value that Moodle generates for the learning process, students have expressed their intention to use Moodle in the future and been inclined to recommend it (Hasan 2021). Good interactions with teachers, educational support, and knowledge exchange with peers, as well as the improvement of skills, are all key elements that encourage students to use online platforms in the future (Nguyen and Tran 2022). Thus, we also hypothesized that:

H_{11}: Knowledge exchange on e-learning platforms positively influences students' future use intention regarding the platforms.

Drawing on theoretical advancements, our study's conceptual model appears in Figure 1, which specifies the vectors that promote knowledge exchange on e-learning platforms.

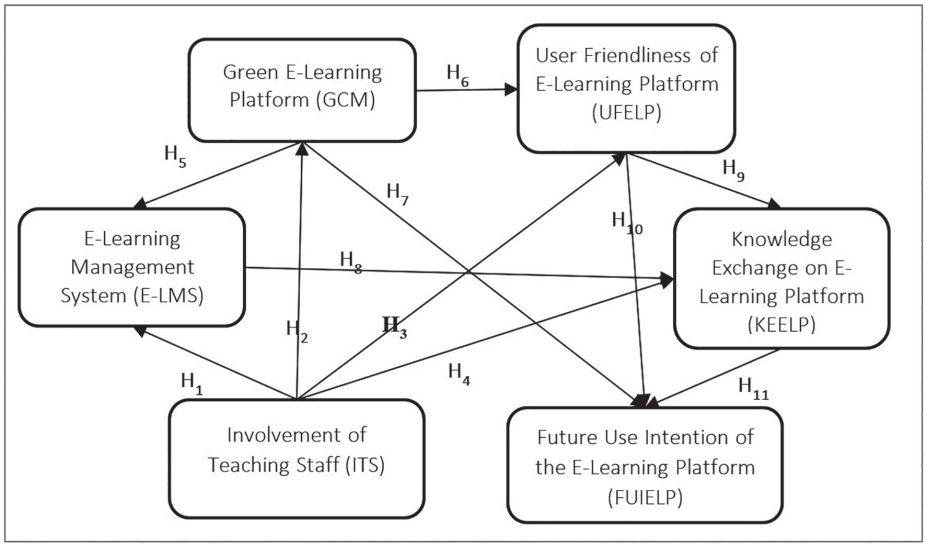

Figure 1. Model of students' future use intention regarding e-learning platforms

2. Methodology

2.1. Research design, sampling, and data collection

Our research involved evaluating the extent to which students' future use intention regarding e-learning platforms is enhanced based on their previous experience with them under the influence of the e-LMS, knowledge of green e-learning platforms, the user-friendliness of those platforms, and knowledge exchange. To that end, an empirical investigation was conducted using a quantitative online survey among students from various faculties, all recruited via convenience sampling, who shared their perceptions of and knowledge about using e-learning platforms in university education. Ultimately, 250 students participated: 124 (49.6%) bachelor's students and 126 (50.4%) master's students (Table 1). The research was conducted in late 2024, and all participants had previous knowledge of using different e-learning platforms.

2.2. Evaluation of the measurement models

The analysis of the conceptual model and hypotheses was performed using SEM in SmartPLS 3.0 (Ringle, Wende and Becker 2024). All dimensions of the reflective conceptual model were tested in terms of item loadings, validity, internal consistency, average variance extracted (AVE), and reliability indicators; values exceeding the required thresholds appear in Table 2. Subsequently, discriminatory validity testing

using the recommended criteria in the literature was performed (Hair, Black and Babin 2010), namely the Fornell–Larcker criterion and the heterotrait–monotrait criterion. The results appear in Tables 3 and 4.

	Bachelor's		**Master's**		**Total**	
	n	%	*n*	%	*n*	%
Economic sciences	68	27.2	54	21.6	122	48.8
Other faculties	56	18.4	72	28.8	118	51.2
Millennial	44	17.6	25	10.0	69	27.6
Generation Z	80	32.0	101	40.4	181	72.4
Man	32	12.8	29	11.6	61	24.4
Woman	92	36.8	97	38.8	189	75.6
Full-time	59	23.6	116	46.4	175	70.0
ID or IFR	65	26.0	10	4.0	75	30.0
Total	124	49.6	126	50.4	250	100.0

Note. ID: long-distance education (bachelor's); IFR: low-frequency education (master's).

Table 1. Sociodemographic characteristics of the sample

As shown in Table 2, all item loadings exceeded the minimum requirement threshold of 0.7 recommended in the literature, which confirmed that the measurements used had convergence validity (Hair, Black and Babin 2010), with values ranging from 0.708 to 0.951.

Item	**Measure**	**Loading**	**α/AVE/ CR**
E-Learning Management System (ELMS) adapted from Navimipour and Zareire (2015) *The educational platform (Moodle) used...*			
E-LMS1	...is always fully functioning.	0.892	0.860/ 0.779/ 0.914
E-LMS2	...is always available.	0.879	
E-LMS3	...facilitates learning.	0.877	
Green E-Learning Platform (GELP) adapted from Navimipour and Zareire (2015) *The educational platform (Moodle) used...*			

GELP1	...facilitates the reduction of paper consumption through the online submission of projects.	0.721	0.884/ 0.633/ 0.912
GELP2	...contributes to the conservation of environmental resources	0.818	
GELP3	...facilitates socially responsible consumption.	0.853	
GELP4	...contributes to the reduction in the consumption of energy and resources.	0.766	
GELP5	...is a green way of learning.	0.800	
GELP6	...is a sustainable manner of learning.	0.808	
User Friendliness of E-Learning Platform (UFELP) adapted from Navimipour and Zareire (2015) *The educational platform (Moodle) used...*			
UFELP1	...is user-friendly.	0.834	0.852/ 0.695/ 0.901
UFELP2	...facilitates the uploading of assignments.	0.872	
UFELP3	...facilitates receiving feedback from the lecturer.	0.866	
UFELP4	...eases online examination.	0.757	
Knowledge Exchange on E-Learning Platform (KEELP) adapted from Navimipour and Zareire (2015)			
KEELP1	The discussion forums of the educational platform (Moodle) help me master my coursework/content.	0.813	0.856/ 0.636/ 0.897
KEELP2	Work groups on the educational platform (Moodle) facilitate learning.	0.855	
KEELP3	I am motivated to use the educational platform (Moodle).	0.835	
KEELP4	Tasks/assignments are easy to perform on the educational platform (Moodle).	0.708	
KEELP5	I use the educational platform (Moodle) to keep my knowledge up to date.	0.768	
Involvement of Teaching Staff in the New Normal (ITS) adapted from Abbad (2021) *In the new normal, the teaching staff has...*			
ITS1	...always provided enough learning materials.	0.747	0.900/ 0.667/ 0.923
ITS2	...provided feedback when I have needed it.	0.848	
ITS3	...disseminated homework and materials in time for each course.	0.849	
ITS4	...been open to suggestions on how to organize online courses.	0.814	
ITS5	...informed the class about grades and points earned during the semester.	0.800	
ITS6	...informed the class about the examination procedure.	0.837	

Future Use Intention of the E-Learning Platform (FUIELP) adapted from Abbad (2021) *In the future, I will…*			
FUIELP1	…use the educational platform (Moodle).	0.951	0.921/ 0.636/ 0.897
FUIELP2	…use the educational platform (Moodle) more often.	0.922	
FUIELP3	…recommend the educational platform (Moodle) to others.	0.914	

Note. α: Cronbach's alpha; AVE: average variance extracted; CR: composite reliability.

Table 2. Constructs and items

The reliability of the constructs in the conceptual model was tested using Cronbach's α > 0.7 according to recommendations in the literature (Henseler and Sarstedt 2013). Per the values shown in Table 2, all constructs met the minimum requirement threshold, with Cronbach's α values exceeding 0.7, and the AVE exceeded the recommended threshold of 0.5, thus indicating the accuracy and adequacy of the measurement model (Chin 1998) and the convergent validity of the constructs. Composite reliability also exceeded the threshold of 0.7 specified in the literature (Hair, Black and Babin 2010); thus, the constructs were considered to be reliable.

Construct	ITS	GELP	E-LMS	FUIELP	KEELP	UFELP
	Fornell–Larcker criterion					
ITS	**0.817**					
E-LMS	0.557	**0.883**				
FUIELP	0.533	0.568	**0.929**			
GELP	0.433	0.591	0.466	**0.796**		
KEELP	0.615	0.656	0.789	0.584	**0.797**	
UFELP	0.550	0.700	0.667	0.749	0.704	**0.833**
ITS						
E-LMS	**0.630**					
FUIELP	0.606	**0.627**				
GELP	0.477	0.657	**0.512**			
KEELP	0.701	0.752	0.881	**0.667**		
UFELP	0.622	0.808	0.750	0.856	**0.822**	

Note. GELP: Green E-Learning Platform; LMS: Learning Management System; UFELP: User Friendliness of E-Learning Platform; KEELP: Knowledge Exchange on E-Learning Platform; ITS: Involvement of Teaching Staff; FUIELP: Future Use Intention of the E-Learning Platform.

Table 3. Testing discriminant validity

Each construct's discriminant validity was assessed both the Fornell–Larcker and heterotrait–monotrait criteria, as detailed in Table 3. According to the Fornell–Larcker criterion, the AVE for each latent variable needs to exceed the correlation coefficient between the construct and all other distinct variables. To guarantee that the constructs were conceptually dissimilar, we employed the heterotrait–monotrait criterion, with a threshold of 0.9 (Henseler, Ringle and Sarstedt 2014). The outcomes, shown in Table 3, depicting the results of discriminant validity analyses using both criteria, confirm that the suggested threshold values were achieved and that both constructs had discriminant validity.

When the dataset was analyzed for collinearity, the variance inflation factor for all indicators was less than 5, which is the threshold for collinearity analysis (Sarstedt et al. 2017). The highest value was 4.754 (FUIELP1), which indicates no multicollinearity. To examine the relationships between the latent variables, a bootstrap procedure was employed, and 11 of the 12 hypotheses were accepted as having significant positive relationships based on *t* statistics.

3. Results

To accurately assess the structural model, we analyzed the correlations between the constructs with particular emphasis on the potential problem of collinearity. For the inner model (i.e., UFELP → FUIELP), the variance inflation factor of 3.020 was one of the highest but remained below the threshold value, meaning that no multicollinearity existed among the constructs. Moreover, the goodness of fit of the saturated model was satisfactory, with a square root mean residual value of 0.064, which adhered to the recommended criteria of <0.08.

The teaching staff's involvement explained 18.7% of the variance in the green e-learning platform ($R2 = 0.187$), whereas the same construct along with the green e-learning platform explained 46.1% of the variance in the e-LMS ($R2 = 0.461$). 62.4% in the variance of the user-friendliness of e-learning platform ($R2 = 0.624$) is explained by the teaching staff's involvement in the new normal and the green e-learning platform, while 59.5% in the variance of the knowledge exchange on e-learning platform ($R2 = 0.595$) is explained by the user-friendliness of e-learning platform, the e-LMS, and the teaching staff's involvement. Last, 65.8% of the variance in the future use intention of the e-learning platform ($R2 = 0.658$) was explained by knowledge exchange on the e-learning platform, the user-friendliness of the e-learning platform, and the green e-learning platform, for a structural model with altogether moderate to strong predictive power (see Figure 2). The effect size $f2$ (≥0.35) with a value of 0.425 indicated the model's large effect (Chin, 1998).

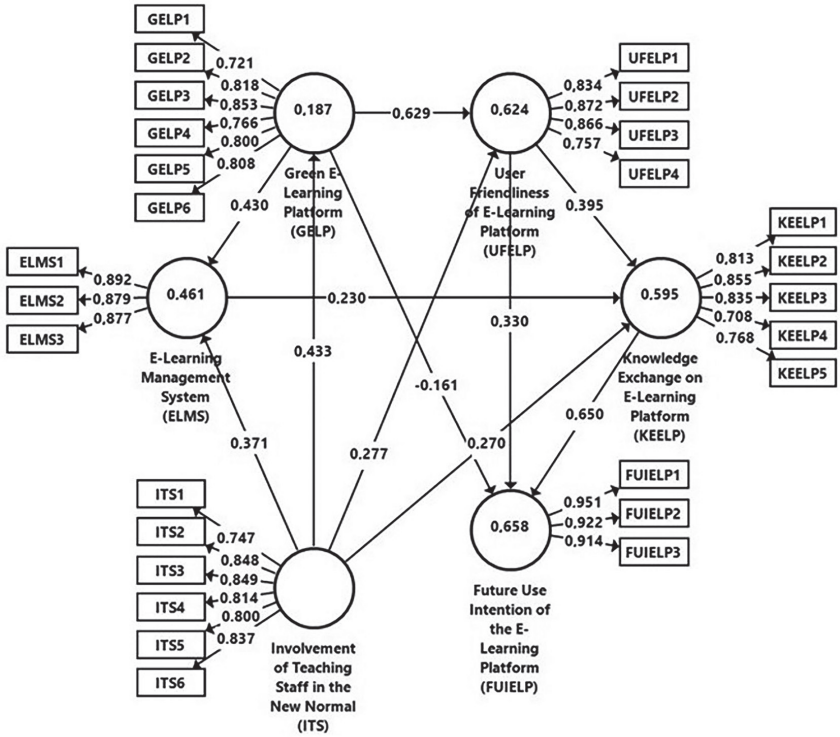

Figure 2. Structural model

Table 4 presents the results of hypotheses testing and the additional metrics supporting their validation.

Paths	Path coefficient	*SD*	*t*	CI (97.5%, 2.5%)	*p*	Hypothesis
CITS → E-LMS	0.371	0.068	5.456	0.248, 0.489	0.000***	H_1, supported
CITS → GELP	0.433	0.057	7.628	0.331, 0.553	0.000***	H_2, supported
CITS → UFELP	0.277	0.054	5.121	0.161, 0.375	0.000***	H_3, supported
CITS → KEELP	0.270	0.061	4.438	0.155, 0.387	0.000***	H_4, supported
GELP → E-LMS	0.430	0.058	7.379	0.324, 0.522	0.000***	H_5, supported
GELP → UFELP	0.629	0.047	13.294	0.527, 0.719	0.000***	H_6, supported

GEL → FUIELP	−0.161	0.070	2.298	−0.324, −0.023	0.022**	H_7, supported
E-LMS → KEELP	0.230	0.068	3.362	0.098, 0.357	0.001***	H_8, supported
UFELP → KEELP	0.395	0.057	6.960	0.290, 0.508	0.000***	H_9, supported
UFELP → FUIELP	0.330	0.084	3.913	0.166, 0.501	0.000***	H_{10}, supported
KEELP → FUIELP	0.650	0.060	10.788	0.535, 0.762	0.000***	H_{11}, supported

Note. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.001$; CI: confidence interval; GELP: Green E-Learning Platform; LMS: Learning Management System; UFELP: User Friendliness of E-Learning Platform; KEELP: Knowledge Exchange on E-Learning Platform; CITS: COVID-19 Involvement of Teaching Staff; FUIELP: Future Use Intention of the E-Learning Platform.

Table 4. Path coefficients of the structural equation model

H_1 hypothesized that the teaching staff's involvement in the new normal positively influences the e-learning management system. Recent studies (Abbad 2021) have revealed that the teaching staff's involvement and the acceptance of e-learning systems can positively affect the entire university system, for it can increase the investment of higher education institutions in such systems. Meanwhile, universities and teaching staff that are innovative will use those systems to adapt their teaching methods (Obidovna 2023). The results (Table 4) prove the strong positive, significant meaning of the relationship; therefore, **H1** was supported.

H_2, meanwhile, proposed that the teaching staff's involvement in the new normal positively influences the green e-learning platform. That dynamic was confirmed by the results (Table 4), which showed a meaningful positive significant relationship; therefore, **H2** was supported. The use of e-learning platforms can be enhanced by teaching staff's participation, which can result in personalized educational experiences for learners, promote innovative teaching methods, and encourage creativity. Such pedagogical advancements can play a role in creating more sustainable, transformative educational experiences (Mashroofa et al. 2023).

H_3 began with the premise that the teaching staff's involvement positively impacts the perceived user-friendliness of e-learning platforms. That relationship was confirmed by the strong significant influence of XXX and thus the acceptance of **H_3**. A key factor in the use of e-learning is the role of teaching staff, who need to be creative in their approaches, styles, and ways of teaching (Ahmed et al. 2021). Being communication-oriented, e-learning platforms enable easy communication supported by technology, which empowers teachers to use all the resources and facilities available to execute their teaching with the support of technology (Ahmed et al. 2021; Corrin et al. 2024).

H_4 expected that the teaching staff's involvement would positively impact knowledge exchange on e-learning platforms. The outcomes (Table 4) demonstrated a strong, significant positive relationship between the constructs, which lent support to **H_4**. Those findings align with the results of Ahmed et al. (2021) and Ngoc Hoi (2023), who have suggested that innovative teaching practices can enhance students' engagement and involvement in online learning, knowledge sharing, and the exchange of information.

Next, **H_5** proposed that green e-learning platforms positively impact the perception of the e-LMS used. The results (Table 4) revealed a strong, significant positive correlation, which confirmed **H_5.** Beyond that, **H_6** postulated that green e-learning platforms positively impact the perceived user-friendliness of those platforms, which was confirmed by results revealing a strong, positive association that supported **H6.** Those results corroborate the findings of Falola et al. (2022), who showed that e-learning platforms play a pivotal role in fostering social and environmental sustainability. The role also implies a reduction in detrimental emissions generated by transport and travel, for students can access virtual courses remotely without the need to commute to campus. On top of that, universities can reduce energy, electricity, heating, and cooling expenses by eliminating the need for students to travel to campus (Pujani, Akbar and Nazir 2023). In virtual classes, teachers and students use readily accessible, user-friendly online materials, which reduces paper waste and supports universities' environmental sustainability initiatives.

H_7 considered the influence of green e-learning platforms on generating students' future use intention regarding the platforms. The results ($\beta = -0.161$, $t = 2.298$, $p = 0.022$) support that assumption, thereby suggesting that the relationship is significant, albeit to a lesser extent, and permits the acceptance of **H_7**. The weaker effect observed in H7 stemmed from the fact that respondents likely did not truly comprehend or were not fully aware of the features of such platforms despite being eager to use it, for it was often imposed by the faculty. Because using such a platform was therefore required, and because there were likely no alternatives, students might have been less aware of the fact that by using such platforms, their behavior was necessarily greener and/or more socially and/or environmentally responsible. Our findings thus complement prior developments in the field (Fülöp et al. 2023), which have showcased the benefits yielded by online education in terms of reduced CO2 emissions engendered by the lack of students' transportation to university venues.

H_8 was based on the premise that e-LMSs foster knowledge exchange on e-learning platforms. The results (Table 4) confirmed a strong, significant influence between the concepts, which validated **H_8**. The benefits of e-LMS that lead to knowledge sharing are highlighted in the literature (Ndou, Mashau and Chigada 2023), which highlights that e-LMSs promote education without borders, allow students and teachers to access education, and are accessible and user-friendly. e-LMSs allow interaction through chatrooms and forums, among other features, in which students and the teaching staff can post topics, host exchanges, and share knowledge. Next, **H_9** considered how the user-friendliness of e-learning platforms influences knowledge exchange through such platforms, which was supported by a strong, positive significant relationship. Therefore, **H9** was accepted. Those results align with other

findings in the literature (Khan et al. 2020; Zheng et al. 2025), which reveal that students choose e-learning platforms because the platforms afford them the freedom to connect with teachers and peers and to exchange information. The ease of accessing resources for study motivates students to adopt e-learning technology, which results in their positive attitude toward e-LMSs.

$\mathbf{H_{10}}$ considered the effect of the perceived user-friendliness of e-learning platforms on students' future use intention, and the results ($\beta = 0.330$, $t = 3.913$, $p < 0.000$) showed a strong significant influence, which supported the acceptance of $\mathbf{H_{10}}$. Last, $\mathbf{H_{11}}$ considered the impact of knowledge exchange via e-learning platforms on students' future use intention, and the results (Table 4) indicated an exceptionally strong, significant influence, which validated $\mathbf{H_1}$**1. The** literature (Gamage, Ayres and Behrend 2022) suggests that LMSs have many functions that promote creativity in instructors such that they engage students in e-learning, including Moodle's ability to generate quizzes and multiple-choice questions and to provide automatic scoring and feedback. A positive user experience with e-learning systems contributes to the higher acceptance of learning platforms in general (Miya and Govender 2022). Indeed, students acknowledged the benefits of Moodle's e-learning system and reported intending to use and recommend it in the future (Nguyen and Tran 2022).

4. Discussions and conclusions

4.1. Summary of the findings and originality inputs

Our empirical research has generated several straightforward findings that are worth analyzing. First, the proposed model explained more than 65% of the variance in the future use intention of the e-learning platform by students and nearly 60% of the variance in the knowledge exchange on the platform. That evidence confirms the model's substantiality and significantly complements the validation of all relationships inferred. Therefore, our study highlighted the multifaceted advantages of embracing e-learning systems, including in theoretical, pedagogical, environmental, and professional dimensions.

From a theoretical standpoint, we envisioned a six-factor model meant to capture the way in which the teaching staff's involvement could enable knowledge exchange on e-learning platforms and, more notably, students' future use intention of the platform, thereby acknowledging the driving influence of e-LMSs, green e-learning platforms, and the user-friendliness of e-learning platforms. The conceptual framework is compelling and comprehensive and delves into the underlying connections among constructs from a novel perspective, while simultaneously investing into the literature a phenomenological view of the unprecedented crisis generated by the COVID-19 pandemic in the realm of education.

From practical and educational perspectives, the implications of our results are manifold. For one, they indicate a significant shift from traditional teaching methods to online platforms as a viable substitute for face-to-face instruction. The urgent shift to e-learning platforms has empowered students to pursue their studies remotely.

The findings showed that the teaching staff's involvement has been influential in facilitating the shift toward the online environment. Furthermore, e-learning systems have demonstrated numerous advantages in facilitating knowledge dissemination among students. The accessibility of course materials at any time and location grants students remarkable convenience, particularly ones with additional obligations or who reside in geographically isolated areas. Likewise, collaborative learning is stimulated because e-learning platforms frequently include components such as discussion boards, chatrooms, and/or group projects to facilitate students' participation. Collaborative learning activities can augment comprehension and foster a sense of community among students. Users gain access to an array of worldwide resources and specialists, which enriches their educational experience in terms of breadth and depth. Individual speed of learning is also facilitated, which enables students to acquire knowledge and comprehend material more effectively and promotes more effective knowledge acquisition and improved retention.

From a professional standpoint, using e-learning platforms also aids in cultivating essential digital skills among students, which is crucial in the contemporary job market. Familiarity with various digital systems, tools, and platforms has become indispensable for work activities, thereby making experience-based training during university courses an asset in the new normal. From a sustainability-focused perspective, our study has additionally revealed that e-learning systems implicitly contribute to environmental sustainability. Digital learning platforms exhibit ecofriendly characteristics by mitigating the consumption of paper often associated with conventional classroom settings and by decreasing the pollution generated by students' transportation to campus. ChatGPT-4-based education (Peters et al., 2023) and sustainable development in universities (Lăzăroiu, 2017) integrate generative AI technology and algorithmic predictive modeling (Lazaroiu and Rogalska, 2023, 2024) for a digital twin-based, cyber–physical, and extended-reality metaverse (Lazaroiu et al., 2024) across e-learning management systems.

4.2. Limitations and directions for future research

Despite our study's noteworthy contributions, we acknowledge certain limitations that should be considered in future research. First, our sample was drawn exclusively from a single university in Romania, which potentially limited the diversity of perspectives on the examined relationships among constructs. To enhance the generalizability of our findings, future studies should broaden their scope by incorporating samples from multiple institutions, including ones beyond national borders. That approach would facilitate comparative analyses and provide more nuanced insights through in-depth investigations.

Second, the research instrument relied on self-report measures, which introduced a degree of subjectivity compared with objective metrics. Because we aimed to capture respondents' perceptions and intentions regarding social phenomena, the chosen design aligned with its purpose. On that count, future investigations should involve analyzing the actual behaviors of students measured according to objective

parameters such as online attendance rate, time spent on the platform, and access to certain online resources.

Last, future research could consider using a more representative sampling technique than convenience sampling in order to reduce potential bias and enhance generalizability. Although using self-report data is appropriate for capturing perceptions, incorporating objective use metrics (e.g., system log data or platform analytics) could strengthen the findings. Expanding the study across multiple universities and/or countries would also provide a broader perspective and validate the model in different educational contexts.

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