



Unveiling e-learning and knowledge sharing during the pandemic: From expert skills perception to student satisfaction

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ABSTRACT

The present undertaking seeks to explore the relationships between five main constructs, that is, e-learning, expert skills perception, knowledge perceived value, knowledge sharing and student satisfaction in the context of the COVID-19 pandemic. Even though there is a wide array of studies looking into the impact of the pandemic on the online teaching environment and on student satisfaction, this investigation is paving the way towards scrutinizing the role of expert knowledge in the overall equation. A questionnaire-based survey with 310 master students who participated to expert online lectures in various marketing and business administration classes in the context of the pandemic e-learning environment was carried out between March 2020 and May 2022. The results indicated that Expert Skills Perception explains 58.8% of the variance of Knowledge Perceived Value, while Knowledge Perceived Value and e-Learning Process explain 45.2% of the variance in Knowledge Sharing and Knowledge Sharing and e-Learning Process explain 65.6% of the variance in Student Satisfaction, defining a strong predicting power of the structural model. By addressing students' perceptions of the online education process which relies on expert knowledge sharing is liable to offer a reference point for conducting and enhancing similar endeavors even in the post-pandemic 'new normal'.

1. Introduction

Since March 2020, the higher education ecosystem has been dramatically afflicted by the restrictive measures aimed to slow down the outbreak of the coronavirus (COVID-19) outbreak, this, in most countries resulted in the closure of the physical facilities of higher education institutions that turned to e-learning. This situation has led to a high level of uncertainty with respect to the engendered consequences for higher education and subsequently for the institutional knowledge structure and processes [1]. This happened mainly because the pandemic brought about a comprehensive transformation to most of the educational pursuits. On the one hand, numerous higher education institutions switched from conducting educational activities in person to fostering a propelling online environment, thus capitalizing e-learning [2,3]. On the other hand, the educational community was dared to adapt the ways in which it taught, learned, and worked. As the new normal boosted accelerated digitalization and increased connectivity, it also

avored novel forms of valuing knowledge and expertise and the emergence of new types of knowledge sharing [4,5].

According to Iivari, Sharma, and Venta-Olkkonen [6] and Schlagwein et al. [7], the urgency of the digitalization process - based on the intensive use of information and communication technologies (ICTs) - has catalyzed the configuration of various forms of collective intelligence and new knowledge sharing processes among peers. Adjunctly, the shift to the genuine online space has thus triggered unprecedented patterns of conveying knowledge, of valuing knowledge and of sharing knowledge [8–10].

Focused on guaranteeing a continuous flow of knowledge toward the academic community (i.e., especially students) and on consolidating the premises for real learning organizations [11], universities have reassessed the noteworthiness of expertise and have emphasized the benefits of knowledge sharing at various levels. As a result of acknowledging the imperative to accommodate knowledge sources and processes to the challenging e-learning environment, the consideration of experts to

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deliver some courses to students has sprung as a general practice even more so as expert knowledge is proved to be linked to solving practical problems [12]. Experts were expected to bring new daring perspectives to students given that they had the skills to address the underlying relationships between different components of knowledge and provide shortcuts to problem-solving and complex situations [13–15].

At this level, students' perception of expert knowledge is highly dependent on the experts' skills to share their expertise in an attractive and creative manner. In their endeavor to improve their professional competences [16,17], most of the students have a learning style oriented toward the usefulness of knowledge and therefore their perception of expert knowledge is very much dependent on its relative perceived value. Consistent with Islam et al. [18], the learner's openness and propensity toward learning enriches communication and augments overall satisfaction. Briefly put, the more skilled the expert, the more knowledge perceived value by the audience whereas the more knowledge perceived value, the more student satisfaction and knowledge sharing.

This happens because the knowledge perceived value emerges as a knowledge sharing catalyzer, unfolding the process of learning through sharing [8,19] and ultimately expanding the university's organizational knowledge [20]. Moreover, knowledge sharing is also determined by the individuals' motivation to communicate with their peers and by their satisfaction with the knowledge perceived value which is translated into the externalization of tacit knowledge and its combination through social interactions [21].

Focusing on the e-learning process, Dominici and Palumbo [22] found that a user-friendly and flexible platform was one of the main requirements for student satisfaction in e-learning. Rahman et al. [23] noticed that technology skills and self-efficacy has a high impact in the perception as user-friendly of the e-learning platforms that is at the basis of the student's behavioral intention to approach e-learning efficiently. Drennan, Kennedy, and Pisarski [24] as well had pointed to the favorable approaches of the technology-centric environment to be one of two key factors accounting for student satisfaction. The second one envisaged the autonomous and innovative learning styles the instructor advanced. At this level, Sahin [25] found that the most relevant antecedents of student satisfaction were, among others, the underlying relationship between the course content and the instructor's expertise and experience and the authentic learning oriented towards real-life problem-solving. Moreover, Richardson and Swan [26] revealed a positive correlation between students' perceptions of the overall learning experience with the instructor and their satisfaction.

Following the rationale of the dyad COVID-19 and online education, Baber [27,28] showcased that the period of Covid-19 restrictions that led to the necessity of online courses has been crucial to test the students' satisfaction towards e-learning. The author concluded that the main determinants of the success and customer satisfaction for e-learning courses were perceived interaction, motivation, course contents, and the role and students' perception of the lecturer. Baber [29] continued the analysis bringing forward that certain factors (i.e., instructor and student characteristics, and the technology acceptance model exerted positive effects on learners' behavioral intention to use and accept the e-learning system during the pandemic. Saxena et al. [30] suggested that during the pandemic, assurance, reliability, responsiveness, and website content had a strong influence on the e-learning quality which also had a compelling impact on students' satisfaction. Likewise, Kumar, Saxena and Baber [30] highlighted that there are meaningful relationships between the e-learning content and e-learning quality, and further between e-learning quality and students' satisfaction whereas e-learning quality emerged as a significant mediator between content and students' satisfaction. In a more comprehensive approach, Baber et al. (2022) synthesized the manifold challenges associated with the transition to online learning and advanced practices to make online learning more suitable for students while Baber [31] looked into the lessons learned and prospects on online learning.

Nevertheless, most of the mentioned studies point to the imperative to systemically analyze the specific context of online learning and COVID-19. One such area that necessitates additional investigation is student satisfaction. In this front, given the rapid transition to virtual education, it is crucial to conduct a thorough examination of students' satisfaction levels as gaining insight into learners' perceptions of the online learning experience, the obstacles they encounter, and their general contentment is essential for formulating efficient strategies for remote education, even beyond the pandemic context.

By rectifying the deficiencies in prior research and prioritizing student satisfaction, the study endeavors to improve their educational prospects and look into the commendable education they are entitled to, even in the midst of unparalleled circumstances. Therefore, it seeks to explore the relationships between five main constructs, that is, e-learning, expert skills perception, knowledge perceived value, knowledge sharing and student satisfaction in the context of the COVID-19 pandemic. To the best of our knowledge, this is one of the first studies scrutinizing the role of expert knowledge in the overall equation. Experts are hereinafter defined as individuals with area-centric knowledge derived from the personal experience of the expert, obtained through a continuous construction and refinement from experiential learning [32]. Experts come from the various fields outside academia and are credited with prominent skills to unravel unique knowledge patterns and processes with high potential in problem-solving and addressing complex situations [13,15]. Therefore, the focus of our research is analyzing the inferred relationships among the considered constructs as indicative of expert variables and student perception.

To this end, a questionnaire-based survey with 310 students was carried out between March 2020 and May 2022. The respondents were represented by master students, who participated in various marketing and business administration disciplines during the four semesters of online education. Fathoming their perceptions of the online education process which encompasses experts in the field of reference is liable to offer a reference point for conducting and enhancing similar endeavors even in the post-pandemic 'new normal'. The main assumption is that whenever experts share their knowledge with students, they advance a different vision on the business environment than academics given that they are actively involved in solving specific problems and constantly challenged to identify key issues of success and failure. Still, they are simultaneously dared to translate expert knowledge into coherent and comprehensive lectures so that the knowledge sharing process is effective and student satisfaction is achieved.

Building on this rationale, the paper was structured as follows. The first section introduces the theoretical background and the hypotheses formulation. Next, the materials and methods are presented followed by the assessment of the measurement and structural models. The argumentation continues with the discussion of the findings, conclusions, implications, limitations and future research directions.

2. Theoretical background and hypotheses formulation

2.1. Input-Environment-Outcome (IEO) model as founding theory

The theory supporting the current conceptual approach relies on Astin's Input-Environment-Outcome (IEO) model, which is used to conceptualize and evaluate academic success, including student satisfaction [33]. Developed by Alexander Astin in the 1970s, the IEO model is frequently utilized in educational research to assess the effectiveness of educational programs and policies. This framework looks into the inputs (student-related characteristics), the environment (institutional experiences), and the outcomes (including satisfaction and academic achievement), allowing for a comprehensive analysis of the factors that contribute to student satisfaction [34].

This theory offers a structured way to consider the various factors influencing student satisfaction, from institutional engagement and teaching quality to manifold peer interactions. Against the backdrop of

the current research, the inputs refer to the characteristics that students bring into the educational setting, such as personal expectations of expert skills and knowledge value. These inputs are considered the baseline from which changes or developments are measured. The environment stands for all the experiences, interactions, programs, and aspects of the e-learning climate that students are exposed to. This includes online classroom experiences and teaching experiences as part as the e-learning process, interactions with faculty and peers (i.e., knowledge sharing), and all other underlying influences. The outcome is related to the changes in the students that can be observed after exposure to the environment. In this particular context it includes student satisfaction.

The strength of the IEO model lies in its comprehensive approach to examining the scope of higher education's impact on students even in the context of the e-learning environment availed by COVID-19 pandemic. It implies that by understanding and measuring the inputs and the environment to which a student is exposed, educators and policymakers can more accurately predict the outcomes of their educational experiences. Moreover, Astin's model has been influential in shaping how scholars and educators think about designing supportive environments that promote student success and learning. Additionally, it has been used as a basis for a multitude of empirical studies that seek to understand and improve student development and learning outcomes in higher education [34].

2.2. e-learning and expert skills perception

E-Learning is a generic concept that refers to a variety of methods using technology as mediators for learning. The most frequently used terms are electronic learning (e-learning), mobile learning (m-learning), and the digital learning (d-learning), as individual or complementary forms of technological learning [35–38]. In this era of digitalization, the D-learning term is increasingly replacing the traditional e-learning term. Basak et al. [35] define *digital learning* as “any instructional practice that effectively uses technology to strengthen a student's learning experience and encompasses a wide spectrum of tools and practices” (p. 195). The American Society for Training and Development (ASTD) defines *e-learning* as “a wide set of applications and processes, such as Web-based learning, computer-based learning, virtual classrooms, and digital collaboration. It includes the delivery of content via Internet, intranet/extranet (LAN/WAN), audio- and videotape, satellite broadcast, interactive TV, and CD-ROM” ([39], p. 920).

E-learning can be delivered synchronously (the same timeframe for both professors and students), or asynchronously (different time frames for professors and students). From this perspective, e-learning is more flexible because it allows students to advance in their learning process with their own speed. Also, the existence of the stored materials on the e-learning platform may stimulate iterations and a kind of reversibility that is not possible in the face-to-face learning when the professors' performance is consumed in real time, in an irreversible way [40]. From the learning perspective, e-learning requires a greater effort from professors to prepare their materials and to change their delivering style by comparison with the traditional learning environment. Also, students should change their behaviors and engage in the new perspective of learning through the mediation of technology [39–41].

The COVID-19 pandemic produced many disruptions in economics, health systems, social life, and education all over the world. As reported by UNESCO, in April 2020, higher education institutions were closed in 195 countries, a fact which impacted 1.3 billion of the total number of students worldwide [42]. Therefore, universities were forced to switch from face-to-face instruction to e-learning. Those institutions which used before the pandemic a blending learning system had no problems in applying this drastic change, but many other universities faced difficulties in implementing rapidly e-learning technologies and in training both professors and students how to use them efficiently [18,43–45].

Inviting experts to deliver some courses to students has constituted a

general practice in universities because they can share their expert knowledge linked to solving practical problems [12]. Consequently, involving experts in course delivery seemed very suitable in the pandemic context given that experts were expected to bring new compelling perspectives and offer students unexpected relationships between the concepts and principles learned during their formal courses. Such strategy was deemed appropriate mainly because the new learning environment has become more challenging due to the lack of emotional bond that is specific to the face-to-face learning context. In this vein, the “learner engagement enriches communication, skills and ensures quality, which increases overall satisfaction” ([18], p. 4). Experts come forward as professionals with high performances in their fields of activity. They are widely recognized by their peers due to their capacity and skills to solve complex problems in conditions of uncertainty and offering solutions which are unconceivable for many others. Therefore, their expertise is organically complemented by the reification of skills apposite for specialized sectors and processes [14,46–48] and is prone to be transmitted as such to various recipients. Based on these considerations, it is presumed that.

H1. e-Learning has a positive influence on the expert skills perception.

2.3. Expert skills and knowledge perceived value

Independent of how one chooses to articulate the meaning of the term “skill”, at its core, a skill can be understood as the capability of successfully completing a particular job or undertaking based on accumulated knowledge content which comes both from personal experience and from a process of learning through indirect means [12]. It therefore encourages considering both implicit and explicit forms of knowledge (Davenport & Prusak, 2000 [49]; Dombrowski et al., 2013).

Expert knowledge is domain-specific, and it has a structure with a high degree of subjectivity derived from the personal experience of the expert, obtained through a continuous construction and refinement from experiential learning [32]. Tynjälä [50] considers that *expert knowledge* is composed of formal knowledge, practical knowledge, and self-regulative knowledge. Formal knowledge or declarative knowledge is explicit and factual and learned in schools and universities. It is universal and objective. Practical knowledge or procedural knowledge is personal and tacit and acquired through direct experience. It shows how to do something, without being necessary to be expressed in natural or symbolic language. Self-regulative knowledge is a result of the meta-cognitive skills of an individual to evaluate his own actions. It is closely related to reflective thinking.

Experts have the ability and skills to find efficient relationships between different components of knowledge creating unique patterns which become very useful in problem-solving and creating new perspectives for understanding complex situations [13–15]. Expert knowledge is built up on experience but in a nonlinear way that is specific to everyone's capacity of reflecting upon it and discovering links between different components of those experiences. Thus, experience it is a necessary but not enough condition to reach the level of expertise and to use it in a creative and intelligent way. Expert knowledge is oriented toward practice and to problem solving. Its usefulness is contextual and bound to a certain activity domain. For instance, a great chess master has great expert knowledge, but that knowledge cannot help him too much in solving problems in other domains that are different than chess playing. It could be helpful for detectives and policemen but not too much for people working in agriculture or industry where the governing rules are totally different.

From the theory of knowledge fields [51,52] perspective, expert knowledge integrates rational, emotional, and spiritual knowledge in different degrees, in concordance with the specificity of each activity domain. Rational knowledge is the formal knowledge discussed by Tynjälä [50], and emotional knowledge is very close to practical knowledge acquired through direct experience. Spiritual knowledge

approaches the self-regulative knowledge due to its content and role in decision making [53,54]. Due to this component, expert knowledge is very close to wisdom without overlapping it [55].

The advantage of using this theory is that it explains the transformation of knowledge from one field into any other field making possible the progressive construction of the expert knowledge. This construction is performed through a series of iterative transformations of knowledge structure leading toward a fix point that is expert knowledge, a knowledge *eigenform* [56,57]. Expert knowledge structure is based on patterns reflecting a highly organized and conceptually integrated knowledge [46,58].

As previously contended, expert knowledge is field-centric [50]. It is contextual and its value results from using it in solving problems which are characteristics to that domain or similar ones. Beyond its intrinsic value, expert knowledge has a relative value related to its usefulness in practice [12,14]. Most of the students have an oriented learning style toward the usefulness of knowledge and therefore their perception of expert knowledge is through its relative value. Also, their perception is influenced by motivation to improve their professional competences [16,17]. Expert knowledge is highly organized and dense in information. That creates a high level of knowledge deficit with respect to the level of students' understanding. Therefore, experts should translate their knowledge [59] by using metaphors [60] and practical examples to make it more accessible. By conflating these arguments, we infer that.

H2. Expert skills have a positive influence on the knowledge perceived value.

2.4. Knowledge perceived value and knowledge sharing

Knowledge sharing is a specific process of knowledge transfer based on an intrinsic motivation to offer something from personal experience to some other people. As Brătianu [61] remarks, "The fundamental mechanism of knowledge sharing is the social interaction of people and their motivation in communicating with their peers" (p. 43). Knowledge sharing has an important role in creating organizational knowledge through externalization of tacit knowledge and its combination through social interactions as demonstrated by Nonaka and Takeuchi [21,49].

Knowledge sharing changes the organizational knowledge probability distribution and leads to increasing knowledge entropy [62], and to a higher level of the average organizational knowledge. In a complex causality process, that leads to powerful stimulation of innovation and value creation [63,64]. As Ruparel and Choubisa [65] remark, "knowledge sharing is considered vital for improving the performance of the organization because it acts as a determinant of organizational success" (p. 6).

Knowledge sharing becomes a powerful force in customer knowledge management, where knowledge flows in both directions: from the organization towards customers, and from customers toward organization [66–68]. Also, knowledge sharing is a significant contributor in the inter-organizational knowledge transfer [69–71]. Knowledge networks which exploded during the COVID-19 pandemic stimulate knowledge sharing as a generic mechanism for knowledge capitalization (Vătămănescu et al., 2023). The above research shows how knowledge sharing can be scaled-up from team social interactions to organizational level, and then to network's level, becoming an efficient boundary spanner, especially when knowledge relies on expertise and acknowledgment, on value and validity among communities of experts [8,9,19,72]. Deriving from these arguments, the following hypothesis was formulated.

H3. Knowledge perceived value exerts a positive influence on the knowledge sharing.

2.5. e-learning and knowledge sharing

Although there are many studies concerning the implications of e-

learning during the COVID-19 pandemic, few of them focus on the emotional dimension that influences the learner's engagement and the knowledge dynamics at the students' level [51,73]. He and Song [74] developed the PAD (Pleasure-Arousal-Dominance) theory showing the key role played by emotions in determining the students' behavioral. According to this theory, "the user's level of emotional pleasure represents the extent to which students are engaged in and benefit from their online learning experiences; the level of arousal represents the effectiveness with which students apply their imagination and initiative to their online coursework; and the level of dominance represents the extent to which students accept and internalize what they learn" ([74], p. 3).

When experts are invited to share their expert knowledge to students situated in a given e-learning environment, the emotional states of students [54,75] are expected to impact expert skills perception and knowledge value perception. The emotional reactions [54,75] generated by e-learning stimulate students' attention and comprehension, and subsequently the propensity towards sharing expert knowledge. The knowledge conveyed by experts is intrinsically attractive and challenging as it often dares the status-quo and create unique patterns displaying usefulness in problem-solving and dealing with intricate situations [13–15]. Therefore, knowledge sharing comes forward as an organic step, following the logic of the knowledge flows within the communities of practice where people motivated by common interests learn together from one another through knowledge sharing [76]. Stemming from these considerations, the following hypothesis was advanced.

H4. e-Learning has a positive influence on knowledge sharing.

2.6. e-learning and student satisfaction

As already underscored, the rise of online education has ushered in a revolutionary change not only in the way people learn but also in the way they are instructed [1–3]. According to one line of reasoning presented by Sinclair [77], there is an ever-increasing demand to have a better comprehension of the factors that contribute to the level of student satisfaction with online education. In this sense, there have been many studies conducted on the topic of student satisfaction with e-learning [78–81], most of them concluding that student satisfaction is a strong contributor to the success of online learning programs.

As generally agreed, upon, the definition of student satisfaction is "the learner's perceived value of their educational experiences in an educational setting" ([82], p. 5). From this point of view, Kransow [83] highlights the significance of cultivating a feeling of community within the context of an online environment, which is anticipated to contribute to increased levels of student satisfaction. This may cover interactivity, instructor skills and expertise, and technology attributes, three most critical factors in determining a student's level of satisfaction with online courses, as also posited by Bollinger [84]. Based on these issues, the following relationship was inferred.

H5. e-Learning has a positive influence on student satisfaction.

2.7. Knowledge sharing and student satisfaction

The consolidation of knowledge sharing within communities of interest requires contact between students and instructors as well as among students themselves. Here, Sher [85] argued that interaction amongst students serves as a major influence on both the learning and the contentment of individual students. There are several factors that can contribute to successful outcomes in this area, including the course design [86] and students' perception of the value of learning [87].

The variety in the activities of teaching and learning that take place online [88,89] comes forward as a strong predictor of knowledge sharing and further of student satisfaction. The overall presence of the instructor in online settings (i.e., expert perceived skills and knowledge

perceived value) as well as the unfolding of interactions between students, professors, and content coupled with deliberate follow-up connections among peers (i.e., knowledge sharing) all converge to granting student satisfaction [90]. In this sense, it may be inferred that.

H6. Knowledge sharing has a positive influence on student satisfaction.

Building on the research hypotheses, the following conceptual model was proposed (Fig. 1).

3. Materials and methods

3.1. Sample and data collection

The aim of this research was to determine relevant predictors of knowledge sharing in the academic realms (with an emphasis on expert – student relationship) alongside student satisfaction (see Fig. 1). The research was carried out by means of a questionnaire applied online during the pandemic (i.e., March 2021–May 2022). The questionnaire has been previously pretested one semester before, and slightly adapted to meet its purposes depending on the feedback obtained. The respondents were represented by master students, who participated in various marketing and business administration disciplines during the 3 semesters of online education. Sampling was one of convenience, thus wanting to attract as many subjects as possible. In the preamble, respondents were asked for their consent to complete the questionnaires, as they were informed that the answers given would be anonymized and that each respondent would not be able to be identified.

The sample consisted of 310 master students who participated in online lectures delivered by specialists from business sectors and/or by well-reputed foreign instructors. The lectures given by guest lecturers were from the business administration field. Among the guest lecturers/specialists who developed knowledge co-creation were four instructors with university affiliations in Germany, the United Kingdom and Finland and 4 specialists from business. All of them presented concrete examples of good practices and their experience within their respective fields, thus contributing to knowledge co-creation.

From the initial collected data (i.e., 355 questionnaires), 45 questionnaires with missing data were dropped according to the literature (see Ref. [91]). Only completely filled in questionnaires were considered for further processing. To estimate the minimum sample size, we conducted a G*Power Analysis [92]. The results of the analysis showed that for two predictors (i.e., e-Learning Processes, and Knowledge sharing), a multiple regression analysis, and an f^2 size effect of 0.35 (large effect), a sample of 66 questionnaires would be required for the current study, thus the sample size was appropriate.

To check if the collected data has any bias, we firstly made comparisons between pairs of the students who participated in the German,

English and Romanian courses (German with Romanians, German with English, English with Romanian) regarding the dependent construct (Student Satisfaction). In this regard, independent sample t-tests were performed. These tests did not pinpoint significant differences between the groups (German with Romanians $F = 0.324$ and $p = 0.264$; German with English $F = 0.267$ and $p = 0.198$; English with Romanian Zers $F = 0.431$ and $p = 0.364$), so it was concluded that the sample is bias free at this level [93]. Secondly, in order to test that there is no bias associated with the period of data collection (i.e., 2021 and 2022), we ran independent sample t-tests between years. The results did not indicate significant differences between the groups ($F = 0.280$ and $p = 0.597$), so it was also concluded that the sample is bias free.

In what concerns the language of the lectures, 13 respondents (4.2%) assisted lectures in German, 58 respondents (18.7%) in Romanian, and 239 respondents (77.1%) in English. Of the 310 respondents who participated in the research, 225 were women (72.6%), and 85 men (27.4%). 64 students were enrolled in the first year of studies (20.6%) and 246 students respectively in the second year of studies (79.4%). Of these, 281 students (90.6%) attended full-time classes, while 29 students (9.4%) took part-time courses at the time of this research. As for the study/specialization program, 63 students (20.3%) pursue a master's degree in the field of Business Administration (International Management; Business Administration in Trade, Tourism, Services; Business Administration and Communication; E-Business; Agrobusiness; Business Administration Management), 103 students (33.2%) pursue a specialization in the field of Management (Human Resources Management; Business Development Management; European Fund Administration and Management), 109 students (35.2%) in the field of Marketing (Digital Marketing, Marketing Strategies and Policies), 25 students (11.3%) in the field of International Business Management, International Business). 228 respondents (73.5%) are between 20 and 24 years old, the remaining 82 respondents (26.5%) being 25 years old and over.

3.2. Method and measures

The research model in Fig. 1 was analyzed using structural equations modeling (SEM) using SmartPLS software [94], which allowed the investigation of the dependency relations between the model concepts. For the research based on small sample size and non-normally distributed data, PLS-SEM is advised [95]. Additionally, SmartPLS is very helpful for evaluating complex models [96], such as the one proposed here.

Five multi-item constructs were integrated in the research framework, all of them being assessed as reflective. The compenence of each construct as well as the reference sources for their development were illustrated in Table 1.

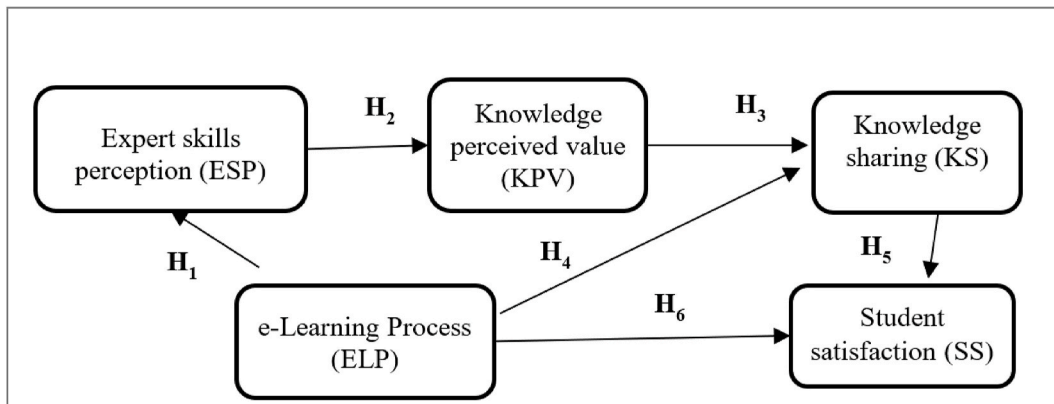


Fig. 1. Conceptual model.

Table 1

Constructs and items.

Item	Constructs, measurements, and sources	Loading	α /CR/AVE
Expert skills perception (ESP) adapted after [97,98].			
<i>The guest lecturer/specialist ...</i>			
ESP1	... has shown special competence in addressing the subject matter.	0.811	0.956/0.960/0.602
ESP2	... was open to counseling/questions.	0.766	
ESP3	... communicated the information clearly to students.	0.795	
ESP4	... was friendly.	0.796	
ESP5	... always had an answer to questions asked.	0.791	
ESP6	... was empathetic.	0.759	
ESP7	... harmoniously combined theoretical concepts with practical examples.	0.782	
ESP8	... is qualified.	0.795	
ESP9	... always made a good point.	0.747	
ESP10	... recommended other sources.	0.757	
ESP11	... offered recommendations depending on the questions asked.	0.775	
ESP12	... facilitated communication within the lecture	0.737	
ESP13	... has vast practical experience.	0.760	
ESP14	... has ample theoretical knowledge.	0.762	
ESP15	... knows how to talk to students.	0.768	
ESP16	... was quick to answer students' queries.	0.811	
e-Learning Process (ELP) adapted after [99,100].			
<i>Since the cancellation of in-person classes due to the COVID-19 pandemic ...</i>			
ELP1	... I received homework and materials for each course on time.	0.826	0.915/0.932/0.661
ELP2	... the lecture/seminar professor was open to suggestions on how to organize online courses.	0.829	
ELP3	... the lecturer informed us about the situation of the points accumulated along the way.	0.786	
ELP4	... the lecturer informed us on how the exam would take place.	0.773	
ELP5	... the support/help offered by the teacher was very good.	0.831	
ELP6	... the lecturers have always provided enough materials.	0.835	
ELP7	... the lecturers provided feedback when I needed it.	0.810	
Knowledge Perceived Value (KPV) adapted after [99].			
<i>The guest lecturer/specialist gave answers that were ...</i>			
KPV1	... easy to understand.	0.787	0.919/0.937/0.713
KPV23	... pertinent.	0.830	
KPV	... correct.	0.853	
KPV4	... quick.	0.861	
KPV5	... complete.	0.868	
KPV6	... relevant.	0.866	
Knowledge sharing (KS) adapted after [97].			
KS1	I would recommend the lecture of this guest lecturer/specialist to others.	0.880	0.890/0.924/0.753
KS2	I paid attention to the information and/or examples provided during the lecture.	0.832	
KS3	I would attend another lecture of this specialist at any time.	0.899	
KS4	I could present the ideas from this specialist's lecture to my friends/acquaintances anytime.	0.858	
Student Satisfaction (SS) adapted after [100,101].			
<i>I am satisfied with ...</i>			
SS1	... real-time video conferencing with the lecturer.	0.807	0.898/0.925/0.711
SS2	... the audio-video recordings posted on Moodle for this course.	0.823	
SS3	... the materials sent by the lecturer.	0.859	
SS4	... the online communication with the lecturer.	0.851	
SS5	... the feedback received from the lecturer	0.874	

Note: Factor loading > 0.6; Cronbach's Alpha/ α > 0.7; Average variance extracted (AVE) > 0.5; Composite reliability (CR) > 0.7 (see Ref. [102]).

3.3. The evaluation of the measurement model

The constructs rendered in the conceptual model were reflective and were verified through various analyses, namely validity, internal consistency, item loadings, average variance extracted (AVE), reliability (Table 1), discriminant validity applying the Fornell-Larcker and Hetertrait-Monotrait procedure (Table 2).

Table 1 shows that item loadings exceed the recommended threshold of 0.70, items having validity convergence and basically measuring exactly the investigated phenomenon [102]. Construct Reliability was tested by Cronbach α analysis, the values exceeding the requirement threshold of 0.7 [103]. Average variance extracted exceeds the requirement threshold of 0.5, highlighting the correctness of the analysis model [104] and construct convergent validity. Composite Reliability (CR) exceeds the threshold of 0.7, which indicates construct reliability [102].

Next was the discriminant validity testing, analysis for which the Fornell-Marcker test and Hetertrait-Monotrait test – HTMT (Table 2) – were employed. In the case of the Fornell-Larcker test, the values of the

diagonal must be higher than the values below the diagonal for they represent the square root of the average variance extracted, and in the case of the HTMT test the values must be less than 0.9, indicating that all the concepts considered are not similar [105].

Testing item collinearity was performed by determining variance inflation factors for all items, with values below the threshold of 3.3 [106]. The highest value is $3.100 < 3.3$ (KS3 item) for the dataset; this is descriptive of the absence of multicollinearity in the current framework. A bootstrap procedure was run afterwards with a view to test the relationships between the latent variables. All hypotheses were supported as depicted below.

4. Findings: the evaluation of the structural model

The analysis of the construct collinearity highlighted the lack of this issue as the highest VIF value, value of the inner model, being 1.207 (KS→SS), way below the 3.3 threshold. Following the approach of Kock [107], given that all VIF values in the inner model are lower than 3.3, the model is devoid of common method bias.

Table 2
Discriminant validity analyses.

Fornell-Larcker					Con-struct	Hetertrait-Monotrait				
ESP	KPV	KS	SS	ELP		ESP	KPV	KS	SS	ELP
0.776					ESP					
0.767	0.844				KPV	0.816				
0.753	0.638	0.868			KS	0.815	0.704			
0.466	0.422	0.485	0.843		SS	0.501	0.465	0.541		
0.398	0.337	0.414	0.791	0.813	ELP	0.422	0.366	0.456	0.862	

Note: ELP: e-Learning Process; ESP: Expert skills perception; KPV: Knowledge Perceived Value; KS: Knowledge sharing; SS: Student Satisfaction.

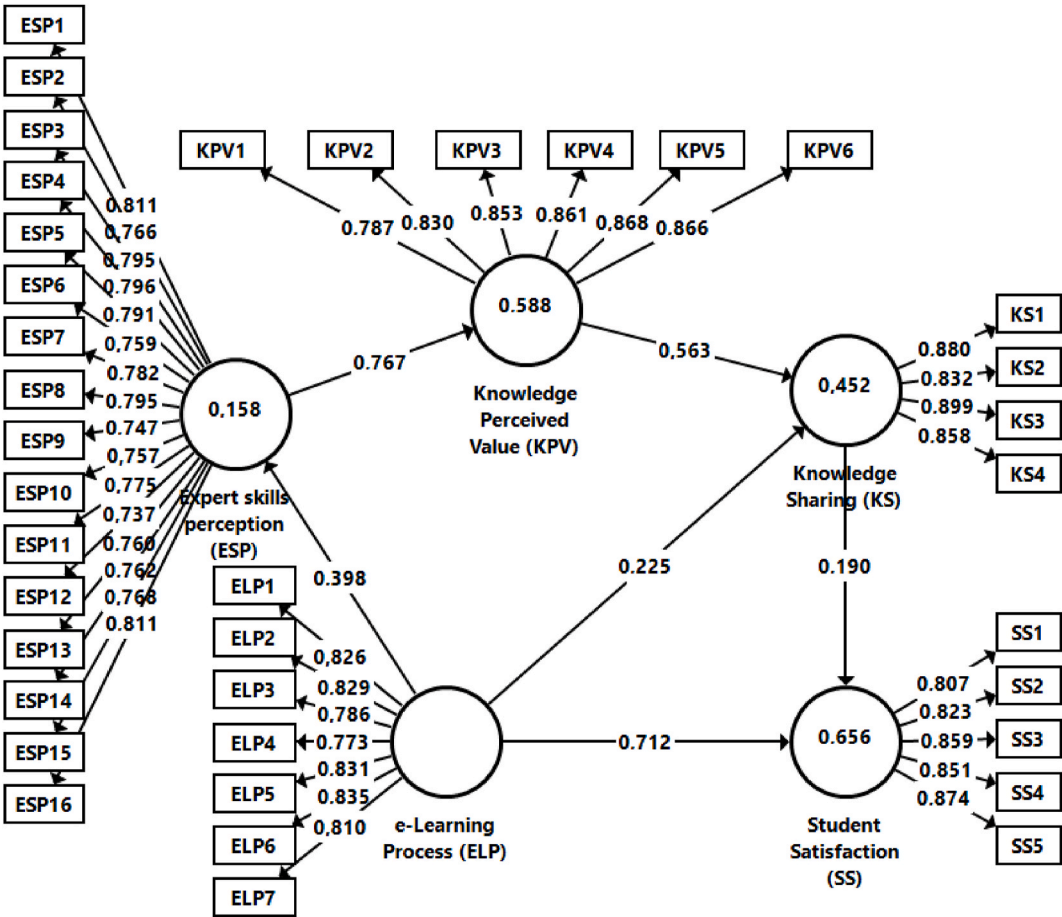


Fig. 2. Structural model.

The goodness of fit of the saturated model is also acceptable. The square root mean residual (SRMR) has a value of $SRMR = 0.053 < 0.08$ which fulfils the threshold. Besides, *Expert Skills Perception* explains 58.8% of the variance of *Knowledge Perceived Value* ($R^2 = 0.588$), while *Knowledge Perceived Value* and *e-Learning Process* explain 45.2% of the variance in *Knowledge Sharing* ($R^2 = 0.488$) and *Knowledge Sharing* and *e-Learning Process* explain 65.6% of the variance in *Student Satisfaction* ($R^2 = 0.656$), defining a strong predicting power of the structural model (see Fig. 2).

Table 3 illustrates the main results of the structural model assessment and the confirmation of the inferred relationships among constructs. As showed below, all the research hypotheses have been supported by the unfolded empirical investigation.

To sum up, H_1 inferred that e-Learning Process has a positive influence on the expert skills perception. The results ($\beta = 0.398$; T-value = 4.318; $p < 0.001$) show an intense and strong positive relation, therefore H_1 can be accepted. Further, H_2 assumed that e-Learning Process has a positive influence on knowledge sharing. The results ($\beta = 0.225$; T-

value = 3.721; $p < 0.001$) exhibit a moderate intensity and strong positive relation, so H_2 is to be confirmed.

H_3 presumed that e-Learning Process has a positive influence on students' satisfaction. The results ($\beta = 0.712$; T-value = 19.596; $p < 0.001$) depict a very intense and strong positive influence, also confirming the third hypothesis. H_4 argued that expert skills perception exerts a positive influence on the knowledge perceived value. The results ($\beta = 0.767$; T-value = 15.692; $p < 0.001$) highlight a very intense and strong positive influence, meaning that the assumed hypothesis is accepted.

H_5 investigated the influence of the knowledge perceived value on the knowledge sharing behaviour. The results ($\beta = 0.563$; T-value = 9.624; $p < 0.001$) show that the influence is strong and positive, so H_5 is accepted. Finally, H_6 analyzed the influence of the Knowledge sharing behaviour generates students' satisfaction. The results ($\beta = 0.190$; T-value = 4.253; $p < 0.001$) exhibit a moderate intense, but still strong positive influence, allowing us to confirm the hypothesis.

Table 3

The path coefficients of the structural equation model.

Paths	Path Coefficients	Standard Deviation	T-Value	CI ¹	P-Value	Hypotheses
ELP → ESP	0.398	0.049	4.318	0.202–0.553	0.000***	H ₁ -Accepted
ELP → KS	0.225	0.060	3.721	0.100–0.332	0.000***	H ₂ -Accepted
ELP → SS	0.712	0.036	19.596	0.627–0.777	0.000***	H ₃ -Accepted
ESP → KPV	0.767	0.049	15.692	0.647–0.844	0.000***	H ₄ -Accepted
KPV → KS	0.563	0.058	9.624	0.448–0.665	0.000***	H ₅ -Accepted
KS → SS	0.190	0.045	4.253	0.102–0.275	0.000***	H ₆ -Accepted

Note: *** $p < 0.001$; ELP: e-Learning Process; ESP: Expert skills perception; KPV: Knowledge Perceived Value; KS: Knowledge sharing; SS: Student Satisfaction. ¹CI=Confidence Interval (2.5%–97.5%).

5. Discussion of the findings

The evidence brought forward by the first hypothesis, namely *e-Learning has a positive influence on the expert skills perception* indicated that the online environment is a propelling factor for a favorable perception of expert skills by student attendees. This situation may imply that e-learning has the capacity to compensate – to some extent – the requirements of emotional connection via interpersonal physical interaction. Despite the unprecedented transformations availed by the COVID-19 pandemic and the difficult challenges faced by universities in implementing rapidly e-learning technologies, as also addressed by prior studies [18,29,44,45,108], the online teaching system seems to have succeeded in finding new ways to engage students.

Such observation is also supported through the confirmed validity of the second hypothesis which presumed that expert skills have a positive influence on the knowledge perceived value, as also probed by Kumar, Saxena and Baber [109] when stressing the meaningful relationships between the e-learning content and e-learning quality. In the context of the empirical examination, the findings suggest that practical and problem-solving oriented experience of experts during online courses is effectively transmitted to the students, thus increasing their motivation to actively follow classes and learn. Scholars possess the expertise and aptitude to discern effective connections among various elements of information, so generating distinctive patterns that are very advantageous in the realms of problem-solving and the development of novel perspectives for comprehending intricate circumstances (as previously posited by Ref. [13–15,59]). Moreover, as discussed by Nordin [14] and Bratianu and Vătămănescu [12], in addition to its inherent worth, expert knowledge possesses a relative value that is linked to its practical utility. Given that most students possess a learning style that is geared towards the practicality of knowledge, the positive perception of expert knowledge derives from their own goals and interests. Consequently, the view of individuals is liable to be subject to the influence of their motivation to enhance the professional capabilities.

Moving further, the knowledge perceived value probed to exert a positive influence on the knowledge sharing process. The positive involvement of the class due to expert knowledge increases the intrinsic motivation to share knowledge with their peers. In this light, pursuant to Bratianu [61], the primary mechanism underlying the sharing of knowledge is the social interaction among individuals and their intrinsic incentive to engage in communication with their peers. A favorable perception of knowledge value leads to sharing which plays a crucial role in facilitating intraorganizational knowledge transfer, as also advanced by Balle, Steffan, Curado, and Oliveira [69], Keszei [70], Kodama [71], etc. The proliferation of knowledge sharing during the COVID-19 pandemic has served as a catalyst for capitalizing on relevant acumen by means of the online environment [9,10,19], this expansion being particularly effective in bridging boundaries when knowledge is based on expertise, recognition, value, and validity.

This is also confirmed by the positive relation supported via the fourth hypothesis of the research, namely *e-Learning has a positive influence on knowledge sharing*. The emotional responses elicited by e-learning have a positive impact on students' focus and understanding, leading to an increased inclination to share expert information.

Consistent with Bereiter [13], Nordin [14] and Schneider [15], the transmission of knowledge by specialists possesses inherent allure and complexity, as it frequently challenges established norms and generates novel frameworks that demonstrate efficacy in addressing complex problems and navigating intricate circumstances. Hence, the act of knowledge sharing emerges as a natural progression, aligning with the patterns of information exchange within communities of practice. As also posited by O'Dell and Hubert [76] and Vătămănescu et al. [9], in these communities, individuals driven by shared interests engage in collective learning by mutually sharing their expertise.

The verification of the fifth hypothesis led to the conclusion that e-Learning has a positive influence on student satisfaction, confirming that the online environment is prone to favorably impact the way students perceive the learning process. As previously emphasized by Daniels et al. [2], Salinas-Vila et al. [1], and Baber [27–29], the emergence of online education has brought about a transformative shift not only in the process of acquiring knowledge but also in the methods employed for instruction. Operationalized as a subjective assessment made by learners regarding the perceived worth of their educational experiences, student satisfaction has proven to be positively impacted by the online educational environment imposed by the pandemic. Fostering a sense of community in online environments and focusing on interactivity, instructor abilities and experience, and technology qualities, the e-learning process has succeeded in increasing students' level of happiness and contentment with the online courses delivered by experts.

Correlatively, the positive relation supported by the sixth and last hypothesis, that is, *knowledge sharing has a positive influence on student satisfaction*, highlighted how knowledge sharing follow-up interactions among students of e-learning classes, creating a propelling environment for students' satisfaction. As also agreed by Sher [85], the presence of student interaction plays a significant role in shaping the learning outcomes and overall satisfaction of individual students, their evaluation of the educational worth rising as a compelling factor [87]. Moreover, in accordance with Nortvig et al.'s [90] view, the comprehensive involvement of the instructor in online environments, encompassing their perceived expertise and the perceived value of their knowledge, along with the development of interactions among students, professors, and course material, combined with intentional follow-up connections among peers, collectively contribute to the attainment of student satisfaction.

6. Conclusions and future research directions

6.1. Summary of the findings

The advanced structural model has proven to display a strong predicting power given that *knowledge sharing*, and the *e-learning process* explain 65.6% of the variance in *student satisfaction*. Additionally, all the inferred relationships were validated in the context of the current research, therefore supporting the underlying connections among the envisaged constructs (i.e., e-learning, and expert skills perception, expert skills have and the knowledge perceived value, knowledge perceived value and knowledge sharing, e-learning, and knowledge sharing, respectively e-learning and student satisfaction).

6.2. Theoretical and managerial implications

From a theoretical perspective, the present study adds to the existing literature on the impact exerted by the e-learning process on knowledge sharing and student satisfaction yet capturing new peculiarities such as expert skills perception and knowledge perceived value. As previous developments in the field have pointed, student satisfaction stands for a moving-target issue that requires thorough examination. Given the swift shift to virtual education, it has become imperative to comprehensively assess students' satisfaction levels all the more so as the context of reference is an unprecedented one. Understanding learners' perspectives on the online learning experience in relation to various relevant variables (i.e., expert skills, knowledge value, knowledge sharing), and delving into the challenges they face, and their overall contentment are pivotal for developing effective strategies for remote education, even beyond the current pandemic situation.

Furthermore, the paper represents one of the initial investigations examining the significance of expert knowledge within the specific context imposed by the outbreak of COVID-19. Experts are recognized for their ability to analyze and decipher distinctive patterns and processes, with a strong capacity for problem-solving and navigating intricate circumstances, therefore scrutinizing their influence on the efficiency of the e-learning process in terms of skills and knowledge assessments is conducive to novel approaches of the attractiveness and engagement catalyzed the online educational environment.

Overall, the present study provides important insights addressing students' perceptions of the e-learning process which is meaningfully dependent on expert skills and knowledge sharing. Thus, the findings give credit to the relevance of the IEO model advanced by Astin [33] and to its applicability to the pandemic period, showcasing that the online learning environment alongside students' perceptions and peers' sharing behavior succeed in generating student satisfaction. The results of the research can become useful recommendations for the design and implementation of e-learning classes in the actual post-pandemic period.

From a practical perspective, the courses delivered by experts can significantly enhance student satisfaction in e-learning environments. The reasoning is at least two-fold. On the one hand, it boils down to knowledge and credibility. Experts are often recognized for their knowledge and achievements in their field. They can reliably answer students' questions and provide insights that are not typically available from non-expert resources. This accurate and reliable information can foster a sense of trust, enhancing student satisfaction. On the other hand, it is a question of engagement and motivation. Experts often have real-world experience, enabling them to incorporate practical examples into their courses. Through this, they can better engage students, illustrating the theory with applications that are relevant to real-life situations. This can significantly increase students' motivation to learn, therefore improving satisfaction levels. It's essential to note that the effectiveness of expert-delivered courses also relies heavily on the expert's teaching skills. Even the most knowledgeable person may fail to satisfy students if they cannot deliver the information in an understandable, engaging, and interactive way. So, effective e-learning also requires addressing teaching methodologies used.

Even if the findings of this research refer to the special circumstances of the COVID-19 pandemic restrictions, we presume they can be helpful hints for the design of e-learning courses also outside the contextual emergency, including expert knowledge sharing to increase the overall attractiveness of online classes and student satisfaction proves to yield substantive benefits.

6.3. Research limitations and future directions

The present study is subject to several limitations. While subjects were conveniently selected to meet the methodological requirements, the empirical framework is determined by a specific research setting generated by the outbreak of COVID-19. Further research should be

carried on in different settings and outside the period of emergency of the COVID-19 pandemic to further confirm the results beyond restrictive conditions. Indeed, as noted by Baber [31], the shift to online classes during the examined period was not a free-choice but a forced one. Consequently, the perception of online education during the pandemic period was different from previous and subsequent periods. Therefore, further research is needed to compare pre-COVID and post-COVID contexts to properly assess how the overall attitude of e-learning students has evolved.

Another limitation is related to the emphasis laid on the online environment. In this front, it would be interesting to broaden the research scope outside the e-learning environment, favoring comparisons with physical face-to-face courses through the lens of expert skills perception, knowledge perceived value and student satisfaction. Furthermore, advancing transnational comparative analyses would facilitate the identification of the patterns versus idiosyncrasies interlinking the e-learning process and student satisfaction.

Ultimately, the investigation relies on convenience sampling and self-reported measures as adapted from the extant literature. This implies per se a high level of subjectivity and response bias which may be addressed in future undertaking through the introduction of additional objective measures such as the course attendance rate, course recommendations, etc.

All data generated or analyzed during this study are included in this article. Any other data will be made available on request from the corresponding author.

CRediT authorship contribution statement

Dan-Cristian Dabija: Conceptualization. **Constantin Brătianu:** Validation, Supervision. **Gandolfo Dominici:** Writing – review & editing, Supervision, Methodology. **Elena-Mădălina Vătămănescu:** Methodology, Data curation.

Declaration of competing interest

None. This research has no conflict of interests.

Data availability

Data will be made available on request.

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