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Antecedents of E-Learning Readiness and Student Satisfaction in Institutions of Higher Education during the COVID-19 Pandemic

Eveline Siregar

Jakarta State University, Indonesia.
Email: evelines.unj@gmail.com Tel: (+62)8164267713

Abstract

The low levels of readiness for e-learning, followed by the low satisfaction levels experienced by university students during the COVID-19 pandemic, is a crucial yet confounding issue. Many reports relate the lack of technological competence and motivation to this problem. This study examined aspects of technological competence and motivation as antecedent factors that affect student user and e-learning readiness. In addition, the study also tested the determination of the role of e-learning readiness as a mediator of the indirect influence of technological competence and motivation on student satisfaction. The study involved 1228 university students from the province of Yogyakarta, Indonesia. Data collection was assisted by using a closed questionnaire with a five-point Likert scale tested for validity and reliability. Structural Equation Modeling was used to analyze the data through path analysis and bootstrap methods. This study showed that technological competence and motivation significantly affected e-learning readiness and user satisfaction. Furthermore, e-learning readiness was seen to act as a significant mediator in the indirect effect of technological competence and motivation on student satisfaction. Therefore, these results strengthen the theory that shaping student satisfaction in e-learning requires mature e-learning readiness. In forming this readiness, technological competence and balanced motivation are needed.

Keywords: Student satisfaction, E-learning readiness, Technological competencies, Motivation, Higher education.

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Contents

Contribution of this paper to the literature

The results of this study reinforce the point that technological competence and motivation play an important role in the successful implementation of e-learning. In addition, adequate e-learning readiness has an impact on e-learning user satisfaction. The strong relationship with user satisfaction is also determined by the significance of increasing competence and motivation towards the use of technology. However, student e-learning outcomes are determined by e-learning readiness, where students are required to be motivated and ready to master competence in technology.

1. Introduction

E-learning is the trend or the most widely applied learning model in higher education today, especially during the COVID-19 pandemic (Almaiah, Al-Khasawneh, & Althunibat, 2020; Butola, 2021; Hamid, Aditama, Permata, Kholifah, Nurtanto, & Majid, 2022). The development of technology in the 21st century has brought significant changes, especially for higher education which shares a closeness with technology (Stuchlikova, 2016). Shifting the learning model from classical (learning in physical space) to e-learning (learning in virtual space) is a challenge that must be faced (Mishra, 2007). E-learning is a learning model that is integrated with media, methods, educational technology and information and communication technology (internet, digital platforms, computers and teleconferencing) in the learning process (Holmes & Gardner, 2006). This form of learning has become an important option to transform learning pedagogy into andragogy, heutagogy and cybergogy, which can make significant contributions to successful learning outcomes (Saripudin, Sumarto, Juanda, Abdullah, & Ana, 2020; Zare, Sarikhani, Salari, & Mansouri, 2016). Through the use of e-learning, students and teachers can create a very effective and efficient learning climate, where access to important resources needed for theory and practice such as e-books, journals, video tutorials and systematic procedures, is very easy (Jawad & Shalash, 2020; Scott, Morris, & Marais, 2018; Shrivastava & Shrivastava, 2020). This is certainly very helpful in achieving the goal of competence to the fullest. Several relevant studies have identified e-learning as having complete features that create opportunities for students to experience innovative, communicative, collaborative and literary learning climates (Shah & Barkas, 2018; Wali & Popal, 2020). Likewise, lecturers' teaching assignments have also changed significantly as they become more flexible in managing virtual classes without being present in physical classes (Osman, 2020). In essence, compared to the physical space learning model, e-learning has clear advantages, especially in terms of flexibility (space and time flexibility) during the learning process. However, implementing e-learning requires meeting the main needs or aspects to ensure success. In implementing the e-learning model in developing countries such as Indonesia, the most important step to be taken is to increase student satisfaction with online learning system services (Gay, 2016; Widyanti, Hasudungan, & Park, 2020). Student user satisfaction of electronic learning system services is an important aspect that must be seen to by higher education institutions (Pereira, Ramos, Gouvêa, & Da Costa, 2015). Student satisfaction is defined as the response to feelings caused by the match between expectation and reality from the learning process (Pritchard, 2009). Student satisfaction is also an important indicator of success in achieving competence through learning (Dziuban, Moskal, Brophy, & Shea, 2019). Yilmaz (2017) revealed that student satisfaction in using e-learning system services would foster students' positive attitudes to encourage them to learn optimally. In providing optimal online learning service satisfaction to students, Topal (2016) identified important steps to support satisfaction, mainly through increasing the readiness of aspects that are needed for e-learning. In this context, the readiness of students to engage in e-learning can increase student satisfaction in learning using this method. On the other hand, readiness for e-learning among students is also an important indicator of the successful implementation of e-learning in universities (Dziuban et al., 2019). E-learning readiness is an assessment or measurement tool to identify the extent to which an institution is ready to adopt and implement e-learning, in relation to important aspects or factors that influence it Holmes and Gardner (2006). According to Mabrur, Suwartono, and Lutfiana (2021); Watkins, Leigh, and Triner (2008), e-learning readiness refers to the level of physical readiness of the infrastructure in the institution needed to implement the e-learning process. E-learning readiness is also defined as the factors that must be met before e-learning implementation can be successful (Oketch, Njihia, & Wausi, 2014). Several relevant studies identify student dissatisfaction caused by unpreparedness to follow e-learning as the dominant factor contributing to failure in implementing e-learning (Coşkun, Özeke, Budakoğlu, & Kula, 2018; Widyanti, Hasudungan, & Park., 2020). Past research has identified the weak readiness of students in using e-learning, especially in the case of higher education where achievement in cognitive and psychomotor competencies has failed due to low e-learning readiness, as reported by researchers during the COVID-19 pandemic. In such situations, it is very important to measure and strengthen e-learning readiness to assist vocational education institutions in measuring each stage of their readiness, starting with gap analysis to redesigning strategies to facilitate e-learning implementation (Alqahtani & Rajkhan, 2020; Nwagwu, 2020). Aspects that affect the readiness of e-learning are technological competence and learning motivation which play important roles in encouraging the implementation of e-learning effectively and efficiently (Al-araibi, Mahrin, & Yusoff, 2019). Technological competence is the basis for understanding and mastering the technology used to implement e-learning (Arifin, Nurtanto, Warju, Rabiman, & Kholifah, 2020; Majid, Fuada, Fajri, Nurtanto, & Akbar, 2020; Nurtanto, Widjanarko, Sofyan, Rabiman, & Triyono, 2019; Soler & Blazquez-Parra, 2022). According to Elkaseh, Wong, and Fung (2015), without adequate technological capabilities, the main aims and objectives of e-learning cannot be fulfilled.

Meanwhile, learning motivation is very important to encourage students to engage in e-learning (Maldonado, Khan, Moon, & Rho, 2011). In addition, motivation is needed to provide enthusiasm and mental strength for students to manage their learning (Yilmaz, 2017). Readiness in using e-learning will be formed if students have a strong drive. They should also be supported by a high mental spirit (Yilmaz, 2017). Thus, technological competence and motivation are basic needs that must be improved to increase e-learning readiness so that student satisfaction, which is an indicator of e-learning success, will be fulfilled (Pereira, Ramos, Gouvêa, & Da Costa, 2015).

Researchers focus on technological competence and motivation as a shaper of student readiness and satisfaction in the e-learning mode. The results of this research are presented in the form of a comparative analysis of selected exogenous variables. A total of twelve relevant studies report the importance of success and failure factors in e-

learning implementation, as presented in Table 1. This comparison identifies the technological aspect as the main factor by virtue of it being the most reported. The motivation of students in learning ranks second in affecting the success or failure of e-learning. There are very strong reasons to improve technological competence and learning motivation in the e-learning mode among students, to make e-learning implementation successful in line with raising learning readiness and student satisfaction.

Table 1. Comparison between e-learning success and failure.

Source/ Result	1	2	3	4	5	6	7	8	9	10	11	12
Technological self-efficacy	√	√		√		√	√	√	√	√		√
Lack of technological competency				√		√	√		√	√		
Social interaction									√			√
Learning styles											√	
Student motivation roles	√	√	√		√							√
Lack of digital literacy				√		√			√			
Teaching quality											√	
Learning achievement								√			√	
Social environment								√				
Lack of family support							√					
Peer support								√				
Student satisfaction	√	√		√	√			√		√		√
Service quality	√	√	√						√		√	√
Completeness of infrastructure										√		
Lack of interaction								√	√			
Lack of resources				√						√	√	√
Self-regulated learning	√	√	√	√	√			√	√		√	
Participation level									√		√	

Note: 1= (Yilmaz, 2017); 2= (Topal, 2016); 3= (Maldonado et al., 2011); 4= (Al-araibi et al., 2019); 5= (Abou, Taj-Eddin, Seddiek, El-Khouly, & Nosseir, 2014); 6= (Alqahtani & Rajkhan, 2020); 7= (Putro, Pratama, Prasetyo, & Doewes, 2020); 8= (Nwagwu, 2020); 9= (Adams, Chuah, Sumintono, & Mohamed, 2022); 10= (Mabrur et al., 2021); 11= (Yavuzalp & Bahcivan, 2021); 12= (Pereira et al., 2015). (√) is success of e-learning and (X) is failure of e-learning.

Success of e-learning, as shown in previous studies, is influenced by several factors which include technological self-efficacy, social interactions, learning styles, student motivation roles, teaching quality, learning achievements, social environment, peer support, student satisfaction, service quality, completeness of infrastructure, self-regulated learning and participation levels. Meanwhile, the factors that influence failure in e-learning are lack of technological competency, digital literacy, family support, interactions and resources. The researcher analyzed the four variables of e-learning readiness, namely technological competencies as exogenous variables along with motivation, while learning readiness was measured by student satisfaction. Furthermore, the e-learning readiness variable is also used as a mediating variable for student satisfaction as shown in Table 1. The results prompted the study of these two variables to reveal their roles in increasing e-learning readiness and satisfaction among higher education students. These factors constitute the main recommendation for higher education institutions to increase readiness and satisfaction in implementing e-learning for their students; subsequently, the success of e-learning implementation will also increase. In addition, the study also tested e-learning readiness as a mediator of the influence of technological competence and student motivation on satisfaction. The selection of the e-learning readiness variable as a mediator was done on the basis that this variable is the main factor influencing the success and failure of e-learning implementation. In addition, e-learning readiness support as a good mediator in this study also considers the ideal frequency and relevance of articles that examine these variables. Figure 1 presents the conceptual framework of this research.

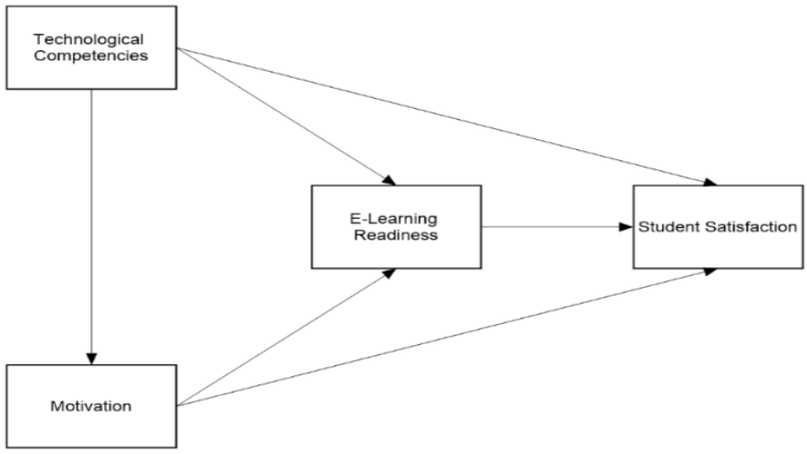

Figure 1. Conceptual model of antecedent factors of e-learning readiness and student satisfaction.

2. Literature Review and Hypotheses

2.1. Effects of Technological Competencies, Motivation and E-Learning Readiness on Student Satisfaction

One of the most important aspects to be considered in implementing e-learning in universities is student satisfaction as users of e-learning. Student satisfaction is one of the important indicators of the successful implementation of e-learning, so this is an important aspect that must be continuously improved (Almaiah, Al-Khasawneh, & Althunibat, 2020). Student satisfaction refers to the compatibility experienced between expectations and the realities of the learning process, both from a technical and non-technical perspective (Hai, 2022; Nurtanto, Sudira, Sofyan, Kholifah, & Triyanto, 2022). In this case, technological competence in e-learning operations is needed

to achieve successful implementation, marked by high student satisfaction in learning to use e-learning. Astuti, Arifin, Nurtanto, Mutohhari, and Warju (2022) and Pavlova (2009) identify five skills that are included in technological competence: technological awareness, technological literacy, technological capability, technological creativity and technological criticism. These five skills have become an important foundation for exploring the benefits of e-learning, in line with the results of several past studies showing that the development of digital technology competencies increases students' optimism and ability to manage e-learning (Al-araibi et al., 2019).

The results of other studies also confirm that the higher the level of competence in digital technology, the wider the perceived usefulness and benefits of e-learning (Al-Fraihat, Joy, Masa'deh, & Sinclair, 2020). In this context, students with strong digital technology competencies feel satisfied because they can learn effectively and efficiently to achieve their learning goals. Based on the above findings the first hypothesis of this study was formed.

H1: Digital technology competence has a significant effect on student satisfaction.

On the other hand, the higher the level of digital technology competence possessed by students, the stronger their learning motivation (Lin, Chen, & Liu, 2017). Day, Kelley, Browne, and Kohn (2020) revealed that students' drive to learn surfaces when they find they can go through the learning processes and achieve their goals. As reported by previous research, the maturity in technology competence is significant in influencing the strength of students' motivation to learn (Alphonce & Mwantimwa, 2019; Hava, 2021). Based on the above findings, the study forms the second hypothesis.

H2: Technological competence has a significant effect on motivation.

The importance of strengthening motivation is seen in the role it plays in increasing student satisfaction, leading to the successful implementation of e-learning (Yilmaz, 2017). In any condition, learning motivation is an aspect that must be developed first along with the competencies needed in learning (Pritchard, 2009). High learning motivation possessed by students supports the successful implementation of e-learning, as reported by several studies (Al-Fraihat, Masa'deh, & Sinclair, 2020; Silva, Mergulhão, Favoretto, & Mendes, 2019). In addition, recent research also reveals the significant role of motivation as an important foundation in the success of online learning outcomes during a pandemic (Almaiah, Al-Khasawneh, & Althunibat, 2020) as it enables an increase in student satisfaction. Thereby the study forms the third hypothesis.

H3: Motivation has a significant effect on student satisfaction.

Meanwhile, the aspect of e-learning readiness is still a trend in research today due to its importance in increasing the success of its implementation (Adams, Chuah, Sumintono, & Mohamed, 2022). Yilmaz (2017) identified that E-learning readiness includes computer self-efficacy, internet self-efficacy, online communication self-efficacy, self-directed learning and learner control. Self-efficacy in using computers and the internet, and communication supported by the ability to learn independently with independent control results in complete readiness to optimize the application of e-learning (Yilmaz, 2017). Optimal implementation of e-learning makes students highly satisfied because they feel ready to use it Topal (2016). Several past studies reveal e-learning readiness to be a significant factor in influencing student satisfaction (Yavuzalp & Bahcivan, 2021; Yilmaz, 2017). This leads to the fourth hypothesis.

H4: e-learning readiness has a significant effect on student satisfaction.

2.2. Technological Competencies and Motivation for E-Learning Readiness

Technological aspects, defined under five skill levels, have an important role in digital technology operational competence (Al-araibi, Mahrin, & Yusoff, 2019). During the COVID-19 pandemic, several research reports and review reports agreed on the problem of unpreparedness for e-learning due to a lack of competence in using digital technology to use e-learning systems (Almaiah et al., 2020; Helm, Huber, & Loisinger, 2021; Pokhrel & Chhetri, 2021; Toquero, 2020). The unpreparedness of the students was identified through their low media information, lack of familiarity with learning management systems, lack of understanding of the supporting equipment needed, limited accessibility and a crisis of attitudes and ethics in the use of digital technology (Astuti et al., 2022; Mutohhari, Sutiman, Nurtanto, Kholifah, & Samsudin, 2021; Sutiman, Sofyan, Soenarto, Mutohhari, & Nurtanto, 2022). In line with this, other studies also identified students' lack of experience in using technology and supporting equipment to support e-learning, thus requiring competency development in that direction (Daniel, 2020). The above results lead to the study's fifth hypothesis.

H5: Technological competence has a significant effect on e-learning readiness.

Therefore, under all learning conditions, especially in online learning or e-learning, universities must strengthen student motivation to encourage enthusiasm and mental strength in learning (Yilmaz, 2017). Learning motivation plays an important role in developing e-learning readiness in students (Gay, 2016). Maldonado et al. (2011) defined the motivation for e-learning in students as referring to the psychological drive that spurs students to be active in the electronic learning process. Motivation is needed to give students the enthusiasm and mental strength to learn to use computer media, the internet and related software (Yilmaz, 2017). Readiness to use e-learning will be formed if students have a strong drive supported by high spirits, as has been reported by Truzoli, Pirola, and Conte (2021); Yilmaz (2017) through their research. Based on these descriptions, the study proposes the sixth hypothesis.

H6: Motivation has a significant effect on e-learning readiness.

2.3. Mediating Role of E-Learning Readiness

Expert opinions strengthened by previous study results agree that student satisfaction is closely related to their readiness to carry out learning activities (Pritchard, 2009). In other words, important aspects that help develop student satisfaction have contributed to increasing student readiness in learning (Wang, Chen, Hu, & Lee, 2019). Aspects of digital technology competence that are reported to have a relationship with a form of readiness to use e-learning indirectly affect student satisfaction (Alqahtani & Rajkhan, 2020). As reported by previous research, the stronger the digital technology competence in students, the higher the satisfaction in the learning process because they have readiness and knowledge in the use of e-learning (Al-Fraihat, Joy, Masa'deh, & Sinclair, 2020; Cidral, Oliveira, Di Felice, & Aparicio, 2018). Thus, e-learning readiness is thought to be a mediator in the indirect effect of technological competence on student satisfaction, thus leading to the seventh hypothesis.

H7: Technological competence has an indirect but significant effect on student satisfaction through the mediating role of e-learning readiness.

In line with this, the motivational aspect which is the foundation of online learning, is seen to indirectly raise student satisfaction in learning (Damaris, Surip, & Setyadi, 2019; Wang, Han, Gao, & Liu, 2021). Student satisfaction due to strong online learning motivation is seen to increase e-learning readiness (Puška, Puška, Dragić, Maksimović, & Osmanović, 2021; Yilmaz, 2017). Past reports reveal that high motivation in using e-learning systems increases students' readiness to implement the system and further increases their satisfaction (Cidral, Oliveira, Di Felice, & Aparicio, 2018). Other studies also report that student satisfaction during online learning is formed because of their readiness to learn as a result of their high motivation (Pereira, Ramos, Gouvêa, & Da Costa, 2015). Thus, e-learning readiness is thought to be a mediator of the indirect effect of motivation on student satisfaction, thus leading to the eighth hypothesis.

H8: Motivation has a significant indirect effect on student satisfaction through the mediating role of e-learning readiness.

3. Methodology

3.1. Research Design

The study involved university student respondents in Indonesia who had adopted e-learning during the COVID-19 pandemic. The study used an adapted ex-post facto design (Cohen, Lawrence, & Keith, 2011). The study used a quantitative data approach with the collected data analyzed using structural equation modeling (SEM) techniques to measure the effects of the independent and dependent variables, either without a mediator or with a mediator which received strong support from the existing theory. Data on all variables were collected through a questionnaire distributed online using a university academic monitoring and evaluation system. The study was carried out simultaneously during the monitoring and evaluation period between March and May 2021.

3.2. Participants

Participants in undergraduate tertiary institutions were selected to respond to the distributed instrument. The selected college is situated in the Province of Yogyakarta, Indonesia. The students selected as participants were in their 2nd to 10th semesters, who had undergone full e-learning during the COVID-19 pandemic. This selection was done on the premise that this particular cohort of students had the longest experience in e-learning. The aim was to gather the most appropriate responses and information based on the context of the study.

Table 2. Demography of participants.

Dimensions	Category	Frequency	Percentage
Gender	Male	616	56.46%
	Female	480	43.54%
Study period	2– 4 semesters	470	42.59%
	5 – 6 semesters	416	37.45%
	7 – 8 semesters	184	15.40%
	9 – 10 semesters	70	4.56%
Expertise	Tourism	345	30.70%
	IT	370	33.08%
	Technology and Engineering	381	36.22%
E-learning intensity	8 – 12 hours	139	13.21%
	13 – 17 hours	166	15.78%
	18 – 22 hours	319	30.22%
	23 – 27 hours	528	50.19%

The same response reduction strategy was used to anticipate invalid answers deviating from the context in accordance with the existing criteria. To ensure participant diversity in filling out the questionnaire, the researcher eliminated 56 invalid responses, including a questionnaire with the same answers for all items and a questionnaire completed in less than 30 seconds. The final sample consisted of 1228 students, representing a 95% response rate. Demographic statistics of participants in this study are presented in Table 2. The demographic data of participants show gender, age range, subject majors, and the frequency of e-learning every week.

3.3. Data Collection and Measurement

Data collection was carried out through a monitoring and evaluation system (e-monev) at each university between March and June 2022 to ensure that students had undergone e-learning for at least 36 hours during lessons. To obtain data from the complete sample, the e-monev system was integrated into the academic information system (AIS). Consequently, to access study results in the system, students were required to first fill out an e-learning readiness questionnaire. Before they did so, socialization and briefing activities were carried out on the aspects that had to be filled in, making it possible to obtain rational data. All variables were measured by an e-monev questionnaire through participants' responses to the items on a five-point Likert-type scale ranging from "strongly disagree" to "strongly agree". The survey items were mostly adapted from scales developed and validated by previous studies, to ensure instrument validation. The *technological competencies* questionnaire was prepared based on the development of indicators from Astuti, Arifin, Nurtanto, Mutohhari, & Warju (2022) and Pavlova (2009) which consisted of five statement items. These were: "I have awareness of digital technology", "I have digital technology literacy", "I have capability in using digital technology", "I have creativity in using digital technology" and "I am critical in choosing digital technology according to learning needs". *Motivation* was measured based on five statement items adopted from Yilmaz (2017), which included: "I am able to concentrate on learning even though there are distractions", "I am motivated to learn new things and challenges in supporting learning achievement", "I am enthusiastic and ready to solve learning problems through e-learning", "I am encouraged to always complete learning assignments" and "I am ready to learn to explore various learning resources in e-learning". *E-learning readiness* adopted the readiness scale from Adams, Chuah, Sumintono, & Mohamed (2022) and Yilmaz (2017) which consisted of the following seven

statement items: "I have self-efficacy to be able to use information and communication technology (ICT)", "I have self-efficacy to organize and learn using the internet", "I have the confidence to be able to communicate effectively using the internet and ICT networks", "I have the ability to control and explore the content of e-learning", "I am motivated to actively learn electronically using devices and networks digitally" and "I am ready to achieve learning outcomes in e-learning". Finally, the *user satisfaction* instrument was developed based on (Yilmaz, 2017), consisting of six statement items, including: "I am satisfied with the teaching and learning process and activities during e-learning", "I am satisfied with the academic guidance service for complaints experienced in the learning process", "I am satisfied with the lecture administration services that can be done easily", "I am satisfied with the convenience provided by the system in providing various aspects of learning support", "I am satisfied with the lecture services in helping to solve learning problems" and "I am satisfied with the attitude of officers in serving students during online learning.

3.4. Validity and Reliability Instruments

Validity and reliability were first measured as absolute criteria before data collection. The level of validity was measured using the Confirmatory Factor Analysis (CFA) method and the level of reliability using Cronbach alpha with the help of the SmartPLS 3.0 application. CFA serves to test and analyze existing hypothetical relationships between indicators and their latent variables (Hair, Black, Babin, & Anderson, 2010). The validity test results showed that all indicators on all research variables had a loading factor value that exceeded 0.700, so none of the indicators of all variables was aborted. All indicators on all instruments met the criteria for validity and were ready to be used for the research (Johnson & Wichern, 2007). The following Table 3 presents the results in detail. Likewise, as seen in Table 4, the reliability test shows numbers with very high criteria value on all instruments (Reid, 2014). This shows that the instrument had a good level of consistency for collecting data on each variable.

Table 3. Validity instrument.

Variables	Indicator	Outer Weight	Outer Loading	Decision
Technological competencies	TC1	0.227	0.864	Valid
	TC2	0.220	0.883	Valid
	TC3	0.219	0.885	Valid
	TC4	0.239	0.826	Valid
	TC5	0.251	0.870	Valid
Student satisfaction	SS1	0.196	0.815	Valid
	SS2	0.217	0.854	Valid
	SS3	0.202	0.827	Valid
	SS4	0.212	0.843	Valid
	SS5	0.202	0.809	Valid
	SS6	0.196	0.746	Valid
Motivation	M1	0.233	0.778	Valid
	M2	0.252	0.833	Valid
	M3	0.232	0.751	Valid
	M4	0.260	0.861	Valid
	M5	0.260	0.809	Valid
E-Learning Readiness	ELR1	0.259	0.907	Valid
	ELR2	0.256	0.929	Valid
	ELR3	0.242	0.911	Valid
	ELR4	0.165	0.824	Valid
	ELR5	0.204	0.838	Valid

Table 4. Reliability for each construct (n=1228).

Variable	α	rho_A	Composite	AVE	Decision
Technological competencies	0.917	0.918	0.937	0.750	Reliable
User satisfaction	0.899	0.901	0.923	0.666	Reliable
Motivation	0.866	0.868	0.903	0.652	Reliable
E-learning readiness	0.929	0.946	0.946	0.779	Reliable

3.5. Data Analysis

Structural Equation Modeling (SEM) analysis was used to test the hypotheses on the influence between variables through path analysis and bootstrap methods. Path analysis measures the direct effect of exogenous variables on endogenous variables, while the bootstrap method is used to measure the role of e-learning readiness in mediating the indirect effect of technological competence and motivation on student satisfaction. Bootstrap is considered to be the method that is the most reasonable and can obtain confidence limits for certain indirect effects in most conditions (Preacher & Hayes, 2008). Analysis of data in this study used the support software SmartPLS 3.0. The research hypotheses were formulated based on relevant theoretical support related to the line of influence of exogenous variables on endogenous variables directly or by using mediation, as stated in the literature review.

4. Findings

4.1. Model Fit Test

The model's fit was tested to measure the degree of suitability of the designed structural model. The overall fit index of the research model is presented (as the main model) in Table 5. As presented, all the overall fit indices of the main model show good results. The chi-square value obtained is a relatively small critical number. The probability obtained is a number that shows a high significance (> 0.050). Goodness of Fit Index (GFI 0.90) as a descriptive measure of model suitability (Jöreskog & Sörbom, 1982), Adjusted GFI (AGFI), which is the Adjusted GFI value (≥0.90), Comparative Fit Index (CFI), which is a measure of the suitability of the comparative-based model with the

null model (≥0.90), Normed Fit Index (NFI) to ensure a perfect fit model with a cut off value constraint (≥0.90) Bentler & Bonett (1980), Standardized Root Mean Square Residual (SRMR) as a measure of absolute fit and standard differences between observed and predicted correlations (<0.05), and Root Mean Square Error of Approximation (RMSEA<0.08) as the approximation value of the mean square root of the error (Bentler, 1990; Maydeu-Olivares, Shi, & Rosseel, 2018; Tucker & Lewis, 1973). Based on these results, it can be concluded that the fit model is based on the acquisition of values included in the goodness of fit category so that structural model analysis can be carried out (Johnson & Wichern, 2007). The structural analysis model used is presented in Figure 2. SEM analysis uses two methods, namely path analysis, to determine the direct effect of exogenous variables on endogenous variables and the bootstrap method to test the role of the mediator variable.

Table 5. Model fit test result of the instrument.

Goodness of fit indices	Saturated	Estimated	Desired levels
Chi-square	22.501	22.501	Small
Probability	0.348	0.348	>0.50
GFI	0.901	0.901	≥0.90
AGFI	0.922	0.922	≥0.90
CFI	0.901	0.901	≥0.90
NFI	0.903	0.903	≥0.90
SRMR	0.028	0.028	<0.05
RMSEA	0.077	0.077	<0.08

4.2. Direct Effect Test

Testing the first to sixth hypotheses was based on the coefficients of the path analysis results. The test results are seen in the original sample value where the T statistics and p-value indicate a significance level of 5%. In addition, the confidence intervals obtained in this analysis are at 97.5% with an error rate of 2.5%. Hypothesis testing was conducted to determine the direct effect of technological competence and motivation on student satisfaction, the direct effect of technological competence on motivation, the direct effect of technological competence and motivation on e-learning readiness and the direct influence of e-learning readiness on student satisfaction. Table 6 and Figure 2 present the results of hypothesis testing using path analysis with the help of SmartPLS 3.0. Technological competence affects student satisfaction with an estimated value of 0.370 and a significance of 0.000, so H1 is supported. Technological competence also affects motivation with an estimated value of 0.621 and a significance of 0.000, so it supports H2. Motivation affects student satisfaction with an estimated value of 0.494 and a significance of 0.000, thus supporting H3. E-learning readiness affects student satisfaction with an estimated value of 0.096 and a significance of 0.000, so H4 is supported. The estimated value of 0.110 and a significance of 0.000 were obtained on the effect of technological competence on e-learning readiness, supporting H5. Motivation affects e-learning readiness with an estimated value of 0.619 and a significance of 0.000, thus supporting H6.

Table 6. Path analysis test results.

Path	Estimate	t value	SE	p
E-Learning Readiness → Student Satisfaction	0.096	4.092	-0.001	0.000
Motivation → E-Learning Readiness	0.619	15.938	-0.002	0.000
Motivation → Student Satisfaction	0.494	14.345	0.001	0.000
Technological Competencies → E-Learning Readiness	0.110	2.530	0.002	0.000
Technological Competencies → Motivation	0.621	25.444	0.001	0.000
Technological Competencies → Student Satisfaction	0.370	11.899	0.000	0.000

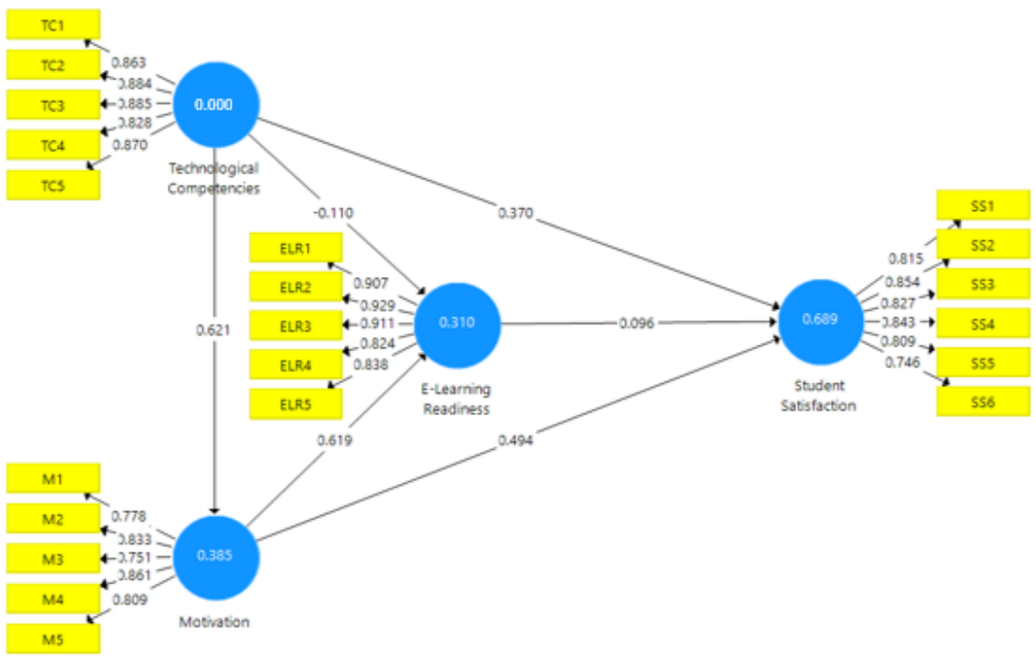

Figure 2. Path model analysis results.

Technological Competencies are exogenous variables as well as predictors of motivation, e-learning readiness and student satisfaction variables. So, in the calculation of the SEM analysis of this variable, the value of the R coefficient is not calculated because it acts only as an initial predictor (not influenced by any variables).

4.3. Mediating Roles of E-Learning Readiness

The mediation effect presents the results of measuring the significance of e-learning readiness as a mediator for the indirect effect of technological competence and motivation on student satisfaction. Measurements were done using the bootstrap method with a confidence interval of 97.5%. This method was used considering the high level of power and confidence in explaining the mediating role of e-learning readiness to obtain the ideal confidence limit in most conditions (Preacher & Hayes, 2008). Table 7 shows the level of the role of e-learning readiness in mediating the indirect effect of technology skills on student satisfaction. The indirect effect of technology skills on student satisfaction through the mediation of e-learning readiness obtained an estimated value of 0.111 with a significance value of 0.000. Thus, it can be concluded that technology skills indirectly but significantly affect student satisfaction by mediating e-learning readiness, so H7 is supported. Furthermore, in Table 8, the same role is shown by the readiness of e-learning in mediating the indirect effect of motivation on student satisfaction with an estimated gain of 0.060 and a significance of 0.000; H8 is thus supported.

Table 7. Mediation effect of e-learning readiness between technological competencies and student satisfaction.

Measurement path	SS		ELR		Estimate	*p*	Bootstrapping 97.5% CI	
	Estimate	S.E.	Estimate	S.E.			Lower limit	Upper limit
TC	0.498	0.023	0.129	0.021				
SS			0.118	0.064				
F^2	0.689		0.268					
Indirect effect					0.111	0.000	0.092	0.131
Direct effect					0.370	0.000	0.298	0.512
Total effect					0.481	0.000	0.409	0.529

Note: TC = Technological competencies; ELR = E-learning readiness; SS = Student satisfaction.

Table 8. Mediation effect of e-learning readiness between motivation and student satisfaction.

Measurement path	SS		ELR		Estimate	*p*	Bootstrapping 97.5% CI	
	Estimate	S.E.	Estimate	S.E.			Lower limit	Upper limit
M	0.586	0.019	0.098	0.034				
SS			0.206	0.027				
F^2	0.341		0.361					
Indirect effect					0.060	0.000	0.048	0.104
Direct effect					0.494	0.000	0.387	0.601
Total effect					0.554	0.000	0.453	0.576

Note: M = Motivation; ELR = E-learning readiness; SS = Student satisfaction.

5. Discussion

The decline in learning achievements during the COVID-19 pandemic paved the way for higher education to develop effective and efficient learning methods (Sia & Abbas, 2021). Universities realize the importance of student satisfaction which is one of the main indicators of learning success (Santini, Ladeira, Sampaio, & Da Silva Costa, 2017). In addition, e-learning readiness is increasingly focused on being improved as a provision in implementing e-learning effectively and efficiently so that learning outcomes enjoy greater success (Adams et al., 2022; Cevik & Bakioğlu, 2022). This study proves the significant influence of technological competence, motivation and e-learning readiness on student satisfaction. In addition, e-learning readiness also proves to be a mediator capable of significantly mediating technological competence and motivation and influencing student satisfaction. These results imply that the strengthening of digital technology competence in students is needed to improve their capabilities in implementing e-learning as this helps to raise their satisfaction levels as learning management system (LMS) users (Widyanti, Hasudungan, & Park, 2020; Yilmaz, 2017). In e-learning, technological competence is needed to support the accessibility and use of digital technology equipment (Kholifah, Sofyan, Pardjono, Sudira, & Nurtanto, 2021; Reisoğlu, 2021). These results are consistent with previous research findings, which prove that digital technology skills are very effective in supporting e-learning because they can increase their capabilities in the aspects needed (Betancourt-Odio, Sartor-Harada, Ulloa-Guerra, & Azevedo-Gomes, 2021; Martzoukou, Fulton, Kostagiolas, & Lavranos, 2020). In addition, other studies also confirm that user satisfaction is a measure of increasing technological competence because, indirectly, the success of e-learning implementation also increases (Al-Fraihat, Joy, Masa'edah, & Sinclair, 2020). This is an important signal to strengthen digital technology competence as a supporter in increasing student satisfaction which is one of the benchmarks of learning success.

This study also proves the significant influence of technological competence and motivation on e-learning readiness. These results indicate that students need a balance of skills development and motivation to form e-learning readiness (Yilmaz, 2017). On the other hand, motivation to use e-learning will also increase when students have technological competence (Ferrer, Ringer, Saville, Parris, & Kashi, 2022), as has been proven in this study; technological competence has a significant influence on motivation. These results are consistent with previous research, which also revealed the effects of digital technology competence in stimulating student learning motivation during the COVID-19 pandemic (He, Huang, Yu, & Li, 2021; Juan-Lázaro & Area-Moreira, 2021). The results of this study are also supported by the research conducted by Peters, Calvo, and Ryan (2018) which supports the importance of strengthening student capabilities in using devices and accessing digital platforms that support e-learning. In addition, other studies also confirm that strengthening skills in students indirectly fosters learning motivation because they feel confident about managing the e-learning mode (Abou et al., 2014).

Finally, this study also tested the significance of e-learning readiness in mediating the indirect effect of technological competence and motivation in influencing student satisfaction. The significance of this influence is

motivated by the need for the main aspect of student satisfaction, namely the formation of learning readiness in them (Leong, Goh, Ismail, Tan, & Ong, 2020). In the e-learning mode, readiness in its implementation must be strong so that readiness for success will be high and student satisfaction will also increase (Alqahtani & Rajkhan, 2020). Readiness to use e-learning certainly requires digital technology competence supported by a strong drive in students (Widyanti, Hasudungan, & Park, 2020). Past research has revealed a lot about the importance of digital technology training for students as the main effort to increase e-learning readiness and student satisfaction (Al-Fraihat et al., 2020; Pham, Limbu, Bui, Nguyen, & Pham, 2019). In addition, other relevant research also state that in online learning, students need to strengthen their learning motivation to increase e-learning readiness to ultimately increase their satisfaction in learning (Abou et al., 2014; Yilmaz, 2017). Thus, student e-learning readiness which is formed based on the above aspects certainly increases student satisfaction, as explained by past research.

6. Conclusion and Recommendation

The structural model in this study proves a significant determination of the influence of technological competence, motivation and e-learning readiness on college student satisfaction. In line with this, the model in this study also proves that e-learning readiness can be a significant factor in mediating the effects of technological skills and motivation on user satisfaction. The findings of this study indicate the importance of strengthening digital technology skills balanced with the strengthening of motivation before using e-learning. On the other hand, the readiness for e-learning in students is the main reason for increased student satisfaction, so this aspect is very important in higher education. This research is limited to the variables of technological competence, motivation and e-learning readiness as predictors of student satisfaction in e-learning. In addition, this study also has limitations in data collection. In particular, the data collection period was quite long, from March to June 2021, so there may be differences in the levels of student satisfaction in using e-learning. We recommend further research to uncover various other important factors to raise student satisfaction in using e-learning. We also invite universities to strengthen digital technology skills balanced with strengthening motivation and the formation of e-learning readiness so that student satisfaction will align with the increase.

References

Abou, E.-S. M. S., Taj-Eddin, I. A., Seddiek, N., El-Khouly, M. M., & Nosseir, A. (2014). E-learning and students' motivation: A research study on the effect of e-learning on higher education. *International Journal of Emerging Technologies in Learning (iJET), 9*(4), 20-26.Available at: https://doi.org/10.3991/ijet.v9i4.3465.

Adams, D., Chuah, K. M., Sumintono, B., & Mohamed, A. (2022). Students' readiness for e-learning during the COVID-19 pandemic in a South-East Asian university: A Rasch analysis. *Asian Education and Development Studies, 11*(2), 324–339.Available at: https://doi.org/10.1108/aeds-05-2020-0100.

Al-araibi, A. A. M., Mahrin, M. N. B., & Yusoff, R. C. M. (2019). Technological aspect factors of E-learning readiness in higher education institutions: Delphi technique. *Education and Information Technologies, 24*(1), 567–590.Available at: https://doi.org/10.1007/s10639-018-9780-9.

Al-Fraihat, D., Joy, M., Masa'deh, R., & Sinclair, J. (2020). Evaluating E-learning systems success: An empirical study. *Computers in Human Behavior, 102*(1), 67–86.Available at: https://doi.org/10.1016/j.chb.2019.08.004.

Almaiah, M. A., Al-Khasawneh, A., & Althunibat, A. (2020). Exploring the critical challenges and factors influencing the E-learning system usage during COVID-19 pandemic. *Education and Information Technologies, 25*(6), 5261–5280.Available at: https://doi.org/10.1007/s10639-020-10219-y.

Alphonce, S., & Mwantimwa, K. (2019). Students' use of digital learning resources: Diversity, motivations and challenges. *Information and Learning Science, 120*(11–12), 758–772.Available at: https://doi.org/10.1108/ils-06-2019-0048.

Alqahtani, A. Y., & Rajkhan, A. A. (2020). E-learning critical success factors during the covid-19 pandemic: A comprehensive analysis of e-learning managerial perspectives. *Education Sciences, 10*(9), 1–16.Available at: https://doi.org/10.3390/educsci10090216.

Arifin, Z., Nurtanto, M., Warju, W., Rabiman, R., & Kholifah, N. (2020). The tawock conceptual model at content knowledge for professional teaching in vocational education. *International Journal of Evaluation and Research in Education, 9*(3), 697–703.Available at: https://doi.org/10.11591/ijere.v9i3.20561.

Astuti, M., Arifin, Z., Nurtanto, M., Mutohhari, F., & Warju, W. (2022). The maturity levels of the digital technology competence in vocational education. *International Journal of Evaluation and Research in Education, 11*(2), 596-603.Available at: https://doi.org/10.11591/ijere.v11i2.22258.

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin, 107*(2), 238–246. https://doi.org/10.1037/0033-2909.107.2.238

Bentler, P. M., & Bonett, D. G. (1980). Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin, 88*(3), 588–606. https://doi.org/10.1037/0033-2909.88.3.588

Betancourt-Odio, M. A., Sartor-Harada, A., Ulloa-Guerra, O., & Azevedo-Gomes, J. (2021). Self-perceptions on digital competences for m-learning and education sustainability: A study with teachers from different countries. *Sustainability, 13*(1), 1-12.Available at: https://doi.org/10.3390/su13010343.

Butola, L. K. (2021). E-learning-a new trend of learning in 21st century during COVID-19 pandemic. *Indian Journal of Forensic Medicine and Toxicology, 15*(1), 422–426.Available at: https://doi.org/10.37506/ijfmt.v15i1.13443.

Cevik, M., & Bakioğlu, B. (2022). Investigating students' E-Learning attitudes in times of crisis (COVID-19 pandemic). *Education and Information Technologies, 27*(1), 65-87.Available at: https://doi.org/10.1007/s10639-021-10591-3.

Cidral, W. A., Oliveira, T., Di Felice, M., & Aparicio, M. (2018). E-learning success determinants: Brazilian empirical study. *Computers and Education, 122*(1), 273–290.Available at: https://doi.org/10.1016/j.compedu.2017.12.001.

Cohen, L., Lawrence, M., & Keith, M. (2011). *Research methods in education.* London: Routledge.

Coşkun, Ö., Özeke, V., Budakoğlu, I., & Kula, S. (2018). E-learning readiness of Turkish medical students: A sample from Gazi University. *Gazi Medical Journal, 29*(4), 340–345.Available at: https://doi.org/10.12996/gmj.2018.91.

Damaris, A., Surip, N., & Setyadi, A. (2019). Analysis service on student satisfaction with motivation as moderating variable. *International Journal of Economics & Business Administration, 7*(2), 118-130.Available at: https://doi.org/10.35808/ijeba/220.

Daniel, S. J. (2020). Education and the COVID-19 pandemic. *Perspectivas, 49*(1-2), 91-96.Available at: https://doi.org/10.1007/s11125-020-09464-3.

Day, M. C., Kelley, H. M., Browne, B. L., & Kohn, S. J. (2020). Assessing motivation and learning strategy usage by dually enrolled students. *Smart Learning Environments, 7*(1), 1-19.Available at: https://doi.org/10.1186/s40561-020-00131-w.

Dziuban, C., Moskal, P., Brophy, J., & Shea, P. (2019). Student satisfaction with asynchronous learning. *Online Learning Journal, 11*(1), 87–95.Available at: https://doi.org/10.24059/olj.v11i1.1739.

Elkaseh, A., Wong, K. W., & Fung, C. C. (2015). A review of the critical success factors of implementing E-learning in higher education. *International Journal of Technologies in Learning, 22*(2), 1–13.Available at: https://doi.org/10.18848/2327-0144/cgp/v22i02/49160.

Ferrer, J., Ringer, A., Saville, K., Parris, M. A., & Kashi, K. (2022). Students' motivation and engagement in higher education: The importance of attitude to online learning. *Higher Education, 83*(2), 317-339.Available at: https://doi.org/10.1007/s10734-020-00657-5.

Gay, G. H. (2016). An assessment of online instructor e-learning readiness before, during, and after course delivery. *Journal of Computing in Higher Education, 28*(2), 199-220.Available at: https://doi.org/10.1007/s12528-016-9115-z.

Hai, N. C. (2022). Factors affecting student satisfaction with higher education service quality in Vietnam. *European Journal of Educational Research, 11*(1), 339-351.Available at: https://doi.org/10.12973/eu-jer.11.1.339.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis: A global perspective* (7th.). Pearson Prentice Hall.

Hamid, M. A., Aditama, D., Permata, E., Kholifah, N., Nurtanto, M., & Majid, N. W. A. (2022). Simulating the Covid-19 Epidemic Event and its Prevention Measures using Python Programming. *Indonesian Journal of Electrical Engineering and Computer Science, 26*(1), 278–288. https://doi.org/10.11591/ijeecs.v26.i1.pp278-288

Hava, K. (2021). Exploring the role of digital storytelling in student motivation and satisfaction in EFL education. *Computer Assisted Language Learning, 34*(7), 958-978.Available at: https://doi.org/10.1080/09588221.2019.1650071.

He, T., Huang, Q., Yu, X., & Li, S. (2021). Exploring students' digital informal learning: The roles of digital competence and DTPB factors. *Behaviour & Information Technology, 40*(13), 1406-1416.Available at: https://doi.org/10.1080/0144929x.2020.1752800.

Helm, C., Huber, S., & Loisinger, T. (2021). What do we know about school teaching-learning processes in distance learning during the corona pandemic? - Evidence from Germany, Austria and Switzerland. *Journal of Education, 24*(2), 237-311.

Holmes, B., & Gardner, J. (2006). *E-Learning: Concepts and practice* (1st ed.). California: Sage Publications Ltd.

Jawad, Y. A. L. A., & Shalash, B. (2020). The impact of e-learning strategy on students' academic achievement case study: Al-quds open university. *International Journal of Higher Education, 9*(6), 44-53.Available at: https://doi.org/10.5430/ijhe.v9n6p44.

Johnson, R. A., & Wichern, D. W. (2007). *Applied multivariate statistical analysis* (6th ed.). USA: Pearson Education, Inc.

Jöreskog, K. G., & Sörbom, D. (1982). Recent Developments in Structural Equation Modeling. *Journal of Marketing Research, 19*(4), 404–416. https://doi.org/10.1177/002224378201900402

Juan-Lázaro, O., & Area-Moreira, M. (2021). Thin layer gamification in e-learning: Evidence on motivation and self-regulation. *Pixel-Bit, Media and Education Magazine, 62*, 146–181.Available at: https://doi.org/10.12795/pixelbit.82427.

Kholifah, N., Sofyan, H., Pardjono, P., Sudira, P., & Nurtanto, M. (2021). Explicating the experience of beginner vocational teachers. *TEM Journal, 10*(2), 719–723.Available at: https://doi.org/10.18421/TEM102-28.

Leong, C. M., Goh, C. F., Ismail, F., Tan, O. K., & Ong, C. H. (2020). E-learning satisfaction: Investigating gender differences. *International Journal of Electronic Commerce Studies, 12*(1), 1–28.Available at: https://doi.org/10.7903/IJECS.1774.

Lin, M. H., Chen, H. C., & Liu, K. S. (2017). A study of the effects of digital learning on learning motivation and learning outcome. *Eurasia Journal of Mathematics, Science and Technology Education, 13*(7), 3553–3564.Available at: https://doi.org/10.12973/eurasia.2017.00744a.

Mabrur, I. A. M., Suwartono, T., & Lutfiana. (2021). Junior high school students' readiness to participate in e-learning and online EFL classes during the COVID-19 pandemic. *International Social Science Journal, 71*(241-242), 153-161.Available at: https://doi.org/10.1111/issj.12271.

Majid, N. W. A., Fuada, S., Fajri, M. K., Nurtanto, M., & Akbar, R. (2020). Progress report of cyber society v1.0 development as a learning media for Indonesian society to support EFA. *International Journal of Engineering Pedagogy, 10*(4), 133–145.Available at: https://doi.org/10.3991/ijep.v10i4.13085.

Maldonado, U. P. T., Khan, G. F., Moon, J., & Rho, J. J. (2011). E-learning motivation and educational portal acceptance in developing countries. *Online Information Review, 35*(1), 66-85.Available at: https://doi.org/10.1108/14684521111113597.

Martzoukou, K., Fulton, C., Kostagiolas, P., & Lavranos, C. (2020). A study of higher education students' self-perceived digital competences for learning and everyday life online participation. *Journal of Documentation, 76*(6), 1413-1458.Available at: https://doi.org/10.1108/jd-03-2020-0041.

Maydeu-Olivares, A., Shi, D., & Rosseel, Y. (2018). Assessing Fit in Structural Equation Models: A Monte-Carlo Evaluation of RMSEA Versus SRMR Confidence Intervals and Tests of Close Fit. *Structural Equation Modeling, 25*(3), 389–402. https://doi.org/10.1080/10705511.2017.1389611

Mishra, S. (2007). E-learning in the 21st century ? By D R Garrison & Terry Anderson. *British Journal of Educational Technology, 38*(4), 755-757.Available at: https://doi.org/10.1111/j.1467-8535.2007.00733_2.x.

Mutohhari, F., Sutiman, S., Nurtanto, M., Kholifah, N., & Samsudin, A. (2021). Difficulties in implementing 21st century skills competence in vocational education learning. *International Journal of Evaluation and Research in Education, 10*(4), 1229-1236.Available at: https://doi.org/10.11591/ijere.v10i4.22028.

Nurtanto, M., Sudira, P., Sofyan, H., Kholifah, N., & Triyanto, T. (2022). Professional identity of vocational teachers in the 21 st century in Indonesia. *Journal of Engineering Education Transformations, 35*(3), 30–36.Available at: https://doi.org/10.16920/jeet/2022/v35i3/22085.

Nurtanto, M., Widjanarko, D., Sofyan, H., Rabiman, R., & Triyono, M. (2019). Learning by creating: Transforming automotive electrical textual material into visual animation as a creative learning products (clp). *International Journal of Scientific & Technology Research, 8*(10), 1634-1642.

Nwagwu, W. E. (2020). E-learning readiness of universities in Nigeria-what are the opinions of the academic staff of Nigeria's premier university? *Education and Information Technologies, 25*(2), 1343-1370.Available at: https://doi.org/10.1007/s10639-019-10026-0.

Oketch, H., Njihia, J., & Wausi, A. (2014). E-Learning readiness assessment model in Kenyas' higher education institutions: A case study of university of Nairobi. *International Journal of Scientific Knowledge, 5*(6), 29–41.

Osman, M. E. (2020). Global impact of COVID-19 on education systems: The emergency remote teaching at Sultan Qaboos University. *Journal of Education for Teaching, 46*(4), 463-471.Available at: https://doi.org/10.1080/02607476.2020.1802583.

Pavlova, M. (2009). *Technology and vocational education for sustainable development.* Queensland: Springer Dordrecht.

Pereira, F. A. D. M., Ramos, A. S. M., Gouvêa, M. A., & Da Costa, M. F. (2015). Satisfaction and continuous use intention of e-learning service in Brazilian public organizations. *Computers in Human Behavior, 46*(1), 139–148.Available at: https://doi.org/10.1016/j.chb.2015.01.016.

Peters, D., Calvo, R. A., & Ryan, R. (2018). Designing for motivation, engagement and wellbeing in digital experience. *Frontiers in Psychology, 9*, 1-15.Available at: https://doi.org/10.3389/fpsyg.2018.00797.

Pham, L., Limbu, Y. B., Bui, T. K., Nguyen, H. T., & Pham, H. T. (2019). Does e-learning service quality influence e-learning student satisfaction and loyalty? Evidence from Vietnam. *International Journal of Educational Technology in Higher Education, 16*(1), 1-26.Available at: https://doi.org/10.1186/s41239-019-0136-3.

Pokhrel, S., & Chhetri, R. (2021). A literature review on impact of COVID-19 pandemic on teaching and learning. *Higher Education for the Future, 8*(1), 133–141.Available at: https://doi.org/10.1177/2347631120983481.

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40*(3), 879-891.Available at: https://doi.org/10.3758/brm.40.3.879.

Pritchard, A. (2009). *Ways of learning: Learning theories and learning styles in the classroom* (2nd ed.). London: Routledge.

Puška, A., Puška, E., Dragić, L., Maksimović, A., & Osmanović, N. (2021). Students' satisfaction with E-learning platforms in Bosnia and Herzegovina. *Technology, Knowledge and Learning, 26*(1), 173-191.Available at: https://doi.org/10.1007/s10758-020-09446-6.

Putro, B. N., Pratama, H. G., Prasetyo, W., & Doewes, R. I. (2020). E-learning implementation in physical education department in higher education during COVID-19 pandemic. *Information Technology, Education and Society, 17*(2), 67-80.Available at: https://doi.org/10.7459/ites/17.2.05.

Reid, H. M. (2014). *Introduction to statistics: Fundamental concepts and procedures of data analysis.* USA: Sage Publications, Inc.

Reisoğlu, İ. (2021). How does digital competence training affect teachers' professional development and activities? *Technology, Knowledge and Learning, 4*(2), 1–14.Available at: https://doi.org/10.1007/s10758-021-09501-w.

Santini, F. D. O., Ladeira, W. J., Sampaio, C. H., & Da Silva Costa, G. (2017). Student satisfaction in higher education: A meta-analytic study. *Journal of Marketing for Higher Education, 27*(1), 1–18.Available at: https://doi.org/10.1080/08841241.2017.1311980.

Saripudin, S., Sumarto, S., Juanda, E. A., Abdullah, A. G., & Ana, A. (2020). Vocational school teachers' perceptions of e-learning during covid-19. *Journal of Engineering Education Transformations, 34*, 7–13.Available at: https://doi.org/10.16920/jeet/2020/v34i0/157844.

Scott, K., Morris, A., & Marais, B. (2018). Medical student use of digital learning resources. *The Clinical Teacher, 15*(1), 29-33.Available at: https://doi.org/10.1111/tct.12630.

Shah, R. K., & Barkas, L. A. (2018). Analysing the impact of e-learning technology on students' engagement, attendance and performance. *Research in Learning Technology, 26*(1), 1–18.Available at: https://doi.org/10.25304/rlt.v26.2070.

Shrivastava, S. R., & Shrivastava, P. S. (2020). Assessing the impact of e-learning in medical education. *International Journal of Academic Medicine, 6*(1), 40.Available at: https://doi.org/10.4103/ijam.ijam_5_19.

Sia, J. K. M., & Abbas, A. A. (2021). Facing the unknown: Pandemic and higher education in Malaysia. *Asian Education and Development Studies, 10*(2), 263–275.Available at: https://doi.org/10.1108/aeds-05-2020-0114.

Silva, B. B., Mergulhão, R. C., Favoretto, C., & Mendes, G. H. S. (2019). Critical success factors of Six Sigma implementations in companies in Brazil. *International Journal of Lean Six Sigma, 10*(1), 143–160.Available at: https://doi.org/10.1108/ijlss-01-2018-0008.

Soler, J. F., & Blazquez-Parra, E. B. (2022). A correlation analysis of education for sustainable development in pre and post COVID scenarios. *International Journal of Education and Practice, 10*(1), 1–10.Available at: https://doi.org/10.18488/61.v10i1.2271.

Stuchlikova, L. (2016). *Challenges of education in the 21st century*. Paper presented at the ICETA 2016 - 14th IEEE International Conference on Emerging ELearning Technologies and Applications, Proceedings, 335–340.

Sutiman, S., Sofyan, H., Soenarto, S., Mutohhari, F., & Nurtanto, M. (2022). Students' career decision-making during online learning: The mediating roles of self-efficacy in vocational education. *European Journal of Educational Research, 11*(3), 1669–1682.Available at: https://doi.org/10.12973/eu-jer.11.3.1669.

Topal, A. D. (2016). Examination of university students' level of satisfaction and readiness for e-courses and the relationship between them. *European Journal of Contemporary Education, 15*(1), 7-23.Available at: https://doi.org/10.13187/ejced.2016.15.7.

Toquero, C. M. (2020). Challenges and opportunities for higher education amid the COVID-19 pandemic: The Philippine context. *Pedagogical Research, 5*(4), 1–5.Available at: https://doi.org/10.29333/pr/7947.

Truzoli, R., Pirola, V., & Conte, S. (2021). The impact of risk and protective factors on online teaching experience in high school Italian teachers during the COVID-19 pandemic. *Journal of Computer Assisted Learning, 37*(4), 940-952.Available at: https://doi.org/10.1111/jcal.12533.

Tucker, L. R., & Lewis, C. (1973). A reliability coefficient for maximum likelihood factor analysis. *Psychometrika, 38*(1), 1–10. https://doi.org/10.1007/BF02291170

Wali, A., & Popal, A. (2020). The emerging issues and impacts of technology in classroom learning. *International Journal of Emerging Technologies in Learning (iJET), 15*(15), 237-245.Available at: https://doi.org/10.3991/ijet.v15i15.14175.

Wang, R., Han, J., Gao, C., & Liu, C. (2021). Chinese university students' perceptions of facilitation strategies, learning motivation, and satisfaction in cloud-based virtual classrooms. *Frontiers in Psychology, 12*(1), 1–14.Available at: https://doi.org/10.3389/fpsyg.2021.801191.

Wang, S.-L., Chen, H.-P., Hu, S.-L., & Lee, C.-D. (2019). Analyzing student satisfaction in the technical and vocational education system through collaborative teaching. *Sustainability, 11*(18), 4856.Available at: https://doi.org/10.3390/su11184856.

Watkins, R., Leigh, D., & Triner, D. (2008). Assessing readiness for E-learning. *Performance Improvement Quarterly, 17*(4), 66–79.Available at: https://doi.org/10.1111/j.1937-8327.2004.tb00321.x.

Widyanti, A., Hasudungan, S., & Park, J. (2020). e-Learning readiness and perceived learning workload among students in an Indonesian university. *Knowledge Management & E-Learning: An International Journal, 12*(1), 18-29.

Yavuzalp, N., & Bahcivan, E. (2021). A structural equation modeling analysis of relationships among university students' readiness for e-learning, self-regulation skills, satisfaction, and academic achievement. *Research and Practice in Technology Enhanced Learning, 16*(1), 1-17.Available at: https://doi.org/10.1186/s41039-021-00162-y.

Yilmaz, R. (2017). Exploring the role of e-learning readiness on student satisfaction and motivation in flipped classroom. *Computers in Human Behavior, 70*(1), 1–16.Available at: https://doi.org/10.1016/j.chb.2016.12.085.

Zare, M., Sarikhani, R., Salari, M., & Mansouri, V. (2016). The impact of E-Learning on university students' academic achievement and creativity. *Journal of Technical Education and Training, 8*(1), 25–33.Available at: https://doi.org/10.30880/jtet.2016.13.01.002.