Investigating the moderating effects of perceived usefulness on the student satisfaction: Evidence from Indonesian higher education

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Abstract:

This study examines technological competence, e-learning readiness and motivation that affect student user satisfaction. In addition, the involvement of perceived usefulness is a moderator of student user satisfaction. A total of 1217 students of engineering in the province of Yogyakarta, Indonesia, filled out the instrument. Data collection is done online through E-Monev, integrated with AIS with a Likert scale of five, and tested for validity and reliability. Data were analyzed using the path analysis method and bootstrapping with the PLS-SEM application. The results of the study respondents that technological competence, e-learning readiness, and motivation have a significant effect on user-student satisfaction. Furthermore, e-learning readiness moderated by perceived usefulness has a significant effect. This finding confirms that it is important for higher education to ensure that user students master technology competence and motivation in a balanced way. In the future, e-learning and hybrid learning that has taken place must be balanced with mastery of basic skills, namely technological competence and motivation through various pieces of training and direct involvement.

Keywords: e-learning perspective, student satisfaction, motivation, e-learning readiness, higher education

1. Introduction

E-learning is one of the most widely used strategies in education, especially in universities, during the COVID-19 pandemic (Almaiah, Al-Khasawneh and Althunibat, 2020; Butola, 2021). This trend is in line with the demands of learning in the 21st century, which is integrated with technology in all learning elements. The learning shift has occurred from physical space to virtual space, even in the normal era. It is predicted that e-learning will still be maintained through hybrid learning. E-learning is the cause of new habits emerging and the development of digital technology literacy today. Learning that was originally pedagogy has shifted into andragogy, heutagogy, and even cybergogy (Arifin, Nurtanto, Priatna, *et al.*, 2020; Arifin, Nurtanto, Warju, *et al.*, 2020; Saripudin *et al.*, 2020). Previous researchers revealed that the use of e-learning during the COVID-19 pandemic resulted in two sides, namely the occurrence of setbacks and increasing technological capabilities. In the perspective of e-learning, excellence is the creation of a more effective and efficient learning climate. During e-learning, it is easy for students and teachers to get access to learning resources and the availability of various platforms that are increasingly complete.

Other problems caused by e-learning are limited accessibility, facilities, and low personal abilities (Hamid et al., 2020). Moreover, changing classes from physical to virtual is a burden for some students. They found the psychological burden in the form of high-stress levels due to the intensity of the task, unfriendly networks, and inexpressive study spaces. Furthermore, a study (Hamid et al., 2020) revealed that student involvement in e-learning was around 74.2% less ineffective. Other findings also revealed setbacks from e-learning, including fatigue and eye strain (Octaberlina and Muslimin, 2020), physical and mental disorders (Atmojo and Nugroho, 2020), poor connection disorders, and low student motivation (Febrianto, Mas'udah, and Megasari, 2020). However, in an empirical study, we found evidence that e-learning is ready to use and that student users feel its benefits and satisfaction (Yavuzalp and Bahcivan, 2021).

The study conducted by Lavrinenko et al. presents data on assessing the impact of motivation on the effectiveness of the educational process and reveals students' motivation to master their future profession, which indicates a conscious approach to learning (Lavrinenko, Arpentieva and Kassymova, 2019). According to another research, the results obtained on the impact of Internet use on the effectiveness of the educational process indicate that the majority of students use the Internet to communicate in social networks (56%); only 13% of students use the Internet for educational purposes. Naturally, such students are more successful in their studies. At the same time, the results of an educational activity (59%) are observed in students who use the Internet mainly for online games and watching videos (Lavrinenko, Arpentieva and Kassymova, 2019).

Recent studies have tested the operation of a programmable logic controller (PLC) kit in the e-learning environment. The implications of this research have led to the creation of a teaching aid that teachers can use as a template to create teaching aids that are more accessible, easy, and safe to use so that they can be motivated to innovate in teaching and become a new career opportunity (Pratama *et al.*, 2022). E-learning can also be used to create a more interactive learning environment where students can interact directly with virtual world objects so that students can learn while playing opportunity (Pratama *et al.*, 2022).

Pritchard (2009) defines student satisfaction as a response to his feelings due to the match between expectations and reality from the learning process using e-learning mode. Student satisfaction has a positive effect on encouraging them to learn optimally (Yilmaz, 2017). Student satisfaction during the e-learning process can be observed from various aspects, namely perceptions of the learning process, academic services and guidance obtained, administrative services, learning systems used, lecture services, and the attitude of officers in facilitation. However, student satisfaction is also influenced by internalization aspects such as mastery of digital technology, motivation, and e-learning readiness.

The study revealed (Al-araibi, Mahrin and Yusoff, 2019) that e-learning readiness is influenced by technological competence and student learning motivation to be more effective and efficient. Technological competence is a basic competency before e-learning (Hamid et al., 2022; Majid et al.,

2020; Rasmitadila et al., 2020). According to (Pavlova, 2009; Mutohhari et al., 2021; Astuti et al., 2022), technological competence has a mastery level, namely awareness, literacy, ability to use, creativity, and critical in using digital technology. Student satisfaction can be achieved if the mastery of digital technology reaches all aspects, at least at the level of being able to use it so that the main aims and objectives of learning are met. Coşkun et al. (2018); Widyanti et al. (2020) asserted that the unpreparedness of e-learning caused the failure of e-learning. According to Mabrur et al. (2021); Watkins et al. (2008), e-learning readiness is the level of physical readiness that refers to the infrastructure to carry out the e-learning process. Several studies reported that the low readiness of students' e-learning was the cause of the non-delivery of learning objectives.

The motivational factor is crucial to encourage students to run e-learning and actively participate in it (Maldonado *et al.*, 2011). Readiness in using e-learning will be formed if students have a strong drive. They are also supported by a high mental spirit (Yilmaz, 2017). Decreased motivation is also a factor causing e-learning failure and student dissatisfaction. Thus, digital competence and motivation are basic needs that must be met before e-learning is implemented. This study also reveals the moderation of perceived usefulness in the three previous aspects of achieving student satisfaction. Perceived usefulness is defined as a person's confidence level in using a particular system to increase e-learning involvement. Users believe perceived usefulness to have a positive user relationship and engagement. Based on the problems and concepts described the relationship between the components becomes important and interesting to research and study and becomes an e-learning artifact during the COVID-19 pandemic. This study focuses on measuring the significance of student satisfaction based on digital technology capabilities, e-learning readiness, motivation and also mediating aspects of perceived usefulness. The relationship between the components is presented in Figure 1. This study was conducted to test the following hypothesis:

H1: Technology competence affects student satisfaction while applying e-learning.

H2: E-learning readiness affects student satisfaction while implementing e-learning.

H3: Motivation affects student satisfaction while implementing e-learning.

H4: Perceived usefulness affects student satisfaction while implementing e-learning.

H5: Technology competence is moderated on perceived usefulness affecting student satisfaction when implementing e-learning.

H6: E-learning readiness is moderated on perceived usefulness affecting student satisfaction when implementing e-learning.

H7: Motivation is moderated by perceived usefulness and affects student satisfaction when implementing e-learning.
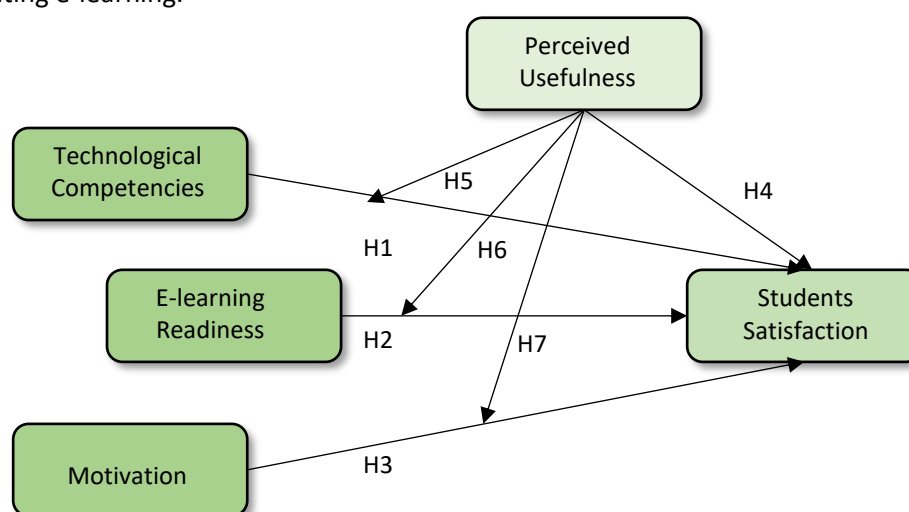

Figure 1. Conceptual framework of student satisfaction during the implementation of e-learning

2. Method

2.1. Research design

E-learning has been going on for more than two years felt by students in higher education. Perceptions of how student satisfaction is based on technological competencies, e-learning readiness, and motivation are important to reveal how aspects of perceived usefulness mediate the influence of the three aspects. Evidence from e-learning in times of COVID-19 is important to report. The study used a quantitative research approach with an ex-post-facto research design adapted by Cohen et al. (2011). The relationship between the dependent and independent variables and moderating variables was analyzed using Partial Least Squares-Structural Equating Modeling (PLS-SEM) with consideration of the ability to test complex hypotheses (multivariate) and no sample restrictions.

2.2. Respondent

Students of engineering higher education in the province of Yogyakarta, Indonesia, were selected and decided as respondents. Other criteria are a minimum of 2-10 semesters of study undergoing online learning. This consideration strengthens students' perceptions of the length of e-learning during COVID-19. This study was not gendering specific, and all were included. A total of three fields of respondents are allowed, including tourism, IT, and technology and engineering, which are closely related to Techniques and Limitations. Another reason for us is that learning in the field of Engineering should focus on experience (practice), but it does not occur normally. Finally, technological competence, e-learning readiness, motivation, and perceived usefulness are important to measure. A total of 1217 students were selected based on criteria and left invalid respondents' answers. For example, outside the field is not considered, and the equivalent answer, i.e., all the same answers, are not selected. We present the statistics of respondents in table 1. which are categorized by gender, length of study using E-Learning, area of expertise, and intensity of e-learning in a week.

Table 1. Demographics of participants

Dimensions	Category	Frequency	Percentage
Gender	Male	716	58.83%
	Female	501	41.17%
Study period	2– 4 semesters	470	38.62%
	5 – 6 semesters	416	34.18%
	7 – 8 semesters	255	20.95%
	9 – 10 semesters	76	6.24%
Expertise	Tourism	445	36.57%
	IT	391	32.13%
	Technology and Engineering	381	31.31%
E-learning intensity	8 – 12 hours	157	12.90%
	13 – 17 hours	189	15.53%
	18 – 22 hours	337	27.69%
	23 – 27 hours	534	43.88%

2.3. Data Collection Instruments

The questionnaire was raised from a literature study on student satisfaction in implementing e-learning during the COVID-19 pandemic. The details are presented as follows:

1. Student satisfaction (SS) was adapted from Yilmaz (2017), which was developed into six indicators. These indicators measure student satisfaction with the learning process, academic services and guidance, administrative services, learning systems, lecture services, and the attitude of officers in student services. Examples of question items are as follows: "*I am satisfied with the activities of the teaching and learning process during e-learning.*"

2. Technological competence (TC) is adapted from Pavlova (2009); Astuti *et al.* (2022); Sutiman *et al.* (2022). They have the same understanding. We simplify into five levels: awareness, literacy, ability to use, creativity, and critical in digital technology. Examples of question items developed: "*I have creativity in using digital technology.*"

3. E-learning readiness (ELR) was adapted from Yilmaz (2017); Adams *et al.* (2022), which was developed into seven indicators, namely self-efficacy in using, organizing and conducting learning, communicating effectively, controlling and exploring active learning, and the achievement of optimal learning outcomes". An example of a question item used is "*I have the confidence to be able to communicate effectively using the internet and ICT*."

4. Motivation (MO) was adapted from Yilmaz (2017) using five indicators: the ability to concentrate on learning, learning new things, enthusiastically solving problems, being encouraged to complete tasks, and learning to explore various learning resources. An example of the item used is "*I am motivated to learn new things and challenges in supporting learning achievement*."

5. Perceived usefulness (PU) was developed by Davis (1989) using four indicators: making work easier and more useful, increasing productivity, increasing effectiveness, and developing work performance adjusted to the moderating component. An example of the item used is "*Technological competence makes work done faster*."

2.4. Data Collection Procedure

Data collection is done through the e-monev system (electronic monitoring and evaluation) in each university. The E-Monev system is integrated with the academic information system (AIS), where students must complete a questionnaire before accessing learning outcomes. They filled out student satisfaction questionnaires based on the academic calendar from March to June 2022. We also informed stakeholders to ask students to fill it out during the filling period before the information system was closed. The questionnaire used to measure each variable has the same scale: a five-point Likert of strongly disagree indicating point 1 and strongly agree indicating point 5. All closed questions are the same, namely positive statements, but are applied randomly to ensure that students have read carefully and seriously and believe in the chosen answer.

2.5. Data analysis

Using PLS-SEM, the data obtained and selected are then tested based on hypotheses to measure the effect between variables (exogenous to endogenous variables). The bootstrap method was chosen to measure student satisfaction with technology competence, e-learning readiness, and motivation mediated by aspects of user satisfaction. This test strengthens whether user satisfaction has a significant effect together. A strong reason for using the bootstrap method is also revealed by Preacher and Hayes (2008) that the method is reasonable and reaches the confidence limit for the indirect effect.

3. Result

3.1. Validities and reliabilities of instruments

Referring to the existing procedures for the feasibility of the questionnaire, we prove the validity and reliability of the instrument first before testing the model and further testing. Consideration of validity refers to the value of outer loading and range of corrected item-total correlation (CITC) as presented in Table 2. Item-total correlation is chosen as a consideration with a position as item correlation or indicator with the combined scores of all items that make up the same set (Koufteros, 1999). The recommended recommendation is that the outer loading value for each item is more than 0.700, and the CITC must exceed 0.300 (Johnson and Wichern, 2007). Table 2 proves the analysis which explains that all outer loading scores are above 0.700 and the CITC is above 0.300, so it is concluded that all of these items are declared valid for the collection of related data. Then, a statistical reliability test based on Cronbach's alpha coefficient value (α) was adopted to consider the consistency and reliability of all questionnaires in this study. As shown in Table 2, the Cronbach alpha value of each measure is well above the recommended threshold of 0.7 in the high category, so it is declared credible to confirm a high level of reliability for data collection (Johnson and Wichern, 2007).

Table 2. Level of validities and reliabilities

Variable	Item	Outer Loading	Range of CITC	α	CR	AVE
Technological Competencies	TC 1	0.863	0.619 – 0.825			
	TC 2	0.883	0.624 – 0.841			
	TC 3	0.885	0.638 – 0.869	0.917	0.937	0.750
	TC 4	0.826	0.580 – 0.793			
	TC 5	0.872	0.629 – 0.837			
E-Learning Readiness	ELR 1	0.907	0.642 – 0.879			
	ELR 2	0.929	0.655 – 0.887			
	ELT 3	0.911	0.647 – 0.883	0.929	0.946	0.779
	ELR 4	0.824	0.573 – 0.781			
	ELR 5	0.838	0.591 – 0.899			
Motivation	Mo 1	0.765	0.483 – 0.731			
	Mo 2	0.719	0.426 – 0.668			
	Mo 3	0.814	0.542 – 0.785	0.829	0.880	0,596
	Mo 4	0.842	0.613 – 0.805			
	Mo 5	0.711	0.411 – 0.674			
Student Satisfaction	ELS 1	0.778	0.496 – 0.738			
	ELS 2	0.826	0.582 – 0.787			
	ELS 3	0.747	0.469 – 0.701	0.866	0.903	0.652
	ELS 4	0.862	0.603 – 0.822			
	ELS 5	0.818	0.549 – 0.774			
Perceived Usefulness	PU 1	0.864	0.617 – 0.823			
	PU 2	0.801	0.529 – 0.764	0.882	0.919	0.740
	PU 3	0.894	0.640 – 0.836			
	PU 4	0.879	0.632 – 0.824			
Independent*Moderation	TC*PU	1.145	0.653 – 0.930	1.000	1.000	1.000
	ELR*PU	1.318	0.691 – 0.993	1.000	1.000	1.000
	Mo*PU	1.201	0.674 – 0.961	1.000	1.000	1.000

3.2. Structural Model Fit Test

Justification of the level of conformity of the structural model is needed to explain the extent to which the model can explain the concept of structural relationships that are formulated so that the model can explain the coefficients of the relationships between variables structurally (Johnson and Wichern, 2007). The analysis of the suitability index of the research model is presented as shown in Table 3. As presented, all of the overall indices in the basic model have a good fit. The chi-square value obtained is a small number by the expectations. The higher probability value on the threshold (p-value 0.050) explains the absence of a difference between the model being tested and the data so that the model is declared capable of predicting the value of its observations (Hosmer, 2000).

Table 3. Model fit test result

| Goodness of fit index	Cut-off value	Result	Evaluation
Chi-square	Expected to be small	44.643	Small
Probability	>0.50	0.237	Good
Goodness of fit index (GFI)	≥0.90	0.971	Good
Adjusted goodness of fit index (AGFI)	≥0.90	0.911	Good
Normal fit index (NFI)	≥0.90	0.906	Good
Standardized root mean squared residual (SRMR)	<0.05	0.037	Good
Root mean square error of approximation (RMSEA)	<0.08	0.072	Good
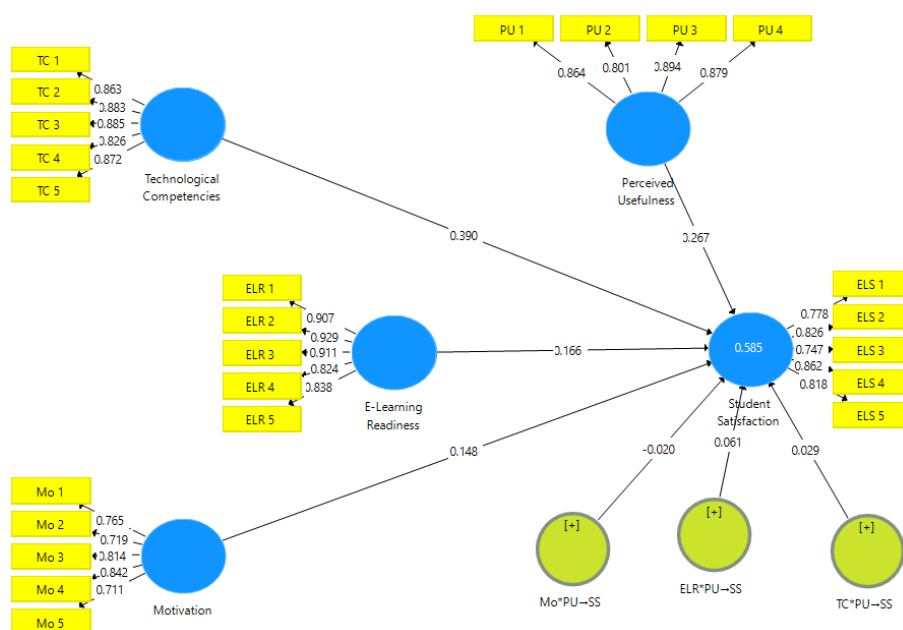
Figure 2. Struktural model

Goodness of Fit Index (GFI ≥0.90), Adjusted GFI (AGFI), which is the adjusted GFI value (≥0.90), Normed Fit Index (NFI≥0.90). 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), so it is concluded that the model has high suitability and structural model analysis can be carried out (Tucker and Lewis, 1973; Bentler and Bonett, 1980; Johnson and Wichern, 2007; Maydeu-Olivares, Shi and Rosseel, 2018). Model, The structural analysis model used is presented in Figure 2. SEM analysis uses two methods, path analysis, to determine the direct effect of exogenous variables on endogenous variables. The second method is bootstrap to test the role of perceived usefulness as a moderator.

3.3. Hypothesis Test Results

Hypothesis testing is based on the results of path analysis using the bootstrap method, which is considered for its accuracy. The hypothesis that refers to a direct or unmoderated effect is accepted if it has a p-value below the 5% significance level (p < 0.050). Moreover, we ensured the analysis of confidence intervals of 97.5% (CI 97.5%) with an error rate of 2.5%. See Table 4. presents the standardized estimate of the direct effect test with the acquisition of values for all paths above the minimum significant limit. In addition, the p-value is also below 0.050 on all lines. The path coefficient between technological competence and student satisfaction is 0.390, and the p-value is 0.000, so H1 is supported. The second consideration is obtained from the path coefficient value between e-learning readiness and student satisfaction of 0.166 and a p-value of 0.000, so H2 is also supported. Likewise, the coefficient value obtained is 0.148, and the p-value is 0.000 on the motivational path with student satisfaction, so H3 is supported. Still, in line with the previous, H4 is also supported by considering the acquisition of a coefficient of 0.267 and a p-value of 0.000 on the path of perceived usefulness with student satisfaction.

Hypothesis testing that refers to the effect of moderating considers the test results of the effect of the interaction of the independent variable with the moderator on the dependent variable. Bootstrapping using 500 iterations proves the results supporting the moderating effect hypothesis. For the first consideration, see table 5, which presents the moderating role of perceived usefulness. The coefficient of the effect of perceived usefulness in moderating technological competencies and student satisfaction is 0.029 with a p-value of 0.569, so H5 is not supported. Meanwhile, perceived usefulness proves its significant role in moderating the effect of e-learning readiness with a coefficient of 0.061 and a p-value of 0.007, so H6 is supported. However, perceived usefulness does not provide

a significant role in moderating the influence of motivation on student satisfaction with the estimated value of -0.020 and p-value of 0.411, so H7 is not supported.

Table 4. Path analysis result

Path	Estimate	SE	p	Evaluation
Technological competencies → student satisfaction	0.390	0.001	0.000	Supported
E-learning readiness → student satisfaction	0.166	0.004	0.000	Supported
Motivation → student satisfaction	0.148	0.002	0.000	Supported
Perceived usefulness → student satisfaction	0.267	0.002	0.000	Supported

Table 5. Standardized bootstrap moderating effect test

Outcome variable	Variable Interaction	F	R	R^2	Estimate	p
Student satisfaction	Technological competencies×student satisfaction	3382.6621	0.585	0.338	0.390	0.000
	Technological competencies×perceived usefulness				**0.029**	**0.569**
	E-learning readiness×student satisfaction				0.166	0.000
	E-learning readiness×perceived usefulness				**0.061**	**0.007**
	Motivation×student satisfaction				0.148	0.000
	Motivation×perceived usefulness				**-0.020**	**0.411**

Note: moderation effect presented in bold text

4. Discussion

The decline in student satisfaction during online learning, which impacts low learning outcomes, has changed how universities think about developing effective and efficient learning innovations (Ahmad and Sonn, 2015; Sia and Abbas Adamu, 2021). Universities realize the importance of student satisfaction factors that must be given as an effort to boost learning outcomes (Santini *et al.*, 2017). In addition, students' perceived usefulness is also increased to ensure higher student satisfaction, which in turn makes it easier for students to learn (Adams *et al.*, 2022). This study proves a significant effect of technological competence, motivation, and e-learning readiness on student satisfaction. In addition, perceived usefulness can be a significant moderator in strengthening the effect of e-learning readiness on student satisfaction. This result implies that strengthening digital technology competence in students is needed to improve their ability to implement e-learning so that estuaries also increase their satisfaction as learning management system (LMS) users (Yilmaz, 2017; Widyanti, Hasudungan and Park, 2020). Strengthening motivation and increasing e-learning readiness toward obtaining perceived usefulness is also important for universities (Sugandini, Garaika and Istanto, 2022). In implementing e-learning, technological competence is needed to support the accessibility and use of digital technology devices (Reisoğlu, 2021). In addition, it is also important to grow e-learning readiness as a consideration for its implementation (Wang, Zhang and Chen, 2021). In addition, motivation is also an important basis for stimulating student satisfaction as a measure of the success of e-learning implementation (Kew *et al.*, 2018). This provides an important signal to strengthen digital technology competencies, e-learning readiness, and student motivation to support increased satisfaction.

4.1. The effect of technological competence, e-learning readiness, and motivation on student satisfaction

Previously, (Holmes and Gardner, 2006) had observed the long process of e-learning implementation and identified a much-needed aspect in its implementation, namely student satisfaction as e-learning users. Holmes & Gardner added that e-learning institutions would not experience success if student satisfaction is not prioritized. From time to time, research uses the main reference and begins to identify factors to increase student satisfaction in implementing e-learning.

Al-araibi, Mahrin and Yusoff (2019); Astuti et al. (2022) reported that the technological aspect is one of the important factors in achieving e-learning success. More deeply, he revealed that strengthening digital technology competencies has an important impact on user satisfaction because there is an increase in their abilities. This is also supported by research from (Meskhi, Ponomareva and Ugnich, 2019) which concludes the results of his research that e-learning is one of the developments in digital technology that must be faced using an operational understanding of digital technology as well. This, of course, implies that digital technology competence, which is identical to the characteristics of e-learning, is an absolute requirement that must be met so that, in the end, students have satisfaction because of mastering the technology for learning (Aldhahi *et al.*, 2022). On the other hand, the higher the level of digital technology competence possessed by students, the stronger the impetus to implement it (Ferrer *et al.*, 2022). El-Seoud *et al.* (2014) revealed that student encouragement is equally important in balancing technological competence to implement e-learning effectively. As reported by previous research, the maturity of technology competence is proven less able to influence student satisfaction during online learning if it is not balanced with motivation from within (Bhuasiri *et al.*, 2012; Fawaid *et al.*, 2022).

Motivation is a strong stimulus influencing willingness to learn (Elkaseh, Wong and Fung, 2015). In other words, student satisfaction will automatically be high if learning motivation is also high (Alphonce and Mwantimwa, 2019). In fact, (Pritchard, 2009) reveals that under any conditions, learning motivation is an aspect that must be grown first, along with the competencies needed in learning. In addition, recent research also reveals the importance of motivation as an important foundation in the success of online learning outcomes during the pandemic (Almaiah, Al-Khasawneh and Althunibat, 2020), so that student satisfaction increases by itself.

Meanwhile, e-learning readiness is still a current trend because of the importance of this aspect in increasing the success of its implementation (Adams *et al.*, 2022). Then, e-learning readiness identified by Yilmaz (2017) includes computer self-efficacy, internet self-efficacy, online communication self-efficacy, independent learning, and learner control. Self-efficacy in using computers, the internet and communication supported by the ability to learn independently with independent control becomes a 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 previous studies revealed e-learning readiness to be a significant main factor in influencing student satisfaction in online learning (Yavuzalp and Bahcivan, 2021).

4.2. Moderating Effect of Perceived Usefulness (PU)

Digital technology competence does not require interaction with perceived usefulness to strengthen its effect on student satisfaction in implementing e-learning. This study does not prove that perceived usefulness plays a significant moderating role in the effect of technological competence on student satisfaction. According to (Henderson, Selwyn and Aston, 2017), technological competence and perceived usefulness have become an inseparable package. This means that when students have mastery of digital technology, they indirectly feel its usefulness in helping the learning process, so they do not need perceived usefulness (Betancourt-Odio *et al.*, 2021). However, it also has important to note that the integration of technological competence and perceived usefulness only applies to students who master these competencies but does not apply to students who have not mastered technology properly (Sugandini, Garaika and Istanto, 2022). In other words, students who have not mastered digital technology competencies still need perceived usefulness in influencing student satisfaction.

Previous research revealed that perceived usefulness could moderate technological competence in influencing user satisfaction which was included in the "low competence" category (Al-Fraihat *et al.*, 2020). Likewise, research from Dziuban *et al.* (2019) reveals that students with high learning satisfaction have felt that using digital technology strengthens their competence. However, the role of perceived usefulness in moderating the effect of e-learning readiness on student satisfaction proved significant. This indicates that the level of e-learning readiness of students cannot fully influence the level of satisfaction in learning. E-learning readiness becomes stronger if it is

strengthened by the intervention of perceived usefulness (Ansong-Gyimah, 2020). Students ready to use e-learning must first feel its usefulness, so that satisfaction can be stimulated (Sugandini, Garaika and Istanto, 2022). Several studies reveal that perceived usefulness is very important for students during learning to accommodate their readiness so that student satisfaction will arise as a result (Pereira *et al.*, 2015; Cidral *et al.*, 2018; Yawson and Yamoah, 2020).

The significant moderating role of perceived usefulness in this context has important implications for universities as e-learning providers. To increase student satisfaction, universities should not only strive to improve e-learning readiness for students, but more than that, it must also be accompanied by limited applications that aim to stimulate students' feelings of usefulness and usefulness (Latip *et al.*, 2022). Finally, the role of moderation is not significantly needed in the effect of motivation on student satisfaction. Motivation seems to be strong enough to stimulate student satisfaction while implementing e-learning. According to Santrock (2007), motivation is a psychological aspect that can lead to learning activities, ensure the continuity of learning activities and provide direction to learning activities so that actual satisfaction is high there. Student satisfaction appears directly in line with the encouragement or willingness to learn (Leong *et al.*, 2020). Departing from this, motivation can be said to be able to stand alone without being influenced by perceived usefulness moderation to affect student satisfaction. This is also consistent with research conducted by Yilmaz (2017), which reports that student satisfaction is directly attached to their learning motivation, so it does not require moderation.

5. Conclusion and Recommendation

There is evidence of a significant relationship between technological competence, e-learning readiness and user-student satisfaction motivation during the COVID-19 pandemic. Correspondingly, e-learning readiness moderated user satisfaction shows a significant effect, but the study findings also reveal that there is no relationship between user satisfaction and technology competence and motivation. This finding contradicts the previously constructed theory. However, the improvement side of the study is important for higher education to implement e-learning and hybrid learning in the future successfully. Considering that student satisfaction in using e-learning is influenced by basic abilities, namely technological competence and motivation and has no significant effect on user perceptions, this is an aspect that must be considered by higher education. Student engagement activities and training on the use of technology are considered to control their abilities and improve them. In addition, this study also has limitations in data collection. In particular, the data collection period is quite long, from March to June 2021, so there can be differences in the level of student satisfaction in learning using e-learning. We recommend further research to uncover other important factors to increase student satisfaction in learning to use 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 be in line with improvement.

References

Adams, D. *et al.* (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), pp. 324–339. doi: 10.1108/AEDS-05-2020-0100.

Ahmad, A. R. and Sonn, N. K. (2015) 'The Acceptance of Mobile Learning Innovation and Initiative at Higher Education Institutions', in *International Business Information Management Association (IBIMA)*.

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

Al-Fraihat, D. *et al.* (2020) 'Evaluating E-learning systems success: An empirical study', *Computers in Human Behavior*, 102(1), pp. 67–86. doi: 10.1016/j.chb.2019.08.004.

Aldhahi, M. I. *et al.* (2022) 'Exploring the relationship between students' learning satisfaction and self-efficacy during the emergency transition to remote learning amid the coronavirus pandemic: A cross-sectional study', *Education and Information Technologies*, 27(1), pp. 1323–1340. doi: 10.1007/s10639-021-10644-7.

Almaiah, M. A., Al-Khasawneh, A. and 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), pp. 5261–5280. doi: 10.1007/s10639-020-10219-y.

Alphonce, S. and Mwantimwa, K. (2019) 'Students' use of digital learning resources: diversity, motivations and challenges', *Information and Learning Science*, 120(11–12), pp. 758–772. doi: 10.1108/ILS-06-2019-0048.

Ansong-Gyimah, K. (2020) 'Students' perceptions and continuous intention to use elearning systems: The case of google classroom', *International Journal of Emerging Technologies in Learning*, 15(11), pp. 236–244. doi: 10.3991/IJET.V15I11.12683.

Arifin, Z., Nurtanto, M., Priatna, A., *et al.* (2020) 'Technology andragogy work content knowledge model as a new framework in vocational education: Revised technology pedagogy content knowledge model', *TEM Journal*, 9(2), pp. 786–791. doi: 10.18421/TEM92-48.

Arifin, Z., Nurtanto, M., Warju, W., *et al.* (2020) 'The tawock conceptual model at content knowledge for professional teaching in vocational education', *International Journal of Evaluation and Research in Education*, 9(3), pp. 697–703. doi: 10.11591/ijere.v9i3.20561.

Astuti, M. *et al.* (2022) 'The maturity levels of the digital technology competence in vocational education', *International Journal of Evaluation and Research in Education*, 11(2), pp. 596–603. doi: 10.11591/ijere.v11i2.22258.

Atmojo, A. E. P. and Nugroho, A. (2020) 'EFL Classes Must Go Online! Teaching Activities and Challenges during COVID-19 Pandemic in Indonesia', *Register Journal*, 13(1), pp. 49–76. doi: 10.18326/rgt.v13i1.49-76.

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

Betancourt-Odio, M. A. *et al.* (2021) 'Self-perceptions on digital competences for M-learning and education sustainability: A study with teachers from different countries', *Sustainability (Switzerland)*, 13(1), pp. 1–12. doi: 10.3390/su13010343.

Bhuasiri, W. *et al.* (2012) 'Critical success factors for e-learning in developing countries: A comparative analysis between ICT experts and faculty', *Computers and Education*, 58(2). doi: 10.1016/j.compedu.2011.10.010.

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), pp. 422–426. doi: 10.37506/ijfmt.v15i1.13443.

Cidral, W. A. *et al.* (2018) 'E-learning success determinants: Brazilian empirical study', *Computers and Education*, 122(1), pp. 273–290. doi: 10.1016/j.compedu.2017.12.001.

Cohen, L., Lawrence, M. and Keith, M. (2011) *Research methods in education*. New York: Routledge:Taylor & Francis Group.

Coşkun, Ö. *et al.* (2018) 'E-learning readiness of Turkish medical students: A sample from Gazi University', *Gazi Medical Journal*, 29(4), pp. 340–345. doi: 10.12996/gmj.2018.91.

Davis, F. D. (1989) 'Perceived usefulness, perceived ease of use, and user acceptance of information

technology', *MIS Quarterly: Management Information Systems*. doi: 10.2307/249008.

Dziuban, C. *et al.* (2019) 'Student satisfaction with asynchronous learning', *Online Learning Journal*, 11(1), pp. 87–95. doi: 10.24059/OLJ.V11I1.1739.

El-Seoud, M. S. A. *et al.* (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*, 9(4), pp. 20–26. doi: 10.3991/ijet.v9i4.3465.

Elkaseh, A., Wong, K. W. and 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), pp. 1–13. doi: 10.18848/2327-0144/cgp/v22i02/49160.

Fawaid, M. *et al.* (2022) 'Entrepreneurial Intentions of Vocational Education Students in Indonesia : PLS-SEM Approach', *Journal of Technical Education and Training*, 14(2), pp. 91–105. doi: https://doi.org/10.30880/jtet.2022.14.02.009.

Febrianto, P. T., Mas'udah, S. and Megasari, L. A. (2020) 'Implementation of online learning during the covid-19 pandemic on Madura Island, Indonesia', *International Journal of Learning, Teaching and Educational Research*, 19(8), pp. 233–254. doi: 10.26803/ijlter.19.8.13.

Ferrer, J. *et al.* (2022) 'Students' motivation and engagement in higher education: the importance of attitude to online learning', *Higher Education*, 83(2), pp. 317–338. doi: 10.1007/s10734-020-00657-5.

Hamid, M. A. *et al.* (2022) 'Simulating the COVID-19 epidemic event and its prevention measures using python programming', *Indonesian Journal of Electrical Engineering and Computer Science*, 6(1), pp. 278–288. doi: 10.11591/ijeecs.v26.i1.pp278-288.

Hamid, R., Sentryo, I. and Hasan, S. (2020) 'Online learning and its problems in the Covid-19 emergency period', *Jurnal Prima Edukasia*, 8(1), pp. 86–95. doi: 10.21831/jpe.v8i1.32165.

Henderson, M., Selwyn, N. and Aston, R. (2017) 'What works and why? Student perceptions of "useful" digital technology in university teaching and learning', *Studies in Higher Education*, 42(8), pp. 1567–1579. doi: 10.1080/03075079.2015.1007946.

Holmes, B. and Gardner, J. (2006) *E-Learning: Concepts and Practice 1st Edition*. 1st edn. New York: SAGE Publications Ltd.

Hosmer, D. w (2000) *Applied Logistic Regression*. Second. New York: John Wiley & Sons, Inc.

Johnson, R. A. and Wichern, D. W. (2007) *Applied multivariate statistical analysis*. 6th edn. United States: Pearson Education, Inc.

Kew, S. N. *et al.* (2018) 'Examining the motivation level of students in e-learning in higher education institution in Thailand: A case study', *Education and Information Technologies*, 23(6), pp. 2947–2967. doi: 10.1007/s10639-018-9753-z.

Koufteros, X. A. (1999) 'Testing a model of pull production: A paradigm for manufacturing research using structural equation modeling', *Journal of Operations Management*, 17(4), pp. 467–488. doi: 10.1016/S0272-6963(99)00002-9.

Latip, M. S. A. *et al.* (2022) 'Factors affecting e-learning acceptance among students: The moderating effect of self-efficacy', *International Journal of Information and Education Technology*, 12(2), pp. 116–122. doi: 10.18178/ijiet.2022.12.2.1594.

Lavrinenko, S. V., Arpentieva, M. R. and Kassymova, G. K. (2019) 'The negative impact of the internet on the educational process', *AIP Conference Proceedings*, 2135(1), p. 020034. doi: 10.1063/1.5120671.

Leong, C. M. *et al.* (2020) 'E-learning satisfaction: Investigating gender differences', *International Journal of Electronic Commerce Studies*, 12(1), pp. 1–28. doi: 10.7903/IJECS.1774.

Mabrur, I. A. M., Suwartono, T. and 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(1), pp. 153–161. doi: 10.1111/issj.12271.

Majid, N. W. A. *et al.* (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), pp. 133–145. doi: 10.3991/ijep.v10i4.13085.

Maldonado, U. P. T. *et al.* (2011) 'E-learning motivation and educational portal acceptance in developing countries', *Online Information Review*, 35(1), pp. 66–85. doi: 10.1108/14684521111113597.

Maydeu-Olivares, A., Shi, D. and 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), pp. 389–402. doi: 10.1080/10705511.2017.1389611.

Meskhi, B., Ponomareva, S. and Ugnich, E. (2019) 'E-learning in higher inclusive education: needs, opportunities and limitations', *International Journal of Educational Management*, 33(3), pp. 424–437. doi: 10.1108/IJEM-09-2018-0282.

Octaberlina, L. R. and Muslimin, A. I. (2020) 'Efl students perspective towards online learning barriers and alternatives using moodle/google classroom during covid-19 pandemic', *International Journal of Higher Education*, 9(6), pp. 1–9. doi: 10.5430/ijhe.v9n6p1.

Pavlova, M. (2009) 'Technology and Vocational Education for Sustainable Development', *Technology and Vocational Education for Sustainable Development*. doi: 10.1007/978-1-4020-5279-8.

Pereira, F. A. D. M. *et al.* (2015) 'Satisfaction and continuous use intention of e-learning service in Brazilian public organizations', *Computers in Human Behavior*, 46(1), pp. 139–148. doi: 10.1016/j.chb.2015.01.016.

Pratama, H. *et al.* (2022) 'The effectiveness of the kit portable PLC on electrical motors course among vocational school students in Aceh, Indonesia', *Kompleksnoe Ispol'zovanie Mineral'nogo syr'â/Complex Use of Mineral Resources/Mineraldik Shikisattardy Keshendi Paidalanu*, 320(1), pp. 75–87. doi: 10.31643/2022/6445.09.

Preacher, K. J. and Hayes, A. F. (2008) 'Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models', in *Behavior Research Methods*, pp. 879–891. doi: 10.3758/BRM.40.3.879.

Pritchard, A. (2009) *Ways of Learning: Learning Theories and Learning Styles in the Classroom*. 2nd edn. New York: Routledge.

Rasmitadila *et al.* (2020) 'The perceptions of primary school teachers of online learning during the covid-19 pandemic period: A case study in Indonesia', *Journal of Ethnic and Cultural Studies*, 7(2), pp. 90–109. doi: 10.29333/ejecs/388.

Reisoğlu, İ. (2021) 'How Does Digital Competence Training Affect Teachers' Professional Development and Activities?', *Technology, Knowledge and Learning*, 4(2), pp. 1–14. doi: 10.1007/s10758-021-09501-w.

Santini, F. de O. *et al.* (2017) 'Student satisfaction in higher education: a meta-analytic study', *Journal of Marketing for Higher Education*, 27(1), pp. 1–18. doi: 10.1080/08841241.2017.1311980.

Santrock, J. W. (2007) *Educational Psychology*. 2nd edn. Whitby: McGraw-Hill Ryerson.

Kholifah, N., Nurtanto, M., Kuspangaliyeva, K., Mutohhari, F., Masek, A. & Kassymova, G. (2022). Investigating the moderating effects of perceived usefulness on the student satisfaction: Evidence from Indonesian higher education. *Cypriot Journal of Educational Science*. *17*(11), 3910-3923. https://doi.org/10.18844/cjes.v17i11.7372

Saripudin, S. *et al.* (2020) 'Vocational school teachers' perceptions of e-learning during covid-19', *Journal of Engineering Education Transformations*, 34(Special Issue), pp. 7–13. doi: 10.16920/JEET/2020/V34I0/157844.

Sia, J. K. M. and Abbas Adamu, A. (2021) 'Facing the unknown: pandemic and higher education in Malaysia', *Asian Education and Development Studies*, 10(2), pp. 263–275. doi: 10.1108/AEDS-05-2020-0114.

Sugandini, D., Garaika and Istanto, Y. (2022) 'E-Learning System Success Adoption in Indonesia Higher Education', *Academic Journal of Interdisciplinary Studies*, 11(1), pp. 149–158. doi: 10.36941/ajis-2022-0013.

Sutiman, S. *et al.* (2022) 'Students' Career Decision-Making During Online Learning: The Mediating Roles of Self-Efficacy in Vocational Education', *European Journal of Educational Research*, 11(3), pp. 1669–1682. doi: 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), pp. 7–23. doi: 10.13187/ejced.2016.15.7.

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

Wang, C. Y., Zhang, Y. Y. and Chen, S. C. (2021) 'The Empirical Study of College Students' E-Learning Effectiveness and Its Antecedents Toward the COVID-19 Epidemic Environment', *Frontiers in Psychology*, 12(1), pp. 1–13. doi: 10.3389/fpsyg.2021.573590.

Watkins, R., Leigh, D. and Triner, D. (2008) 'Assessing Readiness for E-Learning', *Performance Improvement Quarterly*, 17(4), pp. 66–79. doi: 10.1111/j.1937-8327.2004.tb00321.x.

Widyanti, A., Hasudungan, S. and Park, J. (2020) 'e-Learning readiness and perceived learning workload among students in an Indonesian university', *Knowledge Management and E-Learning*, 12(1), pp. 18–29. doi: 10.34105/j.kmel.2020.12.002.

Yavuzalp, N. and 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), pp. 1–17. doi: 10.1186/s41039-021-00162-y.

Yawson, D. E. and Yamoah, F. A. (2020) 'Understanding satisfaction essentials of E-learning in higher education: A multi-generational cohort perspective', *Heliyon*, 6(11), pp. 1–9. doi: 10.1016/j.heliyon.2020.e05519.

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