

# Improving Online Learning through the Use of Learning Management System Platform: A Technology Acceptance Model-Technology Readiness Index Combination Model Approach

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**Abstract:** The COVID-19 Pandemic pushes the learning revolution. The previous onsite learning is suddenly changed to online learning, and the current technological developments support the online learning application through the Learning Management System Platform. However, some problems are found during the application of online learning. Thus, this research aims to improve online learning using the Learning Management System platform. The Technology Acceptance Model and the Technology Readiness Index model were combined to identify the critical factors influencing the intention to use Learning Management System. Fourteen hypotheses were proposed and tested using the Structural Equation Modelling method run in Partial Least Square software. The results indicated that eight hypotheses were accepted. The accepted hypothesis represents the criticality of considering Innovativeness, Job Relevance, Perceived Enjoyment, Perceived Security, and Subjective Norm in the Learning Management System usage in online learning during the COVID-19 Pandemic.

**Keywords:** Online learning, technology acceptance model, technology readiness index.

## Introduction

The COVID-19 pandemic has affected many sectors in Indonesia, including education [1]. Curriyah *et al.* [2] stated that educational institutions in Indonesia, about 170,000 elementary schools, 66,000 middle schools, and high schools, and 3,000 universities have to conduct the teaching and learning activities from home. Pandemic in Indonesia has changed the education system initially conducted offline into learning with an online system. In the university, the teaching and learning activities that previously could be carried out in class or on campus are transformed into online teaching and learning. During the pandemic, the teaching and learning process was carried out online from home between lecturers and students. The lecturers teach the student from home using the online platform.

In a simple definition, online learning means designing and creating a distance learning experience by utilizing information technology and computer system [3,4]. There are some advantages of online learning: it saves time, money, and effort and effortlessly delivers the global experience [5]. However, there are also significant potential issues with online learning [6]. For example, some technical problems arise during the learning implementation:

Installation and log-in problems, audio and video, and download errors. Furthermore, online learning is boring and unengaging for students. It has much flexibility and causes difficulties for students to arrange their time wisely. Students also need two-way interaction, which is challenging to deliver perfectly with online learning.

Furthermore, the learning materials in online learning restrict students from practicing interactively. Those problems resulted in difficulty in understanding learning content. The internet difficulties, such as low internet speed or bad connection, especially during the online exam, also other challenges lead to the complexity of online learning [5]. It is confirmed that the most problems found during online learning are an insufficient internet connection (40%), inadequate school facilities (computer lab) (36%), inadequate self-facilities (32%), and technical issues (32%) [7]. The problems mentioned regarding online learning reflect that the users are not fully ready for the online learning implementation. These problems also affect the effectiveness of online learning.

On the other hand, the researcher found that the effectiveness of online learning is influenced by user acceptance [8]. Several researchers have investigated user acceptance of certain new technologies, including the online learning platform. Buyle, [9] investigated the acceptance of standard data usage and found that Innovativeness influence the Perceived Ease toward Use and Perceived Usefulness. Zarafshani *et al.* [10] investigated the acceptance of the technology in agricultural education. They found that either

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**Table 1.** TAM III variable

Variable	Description	Resource
Job relevance	Believe of individual regarding the applicability of the target system towards the job	[14]
Perceived Usefulness	Believe of individual regarding the IT advantages to improve the Job Performance	[15]
Perceived Ease of Use	Believe of individual regarding the IT advantages to ease the job	[15]
Behavioral Intention to use	The probability that an individual will perform certain behavior	[16]
Subjective Norm	Individual perception about whether people important to them think that he should or should not perform certain behavior	[16]

Perceived Ease toward Use and Perceived Usefulness influence the Behavioral Intention to Use, and Perceived Ease of Use influences the Perceived Usefulness. Syahrudin *et al.*, [11] investigated the acceptance of distance learning during covid 19 on Indonesian sports science and found that Enjoyment influences both Perceived Usefulness and Perceived Ease of Use. They also found that Perceived Ease of Use influences the Perceived Usefulness, and Perceived Usefulness influences the Behavioral Intention to use. However, none of those researches investigated the Learning Management System (LMS). All These issues explained that the user's readiness and acceptance toward new technology, especially the Learning Management System as the online learning platform is questionable and thus, needs to be investigated.

The object of this study is a big private university located in Bandung, Indonesia. The university responds to the COVID-19 pandemic as an opportunity to make breakthroughs. The university copes with the pandemic's effect on education by establishing a portal, Learning Management System (LMS), accessed using Moodle. The LMS was established at the university in 2019. Currently, lecturers and students conduct online learning activities using LMS. Since the COVID-19 pandemic, the use of LMS in the university is significantly increasing. It has become the leading platform used for the teaching and learning process. The teaching and learning data such as teaching materials, student assignment reports, quizzes, and the course syllabus are stored in the LMS, and thus they can be accessed by the students. The learning process can be accessed anywhere and is not limited to certain places by using the LMS.

Problems related to online learning technology mentioned previously also apply to LMS application as an online platform to deliver the learning process. The LMS application will affect the learning process for students. Thus, this study aims to analyze the readiness and acceptance of online learning technology to increase the effectiveness of online learning during the COVID-19 pandemic for university students. This study will enrich the improvement strategy for the online learning process.

## Methods

### Technology Acceptance Model

Technology Acceptance Model (TAM) is a theory about using information technology systems. It is considered very influential and generally used to explain the individual acceptance of information technology [12]. Davis first developed TAM based on the Theory of Reasoned Action (TRA) model [13]. Then, the TAM theory was modified to TAM II in 2000 by extending with Perceived Usefulness determinants [14]. Then, the TAM II was modified to TAM III by extending with Perceived Ease of Use determinants [15]. The TAM III variables used in this research are described in Table 1.

Variables in Table 1 have a specific relationship with each other that is described in Table 2. The relationships between each variable described in Table 1 are described in Table 2.

The TAM is known as a simple model. However, this model has proven a valid model across studies [24]. Thus, TAM is popularly reviewed [25,26] and has been used by researchers for different technologies adoptions, e.g., smart home [27], e-money application [28], and mobile communication for health care [29]. These researches prove the popularity of TAM.

TAM has been further extended with other variables, for instance, with the road network familiarity and Variable Message Sign (VMS) acceptance towards the information quality on the road users [30]. Other researchers have further investigated the extension of TAM; one of them is conducted by Ngabiyanto *et al.* [31], that investigated the extended TAM from combined with other models and frameworks. For example, TAM has been combined with The Theory of Planned Behavior (TPB) [32], Information Adoption Model (IAM) [33], a community of inquiry (COI) [34], previous researchers. In addition, TAM has been and Innovation diffusion theory (IDT) [27]. In addition, the TAM has also been combined with Technology Readiness Index (TRI) [9]. However, as far as our knowledge, there is no research using the combination

**Table 2.** Relationship between TAM variables

Relationship	Description	Resource
Job Relevancy → Perceived Usefulness	It is proved that the job Relevancy has positive Influence towards the perceived Usefulness. Once an individual feel that their job is relevance to the technology used, he will feel that the technology is useful to conduct the job.	[10,15, 17]
Subjective norm → Behavioral Intention to Use	Researchers found that the perception of important people for an individual positively influences the intention of an individual to perform certain behavior	[10,15,18]
Subjective norm → Perceived Ease of Use	The perception of important people for an individual was proved to positively influences the perception of individual regarding the advantages of IT (Technology) to ease the Job	[10,17,20]
Perceived Ease of Use → Behavioral Intention to use	The perception of an individual regarding the advantages of IT (Technology) to ease the job was proven to positively influences the intention of an individual to perform certain behavior	[10,17,20, 21,22]
Perceived Usefulness → Behavioral Intention to Use	Believe of individual regarding the IT advantages to improve the job performance was proven to positively influences the intention of an individual to perform certain behavior.	[10,11,18,19,20,21,22]
Perceived Ease of Use → Perceived Usefulness	The perception of an individual regarding the advantages of IT (technology) to ease the job was proven to positively influences believe of individual regarding the IT advantages to improve the job performance	[10,11,19,20,21,22,23]

**Table 3.** TRI variable

Variable	Description	Resource
Optimism	Believe of individual about the technology ability to improve people lives	[35]
Innovativeness	Indication of individual to create invention and to become leader of technology	
Discomfort	Perception of individual regarding difficulties to control over and being overwhelmed by the technology	
Insecurity	Perception of Individual that the technology may does not work properly	

between TAM and TRI in online learning applications (LMS), especially during the COVID-19 pandemic that plays a significant contribution in the education transformation. This research used the combination of TAM and TRI to investigate the online learning application during COVID-19 to further propose the improvement recommendation.

**Technology Readiness Index**

The Technology Readiness Index (TRI) is a model developed by Parasuraman [36]. This model consists of 36 items scale (10 items represent optimism, seven represent innovativeness, ten represent discomfort, and nine represent insecurity). The description of each TRI variable is available in Table 3.

The TRI is a scale that consists of multiple items developed based on companies’ psychometric properties. These psychometric properties could be used to understand the internal and external customers’ readiness regarding the computer/internet-based technology.

TRI has been used across research. The newest trend of TRI research is regarding web-based/mobile-based application adoption/usage [36,37,38]. In addition, researchers investigated the influence of TRI and

TAM and resulted in the relationship between both models as described in Table 4.

**Hypothesis Formulation**

This research hypothesized the relation between TAM and TRI by referring to previous research on technology usage, including online learning usage/adoption. In research about the intention to use intelligent cities’ data standards, Buyle [25] proved that innovativeness significantly influences the Perceived Ease of Use and Perceived Usefulness. This finding was confirmed by Panday [23], who investigated the acceptance towards academic information systems. Furthermore, Bakirtaş and Akkaş [39] have investigated the academic staff’s acceptance towards the new technology adoption. They found that innovativeness has a significant positive influence on perceived ease of use. Lastly, Ullah [18] has confirmed the significant positive influence of innovation on the perceived usefulness of the distributed ledger technology acceptance among industries in Pakistan.

Thus, this research hypothesized the following:

- H1. Innovativeness will positively influence Perceived Ease of Use
- H2. Innovativeness will positively influence Perceived Usefulness

**Table 4.** TRI-TAM relationship

Relationship	Description	Resource
Innovativeness → perceived ease of use	Researchers found the influence of Innovativeness towards the Perceived Ease of Use. It means that if an individual has an indication to create invention and to become leader of technology, he believes that the IT (technology) has advantages to ease the job	[9,23,39]
Innovativeness → perceived Usefulness	Researchers found the influence of Innovativeness towards the Perceived Ease of Use. It means that if an individual has an indication to create invention and to become leader of technology, he believes that IT (technology) has advantages to improve the job performance.	[9,18,23]
Insecurity → Perceived Ease of Use	Researchers found the negative influence of Insecurity towards the perceived ease of use. It means that if the individual has trust issue towards the technology, he does not believe the IT (technology) could ease the job.	[39,40,41]
Insecurity → Perceived Usefulness	Researchers found the negative influence of Insecurity towards the Perceived Ease of Use. It means that if the individual has trust issue towards the technology, he does not believe the IT (technology) could improve the job performance	[23,40,41]
Optimism → Perceived Ease of Use	Researchers found the influence of Optimism towards the Ease of Use. It means that if individual believe that technology could improve live, he believes that the IT (technology) has advantages to ease the job	[18,23,39,40,41]
Optimism → Perceived Usefulness	Researchers found the influence of Optimism towards the Ease of Use. It means that if individual believe that technology could improve live, he believes that the IT (technology) has advantages to improve the job performance	[39,40,41]

Zarafshani *et al.*[10], Venkantesh and Bala [15] and Okcu, *et al.* [17] studied the technology acceptance of different objects and found that Job Relevance has positively influenced the Perceived Usefulness of learning technology. Thus, this research hypothesized the following:

H3. Job relevance will positively influence perceived usefulness.

Researchers investigated the TAM and TRI relation regarding the technology acceptance among different technology users such as customers, academic staff, and employees [18, 23, 39, 40, 41]. They found that Optimism positively influenced the Perceived Ease of Use. In addition, Bakirtaş & Akkaş [39], Parasuraman & Colby [40], and Tsikriktsis [41] also found that Optimism was positively influenced by Perceived Usefulness. Thus, this research hypothesized the following:

H4. Optimism will positively influence perceived ease of use

H5. Optimism will positively influence perceived usefulness

In their research, Zahrafshani *et al.* [10] evaluated technology acceptance in Iran's agricultural education and found that perceived ease of use influenced both (behavioral) intention to use and perceived Usefulness. Studies strengthened this finding by Mutahar, *et al.* [19], Al-Rahmi *et al.* [21], Salloum *et al.* [22], and Usman, *et al.* [20] found a similar finding. Ullah also supported the positive influence of Perceived Ease of Use towards Perceived Usefulness, Ullah [18] and Syahrudin *et al.* [11]

In addition, it is found that Enjoyment positively influenced both Perceived Usefulness and Perceived Ease of Use, as found by Syahrudin *et al.* [11], Salloum *et al.* [22], and Al-Rahmi *et al.* [21]. All these findings lead to the following hypotheses for this research:

H6. Perceived Ease of Use will positively influence Behavioral Intention

H7. Perceived Ease of Use will positively influence Perceived Usefulness

H8. Perceived Enjoyment will positively influence Perceived Ease of Use

H9. Perceived Enjoyment will positively influence Perceived Usefulness.

Parasuraman & Colby [40] and Tsikriktsis [41] found the positive influence of Security on both Perceived Ease of Use and Perceived Usefulness. Furthermore, the positive influence of Security towards Perceived Ease of Use was supported by Bakirtaş & Akkaş [39] finding in research on academic staffs acceptance towards new technology. On the other hand, The positive influence of Security towards Perceived Usefulness was supported by Panday [23]. Thus, the following hypotheses of this research are as follows:

H10. Perceived Security will positively influence Perceived Ease of Use

H11. Perceived Security will positively influence Perceived Usefulness.

Zarafshani *et al.* [10] found the influence of Perceived Ease of Used towards the Behavioral Intention to Use. They also found that Subjective Norm positively influences both Behavioral Intention and Perceived

**Table 5.** Design of the questionnaire

Code	Questions	Sources
BI1	I have intended to use University LMS online learning system because I have access to the system	
BI2	I expect that I will use University LMS online learning system because I have access to the system	[12, 15, 22]
BI3	I have a plan to use University LMS online learning system in the next few months	
ENJ1	It's my pleasure when using the University LMS online learning system	[15, 22]
ENJ2	I am glad to use University LMS online learning system	
INV1	People come to me for advice on new learning technologies	
INV2	It seems my friends learn more about the latest technology than I do	[9, 40]
INV3	In general, I am one of the first people in my circle to acquire new learning technologies as they emerge	
INV4	I keep up with the latest technological developments in my area of learning interest	
OP1	Products and services that use the latest technology (online learning LMS University) are much more convenient to use	[9,40]
OP2	I prefer to use the most advanced learning technology	
OP3	I like computer programs that allow me to customize things to adjust my learning needs	
OP4	Technology makes me more efficient in the learning process	
OP5	Learning about technology is as beneficial as using the technology itself.	
PEOU1	I don't find it difficult to use the University LMS online learning system	[12, 15, 42, 43]
PEOU2	University LMS online learning system is easy to use	
PS1	When using University LMS online learning, I believe that there is a mechanism to protect me from potential risks (e.g., leakage of personal information, account fraud, etc.) from the LMS online learning system if something goes wrong with the learning process through online learning LMS.	
PS2	I have trust in a third party (e.g., Gmail) to protect me from any potential risks (e.g., leakage of personal information, account fraud, etc.) of the University LMS online learning system if something goes wrong with the learning process through online learning LMS	[44]
PS3	I believe that I cannot be exploited (e.g., leaking personal information, account fraud, etc.) because of doing online learning through University LMS online learning	
PS4	I believe that there are other parties (e.g., e-mail service companies) who have an obligation to protect me from any potential risks (personal information leakage, account fraud, etc.) if something went wrong with my study.	
PU1	Using University LMS online learning system improves my performance in learning	[12,15, 42, 43]
PU2	Using University LMS online learning system increases my effectiveness in learning	
PU3	For me, University LMS online learning system is useful in online learning	
REL1	In my learning process, the use of University LMS online learning system is important.	[10, 45]
REL2	In my learning process, the use of University LMS online learning system is relevant	
REL3	The use of University LMS online learning system is related to my various tasks related to the learning process	[12,15, 45,]
SN1	People who are important to me think that I should use University LMS online learning system	
SN2	The management of University LMS online learning system has assisted me in the use of system	[15, 22]
SN3	In general, management has supported the use of University LMS online learning system	

Ease of Use. The positive influence of Perceived Ease of Used towards the Behavioral Intention to Use was also supported by other researchers [19, 21, 20, 22]. The positive influence of Subjective Norm towards Behavioral Intention to Use was supported by Ullah [18] and Venkantesh & Bala [15]. The positive influence of Subjective Norm towards Perceived Ease of Use was supported by Mutahar *et al.* [19] and Usman, *et al.* [20]. Thus, this research hypothesized the following:

H12. Perceived Usefulness will positively influence Behavioral Intention to Use.

H13. Subjective Norm will positively influence the Behavioral Intention to Use.

H14. Subjective Norm will positively influence Perceived Ease of Use.

## Results and Discussions

### Research Participants

This analysis-based research began during the COVID-19 pandemic. It was carried out by taking respondents from the objected university using the LMS online learning portal during the pandemic. A

total of 200 university students from seven faculties of objected university voluntarily joined this study. The respondents are students from the 2016 to 2020 entrance year.

**Research Procedure**

The questionnaire was administered online to the students at the objected university. The respondent answered the question voluntarily. The researcher needs one month to administer the questionnaire. The respondent was selected randomly and contacted privately via an online platform such as WhatsApp, Facebook, and Instagram. Furthermore, the researcher also posted the question online to reach more respondents

**Table 6.** Respondent's descriptive data

Respondents' Descriptive Data		In percent
Gender	Male	33
	Female	67
Semester	8th or more	36
	6th	39
	4th or less	25
Major	Engineering	69.5
	Non-Engineering	30.5

**Table 7.** Results

Factor	Item	Factor Loading	Cronbach's Alpha	Average Variance Extracted (AVE)
BI	BI1	0.872	0.836	0.751
	BI2	0.897		
	BI3	0.830		
ENJ	ENJ1	0.957	0.911	0.918
	ENJ2	0.959		
INV	INV1	0.812	0.744	0.655
	INV3	0.743		
	INV4	0.868		
	OP3	0.894		
OP	OP4	0.862	0.867	0.790
	OP5	0.909		
	PEOU1	0.900		
PEOU	PEOU2	0.932	0.811	0.840
	PS1	0.864		
PS	PS2	0.853	0.859	0.702
	PS3	0.768		
	PS4	0.862		
	PU1	0.873		
PU	PU2	0.883	0.786	0.704
	PU3	0.755		
	REL1	0.877		
REL	REL2	0.844	0.831	0.747
	REL3	0.872		
	SN1	0.714		
SN	SN2	0.906	0.796	0.711
	SN3	0.895		

**Table 8.** Result of hypothesis testing

Hypotesis	Relationship	Significance	Results
H1: INV → PEOU	Negative	0.109	Rejected
H2: INV → PU	Positive	0.001	Accepted
H3: REL → PU	Positive	0.006	Accepted
H4: OP → PEOU	Positive	0.472	Rejected
H5: OP → PU	Positive	0.743	Rejected
H6: PEOU → BI	Positive	0.229	Rejected
H7: PEOU → PU	Positive	0.003	Accepted
H8: ENJ → PEOU	Positive	0.286	Rejected
H9: ENJ → PU	Positive	0.000	Accepted
H10: PS → PEOU	Positive	0.039	Accepted
H11: PS → PU	Negative	0.546	Rejected
H12: PU → BI	Positive	0.011	Accepted
H13: SN → BI	Positive	0.001	Accepted
H15: SN → PEOU	Positive	0.006	Accepted

**Questionnaire and Study Variables**

The questionnaire consists of three parts. The first part is Introductory, which explains the brief description of the questionnaire, the objective of the questionnaire, and the researcher's contact. The second part is the respondent data. It consists of the department and the entrance year of students (respondents). The third part is the main part consisting of TRI and TAM items. There are 29 items in the main question representing a total of 9 TRI and TAM variables. The 6-point Likert scale was used to answer the main item's question. The questionnaire design is described in Table 5.

**Data Analysis**

The results of the questionnaire were compiled on a spreadsheet. The questionnaire reliability was tested using the Cronbach Alpha reliability test using SPSS statistical software. The smart PLS software was used to analyze the questionnaire result in a proposed model.

**Data Description**

In this research, 200 respondents filled out the questionnaire. The descriptive data of the respondents is described in Table 6

Table 6 illustrates the respondents' gender, semester, and major. According to the gender of the respondent, most of the respondents of the research are female (67%). In addition, the respondents are primarily from the 8th or 6th semester (36% and 39%, respectively) and are from engineering majors (69.5%). Since this research is a case study in a specific university, the studied LMS is developed by the university using moodle. Thus, each respondent in this study uses the same LMS platform and uses the same tool to access the LMS.

It is found that the factor loading for each item is above 0.7. According to Hair *et al.* [46], the ideal factor loading is above 0.7. Thus, the factor loading value was accepted. The construct reliability was calculated using the Cronbach Alpha reliability test. The reliability score for each variable was 0.744, the lowest to 0.911, the highest. According to Nunnally [47], the acceptable Cronbach Alpha score ranges from 0.7 to 0.95. Thus, the Cronbach Alpha score of the proposed variable was accepted. It is mentioned in Amiruddin *et al.* [48] that a higher score of Cronbach's Alpha represents the more reliable instrument. The average variance extract (AVE) was calculated to check the convergent validity of the model and resulted in a value above the acceptable value of 0.5

[46]. The convergent validity explains how convergent all items in a construct. Therefore, the value of AVE  $\geq 0.5$  represents that all construct items in the proposed model have reached adequate convergence.

The PLS-SEM was conducted to test the proposed hypothesis as resulted in Figure 1 and Table 8.

Based on the hypothesis testing results, it was proved that the path proposed in the hypothesis was accepted. Specifically, it was proved that among 14 proposed hypotheses, eight hypotheses were accepted. The eight accepted hypotheses show a positive and significant correlation between the latent factors as proposed. It represents the robustness of the path [49].

Lastly, the model fit measurement was conducted, known as the goodness of fit. This research proved the overall fit using the Standardized Root Mean Residual (SRMR) model fit index. The result of SRMR of the proposed model is 0.069. According to Hooper, the accepted SRMR value fall under 0.8. Thus, the proposed model has a good overall fit [50].

### Discussions

The first and second correlation paths proposed in hypotheses 1 and 2 are  $INV \rightarrow PEOU$  and  $INV \rightarrow PU$ . The results indicated that the INV has an insignificant negative correlation towards the PEOU. On the other hand, the INV was found to have a strong and positive correlation towards the PU. This finding partially supports the previous research of Buyle [9], and Panday [23], who found a strong positive correlation between INV towards both PEOU and PU. In addition, this finding supports the finding of Ullah [18], who found the positive influence of  $INV \rightarrow PU$ . However, it did not support the finding of Bakirtaş & Akkaş [39], who found the positive influence of  $INV \rightarrow PU$ .

Both Buyle [9] and Bakirtaş & Akkaş [29] studied the technology used by workers in the academic field. The working experience of workers sees the innovation as a driver of Perceived Ease Of Use and Perceive Usefulness, and their research occurs under normal conditions. Thus the users are more well prepared for

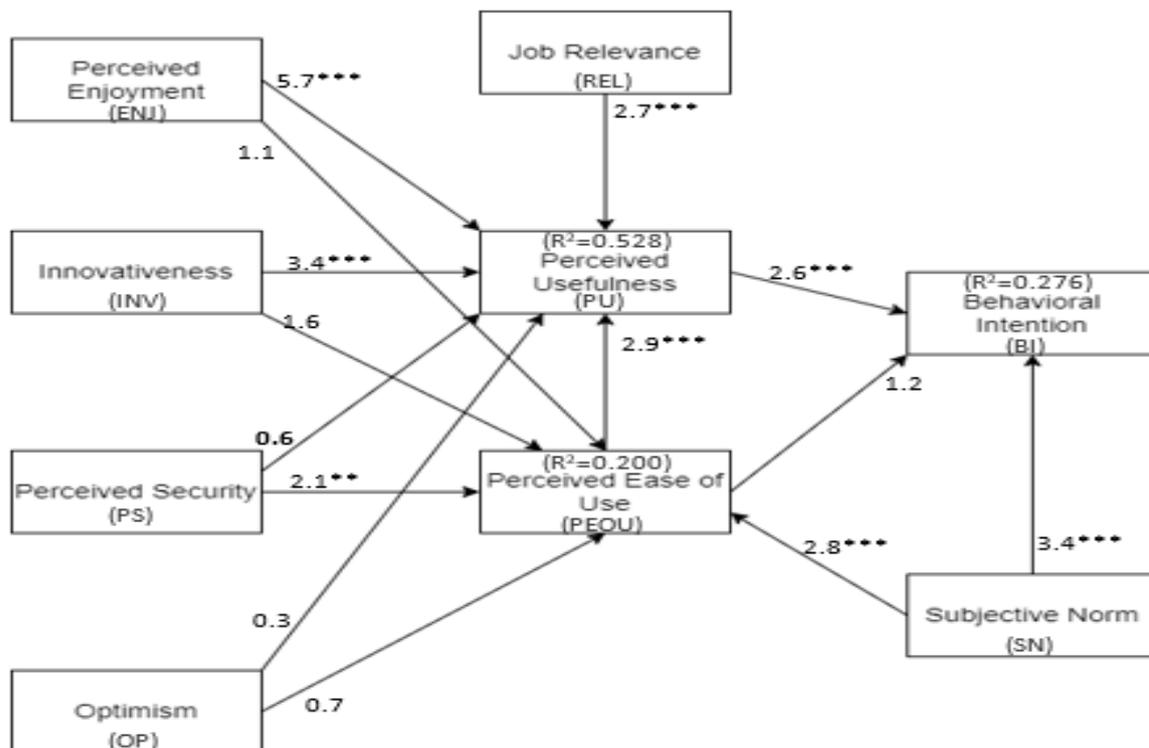


Figure 1. Result of the model  
 \*\*\*\*:  $p \leq 0.01$ , \*\*:  $p \leq 0.05$ , and \*:  $p \leq 0.1$

the upcoming technologies. On the other hand, many of this research's respondents are final-year students who experienced COVID-19 as a sudden phenomenon that forced them to switch to online learning. It is confirmed that those students found difficulties using the online learning innovation technology during the COVID-19 pandemic, as stated in Yaseen *et al.* [51] that there were technological challenges in online learning activities.

The third hypothesis of this research is  $REL \rightarrow PU$ . It is found that the Relevance has a significant positive influence towards the Perceived Usefulness. It supports the previous research of Zarafshani *et al.* [10], which studied the technology acceptance of agricultural education during the pandemic. It shows that online learning technology is relevant to use in a pandemic. Thus, the users see the Usefulness of online learning for studying activities during a pandemic. This also supports the finding of Venkantesh & Bala [15], and Okcu, *et al.* [17]. Okcu, *et al.* [17] studied the use of big data. Although this research was conducted before the pandemics, the results are still relevant as if the technology had been used before the pandemic; during the pandemic, the technology is still and even more relevant.

The fourth and fifth hypotheses are  $OP \rightarrow PEOU$  and  $OP \rightarrow PU$ . It is found that Optimism has a positive influence on Perceived Ease of Use and Perceived Usefulness. However, the influence is not significant. Thus, this research finding does not have strong support towards the previous research of Panday [23], Ullah, [18], Bakirtaş & Akkaş, [39], Parasuraman & Colby [40], and Tsikriktsis [41], which found the strong positive correlation of  $OP \rightarrow PEOU$  and  $OP \rightarrow PU$ . It shows that the Optimism in using online learning has a low tendency of respondent perception about the Usefulness and easiness of using the online learning. This finding might occur because the students are not sure that online learning could help them learn as effectively as onsite learning could. This is reasonable since many of the respondents are final-year students who have experienced offline learning. It proved that students' performance during online learning is reduced [51].

The sixth to ninth hypotheses are  $PEOU \rightarrow BI$ ,  $PEOU \rightarrow PU$ ,  $ENJ \rightarrow PEOU$ ,  $ENJ \rightarrow PU$ . This research shows that Perceived Ease of Use has a significant positive correlation towards Perceived Usefulness, and Enjoyment has a significant positive correlation towards Perceived Usefulness. A positive correlation is also found in both Perceived Ease of Use towards Behavioral Intention to Use and the Perceived Usefulness towards Perceived Ease of Use. However, both correlation is not significant. These findings proved partial support for the study of Salloum *et al.*

[22]. and Al-Rahmi *et al.* [21], who found a positive and significant correlation between  $PEOU \rightarrow BI$ ,  $PEOU \rightarrow PU$ ,  $ENJ \rightarrow PEOU$ ,  $ENJ \rightarrow PU$ . This research does not find significance in the positive correlation between PEOU and BI. This finding means that although online learning looks easy for (some) respondents, they would not intend to use it. This could happen because students know that it is not easy to achieve good performance during online learning [51]. Perceived Enjoyment was found to influence both Perceived Ease of Use and Perceived Usefulness positively. However, a significant result is not found in the correlation between Perceived Enjoyment and Perceived Ease of Use. Although the student could enjoy the online learning as it is more flexible than the onsite learning, they do not think that using online learning is easy because of the technical problems in the online learning [51].

The tenth and eleventh hypotheses are  $PS \rightarrow PEOU$  and  $PS \rightarrow PU$ . This research found that Perceived Security has a strong positive correlation towards Perceived Ease Of Use. However, an insignificant negative correlation was found between Perceived Security towards Perceived Usefulness. It indicated the partial support of Parasuraman & Colby [40] and Tsikriktsis [41] research which found a significant and positive correlation between PS and PEOU-PU. This finding supports Bakirtaş & Akkaş [39] research, but it does not support the finding of Panday [23]. The insignificant negative correlation between PS-PU explains that the more secure the LMS, the less the students feel that it is useful. The negative correlation between those two latent variables is an unusual finding. However, the result is not significant. Thus, it could be ignored.

The twelfth, thirteenth, and fourteenth hypotheses are  $PU \rightarrow BI$ ,  $SN \rightarrow BI$ , and  $SN \rightarrow PEOU$ . This research results indicated that all those three hypotheses were accepted, meaning significant and positive correlations were found between all the three latent pairs. It supports the previous researches findings [10, 15, 18, 19, 20, 21, 22].

This research's resulting model leads to the proposed recommendation to improve the LMS. The eight accepted hypotheses show that the intention to use LMS among students could be increased by considering five factors: Innovativeness, Job Relevance, Perceived Enjoyment, Perceived Security, and Subjective Norm. Specifically, the Innovation, Relevancy, Enjoyment, Security, and support from the environment of the LMS should be improved to increase the intention to use LMS. The higher intention to use LMS represents the LMS's ability to support learning activities.

## Conclusion

This research found the eight accepted hypotheses in the TAM-TRI proposed combination model. Although six hypotheses were rejected, the eight accepted hypotheses among 14 proposed hypotheses indicate that the model has reached the robustness for more paths proposed. The eight accepted hypotheses are the strong positive influence of Innovativeness towards Perceived Usefulness, Job Relevance towards the Perceived Usefulness, Perceived Ease of Use towards the Perceived Usefulness, Perceived Enjoyment towards the Perceived Usefulness, Perceived Security towards the Perceived Ease of Use, Perceived Usefulness towards Perceived Enjoyment, and Perceived Ease Of Use, Perceived Security towards Perceived Ease Of Use, Perceived Usefulness towards the Behavioral Intention, Subjective Norms towards the Behavioral Intention and Perceived Ease of Use. The remaining six rejected hypotheses are mainly due to COVID-19, leading to different research environments. This causes a discrepancy in this research result compared to previous research results.

The implication of the eight accepted hypotheses is the criticality of considering the Innovativeness, Job Relevance, Perceived Enjoyment, Perceived Security, and Subjective Norm. It is recommended that the innovation, relevancy, Enjoyment, security, and support from the environment of the LMS should be improved to increase the intention to use LMS. The LMS's ability to support learning activities could be represented by a higher intention to use LMS. Implementing this recommendation is expected that online learning will better facilitate the learning activities and improve the student's performance.

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