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Extended Technology Acceptance Model for Enhanced Distribution Strategies to Online Learning: Application of Phantom Approach

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Abstract

Purpose: This study is aimed to introduce the application of phantom approach with structural equation modelling method for online learning. By integrating these innovative methodologies, the research seeks to advance the understanding of how the phantom approach can effectively complement and augment structural equation modeling techniques. **Research design, data and methodology:** A theoretical framework of Technology Acceptance Model (TAM) was modified and updated. A questionnaire was developed and used to extract information from 189 instructors who used online learning as their primary medium. The Covariance Based Structural Equation Modelling (CBSEM) was applied to test the direct effects and the phantom approach is used to handle the 2 mediators in the model. **Results:** social influence, perceived usefulness, and perceived ease of use exerted discernible impacts on instructors' intentions to engage in online learning. These findings illuminate the intricate dynamics influencing instructor behavior within the realm of online education, underscoring the significance of various factors in shaping their intentions. **Conclusions:** In additions, the perceived usefulness and perceived ease of use had mediated the effect of social influence and instructor intention using phantom approach. Therefore, one can have concluded that this modified model was also confirmed, thereby reinforcing distribution strategies to online learning and overall education presence.

Keywords : Online Learning, Technology Acceptance Model, Distribution Strategies, Structural Equation Modeling, Phantom Approach

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1. Introduction

Structural Equation Modeling (SEM) is recognized as a second-generation method under statistical modelling to explain the structure of the interrelationship's distribution between different construct applied in the same research model. It refers to statistical modelling that can examine relationships and causality between exogenous and endogenous construct within a model.

The adoption of SEM software to handle statistical mediation analyses is growing rapidly across research fields particularly in the social sciences researches. Although the increasing number of statistical software to perform the mediation analysis, they do not provide a convenient approach to test the specific indirect effects when the model is involves more than one mediator in the model.

Thus, this paper provides illustrative example examining the effect of social influence on instructor intention via perceived ease of use and perceived usefulness factors using real data. That is, this study demonstrates the usefulness of phantom approach as recommended by Macho and Ledermann (2011).

Typically, classroom learning encompasses number of students that physically present in the classroom with consists of one instructor. This form of learning is an approach that promotes an open exchange of ideas and face to face interaction between students and instructors. It also promotes socialization between instructor and students when implementing the group discussion, team project, presentation, report and observation. However, with these kind of assessments for large number of students in the classroom and with the current pandemic is inappropriate in learning environment. As a result, the e-learning system is used as one of the alternative methods for teaching and learning process. The e-learning is described as a learning approach that combines different delivery method with an emerging of enabled technology. Nevertheless, insufficient knowledge and unpreparedness on using learning technology for education purpose during this pandemic may undermine the quality of delivery that is particularly to the instructor community. Thus, the benefits of an online learning will never be maximized accordingly.

2. Literature Review

In recent years, there has been a significant increase in the use of online learning platforms in higher education institutions. The acceptance of online learning is a critical factor in the success of these platforms. The Technology Acceptance Model (TAM) is a well-known theoretical model used to explain user acceptance of technology (Katebi et al., 2022). TAM posits that user acceptance of technology is influenced by two factors: perceived usefulness and perceived ease of use. Social influence has also been identified as a significant factor in user acceptance of technology. In the context of online learning, the instructor's intention to use the technology is also crucial. This literature review explores the relationship between social influence, perceived usefulness, perceived ease of use, instructor intention, and online learning acceptance.

2.1. Technology Acceptance Model in Online Learning Context

Online learning has become increasingly popular, especially with the COVID-19 pandemic forcing many educational institutions to switch to remote instruction (Zhang et al., 2022; Bruggeman et al., 2022). However, technology acceptance remains a challenge for many students and instructors. The Technology Acceptance Model (TAM) has been widely used to study user acceptance of technology in various contexts, including online learning (McCoy et al., 2007; Hess et al., 2004). TAM is a theoretical framework that proposes that perceived usefulness and perceived ease of use are key factors that influence user acceptance of technology. Social influence and instructor intention are also important factors that can affect technology acceptance in the online learning context.

Although many theories can be incorporated to instructor intention with the adoption of online learning, the TAM is the only theory much relevant for the present study. Thus, this theory has been primarily chosen and modified by excluding any unnecessary factor to make sure it can meet with the present research requirement. In the context of online learning, TAM has been used to examine the factors that influence students' acceptance and use of online learning systems (Chang & Tung, 2018).

Perceived usefulness and perceived ease of use are the two main constructs in TAM that are used to explain technology adoption (Akhter & Nur, 2022). Perceived usefulness refers to the extent to which a technology is perceived to improve task performance, while perceived ease of use refers to the extent to which a technology is perceived to be easy to use (Basuki et al., 2022; Davis, 1989).

In online learning, perceived usefulness has been found to be a significant predictor of students' intention to use online learning systems (Liaw & Huang, 2013). Specifically, when students perceive that online learning systems are useful for their learning, they are more likely to adopt and use them. This finding is consistent with previous research that has shown perceived usefulness to be a key determinant of technology adoption in various contexts (Venkatesh et al., 2003).

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Perceived ease of use has also been found to be a significant predictor of students' intention to use online learning systems (Chang & Tung, 2018; Al-Maroof et al., 2020). When students perceive that online learning, systems are easy to use, they are more likely to adopt and use them. However, ease of use may be less important in online learning than in other contexts, as students may be more willing to invest time and effort to learn how to use a system if they perceive it to be useful (Al-Maroof et al., 2020).

In addition to perceived usefulness and perceived ease of use, other factors such as system quality, social influence, and individual differences (such as prior experience and motivation) have been found to influence students' acceptance and use of online learning systems (Al-Maroof et al., 2020). These findings highlight the importance of considering multiple factors when designing and implementing online learning systems to promote students' acceptance and use of these technologies.

2.2. Operational Definition of Instructor Intention

Instructor intention refers to an instructor's motivation and willingness to use technology in their teaching. Several studies have found that instructor intention has a significant effect on technology acceptance in online learning. For example, instructors who are motivated to use technology in their teaching are more likely to adopt and use technology. In addition, instructor support and training can improve their intention to use technology, which can lead to increased adoption and use.

2.3. Hypotheses Development

2.3.1. Social Influence

Social influence refers to the impact that others have on an individual's beliefs, attitudes, and behaviors. In the context of online learning, social influence can come from peers, instructors, or other sources. Studies have found that social influence has a significant effect on perceived usefulness and perceived ease of use, which in turn affect technology acceptance (Wu et al., 2018). Specifically, social influence can lead to a perceived need for technology, which can increase perceived usefulness. It can also help to reduce perceived complexity and increase perceived ease of use, which can lead to greater technology acceptance.

Social influence has been defined as the degree to which an individual is affected by the attitudes, beliefs, or actions of others (Venkatesh et al., 2003). In the context of online learning, social influence can come from peers, instructors, or external factors. Alzahrani and Alghamdi (2020) found that social influence significantly affects university students' intention to use learning management systems in Saudi Arabia. The study suggests that social influence plays a vital role in shaping attitudes towards online learning. Based on the literature review, the following hypotheses are proposed:

H1: Social influence positively affects perceived usefulness in the context of online learning technology acceptance.

H2: Social influence positively affects perceived ease of use in the context of online learning technology acceptance.

H3: Social influence has a significant positive effect on instructor intention to use online learning platforms.

2.3.2. Perceived Usefulness

Perceived usefulness refers to the extent to which an individual believes that using technology will help them achieve their goals or tasks. Several studies have shown that perceived usefulness has a significant effect on technology acceptance in online learning (Wu et al., 2018). For example, students who perceive that online learning technologies are useful for achieving their academic goals are more likely to use them. In addition, instructors who perceive that technology can improve their teaching effectiveness are more likely to adopt and use technology in their courses. Based on the literature review, the following hypotheses are proposed:

H4: Perceived usefulness positively affects instructor intention to use online learning platforms.

2.3.3. Perceived Ease of Use

Perceived ease of use refers to the degree to which an individual believes that using technology will be free from effort or difficulty. Several studies have found that perceived ease of use is an important factor that affects technology acceptance in online learning (Davis, 1989; Wu et al., 2018). Students and instructors who perceive that online learning technologies are easy to use are more likely to use them. In addition, a positive user experience with technology can lead to increased perceived ease of use and subsequent adoption. Based on the literature review, the following hypotheses are proposed:

H5: Perceived ease of use positively affects instructor intention to use online learning platforms.

2.3.4. Perceived Usefulness and Perceived Ease of Use

Perceived usefulness refers to the extent to which a user believes that a technology will improve their performance (Davis, 1989). Perceived ease of use, on the other hand, refers to the degree to which a user believes that a technology is easy to use (Davis, 1989). Both perceived usefulness and perceived ease of use have been identified as critical factors in user acceptance of technology. Kuo et al. (2014) found that both interaction and internet self-efficacy, which are related to perceived usefulness and perceived ease of use, were significant predictors of student satisfaction in online courses. Based on the literature review, the following hypotheses are proposed:

H6: Perceived usefulness mediates the relationship between perceived ease of use and instructor intention to use online learning platforms.

H7: Perceived usefulness mediates the relationship between social influence and instructor intention to use online learning platforms.

3. Methodology

This is a quantitative research study undertaken online owing to the Covid-19 pandemic, which resulted in a lockdown and everyone being forced to stay at home; instead of delivering physical copies to the pupils inside, the university. The full structured online survey is used in a descriptive research design to collect data on the effect of social influence on instructor intention and thus testing their causality through two mediators of perceived ease of use and perceived usefulness.

3.1. Data Collection

The literature was examined for scales that had already been constructed to study the influence of online learning on students and instructors prior to designing measurement instruments for the research model. Following a review of the current validated instruments, several of the constructs implicated in this research have been used in prior studies, and scales for these constructs were presented. However, none of the current scales were properly suited to the

research model: The Effect of Online Learning on Communication between Instructors and Students. As a result, new scales for these structures had to be established. Devellis (2016) developed and validated a multi-item scale to assess the effects of online learning on teacher-student communication, adhering to the recommended standard scale development process advocated in the literature (Churchill, 1979).

A sample of 189 students from the 5 schools in Terengganu, Malaysia is used, and it is reasonable to assume that they are representative of the entire population. Because it is the most straightforward and convenient method, the simple random sampling method is used as the sample methodology for the study. As previously stated, the data gathering instrument is an online survey. Previous literature is used to create appropriate survey items. Some of our survey items can be drawn from previously developed scales. Furthermore, certain items may be produced as a result of conversations on important subjects from various pieces of literature (Lewis et al., 2005).

The research used probabilistic sampling; because positivism is concerned with decreasing bias as much as possible, the probability-based sampling approach was judged the most appropriate. This eliminates the possibility of sampling bias or selectively recruiting people. Furthermore, the sampling technique utilised was basic random sampling, which means that every item in the population has an equal chance of being chosen. For hypothesis testing, the Covariance Based Structural Equation Modeling (CB-SEM) using IBM-SPSS-AMOS software was used.
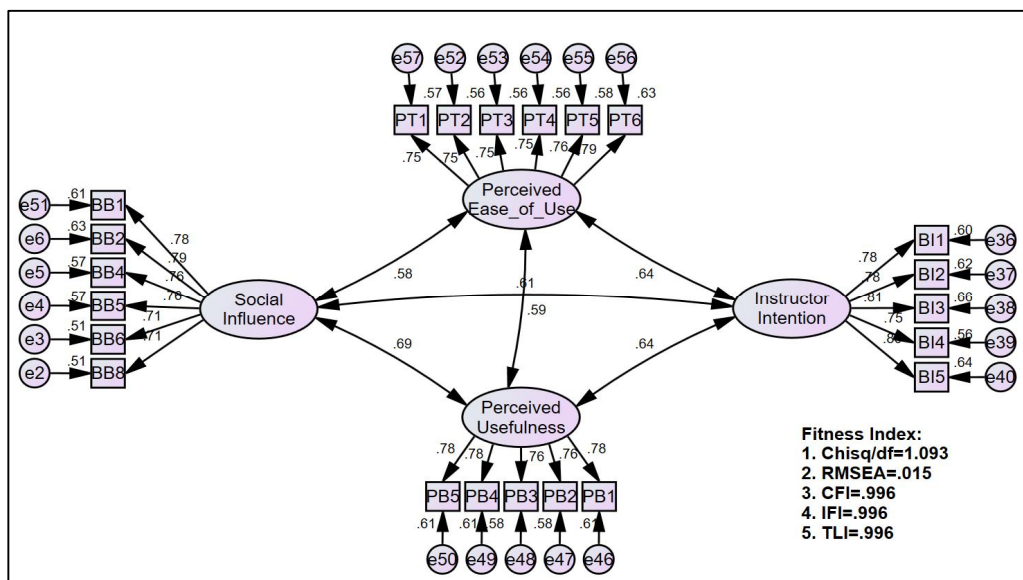
4. Findings

Figure 1: Pooled CFA

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In this stage, the fitness of the model was determined by the value of factor loading and global fitness index. In this case, the value of factor loading meets the minimum value of 0.6 (Yusoff et al., 2021). In particular, the range value of factor loading for Social Influence are between 0.71 and 0.79; Perceived Ease of Use has value from 0.75 to 0.79; Perceived Usefulness was measured from 0.76 to 0.78; and Instructor Intention has value from 0.75 to 0.82. Thus, all items under each construct is retain for the construct validation purpose.

Table 1: The summary of Fitness Indexes

Name of category	Name of index	Index value	Comments
Absolute fit	RMSEA	0.015	The required level is achieved
Incremental fit	CFI	0.996	The required level is achieved
	TLI	0.996	The required level is achieved
	IFI	0.996	The required level is achieved
Parsimonious fit	Chisq/df	1.093	The required level is achieved

Hair et al. (2017) and Afthanorhan et al. (2019) recommend the study should report at least one index from each category of the model fit which are Absolute Fit, Incremental Fit and Parsimonious Fit in order to prove construct validity. From this table, all fitness indexes were satisfied as the value of RMSEA < 0.08; CFI, TLI and IFI > 0.90 and Chisq/df < 3.0. Therefore, one can concluded that the higher order of Instructor Intention model is suitable for the next analysis.

Table 2: Reliability, Convergent and Discriminant Validity

	CR	AVE	Perceived Usefulness	Social Influence	Instructor Intention	Perceived Ease of Use
Perceived Usefulness	0.882	0.598	**0.773**			
Social Influence	0.887	0.566	0.685	**0.752**		
Instructor Intention	0.888	0.614	0.637	0.614	**0.784**	
Perceived Ease of Use	0.891	0.577	0.587	0.582	0.640	**0.759**

Table 2 shows the Composite Reliability and Average Variance Extracted results yielded from value of factor loading. According to Rahlin et al., (2019), the value of CR is achieved when the value of CR is higher than the value of 0.70. As is shown, the value of CR for each construct is higher than the threshold value. In additions, Lowry and Gaskin (2014) suggests the AVE of the construct is considered valid when the value is above 0.50. In this case, the value for each construct is higher than their expectations. Thus, the reliability and validity of each construct is satisfied.

Referring to Table 2, the value of correlation between constructs are fall in the range between 0.582 and 0.685. It can be concluded that this model is free from the detrimental of multicollinearity problem that can effect on results. The discriminant validity is well established when the value of square root AVE is higher the value of construct correlations. In this case, the discriminant validity is satisfied as meet the requirement suggested by Hair et al. (2017) and Afthanorhan et al. (2021).
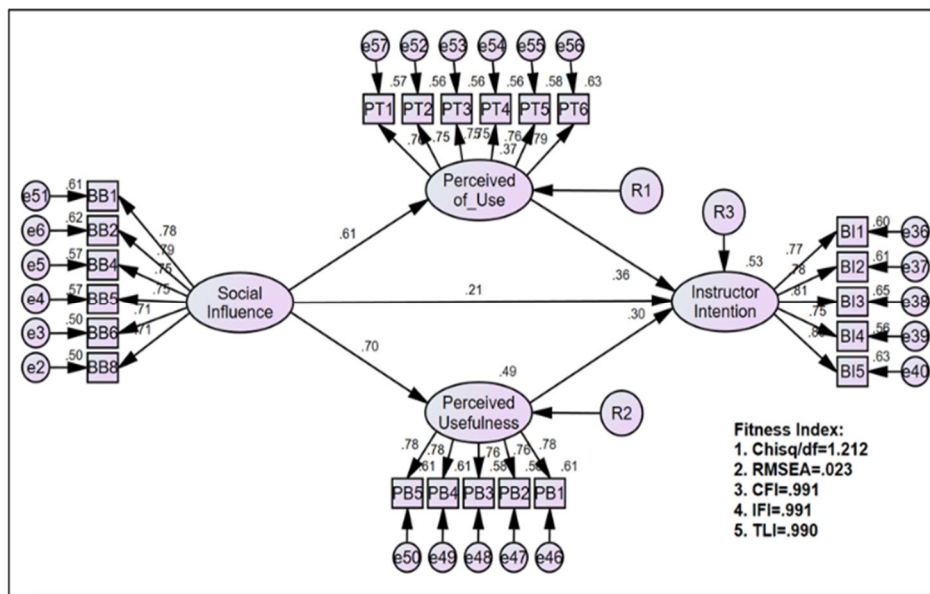

Figure 2: Structural Model

Table 3: Regression Weights

			Estimate	S.E.	C.R.	P	Result
Perceived of Use	<---	Social Influence	.654	.066	9.855	***	Significant
Perceived Usefulness	<---	Social Influence	.814	.072	11.267	***	Significant
Instructor Intention	<---	Perceived Usefulness	.310	.071	4.400	***	Significant
Instructor Intention	<---	Perceived of Use	.398	.067	5.968	***	Significant
Instructor Intention	<---	Social Influence	.249	.094	2.651	.008	Significant

Table 3 shows the regression weight for each path analysis that has being proposed in research hypotheses. From the table, it is clearly show that Social Influence has significant impact towards Perceived of Use and Perceived Usefulness constructs. Then, all these factors were eventually significantly affected on Instructor Intention.

Also, by looking at the causality results, the parameter estimate of Social Influence has the highest impact on Perceived Usefulness compare with Perceived of Use. In terms of the Instructor Intention result, the Perceived of Use seem has highly contributed among the three factors (Perceived Usefulness, Perceived of Use and Social Influence). To test the mediation modelling, the following part describe briefly about their process using novel method of phantom approach.

4.1. Phantom Approach to Test the Parallel Mediation

For analysis of mediating effect of Perceived Ease of Use and Perceived Usefulness concerning Social Influence and Instructor Intention, the Phantom approach has been adopted. The Phantom Approach is a convenient and robust method for arbitrary specific effect comparison, testing, and estimating variables within the SEM structure (Mohamad et al., 2019; Nasir et al., 2020). Table 4 and Table 5 displayed the accumulated result of the Phantom Approach, showing a partial mediator influence of Perceived Ease of Use and Perceived Usefulness on Instructor Intention and Social Influence.
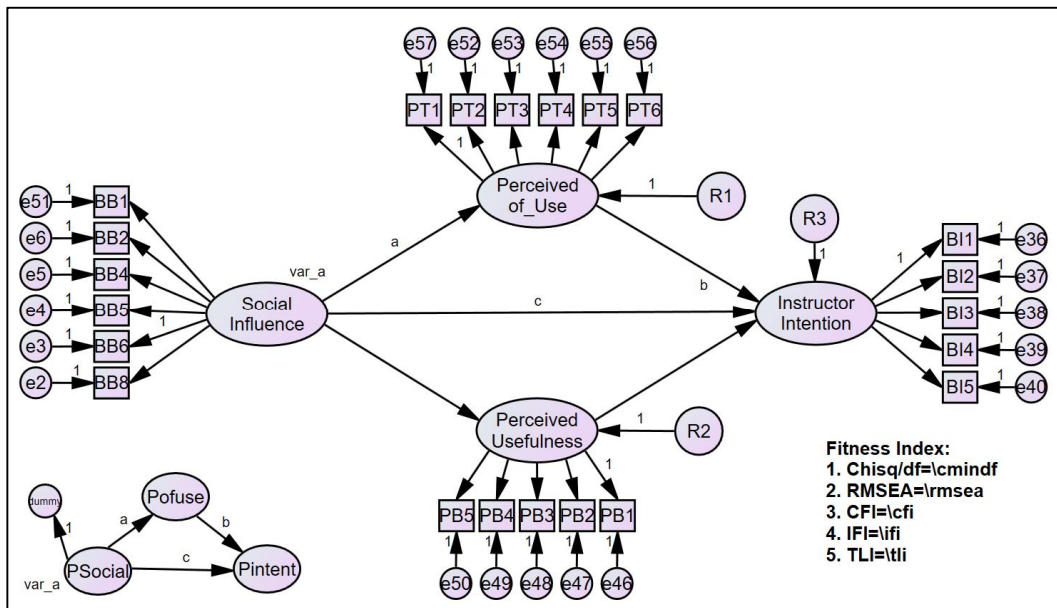

Figure 3: Phantom Modelling using AMOS Software

The analysis of the relationship of Social Influence on Instructor Intention shows Perceived of Use and Perceived Usefulness have a significant mediating effect on this relationship (0.001, p > 0.05). The result indicates that the entire mediating effect is due to the presence of the Perceived Ease of Use and Perceived Usefulness in the model.

4.2. Testing Mediation Effect Using Bootstrap Approach

The author employed the Bootstrap approach to test the mediation effect which recently known as the best recommended approach. This method available in AMOS software. The results for this assessment are shown as the following tables:

Table 4 and Table 5 exhibits the result for the analysis of the mediator construct. To recap, the authors proposed that the Perceived of Use and Perceived Usefulness construct as the mediator for this modelling. Whist, Social Influence examined as an exogenous construct and Instructor Intention as the endogenous construct. The application of this AMOS analysis produced the output for bootstrapping estimates and p-value.

Moreover, the author analysed the result for all direct effect in the measurement model to estimate the type of mediation for Perceived of Use and Perceived Usefulness construct. The regression weight for the direct effect of for all mediation relationship as follows; Social Influence and Instructor Intention is 0.215.

Meanwhile, the probability of getting bootstrap p-value (< 0.05) for the direct effect of for all mediation relationship as follows; Social Influence and Instructor Intention is 0.001, Accordingly, the authors concluded that the type of mediation for both constructs of Perceived Ease of Use and Perceived Usefulness are Partial Mediation because of the significant effect observed in the direct causal effect. Thus, all hypothesis of mediation relationship in this model is accepted.

Table 4: Indirect Effect Results of Perceived Ease of Use

	Indirect Effect	Direct Effect
Bootstrapping Estimate	0.220	0.215
Bootstrapping P-Value	0.002	0.001
Result	Significant	Significant
Research Hypothesis	Mediation occurred since the indirect effect is significant. Therefore, the Perceived Ease of Use has mediated the significant effect Social Influence and Instructor Intention	
Type of Mediation	Partial Mediation	

Table 5: Indirect Effect Results of Perceived Usefulness

	Indirect Effect	Direct Effect
Bootstrapping Estimate	0.211	0.215
Bootstrapping P-Value	0.004	0.002
Result	Significant	Significant
Research Hypothesis	Mediation occurred since the indirect effect is significant. Therefore, the Perceived Usefulness has mediated the significant effect Social Influence and Instructor Intention	
Type of Mediation	Partial Mediation	

5. Discussion

The results from SEM method suggest that social influence, perceived usefulness, and perceived use are all important factors that impact instructor intention in the context of online learning. Specifically, the study found that social influence has a significant impact on perceived usefulness and perceived use, which in turn mediate the relationship between social influence and instructor intention.

These findings are particularly relevant for instructors who are teaching in online environments, where the importance of social influence may be even greater than in traditional classroom settings (Turk et al., 2022; Aldosari, et al., 2022). Instructors who are able to effectively leverage social influence by building strong relationships with their students, for example, may be more likely to be perceived as useful and to have a greater impact on student learning outcomes distribution. Similarly, instructors who are able to design courses and assignments that are perceived as useful and easy to use may be more likely to attract and retain students, which can have a significant impact on instructor intention (Martin et al., 2022; Saputra, 2022).

Overall, these results suggest that instructors who are teaching online should be aware of the importance of social influence as also suggested by Yu (2022), perceived usefulness, and perceived use in shaping their teaching strategies and decisions. By focusing on these factors, instructors can enhance their effectiveness and ultimately improve student learning outcomes in online learning environments.

5.1. Implication to the Practice

The factors of perceived usefulness, perceived ease of use, and social influence are important considerations for instructors when adopting online learning. Perceived usefulness refers to the extent to which instructors believe that online learning will enhance their teaching effectiveness and provide benefits to students (Bansah & Darko Agyei, 2022). Perceived ease of use relates to the degree to which instructors find online learning easy to use and integrate into their teaching practice. Social influence describes the impact that colleagues, peers, and other stakeholders have on an instructor's decision to adopt online learning.

For instructors, these factors have important implications for their intention to use online learning. Instructors who perceive online learning to be useful and easy to use are more likely to adopt it in their teaching practice (Alismaiel et al., 2022; Sarfraz et al., 2022). Similarly, social influence can play a significant role in influencing an instructor's decision to adopt online learning. Peer support, training, and professional development opportunities can all help to increase the likelihood that instructors will adopt and integrate online learning into their teaching practice. Ultimately, the successful adoption of online learning by instructors requires careful consideration of these factors, as well as ongoing support and resources to help instructors

fully realize the benefits of this innovative teaching approach.

5.2. Recommendation and Future Research

The findings on the factors of perceived usefulness, perceived ease of use, and social influence towards instructor intention among instructors based on online learning have significant implications for the adoption and effective implementation of online learning in education (Conrad et al., 2022). To increase the adoption of online learning, it is recommended to provide training and support for instructors. As online learning technologies are constantly evolving, it is important for instructors to receive regular training to help them stay up-to-date and feel confident in using these technologies (Muñoz et al., 2022). Support can also come in the form of resources and guidance for instructors who are struggling to integrate online learning into their teaching practice (Greenhow et al., 2022).

In addition to training and support, fostering a supportive culture among instructors is also crucial. When instructors feel encouraged and motivated to experiment with new teaching approaches, including online learning, they are more likely to adopt and effectively use these technologies (Kew & Tasir, 2022; Egielewa et al., 2022). Clear and compelling benefits of online learning for both instructors and students can also increase perceived usefulness and adoption. For example, online learning can provide instructors with new ways to engage students, support personalized learning, and facilitate collaboration. Meanwhile, students can benefit from the flexibility and accessibility of online learning, as well as the opportunities for collaboration and interaction (Almaiah et al., 2022; Chiu, 2022).

Finally, ongoing professional development opportunities can also help to increase the adoption and effective use of online learning among instructors (Moustakas & Robrade, 2022). These opportunities can provide instructors with access to new tools, resources, and best practices, as well as opportunities to connect and collaborate with other educators (Tarchi et al., 2022). Future research can help to better understand the factors that influence instructor perceptions of online learning, as well as the best ways to support instructors in adopting and using online learning technologies effectively.

One area of research could explore the role of social influence and other contextual factors in the adoption and use of online learning among instructors. This research could examine how peer support, leadership, and institutional culture can impact an instructor's decision to adopt online learning. Other research could focus on understanding the impact of online learning on student outcomes, including academic achievement, engagement,

and retention. Finally, research could also explore the best practices for designing and delivering online learning experiences that are effective and engaging for students.

The application of the Phantom Distribution Approach provides valuable insights into the technology acceptance model, offering a comprehensive framework for understanding the dynamics of online learning environments. By addressing these recommendations and conducting further research in these areas, we can better support the adoption and effective implementation of online learning in education, and ensure that instructors have the tools and resources they need to provide high-quality and engaging learning experiences for their students.

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