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Article

An insight of undergraduate students' attitude and satisfaction with online home-based learning system

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Abstract: The purpose of this study is to investigate different factors associated with remote online home-based learning (thereafter named OHL), including technical system quality, perceived quality of contents, perceived ease of use, and perceived usefulness in relation to the satisfaction of undergraduate students following the post-COVID-19 pandemic in Malaysia. Additionally, the mediating roles of attitude are also investigated. Two hundred questionnaires were distributed using judgmental sampling method and 156 completed responses were collected. The data were subsequently analyzed using PLS-SEM. The findings imply that the OHL system is an effective method although it is challenging to operate. In terms of perceived technical system quality, OHL is currently more gratifying for students; however, some have reported that the quality of the content delivered via the remote system is still unsatisfactory. Moreover, the study found that attitude is a significant determinant of undergraduates' satisfaction with OHL. This study contributes to the advancement of current knowledge by inspecting the factors of the Undergraduate Level OHL System using the mediating roles of attitude. In terms of underpinning theories, Technology Acceptance Model and Information System Model were employed as the guiding principles of the current study.

Keywords: online home-based learning; technology acceptance model; perceived technical system quality; perceived quality of contents; attitude; students' satisfaction

1. Introduction

Online Home-based Learning, a learning method using technologies through internet that allows students to learn remotely (Muhuri and Mukhopadhyay, 2022), has been claimed as a new learning method that imposed new requirements on university students (Liu et al., 2021). The online learning process required learning assistance tools like portable devices which encompass smartphone, computer, and tablet that offer independent multimedia learning and teaching services (Liu, 2023; Vanve et al., 2016). Therefore, Online Home-based Learning (thereafter named OHL) is perceived to establish a flexible educational and comfort learning environment for students (Khusanov et al., 2022). Undoubtedly, this e-learning system has introduced numerous captivating attributes to the realm of education, fostering countless unforeseen prospects (Upadhyay, 2020).

Research studies have outlined that tertiary institutions with online learning systems may provide a better learning environment than the conventional learning system (Wong et al, 2023a; Wong et al, 2023c). Moreover, the function of scenarios-

based online learning supported by artificial intelligence is commonly used by educational institutions to provide improved teaching and learning opportunities during their training activities (Seo et al., 2021). Even so, there is a lack of research on OHL in tertiary learning environment in Malaysia that specifically focused on students' attitude and satisfaction. Hence, this study aims to inspect the linkage between the quality of OHL system and the user's perception, as well as their level of satisfaction.

Given the competitive nature of the online learning market, student satisfaction is now widely acknowledged as a crucial factor contributing to competitive advantage. Extensive research has been carried out to evaluate student contentment in online education, leading to the creation of various conceptual frameworks (Finneran and Zhang, 2003). Mohammadi (2015) conducted a study where they used various theories on the adoption of information technology to analyze the satisfaction and behavioral tendencies of individuals involved in online learning. Prior research has examined the utilization of the Technology Acceptance Model (TAM) formulated by Davis and Bagozzi (1992) to analyze the determinants that impact individuals' adoption of technology. These indicators include the perceived ease of use (PEOU) and perceived usefulness (PU), which measure students' satisfaction with using online remote learning from their homes. The initial concept pertains to users' perception that utilizing OHL will be straightforward.

Furthermore, perceived ease of use has an impact on attitude and indirectly affects satisfaction. Perceived usefulness and user's attitude can potentially impact the satisfaction of undergraduate students, making them reliable indicators of technology adoption. Therefore, the use of OHL is regarded as an innovative technology during the COVID-19 pandemic (Li et al., 2022). However, there is a dearth of research data that examines the level of satisfaction on OHL system among students within Malaysia's higher education, especially at the post-COVID-19 pandemic. Therefore, there is a necessity to address any shift in needs of this OHL system as at today.

This study follows the article of Wong et al. (2023a) that demonstrated both technical system quality (TSQ) and perceived quality of contents (PQC) can enhance the online learning system users' experience and satisfaction simultaneously. However, prior research rarely examined the perspective of users on OHL at the post-COVID-19 pandemic. Therefore, this study seeks to fill the gap by investigating different factors associated with remote OHL, including TSQ, PQC, PEOU, and PU in relation to the satisfaction of undergraduate students after the COVID-19 pandemic.

2. Literature review

2.1. Online home-based learning

The sudden shift of learning and teaching method to Online Home-based Learning (Hu et al., 2022) has caused a significant transformation in the field of education and remote knowledge acquisition (Khlaif et al., 2021). This system encompasses a variety of educational initiatives and materials. According to Suprihartini and Novianto (2022), the integration of OHL systems allows for a customized learning experience that caters to the unique behaviors and preferences of individual users.

Empirical evidence showed that implementing this personalized approach significantly enhances students' ability to govern themselves, their motivation, and compliance with social distancing learning. Unfortunately, the successful implementation of this strategy is hindered by financial limitations, lack of technological capability, and constraints in internet accessibility (Choi, 2022). Thus far, most of the prior studies have been performed during COVID-19 pandemic. Both the scholars and higher education service providers have devoted inadequate attention to the user's disposition and degree of contentment with remote learning, especially in the post-pandemic period.

2.2. Undergraduates' satisfaction

Prior study shows that user satisfaction in OHL systems is determined by learner's perception on the extent this learning system meets their needs and the successful interaction between the system and its users (Alshare et al., 2011). Scholarly investigations have proposed that students' satisfaction might serve as a dependable metric for assessing the caliber of the educational encounter (Sahin and Shelley, 2008; Wickersham and McGee, 2008; Yukselturk and Yildirim, 2008).

Lin and Wang (2012) discovered that the PU of the information has a substantial effect on the users' satisfaction of an online learning system. Besides, the quality of an information system has a direct impact on system effectiveness (DeLone and McLean, 1992), where undergraduates evaluate the reliability and efficiency of these services provided in arriving to their satisfaction (Abu-Rumman and Qawasmeh, 2022). By utilizing the model to analyze user-generated applications, McGill et al. (2003) uncovered persuasive evidence that substantiates the correlation between system quality and user satisfaction. Specifically, PQC and TSQ have been identified by Wong et al. (2023a) as reliable instruments for assessing students' satisfaction. On the other hand, the options of undergraduates as clients (consumers) in utilizing the OHL services would significantly affect the educational institutions' decision in operating system (Abu-Rumman and Qawasmeh, 2022). This is because students' satisfaction is the only measure used to evaluate the effectiveness of higher education service providers. Thus, the present investigation is centered on the satisfaction of undergraduate students with OHL systems. The researchers employed the Technology Acceptance Model (TAM) and Information Systems (IS) as the foundational theories to ensure the correct execution of the study.

2.3. Perceived ease of use

Perceived ease of use (PEOU) pertains to the consumer's subjective evaluation of the ease of use associated with a particular technology or system (Davis, 1989). It has significant impact on technology-driven applications adoption (Doll and Torkzadeh, 1998; Venkatesh, 2000). PEOU is widely recognized as an essential indicator of a successful implementation and long-term viability of online learning systems (Abu Sneineh and Zairi, 2010). Prior study identifies a clear linkage between PEOU and both favorable attitudes and satisfaction among students simultaneously (Kashive and Mohite, 2023). The ease of use of an online learning system is a crucial aspect, as its user-friendliness can strongly motivate students in favor of and fully

engage with e-learning. Some students may choose not to participate in e-learning because they perceive it as challenging and potentially risky.

Therefore, it is widely acknowledged that the notion of PEOU has a significant impact in guaranteeing an effective implementation and sustainable operation of online learning systems (Abu Sneineh and Zairi, 2010; Tran, 2023). Nevertheless, all these studies were carried out before and during the pandemic era, where the educational system allowed the option of partially delivering classes through online or offline means. Hence, the plan of this study was to examine the relationship between PEOU and both attitude and satisfaction among undergraduate students at the post-COVID-19 pandemic. Based on this, it is anticipated that a comparable correlation may arise in this situation, as postulated below:

H_1: PEOU has a positive effect on undergraduate students' attitude towards OHL during the post-Covid-19 pandemic.

H_2: PEOU has a positive effect on undergraduate students' satisfaction with OHL during the post-Covid-19 pandemic.

2.4. Perceived usefulness

The process through which an individual ascertains whether a technological device has the potential to enhance their productivity and efficiency is referred to as Perceived Usefulness (PU). Davis (1989) first introduced this notion, which bears a strong resemblance to the user's viewpoint regarding the system. PU, as defined by Wong et al. (2023b), pertains to the degree of reliability, effectiveness, and economical achieved through the utilization of technology in the domain of online education. Therefore, PU can be defined more precisely as the extent to which individuals perceive innovation to be superior in terms of comfort, satisfaction, convenience, and precision when compared to similar alternatives (Londa et al., 2022).

Based on the discussion above, PU has a substantial influence on students' attitudes and satisfaction regarding online learning from home amidst the COVID-19 pandemic. However, there is a lack of research that has specifically addressed the same factor that affects the satisfaction of undergraduates with remote OHL platforms following the COVID-19 pandemic. To address the current scare, the hypotheses are proposed as below:

H_3: PU has a positive effect on undergraduate students' attitude towards OHL during the post-COVID-19 pandemic.

H_4: PU has a positive effect on undergraduate students' satisfaction with OHL during the post-covid-19 pandemic.

2.5. Technical system quality

Technical System Quality (TSQ) as defined in the data information systems success model by DeLone and McLean (2003), represents the fusion of technological progress with the precision and effectiveness of the information-generating communication system. The fundamental elements and performance indicators of an Information System (IS) are commonly associated with the existence or non-existence of a software vulnerability in the system (Rabaai, 2009). Seddon (1997) establishes a solid ground between TSQ and several factors, including the consistency and

maintenance of the program code, user interface functionality, user-friendliness, and software quality (reliability). The significance of TSQ consistently affects students' attitudes and intentions regarding its utilization (Lin and Lu, 2000).

Although the internet has become more popular, many people still concern on the slow response times, poorly designed websites, too much internet traffic, and unreliable network connections, which reflecting the quality of technical systems (Wong et al., 2023a). Moreover, any instances of security breaches or disruptions in the curriculum that current users experience will significantly impede their capacity to perform with precision. This can result in decrease of TSQ of the machine (Wong et al., 2023a). The variable possesses the capacity to affect the users' dispositions and inclination in utilizing the platform, in addition to their contentment with the system (Chang and Tung, 2008; Lee and Lee, 2008). Hence, under these circumstances, the importance of TSQ in shaping the perspectives of website visitors is crucial.

The presence of TSQ in the post-COVID-19 era could potentially exert a substantial influence on the attitudes and overall satisfaction levels of undergraduate students regarding the utilization of OHL. Apart from the research conducted by Wong et al. (2023a), due to the scarce attention on this factor in the past literature, this study formulated the hypotheses as below:

H_5: TSQ has a positive effect on undergraduate students' attitude towards OHL during the post-COVID-19 pandemic.

H_6: TSQ has a positive effect on undergraduate students' satisfaction with OHL during the post-covid-19 pandemic.

2.6. Perceived quality of contents

The Perceived Quality of Contents (PQC) pertains to several aspects within the telecommunications industry: the lucidity of language employed to depict mobile services and promotional activities, the accessibility of an extensive array of consumer-oriented services and products, the precision of the information presented, and the simplicity of conducting searches for current information (Zhou et al., 2019). By effectively eliciting emotional delight and customer satisfaction, this framework significantly impacted the fundamental basis of customer loyalty. Subsequently, an additional study posits that the satisfaction and enjoyment of customers during interactions with the Instagram account are substantially influenced by the content on the platform (Casaló Flavián and Ibaez-Sanchez, 2017). Furthermore, Boonchutima et al. (2021) found that to facilitate engagement with the content, attract consumers, and generate likes, Instagram account content must be distinctive and of superior quality. For example, the 'Broke Vogue' Instagram account gained 300 followers in a short period of time by featuring do-it-yourself fashion-related activities and content. Likewise, Tee et al. (2023) agreed that the significance of content quality cannot be overstated when it comes to captivating the interest of the intended audience and efficiently conveying messages.

PQC was utilized in the most recent research conducted by Wong et al. (2023a) to determine the degree of contentment that undergraduate students experienced with OHL in the aftermath of the Covid-19 pandemic. Nevertheless, this factor has been rarely investigated (Wong et al., 2023a, b). As a result, the subsequent hypotheses

shall be examined:

H_7: PCQ has a positive effect on undergraduate students' attitude towards OHL during the post-Covid-19 pandemic.

H_8: PCQ has a positive effect on undergraduate students' satisfaction with OHL during the post-Covid-19 pandemic.

2.7. Attitude

Attitudes are characterized by the extent to which an individual has a positive or negative feeling towards a particular subject (Fishbein and Ajzen, 1977; Korhonen et al., 2023). A positive disposition towards information and communication technology (ICT) is widely recognized as an essential prerequisite for its effective integration (Woodrow, 1990; Wong et al., 2023d). Prior studies have demonstrated that students' attitudes are impacted by a range of factors, such as the PU, PEOU, TSQ, and PCQ associated with online learning programs (Saif et al., 2024; Wong et al., 2023c). To foster student acceptance and satisfaction with online learning, it is critical to cultivate favorable student attitudes and engage them in online learning behaviors (Selim, 2007). Although there is some variation, the overall sentiment of undergraduate students towards online learning is positive (Rhema and Miliszewska, 2014). Different from COVID-19 pandemic, the satisfaction of undergraduate students with OHL in the post-COVID-19 pandemic may be subject to attitude. Again, due to the limitation of study in attitude towards OHL after the COVID-19 pandemic, the hypothesis is proposed as below:

H9: Attitudes have a positive effect on undergraduate students' satisfaction with OHL during the post-Covid-19 pandemic.

2.8. Mediation impact of attitude

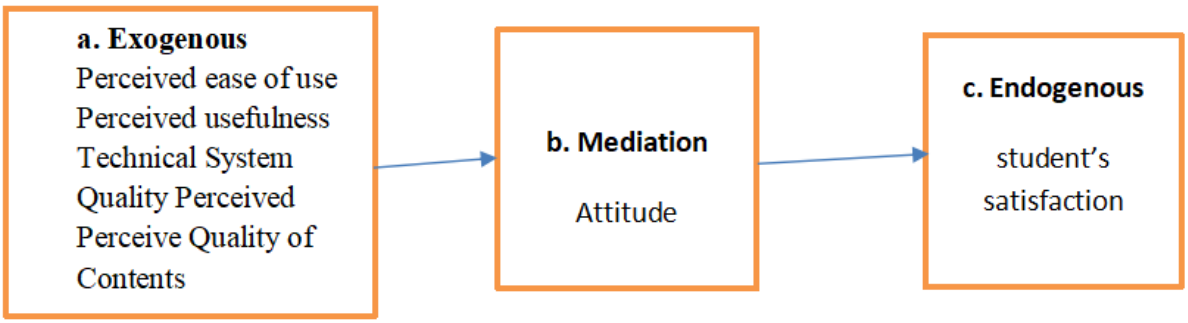

Figure 1. Mediation analysis.

Hair et al. (2014) provided significant emphasis on the necessity of employing bootstrapping to estimate the sampling distribution of the indirect effect, as suggested by Preacher and Hayes (2004, 2008). This method is applicable to models with both a single and multiple mediators (p. 223). Furthermore, this approach is applicable in PLS-SEM, which makes no assumptions regarding the sampling distribution of the statistic or the distribution shape of the variables. Therefore, its applicability is limited to a specific number of samples (Hair et al., 2014; Preacher and Hayes, 2008). According to Zhao et al. (2010), it is not intrinsically necessary for the independent variable to have a substantial impact on the dependent variables. While the overall

impact may not always be substantial, discernible indications of intervention remain.

When the influence of independent variables on the dependent variable is relatively weak, to ensure the maintenance of this relationship, two distinct prerequisites must be met. At the outset, the exogenous variables (PEOU, PU, TSQ, and PQC) from section "A"—the independent variables, which is depicted in the previously mentioned figure, must significantly influence the attitude (the mediator) prior to regression analysis between the attitude and the students' satisfaction. As illustrated in **Figure 1**, it would be critical if the exogenous variables exhibit a significant influence on students' satisfaction on OHL at the post-COVID-19 pandemic. During the post-COVID-19 pandemic, the researcher must establish a theoretical relationship between exogenous variables in part "A" and attitude, and relationship between attitude and students' satisfaction on OHL. Given the confirmed direct correlation between attitude and independent variables under hypotheses $H_{1,3,5,7}$ and H_9 as presented in **Figure 2**, attitude is therefore considered a mediator in this study.

H_{10}: Attitude mediates the relationship between PEOU and students' satisfaction with OHL during the post-COVID 19 pandemic.

H_{11}: Attitude mediates the relationship between PU and students' satisfaction with OHL during the post-COVID 19 pandemic.

H_{12}: Attitude mediates the relationship between TSQ and students' satisfaction with OHL during the post-COVID 19 pandemic.

H_{13}: Attitude mediates the relationship between PQC and students' satisfaction with OHL during the post-COVID 19 pandemic.

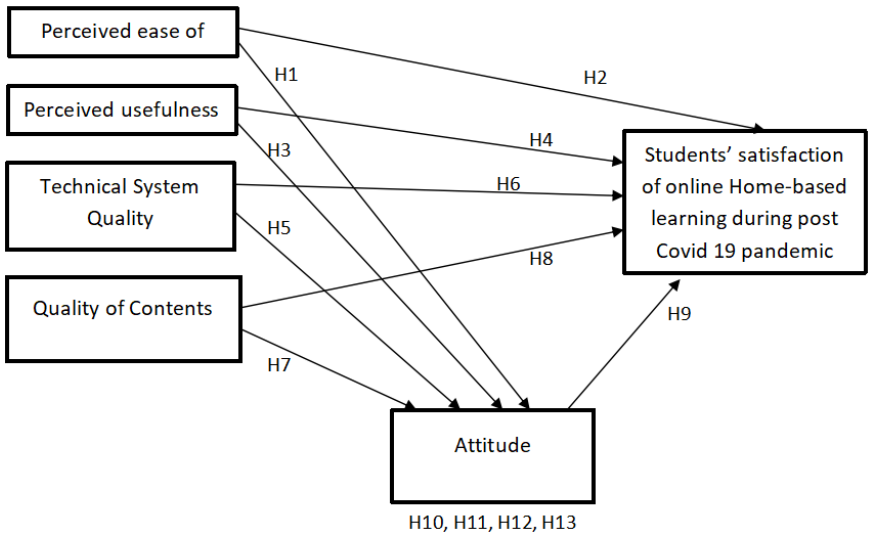

Figure 2. Conceptualized framework.

This study combined the TAM and Information System Model, which includes Perceived Quality of Content and Technical System Quality in assessing students' satisfaction on OHL program at the post-COVID19 period. The researchers were interested to investigate the mediating effect of student's attitude in the relationship of the four factors identified from the two mentioned models above in this framework and the student's satisfaction.

3. Methodology

In this study, the target population was the undergraduate students in Malaysia. G*Power analysis software was utilized to capture a sample size of 129. This study employed self-administrated questionnaire for data collection. The aim was to test the connections between the exogenous variables (perceived ease of use, perceived usefulness, Technical System Quality, Perceived Quality of Contents), mediator (attitude), and endogenous variable (Undergraduates' Satisfaction).

The survey was structured into six distinct sections, with section one containing general demographic inquiries intended to gather information about the participants. The second section and the following sections consisted of inquiries that were related to the perceived ease of use-PEOU (five questions), perceived usefulness-PU (six questions) quality of the technical system-TSQ (five questions), the process of measurement of perceived quality of content-PQC (five questions, Zhou et al. (2019)). The scale's validity and reliability were validated through internal consistency analysis, using Cronbach's alpha.

This study employed the Likert scale in the analysis; values on the scale ranged from one (strong disagreement) to five (strong agreement). The data collection process involved the administration of a Google form questionnaire to enrolled undergraduates within the test period of 1 September 2022 and 30 September 2023. Referring to Wong et al. (2023a), the authors employed the judgmental sampling (Fricker, 2008) in finalizing the sample size for the test at post-COVID-19 pandemic. This is a non-probability sampling method that involves selecting a sample based on the researcher's judgment and knowledge of the population, particularly when the population is not homogeneous. This sampling method allowed the researchers to opt the sample by judgement since during the COVID-19 pandemic, the Standard Operations Procedures (SOP) strongly underscored the social distancing and minimized the physical contact. In addition, the Personal Data Protection Act 2010 (PDPA) limited the researchers' ability to obtain a full list of active undergraduate students and their contact information from universities. Even though judgmental sampling is bias in sampling, the researchers issued a pre-screening question in regards with online home-based learning before students answering the questionnaire. The researchers located the pre-screening question to those students who had attended the online home-based leaning at the post-pandemic period.

In this study, G*Power analysis was applied to compute the minimum sample size of 129. This method was introduced by Erdfelder et al. (1996) as a general stand-alone power analysis program for statistical tests mostly applied in the social and behavioral studies. As stated by G Power Analysis (2018), "G*Power analysis is able to determine an accurate and reliable number of samples for statistical judgments, which can be used to justify the impact of a given size in a particular situation and minimizing the type two error". Therefore, this analysis is vital for rational statistical decisions, and it is an efficient and easy-to-use power analysis programs for personal computers (Goldstein, 1989). A final sample of 156 out of 200 surveys were completed by participants and incorporated into the data analysis. The validity rate of these responses was 78%. Since the participation in survey was voluntary, the possibility of response bias was eradicated. This study adopted the PLS-SEM analysis methodology

in determining the significance of the postulated relationship.

4. Results

4.1. Respondent profile

According to the data presented in **Table 1**, out of one 156 respondents, women made up 63.5%, while men made up 36.5%. This re-affirmed the outcomes of prior research which indicated over 64% of enrolments in Malaysia are female (Bilton, 2018). In terms of age, 56.4% of the respondents fell within the age range of 22 to 25 years old and 34.8% within the range of 18 to 21 years old. Only 5.1% of the respondents aged within the range of 32 to 40 years old and 4.5% aged within 26 and 30 years old respectively. From the demographic analysis, obviously, the undergraduate students who utilized OHL were mostly aged within the range of 22 and 25. There were approximately 69.8% of respondents doing a bachelor's degree and 30.1% were enrolled in a diploma program. Regarding ethnicity, the survey revealed that more than 90% of respondents were Chinese, indicating Chinese students were more interested in OHL than the others in volunteering to participate in this study.

Table 1. Respondent's profile.

Demographic Variables	Categories	Frequency	Percentage (%)
Gender	Male	57	36.5
	Female	99	63.5
Age	18–21	53	34.0
	22–25	88	56.4
	26–30	7	4.5
	31–40	8	5.1
Educational Qualification	Diploma	46	30.1
	Bachelor's Degree	109	69.8
Year of Study	Year 1	36	23.1
	Year 2	39	25.0
	Year 3	49	31.4
	Others	32	20.5
Ethnic	Malay	3	1.9
	Chinese	152	97.4
	India	1	0.6

4.2. Partial least square-structural equation modelling (PLS-SEM)

This study employed the Partial Least Square-Structural Equation Modelling (PLS-SEM) using analytical instrument- Smart-PLS 4.0 for data analysis. As emphasized by Kock and Lynn (2012) when gathering data from a single source via complete collinearity, it is critical to account for Common Method Bias. There is consensus among scholars that one can ascertain the presence of bias-free data from a single source by examining whether the Variance Inflation Factor (VIF) remains

below 3.3. The results of the collinearity tests as presented in **Table 2** showed the absence of any VIF value greater than 3.3, suggesting that the use of a single source in this investigation did not give rise to significant issues.

Table 2. Full collinearity testing.

ATT	PEU	PU	PQC	SAT	TSQ
2.300	2.103	1.883	2.278	2.588	1.786

TSQ indicates technical system quality; PQC indicates quality of contents; ATT indicates attitude; PEU indicates perceived ease of use; SAT indicates students' satisfaction.

4.2.1. Measurement model

In this study, a two-step methodology was utilized to evaluate the model (Anderson and Gerbing, 1988). An initial evaluation was undertaken to ascertain the precision and uniformity of the components in the instrument that comprised the measurement model. The researchers performed the following measurements to assess convergent validity: (i) item loadings, (ii) average variance extracted (AVE), and (iii) composite reliability (CR), as outlined by Hair et al. (2019). It has been noted by scholars that the loading values must surpass 0.708 to enhance the Composite Reliability (CR) and Average Variance Extracted (AVE). Further criteria stipulates that the AVE and CR must both surpass 0.50 and 0.70 respectively.

According to the measurement model displayed in **Table 3**, every AVE value is greater than 0.5, with a precise range spanning from 0.565 to 0.640. Moreover, each CR value is greater than 0.7, ranging from 0.866 to 0.899. The findings in **Table 3** shows two loading values, namely ATT4 (0.693) and PUE5 (0.642), that are inferior to the suggested threshold of 0.708. Nevertheless, this is deemed acceptable due to the high outer loading of the items in Attitude and Perceived Ease of Use, which satisfies the requirements for CR and AVE.

Table 3. Measurement model.

Constructs	Items	Loadings	CR	Cronbach's alpha	AVE
Attitude	ATT1	0.788	0.866	0.900	0.565
	ATT2	0.745			
	ATT3	0.788			
	ATT4	0.693			
	ATT5	0.738			
Student Satisfaction	CS1	0.774	0.882	0.947	0.600
	CS2	0.770			
	CS3	0.811			
	CS4	0.789			
	CS5	0.727			
Perceived Quality of Contents	PQC1	0.755	0.876	0.909	0.585
	PQC2	0.777			
	PQC3	0.702			
	PQC4	0.777			
	PQC5	0.809			

Table 3. (*Continued*).

Constructs	Items	Loadings	CR	Cronbach's alpha	AVE
Technical System Quality	PSQ1	0.762	0.885	0.876	0.606
	PSQ2	0.803			
	PSQ3	0.819			
	PSQ4	0.726			
	PSQ5	0.780			
Perceived Usefulness	PU1	0.846	0.899	0.920	0.640
	PU2	0.801			
	PU3	0.806			
	PU4	0.779			
	PU5	0.765			
Perceived Ease of Use	PUE1	0.771	0.868	0.905	0.570
	PUE2	0.814			
	PUE3	0.798			
	PUE4	0.737			
	PUE5	0.642			

Table 4. Discriminant validity (HTMT).

	1	2	3	4	5
Attitude					
Perceived ease of use	0.676				
Perceived usefulness	0.683	0.719			
Quality of Contents	0.718	0.737	0.635		
Students' satisfaction of online learning	0.838	0.622	0.602	0.803	
Technical System Quality	0.560	0.679	0.570	0.645	0.687

HTMT, as proposed by Franke and Sarstedt (2019) and Henseler et al. (2015), was utilized to evaluate the discriminant validity of the research. The values of the HTMT criterion presented in **Table 4** fell short of the predetermined thresholds of 0.85 and 0.90, which were established by Kline (2015) and Gold et al. (2001) respectively. As a result, the discriminant validity was confirmed.

4.2.2. Structural model

In **Table 5**, the results showed that Attitude (ATT) was positively correlated with the variables PEU ($\beta = 0.175$, $p < 0.05$), PU ($\beta = 0.271$, $p < 0.01$), and PQC ($\beta = 0.306$, $p < 0.01$). The coefficient of determination, R-squared (R^2) value for Attitude was 0.472, where 47.2% of the observed variability in Attitude could be accounted for by the combined effect of the five predictors. Therefore, the analysis findings supported the hypotheses H_1, H_3, and H_7. In addition, in the same table, the results indicated both the TSQ ($\beta = 0.227$, $p < 0.01$) and PQC ($\beta = 0.318$, $p < 0.01$) had significant positive effect on students' satisfaction (SAT). The R^2 for SAT was 0.614, indicating that the five predictors accounted for 61.4% of the variance on SAT. Hence, hypotheses test for H_6 and H_8 were validated. Finally, the last row in **Table 5** presented a significant

positive relationship between ATT and SAT with the beta coefficient of 0.390, significant at 1% level. Again, the results were valid in supporting the hypothesis (H_9).

Table 5. Hypothesis testing direct effects.

Hypothesis	Relationship	Std. Beta	Std. Error	*T*-value	*P* Values	BCI LL	BCI UL	f2	VIF	Decision
H1	PEU →ATT	0.175	0.075	2.171*	0.015*	0.057	0.298	0.025	2.046	Supported
H2	PEU → SAT	−0.044	0.078	0.605	0.273	−0.171	0.078	0.003	2.097	Not Supported
H3	PU → ATT	0.271	0.079	3.457**	0.000**	0.144	0.402	0.082	1.737	Supported
H4	PU → SAT	0.042	0.068	0.523	0.301	−0.057	0.164	0.002	1.879	Not Supported
H5	TSQ → ATT	0.078	0.090	0.874	0.191	−0.068	0.232	0.007	1.641	Not Supported
H6	TSQ → SAT	0.227	0.074	3.080**	0.001**	0.112	0.347	0.080	1.653	Supported
H7	PQC → ATT	0.306	0.089	3.473**	0.000**	0.154	0.447	0.100	1.828	Supported
H8	PQC → SAT	0.318	0.078	4.143**	0.000**	0.189	0.449	0.133	2.01	Supported
H9	ATT→ SAT	0.390	0.072	5.466**	0.000**	0.277	0.513	0.214	1.896	Supported

* denotes *t*-value > 1.645 significance at $p < 0.05$; ** denotes *t*-value > 2.33 at $p < 0.01$.

4.2.3. Mediation analysis

Table 6 showed significant mediator effects on the relationship tested in **Table 5**, which included PEU-ATT-SAT ($\beta = 0.069$, $p < 0.05$), PU-ATT-SAT ($\beta = 0.108$, $p < 0.01$), and PQC-ATT-SAT ($\beta = 0.119$, $p < 0.01$). The results suggested the presence of a mediating effects among the three relationships in question, at a 95% confidence intervals with bias correction do not intersect at zero. To summarize, three hypotheses of H_{10}, H_{11}, and H_{13} were accepted.

Table 6. Hypothesis testing indirect effects.

Hypothesis	Relationship	Std. Beta	Std. Error	*T*-value	*P* Values	BCI LL	BCI UL	Decision
H10	PEU → ATT → SAT	0.069	0.034	1.928*	0.054*	0.006	0.140	Supported
H11	PU → ATT → SAT	0.108	0.041	2.628**	0.009**	0.037	0.193	Supported
H12	TSQ → ATT → SAT	0.036	0.037	0.831	0.406	−0.027	0.120	Not Supported
H13	PQC → ATT → SAT	0.119	0.042	2.952**	0.003**	0.042	0.198	Supported

* denotes *t*-value > 1.645 significance at $p < 0.05$; ** denotes *t*-value > 2.33 at $p < 0.01$.

5. Discussions

This study aimed to provide a better understanding of undergraduate experiences with OHL at the post-COVID-19 pandemic. Out of the four predictors tested, only three showed a positive significant relationship with attitude: PU, PQC, and PEOU. There was confirmation of the link between perceived ease of use and attitude. This finding is in line with previous studies by Mailizar et al. (2021a) and Chang and Wang (2008). Whereby, the data reveals that undergraduates would rather learn from homes (more comfortable) using online systems. Students found OHL intuitive, easy to understand, and less mental effort needed.

In addition, the study confirmed the strong relationship between perceived ease of use and attitude, the former denoted in what useful manner OHL systems are perceived and the later indicate what people feel about them, which is in line with previous research by Qashou (2021) and Kim et al. (2021). The effectiveness of OHL

systems in facilitating learning makes them popular among undergraduates. The educational outcomes they achieve are comparable to those of traditional physical classrooms. Through the online learning platform, the student was able to gain knowledge, complete assignments, and receive instructor assistance efficiently.

Therefore, the study by Casaló et al. (2017) confirms the link between how people feel about online learning and how they rate the quality of the content they encounter. This data reveals that undergraduates would rather receive their course contents through a system that allows them to study at home. A prior study by Mailizar et al. (2021b) indicated that TSQ was significantly related to attitude towards OHL systems due to the system's poor performance, which manifests itself mostly in sluggishness, unclear information display, and sometimes losing connection with the OHL class may affect the attitude. However, our results show that it is not.

Moreover, the findings of this study indicate a strong relationship between students' satisfaction with OHL and TSQ and PCQ. What this means is that the online learning system's content and functionality are meeting the needs of the students. Findings agreed with those of prior research by Boonchutima et al. (2021) and Lee and Lee (2008). Even though students might feel negatively about technical problems like disconnections and response time delays, they can still be tolerant of them. They were made aware of these concerns when they enrolled in a homeschooling course that was conducted entirely online. However, there was no discernible effect of PEU and PU on students' satisfaction with home-based online learning at the post-COVID-19 pandemic. This further proves that the OHL system is not meeting the expectations of the students. Since technical system issues arise from internet connections and the online nature of the platform, undergraduates have a hard time interacting with their peers. This is in line with the study by Maqableh and Alia (2021), where students may experience increased stress and discomfort when they move to online classes.

With this mindset, the indirect relationship of attitude has strengthened the link between PEOU and students' satisfaction toward home-based learning system in Malaysia during post-pandemic era. This reveals that students' positive and favorable emotions can greatly impact their perception of how easy it is to use online learning systems, leading to a high level of satisfaction among them. According to some researchers, the attitude can also strengthen the link between undergraduate perceptions of an online learning system's usefulness and their level of satisfaction with it. To ensure that undergraduates are highly satisfied with OHL systems, their features need to be attractive and beneficial.

The current research also shows that students' attitudes can mediate the relationship between their impressions of the content's quality and their satisfaction with OHL platforms. It is critical that course materials and subject information be engaging and positive if OHL systems are to achieve their goal of high students' satisfaction. Regarding their OHL systems, undergraduate satisfaction was found to be unaffected by the attitudes that mediate the relationship between TSQ and undergraduates' satisfaction. Student express dissatisfaction with the technical aspects of the OHL system, including the connectivity they experience with instructors and peers. Therefore, from the TSQ perspective, OHL systems have not been positively accepted by students thus far.

5.1. Implications of study

This study employed the TAM and the IS theories, specifically using the factors of PEOU, PU, TSQ and PQC to predict the undergraduates' satisfaction with OHL systems at the post-COVID-19 pandemic. Empirical evidence demonstrated that attitude serves as a mediator in the connections between PEOU, PU, TSQ and PQC, and the satisfaction of undergraduate students in using OHL systems. Theoretical incorporation and extension of TSQ and PQC with TAM (PEOU and PU) enabled closer prediction of undergraduate students' satisfaction with OHL at the post-COVID-19 pandemic.

Simultaneously, the findings of this study hold great practical significance for universities, entrepreneurs, and developers of OHL programs. It offers convincing proof that advances the understanding of the connection between PEOU, PU, TSQ, PQC, attitude, and undergraduates' satisfaction in using online learning from home at the post-COVID-19 pandemic. This study also helps to identify the specific areas that require additional focus to attain a high level of students' satisfaction. For the research findings, at the post-COVID-19 pandemic, PQC is the primary determinant in establishing a significant level of student satisfaction with OHL, with PU and PEOU ranking second and third respectively. The universities should focus on the quality of content under remote online learning. The entrepreneurs and developers of OHL program may focus on the perceived usefulness and perceived ease of use of the program to change the student's attitude and by instrumenting these factors in achieving a significant level of undergraduates' satisfaction with the implementation of OHL at the post-COVID-19 pandemic.

5.2. Limitation and suggestion for future research

Several limitations arose despite the contributions. First, this study attempted to extend the TAM by adding Perceived Quality of Contents and Technical System Quality on students' attitude and students' satisfaction. Yet it remained limited in terms of number of variables. Future work can examine consumers technology acceptance with other models such as UTAUT or UTAUT2 (Mangiò et al., 2020). Secondly, this study did not examine the intention of students in continuance usage of OHL system since the aim was to study students' satisfaction. Other than users' acceptance on existing technology, TAM can also be valuable in explaining utilization of new technology (Davis, 1989). Next, this study added two variables namely Quality of Contents and Technical System Quality to TAM and ignore the possibility of other influencing factors. For example, perceived social influence can be a relevant variable and useful in explaining user's perception of the system utilization (Venkatesh and Davis, 2000). Other factors include personal innovativeness (user willingness to try new technology), performance expectancy (the extent to which an individual believes using the system will assist in achieving results), effort expectancy (the extent to which an individual believes that the system is user-friendly) and facilitation condition (the extent to which an individual believes that technical support of system usage is provided) (Jayawardena et al., 2023) may also be valuable for future research. The study would recommend using a larger and more diverse sample for future study.

6. Conclusion

Undoubtfully, irrespective of the time (at pre, during, or post-Covid-19 pandemic, lockdown, or in any other circumstance), online home-based education will perpetually fall short in fully meeting the needs and demands of every student. Contrary to initial hypotheses, this study reported that TSQ was deemed insignificant in relation to attitude towards online learnings at the post-COVID-19. This study investigated the association between students' satisfaction and a range of factors that affect OHL systems, which include TSQ, TQC, PU, PEOU, and attitude, at the post-COVID-19 pandemic. The findings have substantial ramifications for higher education service providers regarding the efficient administration of OHL systems at this period. While this study has illustrated the importance of perceived usefulness, perceived ease of use and perceived quality of content, it is the responsibility of the service provider to guarantee that the learning platform can consistently offer advantages to both the instructor and learner.

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