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Dual Aspects of COVID-19 on Facilitating Conditions and Students' Willingness to Continue Online Learning

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Research Article

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Abstract

Background/purpose. The crisis caused by the COVID-19 pandemic has altered the direction of education worldwide, emphasizing the prospects and problems of using online learning platforms. This study aims to investigate the dual aspects of COVID-19 (positive and negative) on facilitating conditions for learning quality that affect students' willingness to continue online learning.

Materials/methods. The study's hypotheses were evaluated using an online survey of 320 respondents who were enrolled in public universities. The analysis used partial least squares structural equation modeling (PLS-SEM).

Results. The study found that the positive and negative impacts of COVID-19 predict students' facilitating conditions, which in turn have a significant positive effect on their perceived usefulness, perceived ease of use, and tech competency while being negatively associated with subjective norms. Additionally, perceived usefulness, ease of use, and tech competency were found to have a significant positive relationship with students' attitudes toward online learning. However, the subjective norm was negatively associated with attitudes. The study revealed that students' attitudes toward the quality of online learning have a significant negative impact on their willingness to continue with online learning.

Conclusion. The study's empirical contribution lies in its exploration of the positive and negative impacts of COVID-19 on students' willingness to continue online learning. This is particularly relevant and important in the current educational scenery. By identifying and understanding these factors, educational institutions can improve the quality and accessibility of online learning, ultimately leading to better educational outcomes for students.

1. Introduction

Due to the disruption caused by the COVID-19 epidemic, online learning solutions have been quickly used to maintain academic continuity. Online education has been around for a long, but the epidemic has sped up its adoption, giving it the main form of instruction for many students around the world (Agarwal et al., 2024; Zhu et al., 2022). Students have been at the forefront of these concerns as the change to online learning has not been without its difficulties (Phillips et al., 2024; Frei-Landau & Avidov-Ungar, 2022). While some students might benefit from online learning, others might find it difficult to adjust to the new style of instruction (Hopkyns, 2022). Even though the COVID-19 pandemic has been difficult, it has helped online learning become more popular and expand in higher education.

Students' willingness to continue their online education after the epidemic is over is probably a result of its advantages, such as increased accessibility, adaptability, and affordability. The purpose of this study is to examine how COVID-19 affects students' willingness to continue their online education. This study will investigate the factors that influence students' attitudes toward online learning and identify the best practices for efficient implementation. The findings of this study will assist educational institutions and policymakers in better understanding how to provide effective online learning opportunities that meet students' needs and preserve academic continuity under difficult circumstances.

An earlier study found that college students' acceptance of online learning had a significant impact on its success (Rafique et al., 2024; Martin & Borup, 2022). However, several studies have found that certain problems with the current online learning systems utilized in higher education institutions in developing countries make them useless (Adedoyin & Soykan, 2020). The current global health crisis and its consequences may have an impact on university students' motivation to continue their online education, but this is still unknown. As a result, this study addresses the following research questions: (1) How do the positive and negative effects of COVID-19 affect the students' desire to continue their online education? (2) What are the motivating elements for students' perspectives toward the value of online education?

The answers to these two questions significantly contribute to this work's empirical analysis. The study first demonstrated the importance of using a variety of theoretical stances to comprehend online learning behaviour, considering both the beneficial and detrimental consequences of the COVID-19 outbreak. We aimed to improve our comprehension of online learning behaviour by integrating the TAM model with additional behavioural theories, such as the Unified Theory of Acceptance and Use of Technology (UTAUT) concept. Second, there is an increasing need to evaluate the key components of an efficient implementation of online learning as traditional face-to-face in-class teaching and learning increasingly shift to a fully online mode. Studies have become more crucial, particularly China, where the learning environment is rapidly changing and there is a lack of research. We build on the empirical evidence provided regarding the students' willingness to continue online learning by presenting current and accurate findings from a rather large-scale study. For knowledge acquisition and technology integration, online learning is the best alternative to conventional classroom instruction (Abedi et al., 2024; Palaniappan & Noor, 2022). Although researchers have concentrated on online education delivery methods, teaching techniques, the scope of online delivery, and the distinction between face-to-face education and online courses (Khan et al., 2023), there aren't enough studies looking into students' attitudes toward the quality of online learning and willingness to continue online learning.

The introduction to this study highlights the research gap, the research issue, and the goals. The literature study and underlying theory were utilized to support the students' beliefs (Naznen et al., 2023) about their willingness to continue online learning were discussed in the second section. These

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theories included the Unified Theory of Acceptance and Use of Technology (UTAUT) and the Technology Accepted Model (TAM). The third half of this essay addresses the research techniques. The empirical findings of this study are explained and supported by evidence in sections four and five of this study. The study concludes with limitations and suggestions for additional study.

2. Literature Review

2.1. Underpinning theory

The Technology Acceptance Model (TAM) theory can be used to analyze students' attitudes and actions with online learning. According to TAM, the two key elements that influence a person's intention to use technology are perceived usefulness (PU) and perceived ease of use (PEOU) (Szymkowiak & Jeganathan, 2022). Perceived usefulness in the context of COVID-19 and online learning refers to the degree to which students think that online learning can assist them in achieving their academic objectives. Online learning may be viewed as a practical approach for certain students to get access to course materials, work with peers, and get teacher feedback (MacNeill et al., 2024). However, Adams et al. (2024) stated that other students may see online learning negatively because they believe it is a poor alternative for in-person interactions. On the other hand, perceived ease of use describes how simple students perceive using and navigating online learning to be (Wu et al., 2024). This covers elements like the platform's user interface, the ability of educational videos and materials, and the simplicity of connecting with professors and fellow students. When students feel that online learning is easy to use, they are likely to develop a positive impression of online learning and be enthusiastic as far as using it in the future is concerned, The TAM Model, however, can help teachers and administrators to study more the aspects that motivate students to persist in the use of online learning and assist them in strategizing appropriate support measures for them in this new environment.

The Unified Theory of Acceptance and Use of Technology (UTAUT) is a well-known theory for explaining factors contributing to user stress when attempting to adopt new technology for all purposes (Shahreki & Lee, 2024). It is said that the COVID-19 pandemic has had both positive and negative impacts on online education as well as on the social, and economic development of the world. Providing these scenarios, it is very important to interrogate how the UTAUT can be implemented to motivate students who are eager to learn online (Chen et al., 2024). The UTAUT model includes external variables that may influence students' intention to use computers in pursuing their studies. In simple terms, external variables are factors such as money, time, and effort that someone might expend in undertaking an activity. In the context of online education, such variables might be critical because of the positive and negative consequences of COVID-19. The elements could enhance the learning experience and increase the retention of learners pursuing online education, such as high-speed Internet, reliable technology, availability of learning tools, and technical assistance.

2.2. COVID-19's Positive Impact

Higher education has been significantly impacted by the COVID-19 epidemic, which forced many universities and colleges to switch to online instruction (Zaman et al., 2024; Rashid & Yadav, 2020). While many people have found the pandemic to be difficult (Turale et al., 2020), there have also been some positive effects on online learning that have emerged, including improved flexibility, increased access to education, enhanced technology skills, cost-effectiveness, and innovative teaching methods. These factors may encourage students' willingness to continue online learning even after the pandemic has passed. According to Dwivedi et al. (2020), social isolation ensures safety during the pandemic a lot of the time for international students, which is only achievable with online learning environments. Online facilitators give useful talks and teaching resources to students as they are actively engaged in the course using a variety of online platforms and learning technologies.

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According to several research (Sukendro et al., 2020), online schooling during the pandemic has a technological edge. Global learners can receive assistance from invisible teachers and supervision that ensures high-quality education to pursue a higher degree thanks to online learning technologies and supporting sustainable resources. This advantage tempts us to propose a theory:

H1: COVID-19's positive impact influences facilitating the condition of online learning in higher education.

2.3. COVID-19's Negative Impact

While the COVID-19 pandemic has helped online learning in higher education expand (Svihus, 2024; Simamora et al., 2020), it has also had detrimental effects on students' online learning experiences, including decreased interaction, technical issues, difficulty maintaining motivation, and restricted access to resources. Institutions must address these issues and make efforts to guarantee that all students have access to the tools and assistance they require to be successful in their online courses. According to Bacaksiz et al. (2022), students are more likely to become distracted because they cannot see their instructor while taking an online course. Students frequently forget their physical platform, which isolates them. They lose interest in learning because of these feelings of loneliness. Higher education requires a collaborative setting where students can find a public forum for debate and opinion sharing (Salas-Pilco et al., 2022). We can formulate the following hypothesis:

H2: COVID-19's negative impact influences facilitating conditions towards online learning in higher education.

2.4. Facilitating Condition

By giving people the tools and resources, they need to use the technology efficiently, facilitating conditions can affect perceived usefulness (Khlaif et al., 2022). The perceived usefulness, perceived usability, subjective norm, and tech competency can all be significantly influenced by conducive situations. The degree to which a person believes that technology will improve their performance or increase their productivity is known as perceived usefulness (Bansah et al., 2022). Employees are more likely to view technology as valuable if an organisation offers them training and technical support. The degree to which a person perceives technology to be user-friendly is referred to as perceived ease of use (Basuki et al., 2022). Facilitating conditions can affect the perception of the difficulty associated with using a technology that includes thorough explanations and simple interfaces (Rokhim et al., 2022). The sense of social pressure individuals must make use of or stay away from the technologies is what subjective norms describe (Al Shamsi et al., 2022). The use of these technologies requires sophisticated subjective norms, as described by Alowayr (2022), their development was adopted by other facilitating conditions. Furthermore, an essential element is the individual's degree of competence with technology, which is referred to as tech competency. Mukhuty et al. (2022) highlighted that providing certain support and training can improve individuals' skills and, hence, their tech competency. If organizations are willing to include training materials and technical support, employees can learn the proper skills for the appropriate use of technology. On this basis, the following hypotheses are proposed:

H3: Facilitating condition has a significant impact on (a) perceived usefulness, (b) perceived ease of use, (c) subjective norm, and (d) tech competency.

2.5. Perceived Usefulness

Students' perceptions of the value of online courses play a significant role in how they feel about the level of online quality. Students are more likely to be motivated to learn, participate in online learning activities, and have a favourable opinion of the calibre of their online education when they believe that online courses are useful (Salas-Pilco et al., 2022). It will be crucial for educators and

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organisations to concentrate on creating and delivering online courses that are valued by their students as online education gains popularity. Perceived usefulness (PU) measures a person's trust in a specific system via which he or she might enhance productivity at work (Ramezaninia et al., 2022; Rahman et al., 2020; Rahman, 2019). Al-Mamary forecasted users' PU and attitudes in 2022. PU assesses learners' perceptions of how much higher education is made more accessible and efficient by online learning platforms. Online education is the interaction of educators with students who are seeking knowledge and tools to improve their performance. As a result, this study proposed that:

H4: Perceived usefulness has a significant impact on attitudes to online learning quality.

2.6. Perceived Ease of Use

Students' perceptions about the quality of online learning are significantly influenced by perceived usability. Students are more likely to have favourable attitudes towards the calibre of online courses and engage more deeply with course materials when they find online learning platforms to be simple to use (Zhou et al., 2022). Research has shown that students' attitudes about the quality of online learning are strongly related to the intuitive interface ability (Gurban & Almogren, 2022). One of such studies placed the relationship between students' online course satisfaction and perceived ease of use of the online learning system in a favorable position (Azizan et al., 2022). The research also found that students who rated the online learning systems as easy to use were more likely to hold favorable attitudes towards the quality of online courses. Students' attitudes about the quality of online courses were positively influenced by the perceived ease of use of the course learning management systems (Ding & Er, 2018). Students who perceived the online courses as easy to follow also tended to give high ratings to the course quality as well as to the general online learning. Thus, this study suggested that:

H5: Perceived ease of use has a significant impact on attitudes to online learning quality.

2.7. Subjective Norm

The subjective norm is related to the individual's beliefs about the level of social obligations and expectations of other people in their environment such as lecturers, family members, or teachers. In terms of online learning, students' feelings and attitudes and their behaviors are greatly influenced by subjective norms. Yao et al. (2022) stated that students are most likely to have a positive attitude toward online learning when they sense pressure from their peers to participate or appreciate the quality of online classes. For example, students are more likely to adopt favourable attitudes towards online learning and put in more effort when the opinion of their classmates as well as the teacher's endorsement of the practice appears strong. However, other students' attitudes are more negative towards its use if they believe that there are social pressures or norms against it, for example, the belief that online learning is less accepted and valued by employers than traditional in-class learning (Zhang & Yu, 2023; Sarosa, 2022). Institutions can create a positive social environment where students appreciate the benefits of online learning and are encouraged to engage in it. This can be achieved by bringing out the benefits of online learning, showing the success of students, and providing the required help and resources for students to cope with the challenges of online learning. Thus, this analysis has the following proposition:

H6: Subjective norm affects the attitudes towards the perceived and the actual quality of online learning.

2.8. Tech Competency

Tech competency refers to abilities based solely on using modern technology when managing technology's running (Skantz-berg et al., 2022; Hemmati et al., 2024; Newaz et al., 2025). In this research, online education is appealing to a learner who is tech-competent and sufficiently driven.

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An increasing body of literature suggests that students' self-reports regarding online learning quality are strongly correlated to their tech skills. More technologically literate students can navigate online learning environments, access content resources, and communicate with their teachers and classmates more successfully. Kim and Frick (2011), Yang et al. (2024), and Sidek et al. (2024) established that individuals who perceive their level of technological skill as high are more likely to have a positive view of the benefits of online education. Students who possessed greater computer skills tended to rate online courses more favourably and had a positive outlook toward online education in general. According to Arnold and Sangrà (2018), there was a correlation between students' technological competence and their perception of online learning. The study showed that individuals who were more at ease using technology were more open to the idea of studying online as well as engaging with the course materials available on the internet. Therefore, we can suggest that:

H7: Tech competency has a significant impact on students' attitudes to online learning quality.

2.9. Attitudes and Willingness

Students' subjective assessments of the overall efficacy, value, and satisfaction of their online learning experience are referred to as their attitude towards the quality of online learning (Wu et al., 2022; Chen et al., 2022; Rahman et al., 2021a). It includes, among other things, how well they think the online course materials, instructional strategies, evaluation techniques, technological foundation, and support services are. According to Hewei and Youngsook (2022), "students' willingness to continue online learning" refers to their propensity or preparedness to continue pursuing their education through online platforms or courses. It has to do with how valuable and significant the online learning experience is to the students, as well as how motivated they are to keep going in the face of setbacks or difficulties. According to Conrad et al. (2022), several variables can affect a student's willingness to continue online learning, including their satisfaction with the learning process, course content and instructional materials, the accessibility of support services, their social interactions with teachers and peers, and their personal and academic objectives. Higher levels of academic accomplishment, persistence, and completion of online courses and programs are connected with positive attitudes toward online learning and a strong willingness to continue (Yao et al., 2022; Yuan et al., 2021). According to Ferrer et al. (2020) and Teng et al. (2024), attitude is the level of assurance an individual has in their ability to do a particular activity while utilizing a particular technology. Since it enables them to learn at their own pace in a welcoming environment, learners' attitudes towards e-learning are good. More information can be gathered by learners in less time than in the past. The future of education will be significantly influenced by online learning. This study suggested:

H8: Attitude to online learning quality has a significant impact on willingness to continue online learning in higher education.

Based on the review of the literature and theoretical foundation, this study proposed the following conceptual model (Figure 1).

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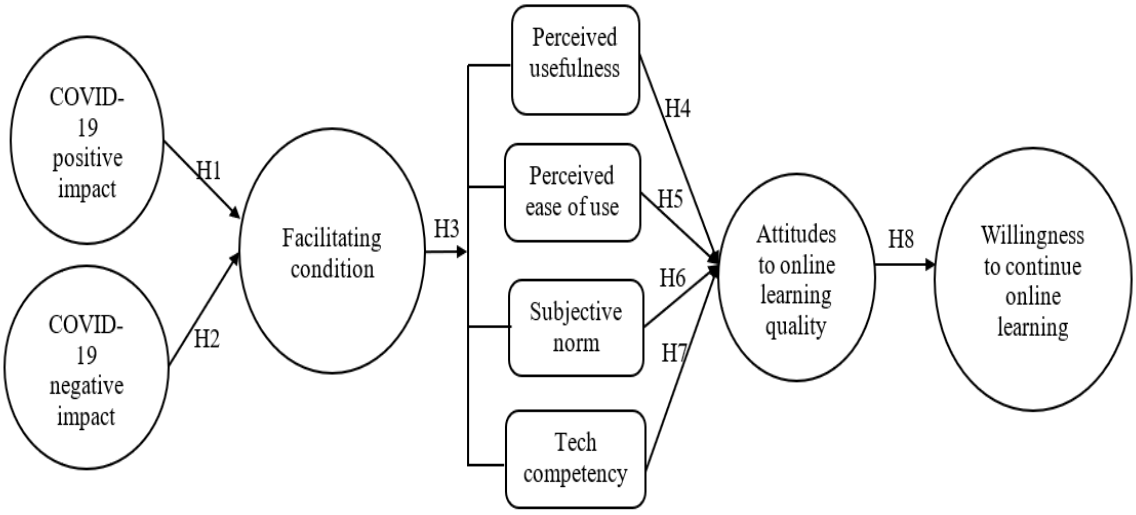

Figure 1. Conceptual model

3. Methodology

3.1. Sample and Data Collection

Based on the number of students, three universities were chosen for data collection in Nanchang and Jiujiang. These two states were chosen as the emphasis since they are centers for the majority of public universities. A survey was run from February to June 2022 for five months. Individual students were recruited randomly to conduct an online survey to gather data. The data collected for this study is entirely anonymous, focusing on students' perceptions or experiences of COVID-19's positive and negative aspects regarding their intention to continue online learning. No personal information is recorded as part of the data collection process. The collected data was maintained securely and confidentially, ensuring the anonymity and privacy of the participants.

The participants of this study were individual university students who are pursuing bachelor's, master's, and PhD in five prominent universities in China. The methodologies of convenience and purpose sampling were combined. Accordingly, convenience sampling methods were used to disseminate questionnaires to students at the purposefully chosen public university. Since the study's primary population was undergraduate, graduate, and doctoral students, purposive sampling was used in this study. Being the majority of the student body at the public university, these students accurately reflect the current scenario. Similarly, the convenient sample technique was used because it was unlikely that all participants from the student population would be admitted to the checklist (Rahman et al., 2023; Rahman et al., 2021b). Before the survey, ethical clearance was acquired from the local committee. Google Forms were employed for the collection of data, while the link to the survey was shared on different social networking sites. This was to filter the participants and include only those who had been exposed to online learning. A pre-test and pilot study was conducted to ensure the validity and reliability of the measurement instruments. Initially, five expert academicians were selected to review the questionnaire for the pre-test phase. Based on their feedback, necessary improvements were made to refine the questionnaire for the subsequent pilot study. The pilot study involved the collection of approximately 30 responses. However, the results indicated that some questions were not easily understood by respondents, prompting further adjustments to improve clarity. The findings revealed that Cronbach's alpha values for each construct ranged from 0.782 to 0.889, which is greater than the threshold of 0.70 (Hair et al., 2019; Wong et al., 2025). These findings affirm that the questionnaire exhibits strong validity and reliability, making it a robust tool for data collection in the study. After completing the pilot test over five months, from April to August 2024, the survey recorded a total of 335 responses. The analysis considered 320 complete responses,

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eliminating 15 that were incomplete. The minimum sample size is advised by Reinartz et al. (2009) to be 100 when using the partial least squares (PLS) statistical method. According to the results of the G*Power test used in the current investigation, 113 samples are required to reach the strength of 0.80 (Faul et al., 2009). In light of this, 320 samples are a reasonable number to examine the co-efficient in the current study.

3.2. Measurement Instrument

Two components make up the questionnaire used in this investigation. The respondents' demographic information was gathered in the first section, and the measuring questions for the five latent components discovered in the research model were included in the second. Each construct's items were obtained through previously published works of literature. In consonance with hypotheses advanced by Khan et al. (2021), Pérez-Fuentes et al. (2020), Mertens et al. (2020), and Sorokowski et al. (2020), the effects of COVID-19 were evaluated using eight questions as a modification to assess the adverse and the advantages of the pandemic. Four criteria were modified by Razami and Ibrahim (2021) for facility condition assessment. Eight sources of perceived utility and perceived ease of use were obtained from Sukendro et al. (2020). While four items by Chung et al. (2020) in relation to technology competency were revised, four new items by Kim et al. (2021) were used to measure subjective norm. Six items from Karim et al. (2021) and Ngah et al. (2022) and four questions by Kim et al. (2021) were amended and used to measure students' readiness to continue online learning. A Likert-type scale with 5 levels ranging from 'most disagree' to 'strongly agree' was adopted for each of the questions to establish content validity. This scale was constructed following the concept of Razami and Ibrahim (2002), where 5=strongly disagree, 1=strongly agree. Zachary et al. (1999) used a Likert scale for respondents in case studies in Japan, Europe, and the United States. To avoid contradictory straight-lined predetermined responses from respondents, a five-point Likert scale was adopted in the questionnaire.

3.3. Common Method Bias

Common method bias (CMB) can be defined as the common method variance bias that can be detected in a model by the variance inflation factor (VIF) whose value exceeds a defined point of 3.3 (Kock, 2017). In addition, if the VIF scores from the collinearity test do not exceed 3.3, the model is also considered free of CMB. It appears from the investigation's results of VIF that they do not exceed 3.3, and CMB is indeed not an issue (see Table 2). Skewness and kurtosis values were also considered to establish the normality of the data. The set values were between the ranges of -1.5 and 1.5 for Skewness and -2.0 and 2.0 for kurtosis. These values fall within the acceptable ranges suggested by Sheridan and Coakes (2011) (Appendix). In the current study, CMB could have been introduced by respondent bias in that they answered questions about the dependent and independent variables at the same time. Specific measures and statistical methods were used to counter this, such as the unmeasured marker variable method developed by Podsakoff et al. (2012), where predicted values of all the endogenous variables included in the model were hypothesized as causal factors by the unobserved marker variables. In terms of CMB, it was amusing to find no substantial bias in the data because the significant effects obtained from the model without the marker variable were effectively replicated in the model with the marker variable. Hence, the results of the current study are valid and CMB was not a concern in this study.

3.4. Data Analysis

In this study, we employed a descriptive statistical method with the aid of SPSS 24.0 to examine demographics and descriptive data while data analysis and forecasting of linkage between the variables in the research model was performed using Smart PLS 4.0, a covariance-based structural equation modeling (SEM) technique (Ringle et al., 2015) The data was collected using a two-stage technique (Hair et al., 2019). In the second phase, a structural model was tested in response to the

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stated hypotheses utilizing a bootstrapping method that resampled a total of 5,000 times. The process performed in the first stage, providing the measurement's model, was targeting to test both convergent and discriminant validities. The Important-performance matrix (IPM) analysis, a method of social science analysis which presents recommendations on how to manage consumer behaviour was used in this study to measure students' readiness to continue their online learning at higher education. This study aims to assess the extent to which a relationship between exogenous and endogenous variables may be deduced by enrolling volunteers as research subjects. The importance of the asymmetric link in the conceptual model is illustrated using partial least square structural equation modelling.

4. Results

4.1. Demographic Information

According to the results, female respondents made up 60.6% of the sample, while male respondents made up 39.4%. The respondents were between 22 and 25 years old (38.7%), followed by 26-29 years (23.6%), above 30 years (29.2%), and 19-21 years old (18.5%) respectively. In addition, the majority of responders were bachelors (47.3%), followed by Master/M. Phil (31.1%), and Ph.D. (21.6%). In terms of enrollment in faculty, most respondents were from the faculty of business administration (32.8%), followed by Engineering (15.9%), Faculty of Education (15%), Faculty of IT (13.4%), Arts and Social Science (11.9%), and Faculty of Science (10.9%). The majority of the respondents were from rural areas (56.3%), whereas 43.8% were from urban areas. Most of the respondents' technology skills level was moderated (70.2%), high (22.6%), and low (7.2%). In terms of Internet access, 54.7% used mobile hotspots, and 45.3% used home Wi-Fi. The frequency of using the internet was 5-10 hours daily (58.8%), below 5 hours (27.5%), and 13.8% depending on their situation. Most of the respondents were national (64.2%), whereas 35.8% were international (Table 1).

Table 1. Demographic information

Characteristics	%	Characteristics	%
Gender		Category of study	
Male	39.4	Bachelor	47.3
Female	60.6	Master/ M.Phil.	31.1
Age		PhD	21.6
19-21 years	18.5	Technology skills level	
22-25 years	38.7	High	22.6
26-29 years	23.6	Moderate	70.2
Above 30 years	19.2	Low	7.2
Enrollment in faculty		Internet access	
Arts and Social Sciences	11.9	Home Wi-Fi	45.3
Business Administration	32.8	Mobile hotspot	54.7
Faculty of IT	13.4	Frequency of using the Internet	
Faculty Engineering	15.9	Below 5 hours daily	27.5
Faculty of Sciences	10.9	5-10 hours daily	58.8
Faculty of Education	15.0	Depend on situation	13.8
Area of residence		Types of Students	
Rural	56.3	National	64.2
Urban	43.8	International	35.8

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4.2. Measurement Model Analysis

Convergent validity and discriminant validity are two conditions that must be satisfied to demonstrate the measurement model's validity (Table 1 and Figure 2). According to Hair et al. (2019), convergent validity necessitates a factor loading of at least 0.60. The factor loadings in this study ranged from 0.627 to 0.905, all of which are higher than the minimum threshold. According to Hair et al. (2019), the composite reliability (CR) and average variance extracted (AVE) both need to be at least 0.70 to be considered valid for convergent analysis. The AVE values (range 0.554-0.803) and CR values (range 0.754-0.918), as shown in Table 2, exceeded the minimal standards, demonstrating the study's convergent validity. The VIF readings also fell below the 3.3-point threshold, ranging from 1.312 to 2.984 (Kock, 2017). An overview of the evaluation of the measurement model is shown in Figure 2.

Table 2. Convergent validity

	Items	VIF	FL	CA	rho_a	AVE
COVID-19 positive impact	4	1.312-1.580	0.689-0.839	0.732	0.754	0.554
COVID-19 negative impact	4	1.374-1.837	0.659-0.824	0.782	0.795	0.605
Facilitating condition	4	1.364-2.889	0.888-0.911	0.918	0.918	0.803
Perceived usefulness	4	1.521-2.822	0.731-0.892	0.855	0.868	0.699
Perceived ease of use	4	1.371-2.090	0.627-0.858	0.807	0.843	0.636
Subjective norms	4	1.843-1.965	0.786-0.863	0.847	0.874	0.683
Tech competency	4	1.944-2.535	0.834-0.862	0.868	0.869	0.716
Attitude	4	1.938-2.984	0.820-0.905	0.891	0.895	0.753
Online learning	6	1.892-2.491	0.752-0.846	0.896	0.905	0.658

Note: Variance inflation factor (VIF), Factor loading (FL), Cronbach's alpha (CA), Composite reliability (rho_a), and Average variance extracted (AVE).

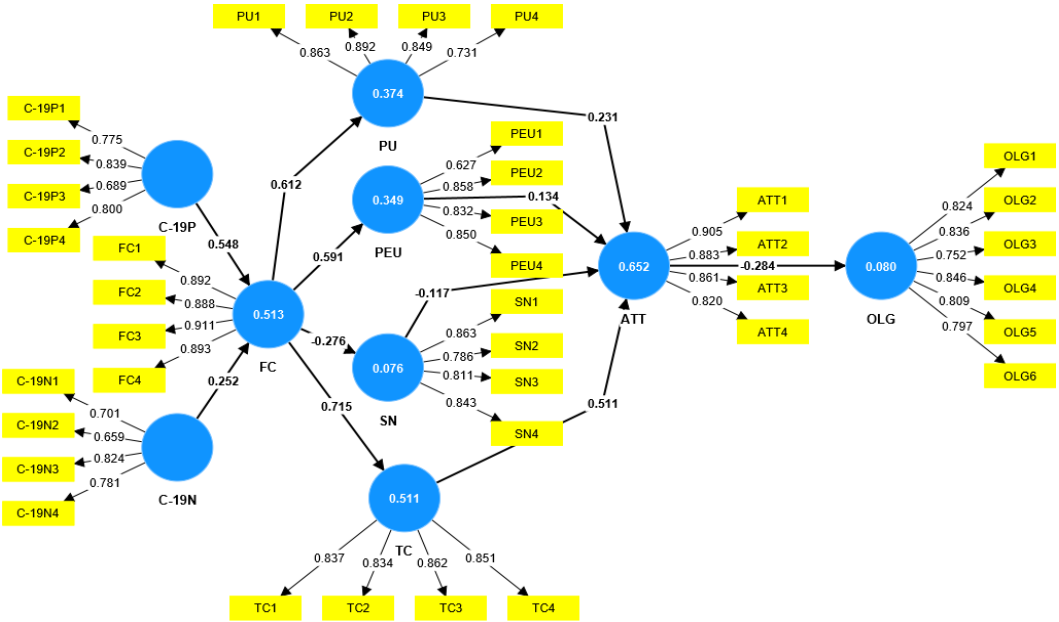

Figure 2. Measurement model

The model's discriminant validity was assessed once the convergent validity was established. According to Franke and Sarstedt (2019), discriminant validity is indicated by a Heterotrait-Monotrait (HTMT) value of less than 0.90. The findings in Table 3 suggested an HTMT value of less than 0.90. As a result, the findings of this study indicate that the model satisfied the requirement for discriminant validity of the assessed components and items. The findings highlight the model's central role of facilitating condition and tech competency. FC showed high correlations with TC (0.800), PU (0.690), and PEU (0.668). However, TC had strong correlation values with ATT (0.842) and C-19 positive impact (C-19P) (0.764). PU and PEU were notably correlated (0.809). SN had lower correlations, particularly with FC (0.304).

Table 3. Discriminant validity

Dimension	ATT	C-19N	C-19P	FC	OLG	PEU	PU	SN	TC
ATT									
C-19N	0.682								
C-19P	0.737	0.705							
FC	0.876	0.656	0.801						
WOL	0.310	0.278	0.116	0.207					
PEU	0.716	0.642	0.592	0.668	0.326				
PU	0.739	0.656	0.608	0.690	0.331	0.809			
SN	0.368	0.178	0.162	0.304	0.819	0.278	0.393		
TC	0.842	0.717	0.764	0.800	0.161	0.677	0.647	0.227	

Note: Attitude (ATT) of online learning quality, COVID-19 positive impact (C-19P), COVID-19 negative impact (C-19N), Facilitating condition (FC), Online learning (OLG), Perceived ease of use (PEU), Perceived usefulness (PU), Subjective norm (SN), Tech competency (TC).

4.3. Structural Model Analysis

A multicollinearity test was carried out after the measurement model had been assessed to make sure there were no collinearity problems. As shown in Table 2, the variance inflated factor (VIF) was utilized to evaluate collinearity. The structural model was then subjected to hypothesis testing using the bootstrapping method. Figure 3 presents the study's structural model's summary results. The direct effect hypotheses were both favourably and negatively supported as shown in Table 4 and Figure 3. Hypotheses H1 and H2 discovered that COVID-19's positive impact has a significant relationship with the facilitating condition (β= 0.252, t = 4.794, p 0.01) and COVID-19's negative impact has a significant relationship with the facilitating condition (β = 0.548, t = 11.056, p 0.01), and as a result, both H1 and H2 were supported.

According to hypothesis (H3), there is a correlation between facilitating conditions and perceived usefulness (β = 0.612, t = 13.376, p 0.01) and usability (β = 0.591, t = 12.423, p 0.01), as well as perceived ease of use. Additionally, the findings showed that facilitating conditions had a substantial negative impact on subjective norms (β = -0.276, t = 3.993, p 0.01) and a significant favourable impact on tech competency (β = 0.715, t = 19.290, p 0.01). As a result, whereas H3c was negatively significant, H3a, H3b, and H3d were all favourably significant.

Regarding H4, the study found a substantial and favourable link between perceived usefulness and attitudes (β = 0.231, t = 4.699, p 0.01). Similar to this, perceived ease of use significantly and favourably influenced attitudes (β = 0134, t = 2.535, p 0.011), but subjective norm significantly and unfavourably influenced attitudes (β = -0.217, t = 2.973, p 0.003). Students' attitudes on online

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learning also had a substantial and favourable relationship with tech competency (β = 0.511, t = 10.276, p 0.01). As a result, whereas H6 was adversely significant, H4, H5, and H7 were all favourably significant. H8 was adversely significant because the results showed that attitudes had a significant and adverse effect on students' willingness to continue online studying in higher education.

To assess the structural model's predictive relevance (Q2) and effect magnitude (f2), blindfolding procedures were used in the current investigation. Q^2 referred to as Stone-Geisser's Q^2, determines the relevance of a model in partial least squares structural equation modeling (PLS-SEM). It observes how well the values given by the model are reconstructed by the model and how accurate it is in predicting outcomes. The model has a predictive relevance for an endogenous construct if Q^2 is greater than zero (Sarstedt et al., 2021). f^2 computes the contribution of a particular predictor in the variance of a structural endogenous variable. It determines how much of the dependent variable's R^2 value can be attributed to that specific predictor variable. Following Cohen's guidelines, sine normed effect sizes f^2 = 0.02, 0.15, and 0.35 can be classified as small, medium, and large respectively (Cohen, 2013).

The outcomes showed that the model had a good ability to predict the variables under study. For example, Q2 values for ATT, C-19P, C-19N, FC, OLG, PEU, PU, SN, and TC were determined to be 0.649, 0.510, 0.432, 0.411, 0.534, 0.403, 0.325, 0.517, and 0.618, respectively. To examine the strength of the association between the variables, effect size (f2) values were also evaluated. According to Cohen (1988), a f2 value of 0.35 denotes a significant impact size, whereas a value of 0.02 denotes a modest effect size. The results showed that the COVID-19 positive impact (0.093), COVID-19 negative impact (0.436), facilitating condition (0.537), perceived usability (0.069), perceived ease of use (0.24), subjective norm (0.035), tech competency (0.462), and attitude (0.087) all had high f2 values. R2 values for attitude (0.652), facilitating condition (0.513), readiness to continue online learning (0.080), perceived ease of use (0.349), perceived utility (0.374), subjective norm (0.076), and tech competency (0.511) were also calculated (Figure-3). The model fit indices are crucial in determining the accuracy of the relations between the observed data and the SEM developed. The model fit indices are of primary interest when a researcher uses SEM and the root mean square error of approximation (RMSEA) computes the model's goodness of fit determined by its lower values which reflect better fit. The Kline (2023) stipulated that an RMSEA ≤ 0.05 corresponds with a good fit. Hence the results revealed an RMSEA value of 0.04, which indicates a good fit model which means this value sufficiently describes the data structure. The standardized root mean square residual (SRMR) is used to gauge the disparity between the observed and predicted correlation matrices. A value of SRMR ≤ 0.08 is a good fit (Kline, 2023). In this regard, the finding of an SRMR value of 0.06 indicates a good fit for the model.

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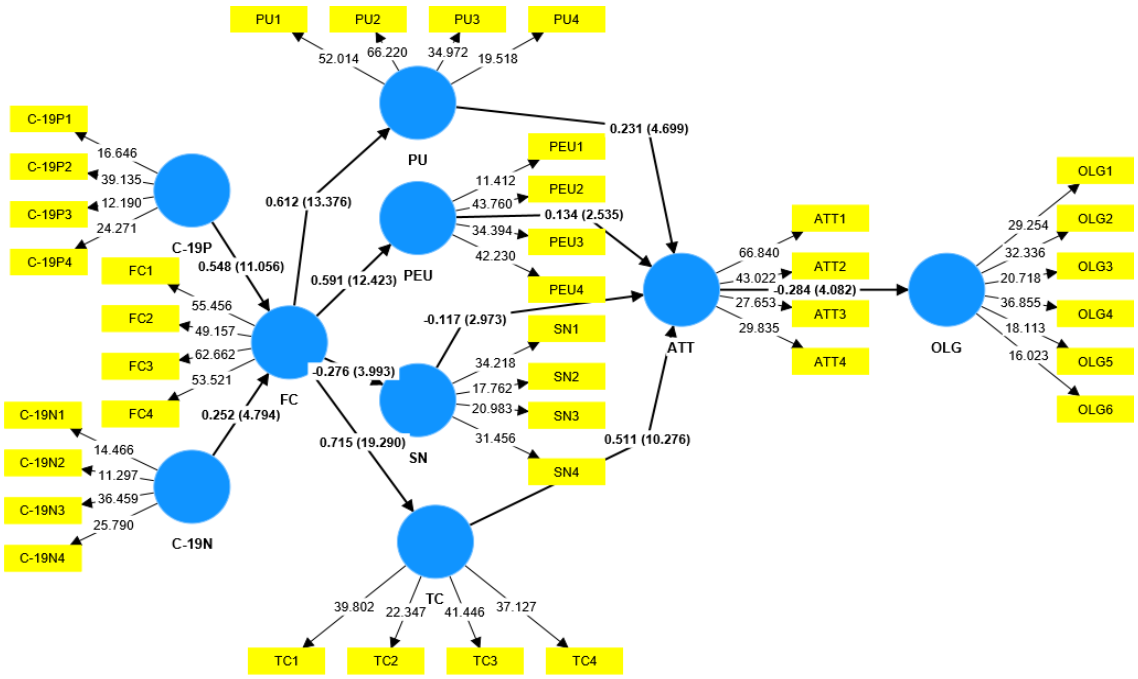

Figure 3. Structural model

Table 4. Path coefficient

HP	Relationship	β	SD	T-values	P-values	Comment
H1	C-19N -> FC	0.252	0.053	4.794	0.000	(+) Significant
H2	C-19P -> FC	0.548	0.050	11.056	0.000	(+) Significant
H3a	FC -> PU	0.612	0.046	13.376	0.000	(+) Significant
H3b	FC -> PEU	0.591	0.048	12.423	0.000	(+) Significant
H3c	FC -> SN	-0.276	0.069	3.993	0.000	(-) Significant
H3d	FC -> TC	0.715	0.037	19.290	0.000	(+) Significant
H4	PU -> ATT	0.231	0.049	4.699	0.000	(+) Significant
H5	PEU -> ATT	0.134	0.053	2.535	0.011	(+) Significant
H6	SN -> ATT	-0.117	0.039	2.973	0.003	(-) Significant
H7	TC -> ATT	0.511	0.050	10.276	0.000	(+) Significant
H8	ATT -> OLG	-0.284	0.069	4.082	0.000	(-) Significant

Note: Hypothesis (HP), Beta value (β), Standard deviation (SD).

The importance-performance matrix analysis (IPMA) identified that the facilitating condition appeared as the crucial factor for the performance of the student's willingness to continue online learning (0.618; 63.921). The next most significant factors for the performance of students' willingness to continue online learning were tech competency (0.511; 63.502), COVID-19 positive impact (0.339; 62.606), attitudes (0.284; 60.993), perceived usefulness (0.231; 57.768), COVID-19 negative impact (0.156; 68.698), perceived ease of use (0.134; 62.659), and subjective norm (0.117; 58.531). Table 5 and Figure 4 illustrate the results of performance and total effect. Hence, the findings indicated that FC (total effect 0.618) had a higher positive impact on willingness to continue online learning, indicating its critical role in supporting user engagement. TC (total effect 0.511) also had a significant impact, which highlights the importance of digital skills. COVID-19 positive impact (total effect 0.339) positively influenced learners' willingness. ATT (total effect 0.284) and PU (total effect

0.231) moderately contributed to willingness. PEU (total effect 0.134 and SN (total effect 0.117) had relatively weaker influences.

Table 5. Performance and total effects

Target Construct	Willingness to continue online learning	
Variables	Total Effect	Performance
Attitudes of online learning quality	0.284	60.993
COVID-19 negative impact	0.156	68.698
COVID-19 positive impact	0.339	62.606
Facilitating condition	0.618	63.921
Perceived ease of use	0.134	62.659
Perceived usefulness	0.231	57.768
Subjective norm	0.117	58.531
Tech competency	0.511	63.502
Willingness to continue online learning	-	60.147

Source: *Author's data analysis*

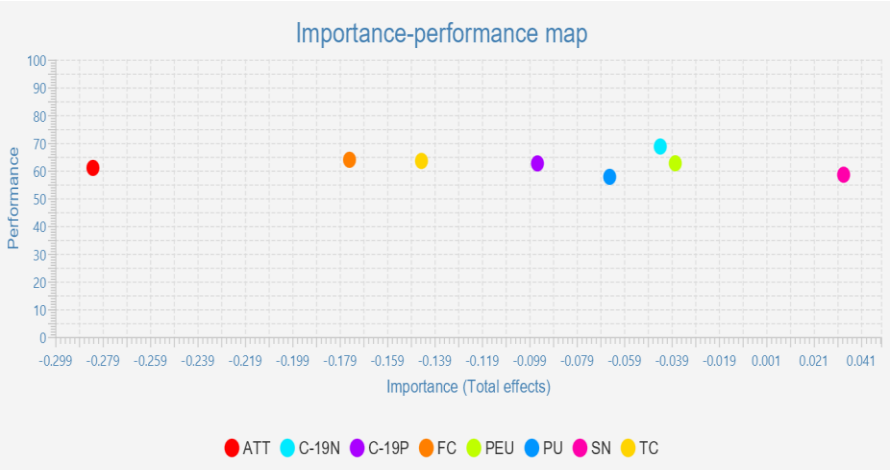

Figure 4. Importance-performance map of online learning

5. Discussion

In the context of students' willingness to continue online learning, the current study looked at the interaction between COVID-19's favourable and unfavourable effects and facilitating circumstances (H1 and H2). According to Sukendro et al. (2020), who suggested that facilitating conditions refer to the belief that technical resources exist to support the use of e-learning during the COVID-19 pandemic, the results showed a significant relationship between COVID-19's positive and negative impacts and facilitating conditions. These findings imply that both favourable and unfavourable COVID-19 characteristics may affect the facilitating circumstances and, in turn, the willingness of students to continue their online education (Weerathunga et al., 2021). The perceived ease of use and perceived usefulness were also affected positively by facilitating conditions (H3a-H3b) as per the results of the study. The facilitating conditions, such as user training and support, boost the perception of the user's ease of use of technology (Foroughi et al., 2025). As such, the support infrastructure allows the user to operate more efficiently and interact positively with the technological systems, which ultimately increases the perceived usefulness of the systems. Cattaneo

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et al. (2025) argued that other facilitating conditions, including the provision of training and technical assistance, affect the confidence and perception of the users regarding the technology. Similarly, Abdalla (2025) noted that users with adequate support resources tend to consider the technology as beneficial and easy to use, thereby increasing their levels of engagement with it.

Facilitating conditions positively impacted tech competency (H3d) but negatively affected subjective norm (H3c). These findings are relevant to Sharma and Saini (2022) arguing that facilitating conditions affect significantly the willingness of lecturers to integrate digital technologies into their teaching. The findings indicated that there is increased external social pressure is less favorable towards the learner's attitude makes sense (β = -0.117). This claim is contradictory to the previous assumption that subjective norms have a strong positive influence on attitudes. It has been suggested that learners are forced into online learning, as opposed to a more voluntary approach. Such social norms could create stress or dissatisfaction (Ajzen, 1991). Al Shamsi et al. (2022) stated that there was a link between enabling conditions and perceived ease of use, but no evidence was found to support the relationship between subjective norms and enabling conditions. Therefore, this rising influence on perceived social pressure generally decreases the impact of social norms. Hence, it is expected to alienate facilitating conditions. This could occur where sufficient resources and support are perceived to render online learning useless in comparison to learning in a traditional classroom environment. Consider students who have access to technology and reliable internet; if the student's peers or family members doubt the students' capability to adhere to online learning, the level of students' voluntary engagement effectively drops.

Furthermore, the absence of adequate support during the students' online learning journey, such as insufficient teacher involvement and absence of validators among peers may render them unwilling or less willing to take up online learning. Such a condition might reduce the importance given to online learning as a viable alternative means of learning alongside the conventional classroom, and the subjective norms regarding online learning would consequently be frustrated. Even though facilitating conditions have an important role in enhancing and supporting online learning (Bamoallem & Altarteer, 2022), additional factors such as subjective norms must also be tackled to ensure that all students view the alternative of online learning positively and as an effective means of education. Specifically, raising awareness of online learning and assisting students in their online learning processes would achieve this goal.

The study findings indicate that there is a strong relationship between people's perceptions regarding the quality of online learning and its perceived usefulness (H4). This result is in line with the advice of Hu et al. (2022) to explain the strong correlation between perceived usefulness and intention by educational institutions providing good online learning (Thi et al., 2022). Sun et al. (2008) suggested that when content is delivered with an interactive approach, learners can achieve their learning goals more easily which in turn increases their perception of the usefulness of the system's delivery. Furthermore, Al-Fraihat et al. (2020) indicated that the system, information, and service quality of an online learning platform has a positive impact on the learner's value perception towards the platform. The learners who perceive more value from the platform often perform well academically and feel satisfied, which increases the perceived usefulness of the system. Perceived ease of use was found to be positively and significantly affecting attitudes (H5). This result is associated with Nuseir and Elrefae (2022) explored that perceived ease of use affects attitudes. Kelm and Johann (2025) emphasized that users' acceptance levels increase proportionately with the levels of ease of use provided by the system. This relationship is elicited through the simple task of cognitive effort reduction which makes interaction pleasant unlike frustrating and annoying. Hosseini et al. (2025) supported this claim by indicating that users' satisfaction and attitude toward the adoption of technologies improve due to positive user experiences resulting from the ease of use phenomenon. Similarly, Luo et al. (2024) in their meta-analysis reported that the ease of use is one of the most

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stable predictors of people's attitudes towards technology acceptance irrespective of the many situations in which such attitude was tested.

The findings revealed that the subjective norm has a significant negative effect on the attitude toward the quality of online learning (H6). Because of the low expenses associated with online learning. From the data presented, it can also be noted that there are external obstacles such as technology fatigue, lack of motivation, or poor engagement that affect one's attitude towards learning in a digital environment. As a result, there is a conclusion that attitude is inversely related to the willingness to engage with online learning environments (β = -0.284). Surprisingly, even with an eagerness to learn, many students willing to learn resort to online learning formats. Thi et al. (2022) asserted that subjective norms could not play a significant role in fostering the intention to accept a study. However, the results of the current study show that subjective norms are likely to negatively influence attitudes toward the quality of online learning because they are critical determinants of attitudes toward social pressure, legitimacy, and credibility and support of online learning. If students feel they have no social support for engaging in learning online, if their social network is likely to disapprove of their online activity, students may feel that their attempts to engage in such online learning are undesirable. This may create negative attitudes towards the quality of the entire learning experience.

Tech competency has a significant impact on students' attitudes to online learning quality (H7). The tech skill of each student will help in conquering the challenges and barriers of online learning (Barrot & Fernando, 2023). For instance, highly tech skilled students tend to utilize online resources more effectively including time management, organization of course materials, and interaction with peers and teachers. Such competencies can help alleviate anxiety and frustration associated with distance education, hence improving their appreciation of the worth value of learning. Students' attitude has a significant impact on willingness to continue online learning in higher education (H8). In comparison with Bloomfield et al. (2023), this result is contrasting who found a strong and positive correlation between attitudes and e-learning. Students' opinions towards the quality of online learning, owing to its influence on motivation, confidence, social connections, and support, and perceived worth and benefit, may discourage them from engaging in it. Possibly, students may regard online learning as less effective than attending classes in person because they lack face-to-face interaction with their peers and instructors, or because they believe that the training or the course materials are of inferior quality. Furthermore, some students may encounter hurdles when trying to use the requisite technology for online learning, including difficulty in accessing online platforms, acquiring course materials, and participating in online forums. This may breed dissatisfaction and lead them to have negative feelings about online learning.

6. Implications

6.1. Theoretical Implications

This study used the concept of TAM to understand how different factors motivate students to persist in engaging in online learning. In view of the good and the bad of the pandemic, the research stresses the importance of positive factors as students' motivation to remain with online learning. For example, facilitating conditions encompass a wide range of categories including technical support, availability of resources, and training that facilitate the adoption of technology in the context of education The resulting TAM framework identified two major variables affecting the acceptance of technology: perceived usefulness and perceived ease of use of the technology. This has a consequent influence on how students perceive the usefulness of online learning and their willingness to pursue it. On the other hand, the pandemic has raised the importance of online classes considering that it is very convenient and indeed enables the pursuit of education. However, barriers such as technical problems and, resource availability can undermine its effectiveness. Nevertheless,

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these shortcomings may be resolved by addressing the relevant institutional aspects and enhancing the overall quality of online education systems. Distance education may give the students more control and freedom in studying, but also may create a sense of isolation towards their classmates and teachers. Organizations can enhance relatedness using shared learning and interaction opportunities, and by making sure students feel integrated into the community. The pandemic made the importance of facilitating conditions in determining the student's intention to continue taking lessons online. It is paramount for organizations to ensure the students' active engagement in their online learning activities. Hence enough technical support, resources, and training needs to be offered together with enhancement of autonomy, competence, and relatedness.

6.2. Practical Implications

The Covid-19 pandemic has had an impact both positively and negatively on the student's willingness to learn online. The pandemic has compelled many students to resort to online learning and other technologies that they may not have used before. This has upgraded their level of comfort and ease with the use of technology for educational purposes. Students enrolled in online learning were able to have greater control over their time and the place where they wished to study. The students who worked or had other duties were able to take the classes online and study whenever it was convenient for them. Students with various challenges that would have kept them away from traditional settings such as those living in remote places, the physically challenged, mothers with young children, and elderly dependents were now able to learn online. However, the other side is that online students also do not require face-to-face interaction, which may leave a void and the students may become more isolated from their peers and the instructors. Self-motivation along with effort can become difficult to achieve. Unforeseen interruptions like internet outages could arise and affect a person's motivation to pursue online learning assistance. However, good and bad are related to learning online due to the COVID-19 pandemic. For equity in learning, institutions must be responsive to the unique diversity within the student and offer relevant support and resources. Also, work towards targeting the issues that face students who are pursuing higher education and could potentially face retirement or discrimination because of transitioning to online centric world.

7. Limitations and Future Research Direction

Although this work has offered fresh perspectives, its shortcomings also need to be considered. Future studies should include students from different private and public higher education institutions to better understand their motivation to continue with online learning. The research only focused on students from universities in China. Future research may examine students' motivation to continue with online learning using different theories, such as SCT theory and SDT theory to evaluate online learning among university students. While SDT may put more of an emphasis on the significance of autonomy, competence, and relatedness in motivation and engagement, SCT may emphasize the function of self-efficacy in influencing behaviour. Examining these theoretical viewpoints can assist in better understanding the elements that affect students' motivation to continue with online learning and how online learning might give students more autonomy and flexibility in their learning.

8. Conclusion

This study examines the factors that motivate students to continue online learning after the outbreak of the COVID-19 pandemic, taking into consideration the various effects such as both negative and positive, as well as the conditions that encourage this change. It has been found that facilitating conditions have both facilitating and constraining effects on perceived ease of use, perceived usefulness, and tech competency as well as subjective norms. These variables are factors that modify students' perceptions and motivation to seek opportunities to learn through online classes. Facilitating conditions are important contributors to the success of online learning. However, the authors warn that this is not all that needs consideration, other factors may influence subjective

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norms and social support. Negative aspects are inadequate social recognition, disassociation from peers and instructors, as well as lack of technical assistance which diminishes their perception of the quality of online learning. The findings highlight a critical factor in this respect such as tech competency, which helps to reshape students' perceptions, motivates them to break the barriers, and improves the overall online learning experience. However, such drawbacks as the lack of contact with instructors, lower quality of the materials, and problems with obtaining the necessary technologies inhibit students' willingness as well as satisfaction with online learning modes. It is essential for educational institutions to take action to construct a favorable atmosphere for their online learning. Additionally, effort is needed to inform people and provide them with assistance to increase the level of perceived quality of online education.

Declarations

Data Availability Statement. Data will be provided upon request.
Conflict of Interest. Authors are declaring that there is no potential conflict of interest.
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Author Contributions. Conceptualization, Muhammad Khalilur Rahman and Md Arafat Hossain; Data curation, Muhammad Khalilur Rahman, Md. Abu Issa Gazi, Mohammad Bin Amin, Md Arafat Hossain and Abdul Rahman bin S Senathirajah; Formal analysis, Muhammad Khalilur Rahman and Md Arafat Hossain; Funding acquisition, Md. Abu Issa Gazi, Veronika Fenyves and Abdul Rahman bin S Senathirajah; Investigation, Muhammad Khalilur Rahman, Md. Abu Issa Gazi, Md Arafat Hossain, Mohammad Bin Amin and Moniya Sultana; Methodology, Muhammad Khalilur Rahman; Project administration, Md. Abu Issa Gazi; Resources, Md. Abu Issa Gazi, Mohammad Bin Amin, Moniya Sultana, Md Arafat Hossain and Abdul Rahman bin S Senathirajah; Software, Moniya Sultana; Supervision, Veronika Fenyves and Abdul Rahman bin S Senathirajah; Validation, Moniya Sultana, Md. Abu Issa Gazi, Md Arafat Hossain, Mohammad Bin Amin, Moniya Sultana and Abdul Rahman bin S Senathirajah; Visualization, Moniya Sultana, Veronika Fenyves; Writing – original draft, Muhammad Khalilur Rahman and Md. Abu Issa Gazi; Writing – review & editing, Muhammad Khalilur Rahman, Md. Abu Issa Gazi, Abdullah Al Masud, Mohammad Bin Amin, Veronika Fenyves, Md Arafat Hossain, Veronika Fenyves and Abdul Rahman bin S Senathirajah.

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