



## Investigating University Students' Acceptance of Blended Learning during COVID-19 Pandemic

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Technology Acceptance Model (TAM) framework; TAM construct; TAM model; Information quality.

### Abstract

More and more instructors have begun using blended learning to overcome the challenges encountered during the covid-19 pandemic. However, still not much known about influential factors in students' acceptance of such hybrid learning systems. For this purpose, a framework that includes key attributes such as; information quality and system quality, system interactivity, user satisfaction, perceived usefulness, perceived ease of use, and blended learning system use was developed. Pearson correlations were used to analyze data from 700 respondents. Findings revealed that, while there exist no significant relationships among system quality-user satisfaction and user satisfaction-use for blended learning and relatively weak, positive relations exist among perceived ease of use-use for blended learning. In addition to a low, positive relationship between perceived usefulness and use for blended learning, moderate positive correlations exist among system interactivity-user satisfaction and perceived ease of use-perceived usefulness. Finally, high positive correlations exist among information quality-user satisfaction, user satisfaction-perceived usefulness, and user satisfaction-perceived ease of use. Information quality is important in students' satisfaction when using the blended systems. This also affects the perceived ease of use and perceived usefulness of the system. The decision-makers and institutions benefit from this study by considering only the factors leading to a successful implementation of blended learning.

**Disciplinary:** Education (Learning Management, Technology Adoption), Information Technology.

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# 1 Introduction

Instructors in higher education institutions constantly seek innovative ways to use and implement emerging technologies into teaching and learning practices for supplementary purposes to keep up pace with 'digital age' students' technology-driven preferences and to involve them actively in educational practices. However, education in the digital era includes more challenges than ever with the outbreak of covid-19. Understanding students' technology-related preferences and gaining insights on what makes students accept and use a specific technology are essential for providing a better quality learning environment. Today's technologically savvy students are immersed in constantly evolving technological advancements. They would like to stay connected and share their experiences rather interactively. They could not benefit much from traditional, offline, non-interactive settings [1]. Today's students learning requirements involve; active engagement with learning, guided support, awaiting for instant response, learning at their own time, speed, and from any location through experience.

Innovative interactive learning environments as a supplement to traditional classroom teaching have emerged to meet such requirements. Namely, blended learning systems (BLS) offer such interactivity with instant feedback available in (a/synchronous options. Learning progress could be efficiently monitored by students and by instructors. The essential features that a blended learning system offers are; tools for managing content and monitoring learning, multimedia content, assignments, measurement and evaluation, and grade book tools.

Higher education institutions have begun integrating blended learning systems more often. The reason is that they want to compete with other institutions. They also need to keep up pace with evolving technology to minimize challenges in dramatically changing learning environments. They try to integrate suitable technologies in teaching and learning by deciding on the most appropriate model accepted by students to fulfill their needs and match their skills. The successful implementation of a blended learning system provides such features. It also presents an opportunity to incorporate face-to-face and online teaching and learning.

Numerous factors play role in the successful acceptance of a blended learning system by students. However, identifying the critical components of the adoption process can be overwhelmingly difficult due to the varied proposed frameworks from the exhaustive evaluation of the extant literature on instructor and student preferences.

There have been a series of research done in the areas geared towards the discovery of BLS acceptance and adoption and the majority of these studies have focused on the adoption of either Unified Theory of Acceptance and Use of Technology (UTAUT) [2,3,4,5] or the Technology Acceptance Model (TAM) frameworks [6,7,8,9]. The relevant studies either focused on the external system characteristics (such as system quality, information quality, system interactivity) with the inclusion of TAM constructs (perceived ease of use and perceived usefulness) and use of BLS as supplementary learning [9]. While other studies concentrated on system characteristics, user satisfaction, and TAM construct (perceived usefulness), and continuous intention to use [8]. In

different research studies, IS success constructs (information and system qualities) and intention to use and UTAUT were addressed [2].

The original acceptance frameworks do not adequately represent system characteristics, IS success factors, and blended learning systems use. The proposed framework emerged from the meticulous evaluation of different acceptance frameworks. However, there is a dearth of research on blended learning systems use to support learning. The significance of this research lies in involving less frequently investigated essential elements that lead to the successful implementation of BLS. In addition, identifying factors on the acceptance of blended learning systems during the ongoing covid-19 pandemic will help bridge the digital gap and provide a guide to reform the learning environments by educators, researchers, and higher education institutions.

## 2 Literature Review

Blended learning aims to improve students' learning skills, performance, and experience. However, several factors affect users' acceptance of this new technology tool. Researchers in [10] investigated the acceptance of blended learning systems and the role this technology plays in higher education society in Europe, using an extended TAM model that includes personal, social, and institutional factors. They collected data from 604 users at various universities in the United Kingdom. In addition, they said that quality of working life, social norms, perceived usefulness, perceived ease of use, facilitative conditions, and self-efficacy are important factors influencing the adoption of web-based learning technologies. However, the sample size is small. Yet this limitation can affect the outcome of the study in some way.

Researchers in [11] pointed out that despite the investment in implementing such learning systems, many students have discovered that they are not optimally using the learning systems. They addressed the issue by investigating the factors that influence student use of these technologies. They adopted the Technology Acceptance Model (TAM) and collected data from 560 students from two universities while analyzing the data obtained by structural equation modeling (SEM). Research results show that perceived self-efficacy system quality, facilitating conditions (FC) are key factors that impede the acceptance of learning systems. Integration of two or more models leads to better results suggested by [12].

Researchers [13] conducted a survey based on the challenges faced by students adopting e-learning through the Technology Acceptance Model (TAM) on college students from some Swedish universities. The results show that the vital element of the TAM is perceived usefulness (PU). Findings indicated that perceived usefulness is important in driving students to embrace e-learning at Swedish universities.

## 3 Conceptual Framework

The proposed framework integrates the updated IS success model with TAM constructs [14]. The subsequent sections are the descriptions of the relevant studies showing stated hypotheses among the constructs of the proposed model.

### 3.1 Information Systems (IS) Success Model Constructs

The original IS success model consists of six constructs: information quality, system quality, system use, user satisfaction, individual impact, and organizational impact. Later the model included service quality. Researchers also elaborated use and intention to use and added net benefits. They stated that intention to use is a measure of an attitude whereas use is an indicator of behavior [14]. As a result, including these factors provides measuring both users' attitudes and behavior. IS success model also included information quality measuring correctness, timely convenience, completeness, relatedness, and stability. They defined system quality as; easy to use a system, to be functional, reliable, being able to adjust, to have a good quality of information served, to have mobility, to be adapted to new settings, and of having practical value. The researchers in [15] defined user satisfaction as perceptions of satisfaction or dissatisfaction after interacting with the system. The researcher in [8] conducted a study with 408 freshmen university students to identify the success factors that are potentially critical in the adoption of a blended learning system in Tanzania. The results of structural equation modeling that she reported which is pertinent with the scope of this study are; positive direct impacts of perceived usefulness, system quality on user satisfaction, and positive direct effect of user satisfaction on continual intention to use BLS. However, no significant effects of information quality on user satisfaction and perceived usefulness on continual intention to use BLS were reported.

The researchers [2] proposed a framework involving IS success constructs (information quality, system quality, user satisfaction), information and system satisfaction, some UTAUT constructs, and attitude of lecturer in their study to measure 124 college students' mobile learning systems use. They noted significant positive direct effects of user satisfaction on behavioral intention to use, information quality on user satisfaction, and system quality on user satisfaction.

In the light of above, this study's purpose is to investigate university students' acceptance of blended learning systems through taking into consideration of system characteristics such as information quality, system quality, system interactivity, and user satisfaction and constructs from TAM as perceived usefulness and perceived ease of use and finally with the inclusion of the use of BLS to support learning as the combination of actual use and intention to use.

### 3.2 TAM Model Constructs

The technology acceptance model was initially proposed by [16] included external variables, perceived usefulness, perceived ease of use, attitude, behavioral intention to use, and actual system use. Later the model was improved and was tested in [17, 18].

The researchers in [10] conducted a study using structural equation modeling (SEM) on 604 university students to assess social, institutional, and individual factors that take part in the use and adoption of the BLS by extending the TAM model (perceived ease of use, perceived usefulness) and other constructs as; social norm, quality of work-life, self-efficacy, facilitating conditions, behavioral intention, and actual use. Among these factors, perceived ease of use and perceived

usefulness directly and positively affect behavioral intention to use BLS i.e. Blackboard system use. A blended learning system is perceived as easy to use which implies that users would also consider it to be useful.

The researchers in [9] conducted a study on 259 college students in Taiwan to measure the influence of system characteristics on the supplementary use and use for distance education of e-learning systems. They reported a significant positive impact of perceived usefulness, perceived ease of use, and system interactivity on the use of e-learning systems for distance education and use for supplementary learning and positive impact of perceived ease of use on perceived usefulness as the results of SEM analysis.

## 4 Method

### 4.1 Research Model and Hypotheses

This research aims to determine the factors contributing to university students' acceptance of BLS use. The research design is correlational. The main research question and the corresponding hypotheses are

Q1: What are the factors that determine university students' acceptance of blended learning systems during the pandemic?

H1: There is a positive relationship between information quality and user satisfaction of university students in the use of blended learning systems use.

H2: There is a positive relationship between system quality and user satisfaction of university students in the use of a blended learning system.

H3: There is a positive relationship between system interactivity and user satisfaction of university students in the use of a blended learning system.

H4: There is a positive relationship between perceived usefulness and user satisfaction of university students in the use of a blended learning system.

H5: There is a positive relationship between user satisfaction and perceived ease of use among university students' blended learning system use.

H6: There is a positive relationship between user satisfaction and university students' blended learning systems use.

H7: There is a positive relationship between perceived ease of use and perceived usefulness of university students' blended learning systems use.

H8: There is a positive relationship between perceived usefulness and university students' blended learning systems use.

H9: There is a positive relationship between perceived ease of use and university students' blended learning systems use.

The proposed model given in Figure 1 was conceived by augmenting the existing technology acceptance models that identify missing linkages. The emerged model is the amalgamation of TAM (technology acceptance model) with perceived ease of use, perceived usefulness, and external variables such as; information quality, system quality, and system interactivity with user

satisfaction. A model excluding system and information quality factors was addressed in [9] where system interactivity as external variable and perceived usefulness with ease of use associated with use for supplementary learning and the study’s model addresses e-learning use. The researchers [19] proposed IS success constructs as information quality, system quality associated with user satisfaction, and user satisfaction affecting intention to use. The proposed model combines success factors, technology acceptance measures, the actual and intended use of blended learning.

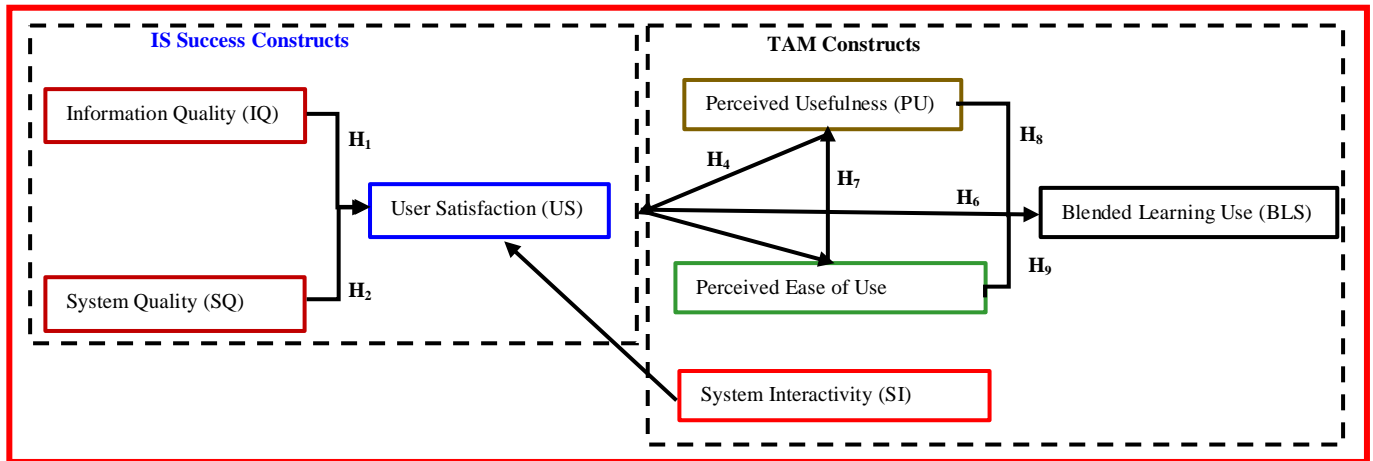


Figure 1: Proposed Model.

## 4.2 Participants and Procedure

The total number of university students constituting the population is slightly more than 93000 during the administration of the study. If the margin of error is estimated as 5% and the confidence interval is 95%, the distribution of the responses is presumed to be normal then the minimum recommended sample size would be 383. In this study, 700 valid responses were used in statistical analysis and the sample size is more than the minimum recommended number.

Table 1 describes the information of the participants. Male university students are dominant as compared to female students. Most of the students were continuing their undergraduate and master’s degrees during the administration of this study. They enrolled in STEM (Science, Technology, Engineering, and Mathematics) and other departments. The data collected were coded into SPSS from 700 valid questionnaire data from 6 accessible universities located in the north part of Cyprus.

Table 1: Participant Information.

Demographics	Description	Frequency	Percentage (%)
Gender	Female	296	42.3%
	Male	404	57.7%
Age	17-22	412	58.9%
	23-27	206	29.4%
	>=28	82	11.7%
Education Level	Undergraduate	345	49.3%
	Masters	296	42.5%
	PhD	59	8.4%
Department	STEM	378	54%
	Other	322	46%



### 4.3 Data Collection Tool

The data was collected by an adopted questionnaire, involving two sections. The first contains five demographic information-related questions (gender, age, department, education level, BLS usage). The second part includes 34, 5-option (strongly disagree-strongly agree) Likert type questions covering the research model dimensions as perceived usefulness (6 items), perceived ease of use (6 items), system quality (7 items), system interactivity (3 items), information quality (5 items), user satisfaction (3 items) and use for supplementary learning (4 items).

The information quality, system quality, and user satisfaction-related questions were adopted from [2]. The researchers [2] adopted such constructs for mobile learning. Information and system quality-related items were adopted from [14,19] and user satisfaction from [20]. Perceived usefulness and perceived ease of use items together with use for support learning items were drafted from [9, 18]. They adapted stated constructs to measure e-learning use. Use for support learning items was adopted in their study from [20] and the model in [17] has two distinct constructs; use for supplementary learning and use for distance education.

In this study, these two constructs were combined under one attribute named blended learning use as in the work of [18]. This construct included use and intention to use items together. They reported that they adapted perceived ease of use and perceived usefulness questions from [16, 21]. The system interactivity was adapted from [9]. The number of items, Cronbach's alpha reliability ( $\alpha$ ), mean (M), and standard deviations (SD) are shown in Table 2. The mean of the responses indicates that participants' responses range from neutral to agree. The adopted questionnaire has very good reliability, all above 0.70 as a rule of thumb. Each construct's reliability is above 0.70 is satisfactory for the recommended acceptable internal consistency values [22, 23].

**Table 2: Reliability and mean and SD of constructs**

Construct	No.	$\alpha$	M	SD
Information Quality	5	0.87	3.24	1.13
System Quality	7	0.80	2.66	0.64
System Interactivity	3	0.73	3.54	1.02
User Satisfaction	3	0.80	3.10	1.21
Perceived Usefulness	6	0.78	3.29	0.88
Perceived Ease of Use	6	0.88	3.11	1.05
Use for Support learning	4	0.71	2.66	0.71
Total	34	0.93	3.05	0.67

### 4.4 Data Analysis

The Likert-type item coding is as follows; 1 for strongly disagree, 2 for disagree, 3 for neutral, 4 for agree, and 5 for strongly agree and were analyzed in SPSS through descriptive statistics. The hypotheses of the study were tested by using Pearson's bivariate correlation.

## 5 Result and Discussion

Table 3 shows tested hypotheses (H), independent (IV) and dependent variables (DV), correlation coefficient value (R), degree, direction, and the result in the form of supported or not, and the p-value denotes the significance of the hypothesis tested.

The findings revealed strong positive relationships among information quality and user satisfaction, user satisfaction and perceived usefulness, user satisfaction, and perceived ease of use. Positive, moderate, significant relations exist among system quality and user satisfaction, perceived ease of use, and perceived usefulness. A weak positive relationship exists between perceived usefulness and BLS use. An almost negligible positive relationship exists between perceived ease of use and BLS use.

However, no significant relationships exist among system quality - user satisfaction and user satisfaction-BLS use. One notable finding is that system quality is not a determining factor in user satisfaction. Hence this is not a determining factor for BLS use. User satisfaction positively correlates with both perceived ease of use and perceived usefulness. However, these factors have the least determining associations with blended learning system use. Better quality of the information in a blended learning system leads to higher user satisfaction and hence increased perceived usefulness and ease of use of BLS.

The researchers [2] developed a framework to understand students' intention to use mobile learning systems. Their proposed research model included IS success factors like information and system quality and user satisfaction and they collected data from 124 university students. They reported that system quality and information quality are positively related to students' satisfaction with mobile learning systems. While they found out that information and system quality has a strong, positive relationship with user satisfaction, user satisfaction has a moderate, positive relationship with behavioral intention to use mobile learning systems. However, this research found no significant relationship between system quality and user satisfaction of BLS use. The strong positive association between information quality and user satisfaction aligns with their finding. Also, this study has contradicting findings that there exists no significant relationship between user satisfaction and use for support learning of BLS while they noted a moderate positive relation among these constructs. However, their study only concentrated on intention to use while this research focused on BLS use to support learning.

The researchers [9] studied 259 college students to understand system characteristics of e-learning system usage. They used structural equation modeling to test their model with similar constructs as system interactivity, perceived ease of use, perceived usefulness, and use for supplementary learning. In their study, while system interactivity directly and positively affects perceived usefulness, system interactivity does not affect perceived ease of use. However, in this study, system interactivity is moderately related to user satisfaction. They also found weak positive effects of perceived ease of use and usefulness on use for supplementary learning and between perceived ease of use and perceived usefulness which are consistent with the findings of this study.

The researcher [8] conducted an SEM study on 408 undergraduate students to identify students' continual usage intention of the web-based learning systems. The author reported a non-significant relationship between information quality and user satisfaction which in this study, there exists a strong positive relationship among these constructs. Positive moderate relations exist



among system quality and user satisfaction and continual intention to use while none of these findings exist in this research. There exists a strong, positive relationship between Perceived usefulness and user satisfaction in this study while she reported a weak positive association between these attributes.

Also, there is no significant relationship between perceived usefulness and continual usage intention. But in this study, there exists weak positive relation among these constructs. The reason for such contradictory findings might be due to the use of different samples. In the aforementioned study, only freshman students with limited BLS usage experience constitute participants whereas in this research there exists a more diverse sample who has got experience on BLS. The findings revealed moderate to strong correlations among IS success constructs and TAM constructs upon the adoption of blended learning systems usage. However, more additional research should be directed towards identifying the direct and indirect effects of these attributes on blended learning systems usage. As it was also addressed by the researchers in [24], investigating the challenges and factors influencing the acceptance, and use of e-learning as a tool will aid to develop a systematic approach for the successful implementation of blended learning and embedding appropriate technology for the constant advancement and transformation. In addition, digitized models of blended learning were suggested by the researchers to maximize the interaction of the stakeholders in education [25]. Besides, the attitude of the students was identified as the most significant factor to predict university students' intention to use such learning facilities during the pandemic [26].

**Table 3: Results of the tested hypotheses.**

H	IV	DV	R	Degree	p-value	Supported
H <sub>1</sub>	IQ	US	0.84	Strong,+	0.000	Yes
H <sub>2</sub>	SQ	US	-0.02	None	0.628	No
H <sub>3</sub>	SI	US	0.62	Moderate,+	0.000	Yes
H <sub>4</sub>	US	PU	0.71	Strong,+	0.000	Yes
H <sub>5</sub>	US	BLS	0.02	None	0.667	No
H <sub>6</sub>	US	PEOU	0.46	Strong,+	0.000	Yes
H <sub>7</sub>	PEOU	PU	0.58	Moderate,+	0.000	Yes
H <sub>8</sub>	PU	BLS	0.30	Weak,+	0.000	Yes
H <sub>9</sub>	PEOU	BLS	0.27	Very Weak,+	0.000	Yes

## 6 Conclusion

The blended learning system (BLS) has been widely used as supplementary to learning however, some important factors were not clearly identified on the acceptance of such systems to support learning in higher education. To fill this gap, a combined framework was developed to identify influential factors of university students' acceptance of BLS use, and the associations among constructs were tested using correlation analyses.

To draw the attention of students, higher education institutions should include high-quality information in BLS which promotes user satisfaction and hence ease of use and usability especially to overcome the challenges encountered in the covid-19 pandemic. In the future, different statistical techniques could be applied such as structural equation modeling to test the overall model fit for further verification of the proposed model.

In addition, other constructs could replace existing weakly correlated ones to improve the model. Different samples can be used to test the model. Structural equation modeling will be used to test the model's fit in the future. The data was collected through self-reports. The accuracy of the information depends on the honesty of the participants. It constitutes the major limitation of this study. Including as many participants as possible to provide a representative sample of the population was considered by this research.

This study is a preliminary attempt to highlight influential factors that could affect the acceptance of BLS use in higher education and to which extent they are related to using BLS to support learning. This study could provide better insight into the successful implementation of blended learning systems for supplementary learning purposes. The findings of this paper have explanatory power on IS success model constructs on successful implementation of BLS in an exemplary developing country.

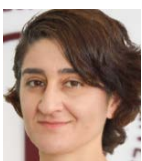
## 7 Availability of Data and Material

Data can be made available by contacting the corresponding author.

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