Adoption of a learning management system among educators of advanced technological institutes in Sri Lanka

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Abstract

Purpose – The study investigates the factors that impact the adoption of learning management systems (LMSs) among educators for effective implementation of open and distance learning (ODL) environment in advanced technological institutes (ATIs).

Design/methodology/approach – This study uses the extended technology acceptance model (TAM) and analyses data using the partial least square–based structural equation modelling approach to validate the construct and test proposed hypotheses. Data were collected through an online questionnaire from the respondents.

Findings – This study reveals that perceived self-efficacy and job relevance significantly impact perceived usefulness (PU) and perceived ease of use (PEU). PU, PEU and service quality significantly impact attitudes of educators, which impact their behavioural intention and actual use of LMS as a chain reaction.

Practical implications – The management should organise hands-on training sessions to improve educators' computer self-efficacy and explain the importance of the LMS and its features to offer an effective ODL environment for delivering high-quality education.

Originality/value – The previous studies focused on LMS use from the students' point of view rather than educators. This study investigates educators' LMS adoption in ATIs using the extended TAM. The findings may be helpful for management to implement an effective ODL environment that offers fully integrated distance learning and e-learning during the prevailing COVID-19 pandemic.

Keywords ATIs, Educators, LMS, ODL, System quality, TAM

Paper type Research paper

Introduction

Every industry has been influenced by the widespread use of information and communication technology (ICT) which has brought various advancements in the education industry. These technological advancements offer educators and students greater prospects of customising teaching and learning (Ratheeswari, 2018). The rapid growth of internet availability and ICT encourages educational institutes to integrate e-learning applications to ensure the continuous

delivery of academic programs and student interaction (Ashrafzadeh and Sayadian, 2015). Teaching and learning can be made more interactive and effective with the help of e-learning technology. One popular technology supporting e-learning is the learning management system (LMS) (Coskuncay, 2013).

The LMS is a web-based application that integrates and organises all teaching and learning initiatives. LMS use significantly lowers the costs and complexity of knowledge transfer within an organisation (Pelet, 2013). Many higher-educational institutes (HEIs) currently use the LMS as an essential element for their course delivery (Browne *et al.*, 2006; Alhazmi and Rahman, 2012; Washington, 2019), and it has become an indispensable tool in higher education for the interactive teaching and learning process (Pelet, 2013; Alturki and Aldraiweesh, 2021). The rising popularity of e-learning, distance education and blended learning and the increased use of the LMS pressure HEIs to deliver high-quality courses online (Alomari *et al.*, 2020). The LMS largely supports traditional face-to-face teaching and is considered the backbone of e-learning at HEIs (Washington, 2019). Educators and students in HEIs are often mandated to adopt the LMS (Shine and Heath, 2020). Educators use the LMS to streamline their students' learning activities. It facilitates educators to share course materials, communicate with students and assess their performance. Educators must engage and interact with students using a suitable LMS to offer a better learning environment (Yen *et al.*, 2018). Many HEIs implement the LMS to enhance the quality of teaching and learning; hence, they provide training on technical skills to users and motivate them to be more interactive (Rhode *et al.*, 2017).

Teaching and learning become more interactive due to the effective use of the LMS (Waheed *et al.*, 2016; Alshammari, 2020; Alshammari *et al.*, 2016). During the COVID-19 pandemic, teaching and learning were physically interrupted in most HEIs and educators were compelled to switch to open and distance learning (ODL) modes. This study focuses on advanced technological institutes (ATIs) functioning under the Sri Lanka Institute of Advanced Technological Education (SLIATE). This institute is a leading HEI in the country, working under the portfolio of the Ministry of Education of Sri Lanka (Gunasekara, 2015). SLIATE has implemented Moodle LMS to support face-to-face teaching and learning for the last decade (Dona *et al.*, 2013). ATIs foster advanced technical education at the post-secondary level in each district of the island. They offer Higher National Diploma (HND) programs in various academic disciplines, including engineering, agriculture, information technology, business and languages. The administration and academic affairs of the ATIs are coordinated by a centralised system managed by SLIATE. Therefore, course curriculum design and implementation and semester-end examinations are undertaken by the SLIATE, while teaching and learning are conducted on the campus (ATIs) of SLIATE under a common academic calendar.

However, LMS use is unsatisfactory among educators and students in ATIs (Jayathilake and Jayawardhana, 2017). Perera (2019) states that only 50% of educators use the LMS in ATIs. ATIs switched to the ODL mode during the pandemic to continue academic activities using the LMS and virtual conferencing applications (VCAs). Nevertheless, ATIs have been struggling to effectively implement the ODL mode due to educators' underuse of the LMS. Therefore, the top management of the ATIs needs to motivate the educators to use the LMS to implement ODL to effectively offer a quality teaching and learning environment. The top management of ATIs should understand critical factors influencing LMS adoption among educators to motivate them to use the LMS. Therefore, this study investigates the factors affecting LMS adoption among educators in ATIs to implement ODL effectively. This study employs a well-known theoretical framework: technological acceptance model (TAM). Many researchers consider the TAM as an appropriate model for investigating the factors affecting user intention and use of technology (Mailizar *et al.*, 2021; Jayathilake and Jayawardhana, 2017; Abdullah *et al.*, 2016).

This paper consists of six sections. The first section is the introduction that gives an overview of the key roles of the LMS and the purpose of this study. The second section is a literature review that focuses on recent literature on LMS, TAM, and the development of hypotheses. Data collection, research design, and conceptual framework are described in the third section. Data analysis and discussions are presented in the fourth and fifth sections. Finally, the last section details the conclusion and implication.

Literature review

Learning management system

The LMS is one of the most widely used web-based applications, and its use in HEIs is burgeoning (Dutta *et al.*, 2013). The LMS includes several integrated technologies for delivering and administering ODL. There are two types of LMSs available: open source (e.g. Moodle, Forma LMS, Open edX, etc.) and commercial (e.g. Google Classroom, Blackboard, Docebo LMS, etc.). Most LMSs are adaptable, simple to use, accessible and user-friendly (Alturki and Aldraiweesh, 2016; Arsovic and Stefanovic, 2020). Educators can use the LMS to develop online course content and then monitor it to improve critical reasoning skills and encourage students to work together on activities in university (Zanjani *et al.*, 2016). The LMS comprises many features, including video conferencing, online group chats, live comments, lecture resources and the interaction between the teacher and the student. Learning modules, course evaluations and grading are available in the LMS, and all of them may be customised to meet teaching and learning needs (Walker *et al.*, 2016). Non-traditional modes of teaching and learning assisted by online approaches to education have a favourable impact on both educators and students (Anshari *et al.*, 2017). Educators use the LMS to share course content and teaching materials with students, as well as to promote collaboration and participation among students via the use of virtual forums. Students are encouraged to engage, share opinions, discuss issues and comment on ideas presented by their colleagues (Goh *et al.*, 2014). The Moodle is an open-source, free LMS online platform extensively used by several HEIs to engage students and develop more comprehensive and interactive course materials (Dhika *et al.*, 2020; Devi and Aparna, 2020; Nagi *et al.*, 2008). Moodle LMS is widely used in almost all HEIs in Sri Lanka (Tennakoon and Lasanthika, 2021; Hasmy, 2020).

Technology acceptance model (TAM)

Davis initially proposed the TAM in 1989, which investigates the elements that have been identified as effects on human behaviour in adopting information systems (ISs). According to the TAM, the actual use (AU) of ISs is affected by the user's behavioural intention (BI), which is affected by the user's attitude (ATT). The ATT is affected by perceived usefulness (PU) and perceived ease of use (PEU). PEU influences PU. Researchers apply the TAM in numerous situations by adding new constructs. These extensions may be categorised into three areas: adding components from related models, adding more belief structures and evaluating predictors of PU and PEU (Wixom and Todd, 2005). Davis (1989) defines PU as "the degree to which a person believes that using a particular system would enhance his/her job performance". He defines PEU as "the degree to which a person believes that using a particular system would be free of physical and mental effort".

Buabeng-Andoh and Baah (2020) investigated the intention of pre-service teachers to use the LMS using the TAM. The finding of the study is that ATT and social influence (SI) significantly affect BI to use the LMS. However, facilitating conditions (FCs) do not affect BI to use the LMS. Goh *et al.* (2014) conducted another study to determine academics' intentions to use the LMS. They find that PU positively supports their intention to use the LMS, but PEU does not. According to Holzmann *et al.* (2020), teachers' use of technology depends on various

factors. As per the study, the FC, PEU and ATT significantly affect teachers' technology use intention, although SI and effort expectancy (EE) do not. Likewise, Onaolapo and Oyewole (2018) investigated the effect of PE, EE and FC on learners' technology use in education. Their study's findings reveal that PE, EE and FC are strongly associated with learners' technology use. Fathema *et al.* (2015) examined the LMS use of educators in HEIs using the extended TAM and show that educators' attitudes about LMSs are significantly influenced by the three suggested external variables: perceived self-efficacy (PSE), system quality (SQ) and facilitating conditions (FC).

According to Holden and Rada (2011), teachers' technology SE influences their use of technology. Panda and Mishra (2007) report that faculty members believed that poor internet connectivity and insufficient training are the key challenges to e-learning adoption, followed by organisational rules and instructional design. They find that faculty adoption of e-learning was mostly driven by a personal interest in using technology, intellectual challenge and adequate technical infrastructure. According to Mokhtar *et al.* (2018), the BI of instructors to use the LMS is directly affected by task–technology fit (TTF), PU and PEU. Meanwhile, TTF, compatibility, convenience, SE, personal innovativeness (PI) and subjective norm (SN) significantly influence PU and PEU. Many previous studies have investigated LMS use from the view of students (Saroia and Gao, 2019; Ashrafi *et al.*, 2020). However, limited research has looked into this topic from the view of educators (Mokhtar *et al.*, 2018). Since educators' LMS use is vital to students' engagement in the learning process through course content creation and sharing, learners' LMS use behaviours can be influenced. As a result, it is imperative to investigate educators' intentions to use the LMS.

Furthermore, many studies have been conducted regarding using e-learning and LMS adoption among students and educators employing various adoption models (Wrycza and Kuciapski, 2018; Uğur and Turan, 2018; Bervell and Umar, 2017; Sharma *et al.*, 2017). These studies failed to accommodate the variables job relevance (JR) (Siyam, 2019; Saroia and Gao, 2019; Hong *et al.*, 2021), PSE (Park *et al.*, 2012; Thongsri *et al.*, 2020; Abdullah *et al.*, 2016) and SQ (Rughoobur-Seetah and Hosanoo, 2021; Mailizar *et al.*, 2021; Abdullah *et al.*, 2016) in their adoption models, even though these variables affect the adoption of ISs. Furthermore, few studies have been conducted in Sri Lanka from educators' point of view (Gunasinghe *et al.*, 2020), and there are no studies in the existing literature in the context of non-degree-awarding, state-owned HEIs. This study fills the literature gap by using the TAM with its six original and the three new variables to investigate the factors affecting the educators' adoption of the LMS in ATIs.

Hypotheses

Most studies have applied the TAM in e-learning research and found that PEU and PU have a strong positive impact on BI to use e-learning platforms (Singh *et al.*, 2020; Maheshwari, 2021). Munabi *et al.* (2020) found that PEU and PU directly impact educators' BI to use the LMS. Ong (2019) states that PEU and PU directly impact educators' ATT to use the LMS; BI to use the LMS is influenced by ATT and AU of the LMS is influenced by BI. The TAM consists of five components: PU, PEU and ATT are considered core variables, while BI and AU are considered outcome variables in many studies. Researchers examine and confirm the relationship between PU, PEU, ATT, BI and AU in various IS contexts. Many empirical studies found that PEU impacts PU and ATT, PU impacts ATT and BI, ATT impacts BI and BI impacts AU (Mailizar *et al.*, 2021; Abdullah *et al.*, 2016; Jayathilake and Jayawardhana, 2017). Therefore, based on the available literature, the following hypotheses are brought forth in this study:

H1. PEU significantly impacts PU of the LMS.

H2. PEU significantly impacts ATT towards using the LMS.

H3. PU significantly impacts ATT towards using the LMS.

H4. PU significantly impacts BI to use the LMS.

H5. ATT significantly impacts BI to use the LMS.

H6. BI significantly impacts the AU of the LMS.

The constructs PEU and PU may not be enough, and additional factors may be required in the TAM to comprehensively investigate IS adoption (Siyam, 2019). Therefore, three external factors were identified after evaluating the relevant literature: JR (Venkatesh and Davis, 2000), SE (Tam and Cheung, 2020; Park *et al.*, 2012; Thongsri *et al.*, 2020; Chen and Tseng, 2012; Abdullah *et al.*, 2016) and SQ (Taat and Francis, 2020). The three proposed external constructs/variables with relevant literature to consider in the adopted conceptual framework of this study are given in detail with justifications in the following subsections.

Job relevance (JR)
According to Venkatesh and Davis (2000), JR is "an individual's assessment of the degree to which the target system is appropriate to his or her work". JR directly and positively impacts PU. Saroia and Gao (2019) and Hong *et al.* (2021) claim that JR impacts PEU. The TAM is expanded by including JR as an external factor directly impacting PU and PEU (Siyam, 2019). In this study, JR is described as the opinion of educators on how useful the LMS system is for managing learning activities at ATIs. Therefore, this study proposes the following hypotheses concerning the relationship between JR and TAM constructs, PU and PEU:

H7. JR significantly impacts the PU of the LMS.

H8. JR significantly impacts the PEU of the LMS.

Perceived self-efficacy (PSE)
PSE is "the extent to which an individual feels capable of performing a task" (Tam and Cheung, 2020). Previous studies stress the relationship between computer SE and PEU of e-learning systems. If users have a favourable view of computer SE, their opinion of e-learning will be "easy to use" and "require little effort" (Thongsri *et al.*, 2020). Several studies confirm the importance of PSE in adopting ISs (Park *et al.*, 2012; Thongsri *et al.*, 2020; Abdullah *et al.*, 2016). A higher degree of PSE results in greater IS use (Alamin *et al.*, 2020). Earlier studies claim that PSE positively impacts PU and PEU (Chen and Tseng, 2012; Hong *et al.*, 2021; Abdullah *et al.*, 2016). As a result, this study proposes that educators with high levels of PSE will use the LMS more frequently and find it more beneficial and easier to use. Therefore, this study proposes the following hypotheses concerning the relationship between PSE and TAM constructs, PU and PEU:

H9. PSE significantly impacts the PU of the LMS.

H10. PSE significantly impacts the PEU of the LMS.

System quality (SQ)
SQ is "in the internet environment measures the desired characteristics (usability, availability, reliability, adaptability and response time) of a system (i.e. LMS)" (Taat and Francis, 2020). Findings suggest that SQ strongly impacts the PU of an e-learning system (Rughoobur-Seetah and Hosanoo, 2021; Mailizar *et al.*, 2021; Abdullah *et al.*, 2016). Bakhsh *et al.* (2017) state that SQ strongly impacts the users' ATT of an m-learning system. This study refers to SQ as the functionality, performance, contents and features of the LMS of

ATIs. Therefore, this study proposes the following hypotheses concerning the relationship between SQ and TAM constructs, PU and ATT:

H11. SQ significantly affects PU of the LMS.

H12. SQ significantly affects users' ATT of the LMS.

Methodology

This study investigated educators of ATIs who volunteered to take part in this online survey. All the participants in this study were directly involved in teaching regular academic programs offered by the ATIs, which fit the study's purpose and context. The questionnaire was taken from Alharbi and Drew (2014) and adapted to fit the local research environment of the study. The questionnaire's face validity and content validity were ensured in the adaption phase by thoroughly assessing the relevant literature and incorporating comments and suggestions of a panel of experts in the field. This questionnaire comprises questions on demographic profiles in the first section and questions on educators' perceptions about the LMS in the second section. These questions were categorised into eight subsections based on the extended TAM-adapted conceptual framework: SQ, PSE, JR, PU, PEU, ATT, BI and AU. Respondents were required to respond to each question on a five-point Likert scale based on their degree of agreement (1: strongly disagree, 5: strongly agree). Due to the COVID-19 pandemic, the questionnaire was converted to Google Forms® and distributed through appropriate WhatsApp® groups, and responses were collected online. The questionnaire was active online for two weeks from 2 September 2021. The survey received responses from 197 educators of ATIs island wide; however, only 164 responses were usable for this study.

Data were analysed using partial least square–based structural equation modelling (PLS-SEM) to examine the conceptual frameworks' model validity and proposed hypotheses. PLS-SEM is a more appropriate approach to examining complex models with many latent constructs and smaller samples (Akter *et al.*, 2017; Hair *et al.*, 2017; Hair *et al.*, 2019). Therefore, the proposed model for this study was analysed using SmartPLS® 3.2. The two-step approach of Schumacker *et al.* (2015) was used to analyse the data in the model: measurement model and structural equation model. The measurement model assessed the observed items' reliability and validity with associated latent constructs. In the measurement model, the construct reliability, convergent validity (CV) and discriminant validity (DV) were evaluated. The structural equation model was used to test the proposed hypothesis in the adapted conceptual framework of this study (Figure 1). The bootstrap strategy with 5,000 subsamples was used to determine the significance of the path coefficients of the structural equation model.
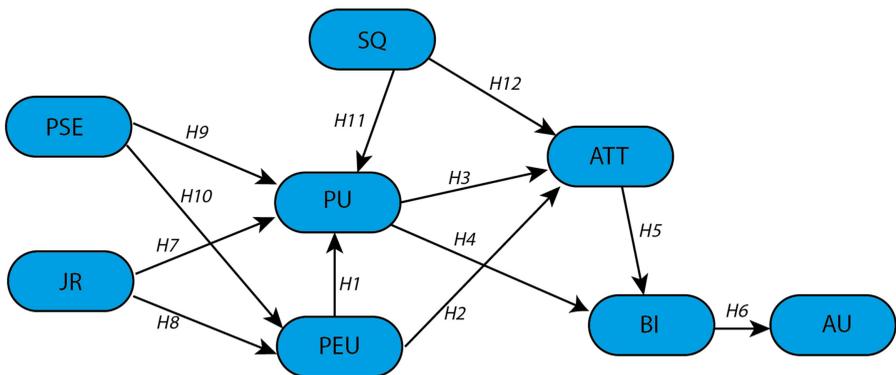
Figure 1.
Conceptual framework

Data analysis and findings

Descriptive statistics

The survey respondents' demographic profile is shown in Table 1. The total number of valid respondents was 164, of which females were 60.4%, while males were 39.6%. Most respondents (43.3%) were above 45 years old, 39% were between 30 and 45 years old and 17.7% were less than 30 years old. Of all the respondents, 37.8% have over 15 years of teaching experience, 36.0% had between 5 and 15 years of experience and 26.2% had less than 5 years of experience. Furthermore, regarding experience in using the LMS, 49.4% had less than 2 years, 17.1% had 2–5 years, 10.4% had over 5 years and 23.2% had no experience. Finally, 81.7% of the respondents were academic staff, whereas 18.3% were academic support staff.

Measurement models. Cronbach's alpha (CA) and composite reliability (CR) were estimated to determine the construct reliability of each construct. Hair *et al.* (2019) recommend that CA and CR values should be greater than 0.70 to consider a construct as a reliable one. Table 2 indicates that the values of all the constructs exceeded the threshold value, suggesting that all constructs are reliable and have internal consistency. The constructs' CV was assessed using the average variance extracted (AVE) value. Table 2 shows the results; the AVE value exceeds the threshold value of 0.5, as Hair *et al.* (2019) suggested, and the CV of all constructs was confirmed. It confirms the validity of the internal structure of the construct. The DV was measured using cross-loadings and Fornell and Larcker (1981) criteria. Table 3 indicates that the cross-loadings for each item of respective constructs are more than 0.5. It confirms the inner construct validity with accepted parameters, as proposed by Hair *et al.* (2019). Table 4 indicates that all the diagonal values are higher than those in the remaining values in respective columns, confirming DV for all constructs, as Fornell and Larcker (1981) suggested. Therefore, it confirms that all constructs in the model satisfy the reliability and validity thresholds and are suitable for further analysis.

Structural model and hypothesis testing. The structural model was tested using PLS-SEM analysis. This study used bootstrapping procedure in SmartPLS with 5,000 subsamples to

Characteristics	Attribute	*N*	Total (%)
Gender	Female	99	60.4
	Male	65	39.6
	Total	164	100
Age, years	Below 30	29	17.7
	Between 30 and 45	64	39.0
	Above 45	71	43.3
	Total	164	100
Experience	Below 5 years	43	26.2
	5–15 years	59	36.0
	Above 15 years	62	37.8
	Total	164	100
Academic position	Academic staff	134	81.7
	Academic support	30	18.3
	Total	164	100
LMS experience	Never used	38	23.2
	Below 2 years	81	49.4
	2–5 years	28	17.1
	Above 5 years	17	10.4
	Total	164	100

Table 1.
Demographic profile

generate respective t-statistics and p-values of regression path coefficient to test the proposed hypotheses. Figure 2 depicts the estimated structured equation model in the bootstrap procedure, and Table 5 shows the hypothesis test results at a 95% confidence interval. This analysis indicates that all the proposed hypotheses are true except H1 since the t-values are greater than 1.96 and p-values are below 0.05.

The path coefficients show that PSE significantly impacts PU ($\beta = 0.299$, $t = 3.737$, $p < 0.000$) and PEU ($\beta = 0.552$, $t = 9.691$, $p < 0.000$), confirming H9 and H10; JR significantly impacts PU ($\beta = 0.135$, $t = 2.048$, $p < 0.041$) and PEU ($\beta = 0.238$, $t = 3.746$, $p < 0.000$), confirming H7 and H8; SQ significantly impacts PU ($\beta = 0.311$, $t = 4.262$, $p < 0.000$) and ATT ($\beta = 0.208$, $t = 2.706$, $p < 0.007$), confirming H11 and H12; PU significantly impacts ATT ($\beta = 0.296$, $t = 3.930$, $p < 0.000$) and BI ($\beta = 0.378$, $t = 5.166$, $p < 0.000$), confirming H3 and H4; PEU significantly impacts ATT ($\beta = 0.297$, $t = 3.999$, $p < 0.000$), confirming H2, and ATT significantly impacts BI ($\beta = 0.347$, $t = 4.363$, $p < 0.000$), confirming H5. BI significantly impacts AU ($\beta = 0.653$, $t = 15.526$, $p < 0.000$), confirming H6; PEU does not significantly impact PU ($\beta = 0.153$, $t = 1.719$, $p < 0.086$), and therefore, H1 was rejected.

Model fit. The coefficient of determination (R^2) measures how much the independent variables explain the variances in the dependent variable in a linear regression model (Chicco *et al.*, 2021; Rodríguez Sánchez *et al.*, 2019). Table 6 shows the structural equation model's coefficient of determination (R^2). It indicates that the model explains a significant amount of the variance in all of the dependent variables: PU (51.7%), PEU (45.4%), ATT (46.7%), BI (41.9%) and AU (42.6%). Falk and Miller (1992) suggest that R^2 should be greater than 0.10. Therefore, all dependent variables meet Falk and Miller (1992) criteria in this model. However, as there is a significant portion of unexplained variations in the model, additional crucial factors might be included to improve the prediction strength of the model.

Many exogenous variables can impact the endogenous variable in a conceptual framework. The removal of an exogenous variable might impact the endogenous variable.

	CA	CR	AVE
ATT	0.904	0.933	0.777
AU	0.906	0.941	0.841
BI	0.821	0.894	0.737
JR	0.839	0.903	0.756
PEU	0.922	0.946	0.815
PSE	0.900	0.937	0.833
PU	0.941	0.958	0.851
SQ	0.935	0.954	0.837

Table 2.
Convergent validity indicators

	ATT	AU	BI	JR	PEU	PSE	PU	SQ
ATT	0.882							
AU	0.461	0.917						
BI	0.571	0.653	0.859					
JR	0.498	0.401	0.403	0.870				
PEU	0.587	0.278	0.405	0.431	0.903			
PSE	0.507	0.355	0.378	0.349	0.636	0.913		
PU	0.595	0.481	0.584	0.441	0.579	0.600	0.922	
SQ	0.557	0.193	0.372	0.433	0.570	0.502	0.607	0.915

Table 3.
Discriminant validity

	ATT	AU	BI	JR	PEU	PSE	PU	SQ_
ATT 1	0.942	0.474	0.620	0.502	0.569	0.472	0.598	0.540
ATT 2	0.827	0.379	0.445	0.430	0.474	0.389	0.431	0.407
ATT 3	0.868	0.362	0.457	0.373	0.473	0.453	0.549	0.491
ATT 4	0.885	0.399	0.471	0.445	0.548	0.469	0.505	0.516
AU 1	0.360	0.891	0.523	0.347	0.243	0.277	0.386	0.100
AU 2	0.462	0.940	0.640	0.382	0.280	0.380	0.494	0.217
AU 3	0.436	0.919	0.623	0.372	0.241	0.311	0.435	0.201
JR 1	0.464	0.382	0.394	0.928	0.437	0.337	0.457	0.449
JR 2	0.422	0.335	0.356	0.853	0.372	0.311	0.357	0.342
JR 3	0.412	0.324	0.287	0.825	0.296	0.253	0.316	0.321
PEU 1	0.386	0.225	0.262	0.304	0.757	0.410	0.403	0.391
PEU 2	0.547	0.246	0.378	0.402	0.920	0.610	0.550	0.541
PEU 3	0.591	0.303	0.430	0.421	0.968	0.619	0.584	0.559
PEU 4	0.570	0.230	0.372	0.415	0.950	0.624	0.534	0.547
PSE 1	0.354	0.263	0.283	0.315	0.522	0.870	0.441	0.395
PSE 2	0.520	0.356	0.368	0.333	0.606	0.941	0.611	0.507
PSE 3	0.496	0.343	0.375	0.309	0.606	0.925	0.573	0.463
PU 1	0.519	0.473	0.540	0.424	0.494	0.510	0.923	0.536
PU 2	0.495	0.464	0.558	0.358	0.497	0.514	0.879	0.506
PU 3	0.595	0.412	0.522	0.398	0.576	0.583	0.937	0.601
PU 4	0.580	0.431	0.537	0.442	0.565	0.601	0.949	0.593
SQ 1	0.480	0.138	0.323	0.359	0.462	0.428	0.529	0.908
SQ 2	0.502	0.190	0.353	0.389	0.517	0.485	0.561	0.923
SQ 3	0.529	0.209	0.372	0.429	0.586	0.514	0.612	0.934
SQ 4	0.527	0.165	0.310	0.405	0.514	0.403	0.516	0.894
BI 1	0.530	0.538	0.887	0.378	0.364	0.327	0.525	0.311
BI 2	0.506	0.591	0.865	0.407	0.353	0.280	0.448	0.338
BI 3	0.434	0.552	0.822	0.249	0.326	0.368	0.532	0.309

Table 4.
Factor and cross-loadings
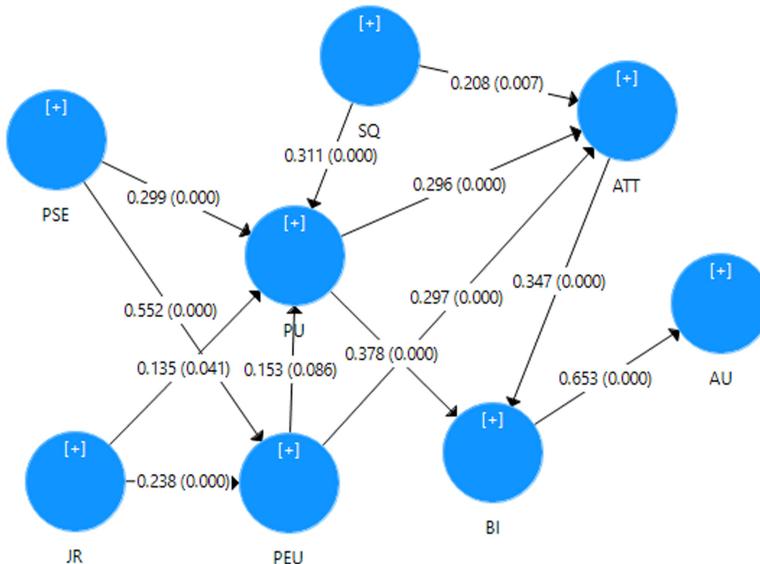
Figure 2.
Estimated path
coefficients

Hypothesised path	Relationship	Estimate(β)	t-value	p-value	Results (null hypothesis)
H1	PEU → PU	0.153	1.719	0.086	Rejected
H2	PEU → ATT	0.297	3.999	0.000	Not rejected
H3	PU → ATT	0.296	3.930	0.000	Not rejected
H4	PU → BI	0.378	5.166	0.000	Not rejected
H5	ATT → BI	0.347	4.363	0.000	Not rejected
H6	BI → AU	0.653	15.526	0.000	Not rejected
H7	JR → PU	0.135	2.048	0.041	Not rejected
H8	JR → PEU	0.238	3.746	0.000	Not rejected
H9	PSE → PU	0.299	3.737	0.000	Not rejected
H10	PSE → PEU	0.552	9.691	0.000	Not rejected
H11	SQ → PU	0.311	4.262	0.000	Not rejected
H12	SQ → ATT	0.208	2.706	0.007	Not rejected

Table 5.
Hypothesis test results

	R^2 value	STDEV	t-value	p-values
ATT	0.467	0.051	9.203	0.000
AU	0.426	0.056	7.657	0.000
BI	0.419	0.059	7.146	0.000
PEU	0.454	0.058	7.769	0.000
PU	0.517	0.053	9.818	0.000

Table 6.
Coefficient of
determination (R^2)

F-square is the change in R-square that occurs when an exogenous variable is omitted from the framework (Aberson, 2019). Table 7 shows the result of the F-square. According to Cohen (1988), F-square is the effect size (0.02 is small, 0.15 is medium and 0.35 is large) (Yıldırım and Güler, 2021). Accordingly, this study reveals that the ATT → BI ($F^2 = 0.134$), JR → PEU ($F^2 = 0.091$), JR → PU ($F^2 = 0.029$), PEU → ATT ($F^2 = 0.098$), PEU → PU ($F^2 = 0.024$), PSE → PU ($F^2 = 0.105$), PU → ATT ($F^2 = 0.091$), SQ → ATT ($F^2 = 0.045$) and SQ → PU ($F^2 = 0.122$) have small effects; PU → BI ($F^2 = 0.159$) and PU → BI ($F^2 = 0.159$) have medium effects and BI → AU ($F^2 = 0.742$), PSE → PEU ($F^2 = 0.491$) have large effects.

The predictive power determines the predictive strength of endogenous constructs. Predictive power is evaluated in this study by executing Stone-Geisser's Q^2 (Geisser, 1974). Hair et al. (2019) suggested that Q^2 values greater than zero suggest that the model is effectively rebuilt and has predictive power. Table 8 shows the Q^2 for each endogenous construct in this model, showing good predictive power.

	ATT	AU	BI	PEU	PU
ATT			0.134		
AU					
BI		0.742			
JR				0.091	0.029
PEU	0.098				0.024
PSE				0.491	0.105
PU	0.091		0.159		
SQ_	0.045				0.122

Table 7.
Effect size (f^2)

Discussion
The study finds that SQ positively impacts PU, consistent with earlier research (Maheshwari, 2021; Abdullah *et al.*, 2016; Fathema and Sutton, 2013). This finding puts forward that SQ aspects like ease of access, system availability to fulfil user needs and system flexibility of the LMS are essential and contribute to the PU of the LMS. This impliedly tells that educators in ATIs seriously pay attention to LMS quality. Therefore, the SQ of the existing LMS should be improved to enhance the engagement of educators in ATIs. Furthermore, Saarinen (1996) quoted, "High system quality requires a good user interface and, in the long run, flexibility, allowing changes in the processing style, and adaptation to new requirements." It proposes that if the system matches user requirements, it has enough functionality to accomplish the goals of adopting the LMS by educators for an effective e-learning system in ATIs. In addition, this study finds that SQ positively impacts ATT of educators towards the LMS. It advocates that if the implemented LMS meets all requirements of educators with greater flexibility, their attitude towards the LMS will be improved.

Furthermore, this research reveals that PSE positively impacts PU and PEU, stating that PSE is identified to influence the belief of educators and behaviour towards the LMS significantly. Users with a favourable perspective of computer SE assures that the system is simple and can quickly fix issues. In addition, this finding emphasises that if educators are competent in using computers and other digital devices, they perceive LMS as user-friendly and a more robust tool for delivering course contents. This result is consistent with that of earlier research (Chen and Tseng, 2012; Abdullah *et al.*, 2016; Thongsri *et al.*, 2020; Alammary *et al.*, 2014). Moreover, JR positively impacts PEU and PU, stating that educators who believe the LMS is an effective and relevant tool for fulfilling their job will find it helpful and user-friendly. This finding is consistent with that of earlier research, suggesting that if the technology is relevant to their job and assists them in fulfilling their duties, they will consider it a supporting tool that raises their PU and PEU (Saroia and Gao, 2019).

In addition, this research identifies that SQ, PU and PEU significantly impact educators' ATT of an LMS. It argues that strong positive beliefs of educators in quality aspects, usefulness and accessibility of an LMS make favourable attitudes towards using the LMS in teaching. Additionally, PU is the stronger predictor of ATT than SQ and PSU, implying that the degree of belief of educators in the usefulness of the LMS largely impacts their attitude towards using the LMS. This finding is consistent with that of earlier research that confirms the relationships (Mailizar *et al.*, 2021; Mou *et al.*, 2017; Hamid *et al.*, 2016).

According to the TAM literature, PEU impacts PU (Ong, 2019; Mukminin *et al.*, 2020). However, the data analysis of this study reveals that the impact is not statistically significant. It evidences that the belief of educators about the usefulness of the LMS is not influenced by its ease of accessibility. The possible reason for this is that all educators in ATIs are well educated and familiar with operating any applications. Hence, operating the LMS is not a complex

	SSO	SSE	Q^2 (=1–SSE/SSO)
ATT	656	423.017	0.355
AU	492	320.034	0.35
BI	492	343.32	0.302
JR	492	492	
PEU	656	424.752	0.353
PSE	492	492	
PU	656	375.539	0.428
SQ	656	656	

Note(s): SSE – sum of squared error; SSO – sum of squares of observations

phenomenon for them. Therefore, this study highlights that ease of access does not mean the LMS is a handy tool for effective pedagogy. Therefore, the management should build the capacity of their staff about the notable advanced features of the LMS for effective teaching.

The proposed model of this study explains that 42.6% of the variations imply that the model accurately predicts LMS use by educators. The PU is the dominant predictor of BI, followed by ATT. This indicates that if educators find the LMS more suitable, more comfortable to use, more helpful and simpler for teaching, their BI to use the LMS will be high. This is consistent with earlier research that confirms the relationships (Fearnley and Amora, 2020; Mailizar *et al.*, 2021). Educators' BI directly affects the AU of the LMS, and this finding is in line with those of earlier research (Fearnley and Amora, 2020; Munabi *et al.*, 2020; Fathema *et al.*, 2015). This indicates that educators with positive attitudes towards the LMS have a higher level of BI, which results in a higher level of actual use of the LMS in ATIs.

Conclusion and implication

Teacher–student interaction is vital to offering quality education. The LMS is an excellent tool to interact with students and engage them in learning activities. LMS use among ATIs' educators is unsatisfactory, and educators have poor interaction with students even after the implementation of ODL due to the pandemic. This study intends to identify the factors influencing LMS adoption among ATIs' educators to offer an effective ODL environment. This study has proposed a conceptual framework based on the TAM with three new external variables – PSE, JR and SQ – to achieve the objective of the study. The findings assert that the framework used in this study performs well in explaining the factors influencing the adoption of the LMS among educators of ATIs in Sri Lanka. PSE and JR significantly impact PU and PEU of the LMS. In addition to PU and PEU, SQ significantly impacts the ATT of educators towards the LMS. PU and ATT significantly impact educators' BI and AU of the LMS. However, PEU has no significant impact on PU. The finding of this study confirms the previous empirical studies that use the TAM.

The findings will highly be helpful to ATIs' top management as they prepare to adopt an effective ODL environment that offers fully integrated distance learning and e-learning during and after the COVID-19 pandemic. These findings have significant practical implications: First, ATIs' management should encourage and facilitate educators to implement ODL through effective use of the LMS. ATIs implemented Moodle LMS, a web application hosted in the cloud. Web applications are frequently updated with new features and come to the market in a short period. It requires an up-to-date high level of internet skills, which affects LMS adoption. Hence, the management should organise hands-on training sessions to improve computer SE and internet skills of educators and explain the importance of the LMS with the latest versions and features. Furthermore, ongoing technical guidance should be arranged to handle various user issues. Second, the system designers should concentrate on the contents and functionalities when designing and developing the LMS. The designers should study deep user requirements to effectively design the LMS, including the display size and system suitability, system integration, interactive media support, learner control, diversity of communication and test types, and user responsiveness. The designers should evaluate the quality and availability of information to enhance the experience of educators while responding to and promoting the benefits of using the LMS.

This study has some limitations. First, the proposed model explains nearly half of the total variations. It suggests that the next half of the total variance is unexplained. Second, this study collected only 164 responses, a relatively small sample. Third, the hypothesised relationship among the construct could be moderated by other variables like gender, age, prior experience, academic discipline, etc. These moderating variables are not considered

when assessing the model in this study. Therefore, we propose that future studies use a model incorporating additional meaningful constructs affecting LMS adoption and moderating variables with a reasonable sample size and thereby, the new model could explain more variances in LMS adoption.

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