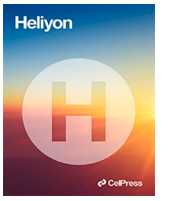
Heliyon 9 (2023) e17505

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon



E-learning adoption for sustainable higher education

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ARTICLE INFO

Keywords:
E-Learning
Sustainable development goals
Theory of planned behaviour
Sustainable teaching
Sri Lanka

ABSTRACT

Electronic learning (*E*-L) is a profound transition that is occurring in education as a new learning platform in countries across the globe. COVID-19 pandemic has forced all higher education institutions in Sri Lanka to adopt e-learning to maintain sustainable teaching. This study identified the relationships between the main influencing factors of e-learning usage behaviour and, in turn, sustainability in teaching. Theory of Planned Behaviour (TPB) was used to formulate the research framework and hypotheses. The population of the study was comprised of permanent academics attached to Sri Lankan public universities under the patronage of UGC. The sample size was 357 for the given population size of 5399, and a stratified sampling technique was used to select the sample. The study used a quantitative method under the philosophical assumption of positivism. The researchers have applied Structural Equation Modelling (SEM) to test the path association among factors. The result explores the path relationship between exogenous and mediating variables, mediating to an endogenous variable. The research outcome shows that attitude and perceived behavioural control influence e-learning usage but not the subjective norm. While behavioural intention mediates the relationship between attitude and perceived behavioural control and e-learning usage, the latter mediates the association between behavioural intention and sustainability in teaching. Gender, academic position and computer literacy level moderate the causal relationships of the factors influencing sustainability in teaching. Finally, this study concludes that Attitude, Perceived Behavioural Control, Behavioural Intention and E-learning Usage Behaviour are the factors influencing sustainability in teaching. This study recommends universities develop infrastructures, train staff members and establish an office for sustainability development. Furthermore, it recommends that future researchers do longitudinal studies and adopt decomposed TPB.

1. Introduction

Electronic Learning (*E*-L) has played an essential role in the Higher Education (HE) sector, expanding opportunities and producing employable, skilled and qualified graduates in local and global job markets [1–3]. Even though e-learning provides several benefits, large groups of academicians are hesitant to accept the e-learning system. The reason behind the reluctance has to be explored. This

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https://doi.org/10.1016/j.heliyon.2023.e17505
Received 24 July 2022; Received in revised form 16 June 2023; Accepted 20 June 2023
Available online 22 June 2023

may be because of computer and internet illiteracy, lack of facilities or the attitude of being embarrassed by new technology and socialized into a specific culture and teaching and evaluation method process.

Considering the local context, Sri Lanka has attempted to implement e-learning in universities over the past several years. Even though several initiatives have been carried out to achieve the vision of Sri Lanka, it does not seem very easy [4]. According to Mahinda Chinthana, Sri Lanka had to achieve its vision of an [5]"International hub of excellence in higher education by 2020" Ministry of Higher Education, 2015). Furthermore, Sustainable Development Goal No. 4 (SDG4) underlines to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" [6] (Dept. Of Census & Statistics 2019), which is on par with SDG 4 of the United Nations, which is 'quality education' (UN, 2016). Despite these two major targets, lecturers' current usage of online portals in their core function of teaching and learning process is not promising.

Higher learning institutions in Sri Lanka must deliberate enough to expand the quantity of university admission and enhance the quality of higher education. Therefore, studying the perception of academics is highly important at present. Academics are the most crucial role players in education and research. Remedial actions could be proposed to solve such issues targeting moving forward to sustainable development e-learning. By resolving the existing issues, universities should formulate policy frameworks and strategies to enhance e-learning adoption to achieve SDG-4. According to the National Policy and Strategy on Sustainable Development of Sri Lanka, "inclusive, equitable and relevant quality education is ensured while promoting lifelong learning opportunities for all". Every university and higher educational institution should prepare standards, policies, procedures and work norms to motivate e-learning adoption. Even though COVID-19 pandemic might have motivated us to gain an advantage in using e-learning portals, the usage should be continued in the future. This study examined factors influencing sustainability in teaching at state universities in Sri Lanka.

2. Research problem

What are the possible reasons for the limited usage of e-learning in Sri Lanka's Higher Education? Understanding the reasons for this low usage would help UGC and university administration formulate strategies to increase e-learning use. There is a lack of research investigating the attitudinal, normative and control factors influencing e-learning usage and sustainable development in Sri Lanka's higher education context. Not all state universities and higher educational institutions were covered in any studies. Therefore, research studies are required to fill the operational and theoretical gaps in e-learning usage and sustainability in teaching by explicitly determining the significant factors behind this issue in the higher education context. The authors believe that research studies are crucial to contribute immensely to the understanding and diffusion of this area of knowledge.

In summary, factors affecting *E*-L usage and its impact on sustainability in teaching have to be evaluated. In addition, the constraints and challenges faced by the academia of these institutions should be identified to find solutions and to take remedial action to enhance the usage of *E*-L system that could contribute to attaining sustainable development goals. This research paper is expected to be the best exploration of the status of Sri Lankan state universities concerning the usage of *E*-L and its impact on sustainability in teaching. Hence, the objective of this study is to examine the factors influencing e-learning usage that impact sustainability in teaching in Sri Lankan state universities. Further, the specific objectives of the study are to explore the factors influencing E-Learning usage; to assess the impact of *E*-L usage on sustainability in teaching; to examine the mediation effect of behavioural intention among the exogenous variables (Attitude, subjective norms and perceived behavioural control) and usage behaviour; to examine the mediating effect of e-learning usage behaviour between behavioural intention and sustainability in teaching; and to analyze the moderating effect of academic position, computer literacy level and gender on the sustainability in teaching.

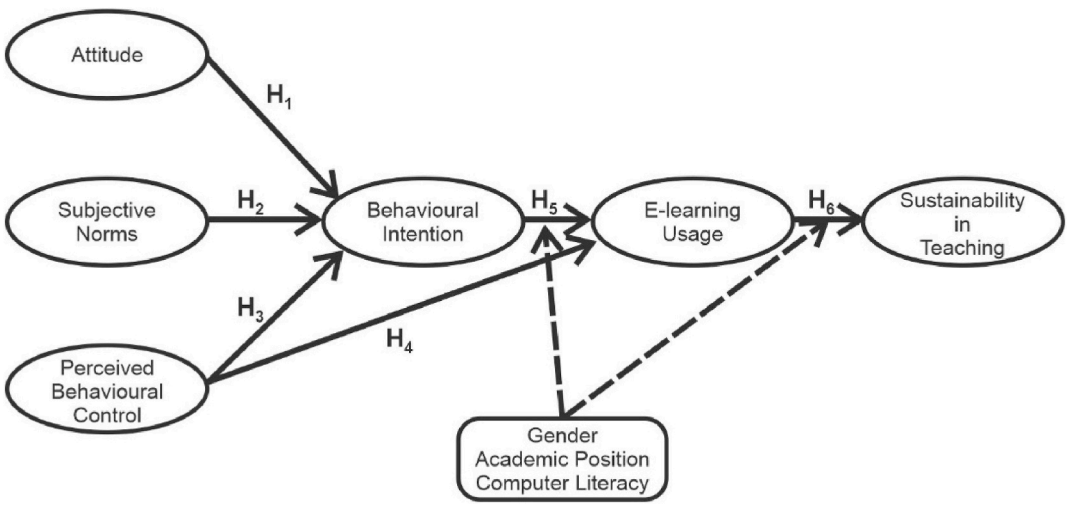

Fig. 1. Conceptual model from TPB by Ref. [7].

3. Literature review

TPB by Ref. [7] was used to formulate the conceptual model. According to TPB by Ref. [7], behaviour of individuals in carrying out certain activities is influenced by their behavioural intention, which is measured through attitude, subjective norms, and perceived behavioural controls together toward performing the behaviour. The main influencing factor in this theory is the intention of an individual to react according to the behaviour. As the desire to engage in an activity grows, the likelihood it will be carried out increases. The researchers follow this theory to examine e-learning usage behaviour.

The researchers have added an extra variable as a dependent, which is sustainability in teaching. Thus, usage behaviour is becoming a mediating variable in our conceptual framework. In addition, three more moderating variables are used to test the moderating effect of academic position, computer literacy level and gender of academics in *E*-L usage and sustainability in teaching. Fig. 1 depicts the theoretical model used to conduct this research.

Though gender was considered a moderator in several other studies to determine the effect of two variables [2,3], it is purported to consider gender as a moderator as it is related to culture, and there is a need to examine it in the Sri Lankan context. There is no existing model that bridges the gap of integrating factors like gender, computer literacy level and academic position that can moderate the adoption intention and behaviour to explain better the adoption of *E*-L technology and sustainability in teaching. Limited research considers 'sustainable development' as a dependent variable.

The rest of this section shows the hypotheses. These hypotheses consist of the "cause-effect" relationships between the proposed construct.

4. Formulation of hypotheses

Many kinds of literature reviewed for this study depicted that people's attitude depends on adopting any novel system or technology [7–11]. Therefore, the following hypothesis was proposed to examine the influence of attitude on behavioural intention.

Hypothesis 1(H1). : There is a direct nexus between Attitude (ATT) and Behavioural Intention (PBIN).

Furthermore, literature shows that social pressure may affect the behaviour as well as the behavioural intention of persons. "Subjective norms emerge from a need or motivation to satisfy the expectations of important people about a certain behaviour" [7]. Nevertheless, earlier research on e-learning revealed a significant effect of subjective norms on behavioural intention [2,12,13]. Therefore, the following hypothesis was formed.

Hypothesis 2(H2). : There is a direct nexus between Subjective Norm (SUBN) and Behavioural Intention (PBIN).

The relationship between behavioural control and intention to use has been extensively renowned in the literature related to the TPB and DTPB [8,14]. Whereas, PBC directly affects the usage behaviour, it also affects BI. It has proven to have a significant relationship with the intention to use in some research [2,12,13,15]. Therefore, it is proposed.

Hypothesis 3(H3). : There is a direct nexus between Perceived Behavioural Control (PBC) and Behavioural Intention (PBIN).

The literature suggests, "The user's willingness or confidence in their own capacity are important components of behavioural control that in turn develops the behaviors of individuals" [16]; PBC has proven to have a significant relationship directly with usage behaviour [2,8,13,14,16,17]. Thus, it is essential to study the impact of PBC on usage, and the following hypothesis was proposed.

Hypothesis 4(H4). : There is a direct nexus between PBC and E-Learning Usage (ELUS).

Furthermore, the relationship between the intention to use and the actual usage has been documented widely in the literature [4,8,16,18–20]. Hypothesis 5 was proposed based on this.

Hypothesis 5(H5). : There is a direct nexus between Behavioural Intention (PBIN) and E-Learning Usage (ELUS).

Sustainability in Education is an emerging research topic that needs the deepest attention of scholars, and [18] concluded institutional functions, especially teaching functions, are key contributors to sustainability. Ahmed et al. [19] have highlighted crucial success elements for enhancing e-learning sustainability and effectiveness [21]. indicated e-learning is a catalyst for sustainability. Another study [22,23]; stated the adoption of the Sustainable Development Goals (SDGs) in 2015 produced a significant impetus for promoting E-Learning as a means of achieving these goals, notably goal number four, "quality education." Therefore, there is a need to identify the determinants influencing e-learning usage, thus, in turn, associated with sustainable teaching. Even though there is little research evidence in testing e-learning usage and sustainability in teaching, the researchers have added the following hypothesis with the hope of a remarkable contribution to the knowledge base in examining the association between e-learning usage behaviour and sustainability in teaching. Therefore, the following hypothesis was formulated.

Hypothesis 6(H6). : There is a direct nexus between e-learning usage (ELUS) and sustainability in teaching (SUST).

4.1. Related to mediating effects of BI

Mediating the impact of behavioural intention among attitudes, subjective norms and behavioural control on usage behaviour is another crucial matter to be tested [4,24]. examined the direct relationship between attitude, subjective norm and perceived

behavioural control with usage without considering intention. This study found that the prediction of usage declined. This study concluded as "BI plays an important and substantive role, as well as pragmatically important in predicting power". Therefore, the following three hypotheses were formulated.

Hypothesis 7(H7). : PBIN mediates the relationship between Attitude and *E*-L Usage Behaviour.

Hypothesis 8(H8). : PBIN mediates the relationship between Subjective Norm and *E*-L Usage Behaviour.

Hypothesis 9(H9). : PBIN mediates the relationship between PBC and *E*-L Usage Behaviour.

Along with the mediating role of behavioural intention, this particular study considers *E*-L usage behaviour as a mediator between behavioural intention and sustainability in teaching. According to TPB, usage behaviour is the dependent variable. However, this study has added sustainability in teaching as the dependent variable, as the ultimate target of *E*-L usage is attaining sustainability. Hence, the *E*-L usage behaviour may act as a mediator. As a result of this reasoning, the study has developed the following hypothesis.

Hypothesis 10(H10). : E-Learning Usage behaviour mediates the relationship between Behavioural Intention and Sustainability in Teaching.

4.2. Related to moderators

Attitudinal and behavioural differences between men and women have been among the most studied topics in adopting new technologies [25]. However, it is rarely studied in *E*-L adoption research [2,9]. Gender moderates the individual's behaviour, as any behaviour may influence masculine and feminine characteristics. Furthermore, computer literacy level also has shown some extent of moderating role [26]. Training is another moderator identified in a few other pieces of literature [26]. Academic position is also considered essential to examine the behaviour of individual. The study of [2] examined the role of academic category in their study. Based on this literature support and the preliminary interviews, the following four hypotheses are proposed.

Hypothesis 11(H11). : Gender moderates the association among exogenous, mediating and endogenous variables.

Hypothesis 12(H12). : Level of computer literacy moderates the association among exogenous, mediating and endogenous variables.

Hypothesis 13(H13). : Academic position moderates the association among exogenous, mediating and endogenous variables.

5. Research method

The research was conducted mainly as a survey using questionnaires. There are fifteen public universities in Sri Lanka under the control of University Grants Commission (UGC). According to the UGC statistic 2020, a total of 5399 academics from all fifteen universities were considered as the population in different academic categories, such as professors, senior lecturers and lecturers. Among them, 357 were considered the sample size, defined by Refs. [26,27]. To represent all categories of academia, a stratified sampling technique was used. Therefore, subjects were selected from all state universities based on the number of academia in each category proportionate to the total numbers. Professors and Associate professors were included under professor's category, which is 729 in number, of which 48 were selected as samples. Similarly, among the 2948 senior lecturers, 195 were used as samples, and among the 1722 lecturers, 114 were selected as samples. Even though 357 was the required sample size, 500 questionnaires were administered. Data collection was a tough challenge for this research. Formal and informal communication channels were used to get the responses, and several reminders were sent. Though around 500 questionnaires were administered, we got only 314 responses, which was less than the required sample size of 357. As a result, the final sample retained for analysis was 314 respondents. The studies of [27,28]proposed a few rules of thumb for determining sample size. Accordingly, "in multivariate research (including multiple regression analysis), the sample size should be several times (preferably 10 times or more) as large as the number of variables in the study" [29]. stated most often, this ratio should be a minimum of 10:1. This study delves with 314 samples from 9 variables that are more multiple than the required number. Therefore, data collected from 314 respondents were utilized for further analysis.

6. Data analysis

The survey received 314 responses, at a response rate of 87.95%. Among the 314 responses, 304 were considered for analysis after data screening. Each variable's reliability and construct validity were tested using SPSS, version 23.0. The reliability of the individual items in each construct was measured with Cronbach alpha against the alpha coefficient, which was higher than 0.7, and thus internal consistency was attained. Confirmatory factor analysis (CFA) was done to examine the construct validity of each variable's measurement models. The measurement model's integrity of fit was measured with Chi-square/df < 3, GFI$>$0.9, AGFI$>$0.9, CFI$>$0.9, and RMSEA$<$0.08 values [28]. When the overall measurement model was accepted (Chi-square/df < 3, fit indices $>$0.9 and RMSEA$<$ 0.08), all the factor loadings were more than 0.5, the discriminant validity was satisfied, the structural model was developed, and goodness-of-fit was evaluated. Then, using AMOS, version 23.0 SEM was used for hypotheses testing and validation.

7. Measurement model

All constructs in this study were measured using multiple indicators used in the previous literature. All indicators were scaled with seven-point scales ranging from 1 (strongly disagree) to 7 (strongly agree). The attitude was measured with five indicators that assessed academics' general understanding of attitudes, such as their idea of using e-learning system for teaching, their willingness, usefulness of e-learning trustworthiness, and its support in achieving sustainable education, which was adapted from Refs. [2,8]. Subjective Norm was measured using five indicators to understand the normative factors influencing their willingness to utilize e-learning systems by the people whose opinion they respect, tech-savvy people, peers, administrators and social pressure, which were adapted from Refs. [2,7,8]. Perceived behavioural control construct measured the facilities, resources, knowledge, and capability to sustain. The previous two were adapted from Ref. [8] in this construct, and the rest were researchers' input. The propensity to engage in e-learning system usage is assessed by the behavioural intention construct by using four indicators as such of the intention of using the e-learning system to assist teaching, instruction, recommending the usage to others and continuance of using in the future, which were adapted from Refs. [2,8]. This factor is supposed to mediate the effect of independent factors and usage behaviour. *E*-L usage behaviours measured the period during which university academics' actual engagement in *E*-L system usage with the help of four measures. However, the measure was not examined by using any indicators in previous studies except [7], which were adapted to this context.

The above-mentioned five variables are derived from TPB [7] and the measures were also adopted.

As a theoretical contribution to the TPB, 'sustainability in teaching' was added as the dependent variable, which is the ultimate target of the research study. Due to a lack of clarity in identifying measures for this construct from the reviewed literature [23,24], this construct was examined by using four indicators that were developed by the researchers by using the grounded theory approach. These four indicators were; enabling teaching during the lockdown caused by COVD -19 pandemic, supporting SDG4, providing equal education opportunities, and advantageous quality, equitable and sustainable learning opportunities.

In addition, moderating effect of three moderating factors, such as gender, computer literacy, and academic position, was also examined. Gender and academic position were examined under moderating effects by Ref. [2], and computer literacy was conceptualized by Ref. [20].

Initially, the measurement model was used to assess the reliability and validity of the conceptual framework with the use of confirmatory factor analysis (CFA) [28]. The CFA indicated that the model fit is assured (CMIN/df = 1.368 < 3, GFI = 0.906 >0 .9,

Table 1
Measurement items and factor loading.

	Factor Loading	Cronbach Alpha	AVE	CR
Attitude				
ATT1	0.748	0.879	0.575	0.871
ATT2	0.772			
ATT3	0.719			
ATT4	0.773			
ATT5	0.779			
Subjective Norm				
SUB1	0.799	0.863	0.544	0.855
SUB2	0.748			
SUB3	0.674			
SUB4	0.631			
SUB5	0.818			
Perceive Behavioural Control				
PBC1	0.761	0.914	0.643	0.915
PBC2	0.828			
PBC3	0.83			
PBC4	0.885			
PBC5	0.801			
PBC6	0.694			
Perceived Behavioural Intention				
PBI1	0.821	0.910	0.694	0.901
PBI2	0.854			
PBI3	0.836			
PBI4	0.822			
E-Learning Usage				
ELU1	0.759	0.900	0.700	0.903
ELU2	0.819			
ELU3	0.901			
ELU4	0.862			
Sustainability in Learning				
SUS1	0.611	0.817	0.535	0.82
SUS2	0.725			
SUS3	0.79			
SUS4	0.785			

All factor loadings are significant at 0.00.

RMR = 0.057 <0 .5, CFI = 0.977 >0 .9, TLI = 0.973 <0 .9 and RMSEA = 0.035 < 0.08) [30]. Hence, the overall measurement model fit is good based on the rule of thumps evidenced in the previous paragraph.

The reliability of the constructs was assessed using Cronbach's alpha. The reliability of the constructs is greater than 0.700 [31]. Hence, reliability was established. The convergent validity of the construct was tested by the significance of the factor loading showing all indicators in all constructs greater than standardized loading 0.05 (Table 1) [29], and another indicator for assessing the convergent validity of constructs is Average Variance Extracted (AVE). The standard criterion for measuring the convergent validity, the AVE greater than 0.05, and the compost reliability (CR) greater than AVE, the convergent validity is acceptable [29]. Therefore, the convergent validity is acceptable as all the indicators are greater than 0.05 (Table 2).

The discriminant validity of the model was assessed based on two criteria. First, inter-correlation between constructs must not be equal to 1) [29] Therefore, the inter-correlation between the constructs is less than 1, and the discriminant validity is established. Second, the AVE was compared with the diagonal value of squared correlations between constructs and ensured that the AVE was greater than the diagonal value of squared correlations [32] (Table 2). As both criteria were met with the standard, discriminant validity was established.

8. The result of structural model

The SEM model is a good fit for the data. Chi-square fit, CMIN/df = 1.667, which is below cut-off point 3. Hence, the model is fitted in line with the Chi-square value to the degree of freedom. TLI and CFI values are 0.951 and 0.957, respectively, which are greater than 0.9, and RMSEA is 0.047, which is lesser than 0.08. Thus, the structural model is valid. As shown in Table 1, most of the relationships are significant. As shown in Table 1, most of the relationships are significant. However, based on 1000 bootstrap resamples as recommended by Ref. [33] the nexus between Subjective Norm (SUBN) and Perceived Behavioural Intention (PBIN) and Perceived Behavioural Control (PBC) and E-learning Usage Behaviour (ELUS) is not significant at 0.05 probability level (Table 1). In terms of these indices, a good model approximation of the sample data is suggested.

Hypotheses were tested through the proposed final model of the study (Fig. 1). Summarized conclusions for the hypothesized relationships of all variables are provided in Table 1.

9. Findings of empirical study

Considering the demographic characteristics of the respondents, 41.4% were lecturers, and 52.6% were males. About two-thirds of them stated their computer literacy to be intermediate level. Direct question on *E*-L usage has exposed that only 44.4% of the responded academics currently use the e-learning system. This means less than half of the academics only use *E*-L system.

Sri Lankan state universities use Learning Management Systems (LMS), mostly Virtual Learning Environment (VLE) and Content Management Systems (CMS), interchangeably and, most commonly, which are based on MOODLE. Most (75.7%) of the respondents indicated Moodle. As this question is open-ended, the following responses were received.

10. Hypotheses testing

Based on the results of structural equation modelling, hypotheses were tested through the proposed final model of the study (Fig. 2). Table 3 summarizes the findings for the hypothesized associations of all constructs at a 0.05 level of significance [33], said that the CR value should be larger than 1.96, and the beta value should be greater than 0.2. Path analysis data were employed to arrive at this conclusion.

H1: There is a relationship between attitude and behavioural Intention (ATT to PBIN).

H1 investigates the association between the primary variable attitude (ATT) and the mediating variable perceived behavioural intention (PBIN). According to the findings (Table 3), the substantial standardized regression coefficient of the path link depicts attitude. It significantly affects perceived behavioural intention (Regression Coefficient r = 0.297, significant level p = 0.000 < 0.01). Thus, the respondents with a good attitude towards the usage of the e-learning system may have a greater intention to use the system. As a result, the data supports H1.

H2: There is a nexus between Subjective Norms and Behavioural Intention (SUBN to PBIN).

H2 examines the relation between subjective norms (SN) and the mediating variable behavioural intention (PBIN). The findings (Table 3) indicate that subjective norms have a positive influence on behavioural intention, despite the fact that the standardized

Table 2
Discriminant validity.

	ATT	SUBN	PBC	PBIN	ELU	SUS
ATT	0.575					
SUBN	0.160	0.544				
PBC	0.036	0.188	0.643			
PBIN	0.148	0.136	0.272	0.694		
ELU	0.368	0.073	0.005	0.044	0.700	
SUS	0.054	0.016	0.024	0.104	0.071	0.535

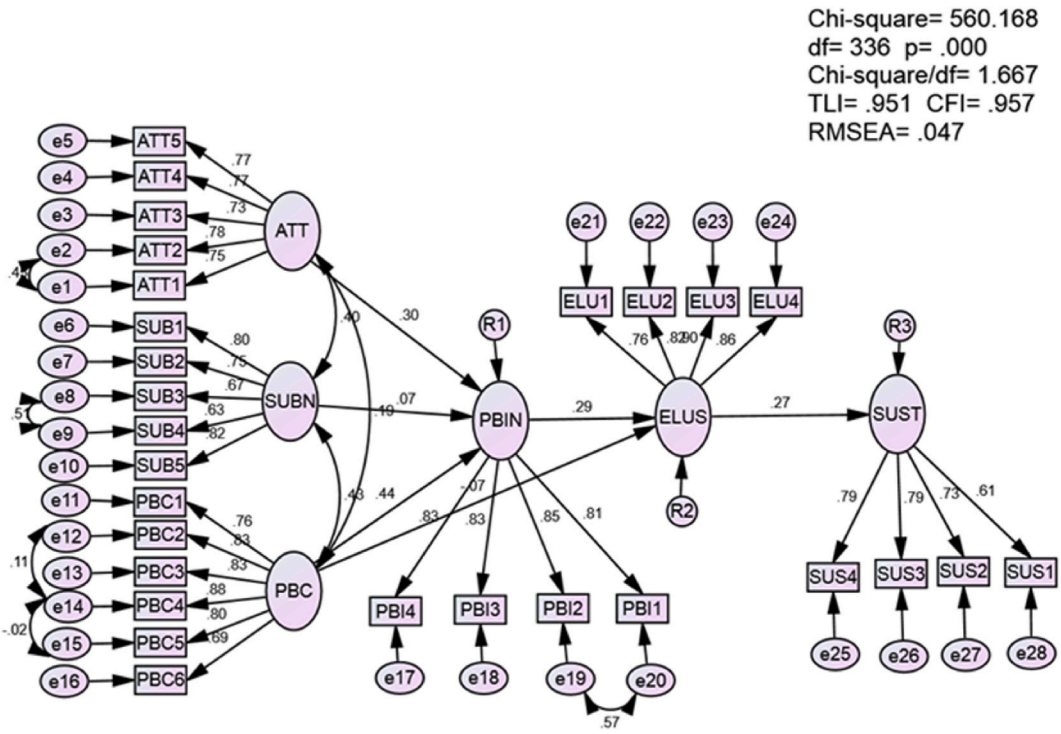

Fig. 2. Overall structural equation model.

Table 3
Hypothesis testing relating to the e-learning usage behaviour.

Variables	Hypotheses	Std. Reg. Weight	Unstd. Regression Weight	SE	C.R	Sig.Level	Conclusion
ATT < — PBIN	H1	.297	.369	0.081	4.577	0.000	Supported
SUBN < – PBIN	H2	.069	.053	0.052	1.003	0.316	Not Supported
PBC < — PBIN	H3	.437	.380	.060	6.379	0.000	Supported
PBC < — ELUS	H4	−.073	−.055	.056	−.982	0.326	Not Supported
PBIN < — ELUS	H5	.286	.247	.067	3.666	0.000	Supported
ELUS < — SUST	H6	.272	.324	.080	4.047	0.000	Supported

regression coefficient of the path relationship between subjective norms and behavioural intention is not statistically significant (Regression Coefficient r = .069, significant level p = 0.316 > 0.05). This could be interpreted as all university academics having academic freedom; thus, no peer or superior influence is effective under the subjective norm category. Academics decide to use the system rather than be influenced by peers or superiors. As a result, the data does not support H2.

H3: There is an association between Perceived Behavioural Control (PBC) and Behavioural Intention (PBC to PBIN)

H3 examines the relationship between Perceived Behavioural Control (PBC) and the mediating variable of Behavioural Intention (PBIN). According to the findings (Table 3), PBC has a significant positive effect on behavioural intention (Regression Coefficient r = 0.437, significant level p = 0.00 < 0.01). These findings show that academics have a few controlling factors influencing their willingness to use the e-learning system. As a result, the evidence supports H3.

H4: There is an association between PBC and Usage Behaviour (PBC to ELUS)

H4 investigates the association between PBC and E-Learning usage (ELUS). The results (Table 3) reveal that there is no beneficial connection between PBC and ELUS since the standardized regression coefficient of the path relationship between PBC and E-learning usage is statistically not significant (Regression Coefficient r = −.073, significant level p = 0.326 > 0.05). Even though PBC positively affects intention, PBC does not directly affect usage behaviour. This means though the controlling factors are sufficient, respondents may not be able to use the system directly without any willingness. Here, the superficial effect on intention is admitted. As a result, the data does not support H4.

H5: There is a relationship between Behavioural Intention PBIN) and E-L Usage Behaviour (ELUS).

H5 investigates the association between the mediating role of behavioural intention (PBIN) and *E*-L usage behaviour (ELUS). The findings (Table 3) indicate that there is a positive relationship between usage behaviour and behavioural intention because the standardized regression coefficient of the path relationship is statistically significant between usage behaviour and behavioural intention (Regression Coefficient r = 0.286, significant level p = 0.000 < 0.05). Any system used mainly depends on users' intentions,

such as e-learning. Actually, the respondents' intention in using the system mediates the relationship of other attitudinal and control factors over the usage behaviour. As a result, the evidence supports H5.

H6: There is a direct positive association between e-learning usage behaviour (ELUS) and sustainability in teaching (SUST).

H6 tests the relationship between the mediating variable of *E*-L usage behaviour (ELUS) and the dependent variable, Sustainability in Teaching (SUST). The results (Table 3) show that there is a positive influence between *E*-L usage behaviour and Sustainability because the standardized regression coefficient of the path relationship between usage behaviour and behavioural intention is statistically significant (Regression Coefficient r = 0.272, significant level p = 0.000 < 0.05). Respondents who utilize the e-learning system will have sustainability in teaching. On the other hand, those who do not use e-learning systems will not sustain in teaching. As a result, the data supports H6.

11. Examining mediating effects

Testing the mediating effect between variables is important for measuring an integrated model. This section is intended to test the mediating effect of Behavioural Intention (PBIN) between ATT, SUBN & PBC and *E*-L usage behaviour (ELUS). Mediating effect of PBIN among Attitude, Subjective Norm, Perceived Behavioural Control and *E*-L usage behaviour (ELUS) was tested separately. Hair et al. [29] stated that there should be significant correlations among independent, mediating and ultimate dependent variables. The direct and indirect effects were considered when analysing the mediating effect. However, according to the conceptual model of this study, the direct path of attitude to e-learning usage behaviour and the subjective norm to e-learning usage behaviour were not studied. Still, PBC to usage behaviour was studied, and it identified that there is no association. Therefore, only the indirect effect was considered in the first two cases. The following hypotheses were created to mediate the effect of PBIN.

H7: PBIN mediates the nexus between ATT and ELUS.

H8: PBIN mediates the nexus between SUBN and ELUS.

H9: PBIN mediates the nexus between PBC and ELUS.

H10: ELUS mediates the nexus between PBIN and Sustainability in Teaching (SUST).

11.1. Mediation effect of behavioural intention (PBIN) between attitude (ATT) and usage behaviour (ELUS)

Because of the standardized regression, the findings (Table 3) reveal that there is a favorable relationship between *E*-L usage behaviour and Sustainability. To see if behavioural intention (PBIN) mediated the relationship between attitude (ATT) and e-learning usage (ELUS), the final SEM model was examined, and it was discovered that the standardized regression coefficient of the path relationship between ATT and PBIN has a significant association at the 0.000 level r = 0.297 (P = 0.000 < 0.05). The standardized regression coefficient of the path relationship between PBIN and ELUS reveals a significant association r = .286 at the 0.000 level (P = 0.000 < 0.05). As a result, the mediating impact of PBIN between ATT and ELUS must be evaluated before making a final determination on the indirect link.

The unstandardized regression indirect effect suggests that the indirect mediated impact between ATT and ELUS via PBIN is 0.002. AMOS was used to compute the indirect and direct impacts. Table 4 provides detailed results.

The 95% CI for the indirect impact of ATT on ELUS is (lower = 0.020, upper = 0.223). The number 0 does not fall inside the range [34]. As a result, behavioural intention influences the association between attitude and the use of e-learning. Therefore, behavioural intention is a mediator between attitude and e-learning usage behaviour. Therefore, H7, "PBIN mediates the relationship between ATT and ELUS" is supported.

11.2. Mediating effect of behavioural intention (PBIN) between subjective norm (SUBN) and usage behaviour (ELUS)

To see if behavioural intention (PBIN) mediated the relationship between subjective norm (SUBN) and E-learning usage (ELUS), the final SEM model was examined, and it was discovered that the standardized regression coefficient of the path relationship between SUBN and PBIN has no significant association at the 0.000 level r = 0.069 (P = 0.369 > 0.05). On the other hand, the standardized regression coefficient of the path link between PBIN and ELUS reveals a significant association r = 0.286 at the 0.000 level (P = 0.000 < 0.05). However, the mediating impact of PBIN between SUBN and ELUS must be verified before making any further decisions on the indirect link.

The unstandardized regression indirect effect suggests that the indirect mediated impact between SUBN and ELUS via PBIN is 0.290. AMOS was used to compute the indirect effects. Table 5 provides detailed results.

The 95% confidence interval for the indirect effect of SUBN on ELUS is (lower = − 0.011, upper = 0.052). The value of 0 falls within

Table 4
Indirect effects analysis using 1000 bootstrap.

	95% Lower Bound			95% Upper Bound			Unstandardized Indirect Effect		
	ATT	PBIN	ELUS	ATT	PBIN	ELUS	ATT	PBIN	ELUS
PBIN	.000	.000	.000	.000	.000	.000	.000	.000	.000
ELUS	.020	.000	.000	.223	.000	.000	.002	.000	.000

Table 5
Indirect effects analysis using 1000 bootstrap.

	95%Lower Bound			95% Upper Bound			Unstandardized indirect effect		
	SUBN	PBIN	ELUS	SUBN	PBIN	ELUS	SUBN	PBIN	ELUS
PBIN	.000	.000	.000	. 000	.000	.000	.000	.000	.000
ELUS	−.011	.000	.000	. 052	.000	.000	.290	.000	.000

this interval, [29]. Hence, PBIN does not mediate the relationship between SUBN and ELUS. Therefore, PBIN is not a mediator between SUBN and ELUS. Therefore, H8 "behavioural intention (PBIN) mediates the relationship between SUBN and ELUS" is not supported. This result could also be assumed since the SUBN and PBIN have no significant association. However, it has been proven statistically.

11.3. Mediating effect of behavioural intention (PBIN) between perceived behavioural control (PBC) and E-L usage behaviour (ELUS)

According to the final SEM model, the standardized regression coefficient of the direct route association between PBC and PBIN is strongly and significantly associated. Thus, it is time to investigate whether or not PBIN mediates the relationship between PBC and PBIN, r = 0.437 (P = 0.000 < 0.05), and the standardized regression coefficient of the path direct relationship between PBIN and ELUS is significantly associated r = .286 at 0.000 level (P = 0.000 < 0.05). Hence, there may be a full/partial mediating effect of PBIN between PBC and ELUS, which has to be tested for further indirect relationship decisions.

As the standardized regression coefficient of the path direct relationship between PBC and ELUS is not significantly associated (r = −.073, P = 0.326 > 0.05), mediating effect of PBIN between PBC and ELUS has to be tested for further decision on the indirect relationship, because PBIN may act as a mediator between PBC and ELUS. Furthermore, the unstandardized regression indirect effect demonstrates the indirect mediated impact between PBC and ELUS through PBIN is.002. AMOS was used to compute the indirect effects. Tables 8 and 9 provide detailed results (see Table 10).

In this section, the mediating effects of PBIN between PBC and ELUS are reported. AMOS was used to calculate the indirect and direct impacts. Table 6 includes the most comprehensive results.

The mediating standardized indirect effect of PBC is 0.002 (Table 6). The 95% confidence interval for the indirect effect of PBC on ELUS is (lower = 0.035, upper = 0.163). In this interval, '0′ does not fall within it. The direct path from PBC to ELUS is not significant. However, PBIN mediates the relationship between PBC and ELUS. Therefore, PBIN acts as a full mediator between PBC and ELUS. Therefore, H9: "PBIN mediates the relationship between PBC and ELUS" is supported.

11.4. Mediating effect of E-learning usage behaviour (ELUS) between behavioural intention (PBIN) and sustainability in teaching (SUST)

To test whether e-learning usage behaviour (ELUS) mediates the relationship between behavioural intention (PBIN) and sustainability in teaching (SUST), the final SEM model was examined, and the standardized regression coefficient of the path relationship between PBIN and ELUS has a significant association at 0.000 level r = 0.286 (P = 0.000 < 0.05). At the same time, the standardized regression coefficient of the path relationship between E-Learning Usage Behaviour (ELUS) and Teaching Sustainability (SUST) exhibits a significant association r = .272 at the 0.000 level (P = 0.000 < 0.05). As a result, the mediating influence of E-Learning Usage Behaviour (ELUS) between behavioural intention (PBIN) and teaching sustainability (SUST) must be examined before making any further decisions on the indirect link.

The unstandardized regression indirect impact demonstrates that the indirect mediated effect between behavioural intention (PBIN) and sustainability in teaching (SUST) via E-Learning Usage behaviour is 0.004 (ELUS). AMOS was used to compute the indirect and direct impacts. Table 7 provides detailed results.

The 95% confidence interval for the indirect effect of behavioural intention on sustainability is (lower = 0.016, upper = 0.127). The value of 0 does not fall within this interval [29]. Hence, E-Learning Usage behaviour (ELUS) mediates the relationship between behavioural intention and sustainability. Therefore, e-learning usage behaviour (ELUS) is a mediator between behavioural intention and sustainability in teaching (SUST). Therefore, H10, "E-Learning Usage behaviour (ELUS) mediates the relationship between behavioural intention (PBIN) and sustainability in teaching (SUST)" is supported.

12. Examining the moderating effects

Moderating factors may change the association between independent and dependent variables. The moderating impact was tested

Table 6
Indirect effects analysis using 1000 bootstrap.

	95%Lower Bound			95% Upper Bound			Unstandardized indirect effect		
	PBC	PBIN	ELUS	PBC	PBIN	ELUS	PBC	PBIN	ELUS
PBIN	.000	.000	.000	.000	.000	.000	.000	.000	.000
ELUS	.035	.000	.000	.163	.000	.000	. 002	.000	.000

Table 7
Indirect effects analysis using 1000 bootstrap.

	95% Lower Bound			95% Upper Bound			Unstandardized Indirect Effect		
	PBIN	ELUS	SUST	PBIN	ELUS	SUST	PBIN	ELUS	SUST
ELUS	.000	.000	.000	.000	.000	.000	.000	.000	.000
SUST	016	.000	.000	.127	.000	.000	.004	.000	.000

Table 8
Regression weight estimates for unconstrained model for gender.

		Estimate	SE	CR	P	Conclusion
PBIN < —	ATT					
	Male	.325	.118	2.756	.006	Significant
	Female	.430	.110	3.900	.000	Significant
PBIN < —	SUBN					
	Male	.138	.073	1.895	.058	Insignificant
	Female	−.024	.073	−.325	.745	Insignificant
PBIN < —	PBC					
	Male	.316	.075	4.196	.000	Significant
	Female	.442	.093	4.774	.000	Significant
PBIN < —	ELUS					
	Male	.245	.097	2.528	.011	Significant
	Female	.243	.093	2.615	.009	Significant
PBC < —	ELUS					
	Male	−.009	.074	−.117	.907	Insignificant
	Female	−.106	.086	−1.231	.218	Insignificant
ELUS < –	SUST					
	Male	.291	.106	2.747	.006	Significant
	Female	.394	.119	3.311	.000	Significant

Table 9
Regression weight estimates for unconstrained model for computer literacy level.

		Estimate	SE	CR	P	Conclusion
PBIN < —	ATT					
	Expert	.477	.129	3.689	.000	Significant
	Intermediate	.258	.110	2.348	.019	Significant
PBIN < —	SUBN					
	Expert	−.048	.084	−.573	.566	Insignificant
	Intermediate	0.127	0.070	1.818	0.069	Insignificant
PBIN < —	PBC					
	Expert	.369	.081	4.552	.000	Significant
	Intermediate	.436	.091	4.769	.000	Significant
PBIN < —	ELUS					
	Expert	0.165	0.104	1.590	0.112	Insignificant
	Intermediate	.227	.100	2.267	.023	Significant
PBC < —	ELUS					
	Expert	−.127	.076	−1.656	.098	Insignificant
	Intermediate	.031	.086	.362	.717	Insignificant
ELUS < –	SUST					
	Expert	.277	.106	2.610	.009	Significant
	Intermediate	.389	.118	3.312	.000	Significant

using multi-group analysis. Groups for each moderator have already been defined; data are grouped accordingly. During the multi-group analysis test, six models were created. These six models are referred to as unconstrained, measurement weights, structural weights, structural covariance, structural residuals, and measurement residuals. To investigate the moderating impact, only unconstrained and measurement residuals are used. As a rule of thumb, the moderating effect is present if the unconstrained model outperforms the residual measurement model [29]. A multi-group CFA was done to see if the variant (unconstrained) model differed from the invariant (measurement residual) model. This particular research model examines the moderating effect of gender, computer literacy level, and academic position on e-learning usage behaviour as well as sustainability.

12.1. Moderating effect of 'gender'

The mediating influence of 'gender' was investigated using male and female groups. Based on ×2 (CIMIN) = 119.729

Table 10
Regression weight estimates for unconstrained model for academic position.

		Estimate	SE	CR	P	Conclusion
PBIN < —	ATT					
	Professors	.506	.150	3.378	.000	Significant
	Senior Lecturers	.244	.108	2.249	.025	Significant
	Lecturers	.718	.237	3.029	.002	Significant
PBIN < —	SUBN					
	Professors	−.035	.104	−.333	.739	Insignificant
	Senior Lecturers	.073	.076	.964	.335	Insignificant
	Lecturers	.076	.111	.684	.494	Insignificant
PBIN < —	PBC					
	Professors	.372	.100	3.736	.000	Significant
	Senior Lecturers	.358	.080	4.441	.000	Significant
	Lecturers	.439	.168	2.621	.009	Significant
PBIN < —	ELUS					
	Professors	.469	.177	2.646	.008	Significant
	Senior Lecturers	.124	.090	1.378	.168	Insignificant
	Lecturers	.312	.109	2.859	.004	Significant
PBC < —	ELUS					
	Professors	−.007	.126	−.052	.958	Insignificant
	Senior Lecturers	−.015	.074	−.202	.840	Insignificant
	Lecturers	−.214	.119	−1.803	.071	Insignificant
ELUS < –	SUST					
	Professors	.291	.152	1.917	.055	Significant
	Senior Lecturers	.341	.127	2.690	.007	Significant
	Lecturers	.382	.134	2.843	.004	Significant

(1193.760–1074.031); df = 70 (742–672); p = 0.000, the measurement residual ×2 is bigger than the unconstrained ×2. Because of the indices, the unconstrained model was determined to be superior to the measurement residuals model. As a result, in the overall model, gender has a mediating effect on sustainability factors in teaching. The regression weight is next analyzed for the likelihood level, CR and beta values. As a general guideline, Ho [31] said that the CR value should be more than 1.96 at the 0.05 significant level, and the beta value (standard regression estimate) should be greater than 0.2 if a connection is significant.

Gender influences sustainability by influencing the individual path and behavioural intention. Similarly, gender moderates the effect of attitude and perceived behavioural control on behavioural intention, even though the moderating effect between subjective norm and behavioural intention is insignificant, as is the moderating effect between perceived behavioural control and e-learning usage behaviour. Finally, both the male and female groups considerably reduce e-learning using behaviour and sustainability. As a result, hypothesis H11 is accepted: Gender moderates the association among exogenous, intervening and endogenous factors.

12.2. Moderating effect of computer literacy level

Computer Literacy level was divided into three groups. Anyhow, respondents have selected only two groups; they are intermediate and expert level. The researchers examined the moderating effect of these two groups on the exogenous, mediating and endogenous variables. While testing the moderating effect of Computer Literacy level, the measurement residuals ×2 was greater than unconstrained ×2 based on Δ ×2 (CIMIN) = 75.139 (1175.954–1100.815); Δ df = 48 (742–694); p = 0.000. As a result, based on the indices, the unconstrained model was judged to be superior to the measurement residuals model (assuming the unconstrained model is correct). As a result, in the overall model, computer literacy moderates the determinants of e-learning usage behaviour. The p-value for the residual measurement model was 0.000 < 0.05. As a result, Computer Literacy had a strong moderating influence on the whole model.

"If beta for group one is significant and beta for group two is insignificant, there will be a moderating effect" [29]. Hence, when the beta value was examined against the p values, it was found that both intermediate and expert-level computer literacy levels moderate the association among attitude and behavioural intention, perceived behavioural control, and behavioural intention. While examining the moderating effect between behavioural intention and e-learning usage behaviour, only the expert level has a significant moderating effect. Furthermore, there is no significant moderating effect of both expert and intermediate levels between behavioural intention and subjective norm, as well as perceived behavioural control and e-learning usage behaviour. Finally, these two groups significantly moderate e-learning usage behaviour and sustainability in teaching. Therefore, H12*:* Computer Literacy level moderates the association among exogenous, mediating and endogenous variables.

12.3. Moderating effect of 'academic positions'

Similarly, moderating effect of academic status was also tested. The measurement residual ×2 is greater than unconstrained ×2 based on Δ ×2 (CIMIN) = 212.822 (1728.915–1516.093); Δ df = 140 (1148–1008); p = 0.000. The unconstrained model was found to be better than the measurement residuals model because of the indices. Therefore, academic position moderates the determinants of sustainability in teaching in the overall model.

While analysing a little deeper regarding the moderating effect of Academic positions, which are divided into three groups: Professors, Senior Lecturers and Lecturers, the moderating effect between the individual path of exogenous variable and behavioural intention is examined using the p value, which is significant at 0.05. All three professional groups moderate attitudes and behavioural intention as the individual path is significant at a p-value of less than 0.5. Similarly, perceived behavioural control and behavioural intention also have a significant p-value, so academic position moderates the two variables, whilst subjective norm and behavioural intention are insignificant. Thus, this path is not moderated by academic position. Similarly, perceived behavioural control and e-learning usage behaviour are also not moderated by Academic positions. However, behavioural intention and e-learning usage behaviour are moderated by two groups: Professors and Lecturers. Even though one group is significant and the other is insignificant, the path is moderated [29]. Finally, all three groups of the academic position moderate e-learning usage behaviour and sustainability in teaching. Therefore, hypothesis H13: Academic position moderates the association among exogenous, mediating and endogenous variables, is accepted.

13. Discussions

The main aim of this research study is to explore the major factors that influence the sustainability in teaching in respect of e-learning system usage in the public universities of Sri Lanka. The result shows that attitude and perceived behavioural control directly influence behavioural intention, whilst subjective norm has no significant effect.

It is widely documented that the attitude toward using certain technologies will be a key determinant of the final behaviour [2,7,8,35] and this finding is consistent with those studies. In addition, perceived behavioural control significantly affects behavioural intention, which is consistent with previous literature [7,8]. However, contrary to a few pieces of literature, the subjective norm has no significant relationship with behavioural intention [2,12,36,37]. Thus, it can be interpreted that behavioural intention is associated with the attitude of persons and the control factors but not really by normative factors.

Furthermore, behavioural intention also correlates statistically with e-learning usage behaviour. This result is consistent with a few studies [7,9,15], while perceived behavioural control has no direct relationship with E-learning usage behaviour. The literature suggests that "the user's willingness or confidence in their own capacity are important components of behavioural control that in turn develops the behaviors of individuals" [14]. However, the findings of this study contradict the few previous studies that had proven perceived behavioural control has a significant direct relationship with usage behaviour [2,8,13,16].

Considering the final dependent, in consistence with our anticipations, e-learning usage behaviour influences sustainability in teaching. The mediating effect of behavioural intention between exogenous variables and e-learning usage behaviour was explored. Behavioural intention mediates the relationship between attitude, e-learning usage behaviour and perceived behavioural control and usage behaviour. It was found that there was no mediation effect of behavioural intention between subjective norm and e-learning usage behaviour.

In addition, e-learning usage behaviour is a mediator between behavioural intention and sustainability in teaching. This is a fresh finding of this study, which should be explored further by future researchers. Because TPB ends with the dependent variable, which is the usage behaviour and another theoretical contribution of this study is sustainability in teaching was added as a dependent, and thus e-learning usage behaviour plays a role as mediator.

Moderating effects of the three variables examined in this study are gender, academic position and computer literacy level. Impressive results were found with respect to the moderating effects. All these three variables act as moderators between attitude and behavioural intention, as well as behavioural intention and usage behaviour. Moreover, it was found that e-learning usage behaviour and sustainability in teaching are significantly moderated by these three moderators. These three moderators do not moderate subjective norms and behavioural intention. It could be assumed that subjective norm has no significant association with behavioural intention, and there may be no moderating effect. Similarly, perceived behavioural control has no direct association with e-learning usage behaviour and no moderating effect, but it has an association with behavioural intention. Hence, it is crucial to understand that these 03 moderating factors have a superficial weight on intention to user behaviour.

Nevertheless, this study also included sustainable development as the major dependent, influenced by e-learning usage behaviour, and the effect is moderated by gender, academic position and computer literacy level. Finally, this study concludes Attitude, Perceived behavioural Control, Behavioural Intention, and e-learning usage behaviour are the factors influencing sustainability in teaching.

As subjective norm does not affect behavioural intention, it is recommended not to revisit these factors in future studies. It is also recommended that university administrations motivate faculty members to use the *E*-L system more productively for effective teaching by developing work norms and policies.

This study recommends longitudinal surveys to assess behavioural intention because the usage behaviour may need to be realistic after having the sense of developing countries like Sri Lanka, which still lacks usage behaviour. In addition, the third part analyses its impact on sustainable development as a dependent variable. Therefore, it is good to have longitudinal surveys to validate sustainability's explanatory power rather than a cross-sectional study.

A level of computer literacy is a type of competency that moderates the intention and use. Although the level varies among the academics in a particular institution (intermediate and expert), the university still has to pay more attention to developing their skills. Due to the complexity of the process of e-learning usage, staff competency is an essential requirement. Computer literacy will determine the success of the usage of any *E*-L system. Competencies are characteristics of a person that result in the best performance. Hence, this is an essential aspect that universities must consider when implementing e-learning.

Primarily, it is vital to develop a conducive environment for the lecturers to enhance their interest in e-learning usage by supporting them with the necessary facilitating conditions like timely services and information. This conducive environment would motivate them

to use the e-learning portals enthusiastically and improve their teaching performance.

University administration and the faculty must work collaboratively to ensure that all the relevant conditions are fulfilled and the resources freely available to access and use the e-learning system effectively and efficiently. Moreover, Faculty members should be trained to update the information regarding *E*-L system usage periodically. It is essential to develop interpersonal relationships between males and females to get the most out of the system at the faculty level.

University administration has to establish an office to work on Sustainability development, and an officer should be in charge of relating education for sustainability and sustainability education through various strategic plans, including e-learning system used for teaching, learning and evaluation purposes.

14. Implication

The theoretical implication of e-learning adoption for sustainable higher education refers to the potential consequences and effects of incorporating online learning methods in the context of sustainability within higher education institutions. Here are some key theoretical implications to consider:

Resource Efficiency: E-learning reduces the need for physical infrastructure, such as large universities, classrooms, and transportation. Higher education institutions can reduce their ecological footprint by shifting to online platforms, leading to resource efficiency and environmental sustainability.

Pedagogical Innovation: E-learning encourages using interactive and multimedia resources, promoting innovative teaching approaches. It allows for personalized and adaptive learning experiences, fostering critical thinking, problem-solving, and creativity. These pedagogical innovations can contribute to a more sustainable and transformative educational experience.

Computer Literacy and Skills: The adoption of e-learning requires individuals to develop computer literacy skills, including information literacy, online communication, and digital collaboration. Promoting digital literacy not only enhances educational outcomes but also prepares learners for the digital era and the evolving job market, contributing to sustainable development at both the individual and societal levels.

In addition to the theoretical contributions, policymaking and training are the most prominent practical implications. It will help to pave the path for the development of university education. Public universities in Sri Lanka are bound to utilize e-learning systems for teaching and learning to maintain sustainability in higher education, even during pandemics like COVID-19, natural and man-made disasters, or any unforeseen crisis. On the other hand, to expand the higher education opportunities to those who were denied admission even after securing good results in the G.C.E. Advanced Level examination, at least by distance mode. Hence, the increasing need for effective usage of e-learning and the factors necessitating sustainability in teaching should be explored further.

15. Conclusions

In conclusion, this study investigated the factors influencing e-learning usage behaviour and its relationship with sustainability in teaching among permanent academics in Sri Lankan public universities. The findings of the study, based on the Theory of Planned Behaviour (TPB) framework, shed light on the complex dynamics involved in the adoption of e-learning and its implications for sustainable teaching.

The research highlighted that attitude and perceived behavioural control significantly influence e-learning behavioural intention, while subjective norm did not have a significant impact. Moreover, behavioural intention was found to mediate the relationship between attitude and perceived behavioural control, and e-learning usage behaviour mediated the association between behavioural intention and sustainability in teaching.

Additionally, the study identified that gender, academic position, and computer literacy level have moderating effects on the causal relationships among the influencing factors of sustainability in teaching. These findings indicate the importance of considering individual characteristics and contextual factors when implementing e-learning for sustainable teaching practices.

Based on the results, the study recommends that universities focus on developing the necessary infrastructures, providing training programs for staff members, and establishing a dedicated office for sustainability development. These initiatives can facilitate the successful integration of e-learning into teaching practices and promote sustainable educational outcomes.

Furthermore, it is suggested that future researchers conduct longitudinal studies to explore the long-term effects of e-learning adoption on sustainability in teaching. Additionally, adopting a decomposed TPB approach could provide a more nuanced understanding of the underlying factors and processes involved in the adoption of e-learning.

Overall, this study contributes to the growing body of knowledge on e-learning adoption for sustainable higher education. Identifying the key factors influencing e-learning usage behaviour and their implications for sustainability in teaching provides valuable insights for educational policymakers, administrators, and practitioners seeking to enhance the effectiveness and sustainability of online learning platforms.

16. Limitation

The scope of this study only focused on public universities in Sri Lanka, which are under the patronage of UGC. Even though many private universities are at a budding level, a few well-established private universities could be considered. Another limitation is that this study population is only academics. Students' communities should be considered in future studies. As this research was done in 2020 and is cross-sectional, future studies are to do longitudinal surveys inclusive of various other factors such as perceived usefulness,

perceived ease of use, self-efficacy, university support, library support, etc. It is necessary to evaluate the effectiveness of actions between each survey.

Based on the reviewed literature, the researchers could suggest a suitable theory known as Decomposed Theory of Planned Behaviour (DTPB) as appropriate to this study, with a few inputs of decomposed factors, such as socio-economic, cultural, and pedagogy-related factors. Furthermore, a qualitative survey would be more impressive to validate the results from the quantitative analysis. Therefore, future studies may include both qualitative and quantitative analysis.

Ethics statement

This study was reviewed and approved by Institutional ethical committee, Scientific Research Commitee, College of Business Administration, Kingdom University, Bahrain number is CBA10/22.

Funding statement

We/I certify that financial support for this research clearly stated in the Acknowledgements section of this manuscript and grant number is 2017–49.

Author contribution statement

Mohamed Majeed Mashroofa: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper.

Athambawa Haleem: Conceived and designed the experiments; Wrote the paper.

Nishad Nawaz: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Mohamed Azahim Saldeen: Performed the experiments; Contributed reagents, materials, analysis tools or data.

Data availability statement

Data will be made available on request.

Additional information

No additional information is available for this paper.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

The authors would like to thank the research council at Kingdom University, Bahrain for financial support for this publication.

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