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Factors Affecting E-Learning Adoption in Developing Countries—Empirical Evidence From Pakistan’s Higher Education Sector

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ABSTRACT E-learning has reshaped traditional education into more flexible and efficient learning in developed nations. However, e-learning remains underutilized and in the rudimentary stages of development in developing countries. Therefore, understanding the critical factors behind the adoption and acceptance of technology is a prime concern in developing countries like Pakistan. This paper provides and examines the adoption and acceptance baseline for e-learning systems by incorporating critical external factors in the technology acceptance model. A conceptual model—the Pakistan E-Learning Adoption Model—is proposed in the context of higher education. Data were collected from 354 learners at the Virtual University of Pakistan and structural equation modeling was employed to test the research hypotheses. The empirical investigation indicates that computer self-efficacy, Internet experience, enjoyment, and system characteristics are significant predictors of perceived ease of use, while system characteristics are a strong predictor of perceived usefulness. Moreover, the subjective norm is not found to be significant for perceived usefulness. The findings provide practical implications for policy makers, practitioners, and developers in successful e-learning systems implementation.

INDEX TERMS Critical success factors for adoption, e-learning adoption, e-learning adoption in Pakistan, TAM.

I. INTRODUCTION

With the rapid growth of Information and Communication Technologies (ICT), online learning has been amalgamated into the traditional educational structure [1]. E-learning is extremely beneficial in providing cost effective education irrespective of time and geographical boundaries [2], [3]. Over the past few years, the developing states have been shifting to inexpensive and innovative ways of delivering education to learners [4].

While considering the importance of e-learning, Higher Education Institutes (HEIs) have developed this recent trend in education in developing nations [5]. It has become increasingly important for learners to complete their higher education equipped with technological skills that they will require for their professional development in the workplace [6]. However, introducing ICT into HEIs neither guarantees acceptance nor continued usage of such systems. In this regard, much effort has been made to implement e-learning systems in developing countries but under-utilization remains a problem [7]. Furthermore, content and infrastructure development

have not proven sufficient for successful implementation of e-learning systems [8]. In addition, learners are unable to take advantage of these systems unless they are willing to use them. The effectiveness and efficiency of e-learning systems depend on learners’ attitudes to adopting and accepting the modern technology [7], [9], [10]. The successful implementation of e-learning systems is mainly influenced by learners’ attitudes to adopting and using e-learning systems. These factors have been supported extensively in numerous empirical studies in developed nations [9], [11]–[13]. However, the factors that may influence the technology adoption remains concealed in developing nations. In order to address this issue, the implementation of e-learning systems in developing nations requires that policy makers and practitioners should understand the factors that affect the adoption and acceptance of e-learning systems to enhance learners’ usage behavior.

It is clear from the extant literature that user adoption and acceptance is significantly influenced by individual, social, and organizational context within a specific culture [14], [15]. Furthermore, learners’ acceptance is influenced by diverse

factors such as demographics, organizational impact, and social influence, along with the perceived usefulness and ease of use of e-learning systems [14], [16]. Although significant theoretical research has been conducted into e-learning in the context of Pakistan, which highlights the importance of demographic factors, individual differences, social influence, and accessibility [14], [17], [18], little attention has been paid to identifying the factors that are influential in the adoption and acceptance of e-learning, a native conceptual model, and empirical validation of the model. In addition, the development, implementation, and usage of e-learning systems depend on contextual, social, and cultural aspects, which differ from one country to another.

In Pakistan, the progress made in the educational sector has not been encouraging for the past few decades. Higher education faces numerous problems in this regard. The population of Pakistan is 170 million and the adult literacy rate is 58%. Moreover, it is reported that Pakistan is ranked 129th among 157 countries for global competitiveness index [19]. Education is given low priority with an expenditure of only 2% of the Gross Domestic Product (GDP). Pakistan's educational facts are miserable and e-learning in HEIs remains at the early stages of development and implementation. In this regard, the Government of Pakistan (GOP) is trying hard to provide quality education in both urban and rural areas. In 2002, the Virtual University of Pakistan was established to deliver quality education to all areas of Pakistan. Moreover, the ICT Research & Development fund is another step to achieving the goal of changing traditional education to the new mode of education. Furthermore, the GOP and Ministry of Education have invited universities to establish learning management systems. In order to develop such systems, numerous challenges related to the socio-economic, technological, and personality traits of individuals have been identified as great hurdles in e-learning adoption and acceptance.

The literature review shows the presence of a significant gap, insofar as focus must be placed on external factors that influence learners' attitudes and perceptions of e-learning systems. These factors need to be studied in the context of e-learning acceptance in Pakistan. Moreover, researchers have highlighted the need for a native e-learning adoption model for this region [16], [17], [20].

To address these research limitations, the research study aims to integrate the key drivers of technology adoption. The most influential model of technology adoption is the Technology Adoption Model (TAM) proposed by [21]. The TAM has proved to be a robust and widely applied model in different regions. It provides insight to predict learners' intention to use e-learning systems with the addition of external factors. This study highlights the external factors, including learner characteristics such as self-efficacy, internet experience, enjoyment, and computer anxiety, and the impact of these factors on learners' intention to adopt e-learning systems. The conceptualization of e-learning system acceptance is highly influenced by societal impact. Moreover, the ease of organizational accessibility, such as

computer hardware and software, is also considered an important factor in learners' attitudes to adopting a system. In addition to the above-mentioned concerns, system characteristics including functionality, response, and interactivity not only play a positive role in adoption but also improve learning experience and satisfaction, and increase the opportunities for continued use of the e-learning system. Based on previous studies, this study identifies learner characteristics, organizational accessibility, social influence, and system characteristics as external antecedents to e-learning adoption and acceptance. A significant conceptual model is proposed, followed by an empirical investigation in the context of Pakistan.

Furthermore, this study establishes valuable recommendations for practitioners, policy makers, and designers in the design and acceptance of e-learning systems. Moreover, an in-depth analysis of critical factors will provide the baseline for policy makers to enhance modern technology and promote e-learning systems in Pakistan's HEIs.

A. ADOPTION OF E-LEARNING

The adoption and acceptance of e-learning systems is a vital challenge for HEIs in developing countries. The research implies that learners in developing countries may have a very low adoption and acceptance rate of e-learning as compared to developed nations. In the literature, a number of adoption and acceptance models have been proposed. The TAM, the Theory of Reasoned Action (TRA), the Theory of Planned Behavior (TPB), and the Unified Theory of Acceptance and Use of Technology (UTAUT) are adoption models used to predict learners' attitudes towards adoption, acceptance, and continued use of information technology. After investigating the literature, it is demonstrated that TRA have some limitations of confounding between norms and attitude. It is also needed some additional explanatory variables to predict the intention. Moreover, TRA and TPB are predictive models that predict an individuals' action on some criteria. Individual actions may change and do not behave as predicted by those criteria [50]. In addition, UTAUT has four core constructs: Performance Expectancy, Effort Expectancy, Facilitating Conditions and Social Influence. Although the four constructs of UTAUT explains 70% of the variance in usage intention. However, to yield more significant results, the high R^2 of UTAUT is only attained when moderating key relationship with up to four variables (age, gender, experience and voluntariness). It makes UTAUT less parsimonious than TAM. Moreover, the grouping of constructs for facilitating conditions and social influence are difficult [12]. Furthermore, TAM has provision of adding more external variables in different contextual setting [13]. TAM is considered to predict and explain individuals' acceptance of ICT and has a strong theoretical and empirical background in e-learning [9], [22]. The TAM has proved to be the most robust and parsimonious model of technology acceptance [23]. The two core constructs of the TAM are Perceived Ease of Use (PEOU) and Perceived Usefulness (PU), which may affect users' attitudes and intention to adopt e-learning [22], [24], [25].

Over the past few decades, researchers have argued that the TAM provides general information without considering region specific external factors. These external factors yield significant and valuable suggestions to better understand the factors that affect PEOU and PU, which in turn increase the adoption and usage of these systems [26].

The critical literature review has demonstrated that TAM has been applied to developed countries rather than developing countries. The researchers have argued that the educational circumstances of developing countries differ completely from those of developed countries. Furthermore, the personal characteristics, resources, internet access, accessibility, infrastructure, culture, social norms, and implementation policies of e-learning are the major factors of e-learning adoption and acceptance in developing nations [5], [14], [20], [27], [28].

Park [9] investigated the adoption model based on the TAM in the context of South Korean University. It was identified that self-efficacy and subjective norm are significant predictors of e-learning use and intention to use, whereas system accessibility is not a prominent factor due to the fact that developed countries have an obligatory infrastructure of ICT.

In another study, Cheng [2] pointed out that system and individual attributes affect e-learning acceptance through perceived enjoyment, PEOU, and PU, which ultimately enhance performance.

Pituch and Lee [13] used the TAM and found that system characteristics such as functionality, response, and interactivity are significant. Besides system characteristics, the personal characteristics of users, such as self-efficacy and internet experience, are also found to be significant. Raaij and Schepers [12] discussed the acceptance and usage of an e-learning system. The major constructs of the model they proposed were subjective norm, personal innovativeness, and computer anxiety. The study analyzed the effect of these constructs on PU and PEOU. The empirical evidence revealed that subjective norm via PU significantly affects the use of the system whereas it does not affect personal innovativeness. Moreover, the constructs of computer anxiety and personal innovativeness have been verified to affect PEOU. Liaw and Huang [29] discussed the two core individual characteristics of self-efficacy and anxiety along with the interactive learning environment. The results demonstrated that computer anxiety is not an essential predictor of PU while self-efficacy and interactive learning environment positively influence the usage of e-learning systems.

B. E-LEARNING IN DEVELOPING COUNTRIES

In the context of developing countries, the underutilization of e-learning in HEIs has been analyzed [30]. The TAM has been applied to understand the adoption and acceptance of e-learning and the effect of individual characteristics, i.e., self-efficacy, internet self-efficacy, and learning outcomes, as well as system accessibility and learning contents. The results reveal that individual characteristics, accessibility, and learning outcomes are significant predictors of e-learning

adoption and usage behavior [21]. Tarhini *et al.* [7] empirically investigated the e-learning adoption model in the context of a developing state, i.e., Lebanon. This study extended the TAM by adding the constructs of subjective norm and quality of work life. It was found that both constructs are significant predictors of e-learning adoption along with the moderating variables. Another study was conducted in the context of Saudi Arabia to investigate learners' attitudes towards e-learning acceptance. The researcher implemented the TAM3 in the southern universities of Saudi Arabia and found that managerial, organizational, and individual characteristics are significant predictors of e-learning acceptance and continued use [23].

Qureshi *et al.* [18] investigated the numerous challenges faced by Pakistan in the deployment of e-learning systems. The research study was conducted in a private university in Pakistan to identify the barriers and issues in successful adoption of e-learning. The results of the research study concluded that computer access, technical language, and privacy issues are major challenges in the adoption of e-learning. In the context of Pakistan, it is identified that successful integration of ICT in HEIs demands that critical factors should be analyzed and merged into a locally developed model of technology adoption [17].

Furthermore, it was investigated that there is no universal model for e-learning adoption as acceptance and refusal may depend on contextual factors that are culturally dependent. In this study, it was also highlighted that the user characteristics, organizational characteristics, social environment, and ICT-policies of Pakistan are different from any other state [14].

In addition, the success of e-learning systems does not depend on the availability of technology. The problem arises when the system is not designed from learners' perspectives due to differences in terms of culture, and social impact [20]. In another study, Basar *et al.* [16] explored how one of the reasons for low adoption and acceptance is poor local research. It is highly necessary to record users' views and requirements according to the local context for the successful implementation of e-learning systems. Farid *et al.* [28] identified low student motivation, shortage of qualified faculty, lack of educational facilities, and access to higher education as the major problems in Pakistan.

In another study, it was emphasized that hardware and technology support, teachers' and learners' intention to use e-learning systems, and a knowledge and communication gap among stakeholders (users, developers, and policy makers) may lead to failure of the system [31]. Among all the related concerns, the prerequisite for policy makers, practitioners, experts, and system developers is to analyze the factors that may significantly affect learners' attitude and positively influence their continued use of e-learning systems.

Successful integration and implementation of e-learning necessitates for policy makers, practitioners, and experts to consider the region specific issues of e-learning acceptance, which eventually affect the continued use of the system.

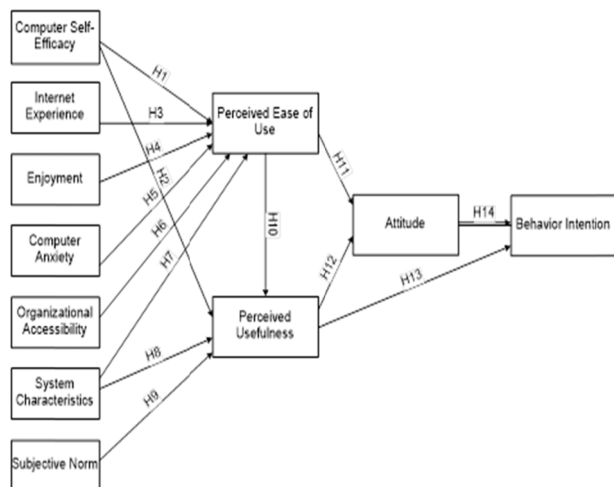


FIGURE 1. PELAM – conceptual model.

In this regard, researchers need to pay attention and consider the individual requirements, culture, and social and economic concerns of Pakistan when integrating e-learning systems into the traditional education system [16], [17]. Hence, it is important to highlight the region specific external factors of technology acceptance that influence the usage of e-learning systems.

II. RESEARCH MODEL AND HYPOTHESES

Fig. 1. depicts the research model used in this study. The model extended the TAM by adding external variables that may provide insight into e-learning acceptance and intention towards future use [9], [24], [32]. In the context of e-learning adoption, prior studies concluded that several types of external variable are considered critical in influencing learners’ attitudes through PU and PEOU towards adoption and acceptance of e-learning systems. Learners’ attitudes towards e-learning may be influenced by some of their personal characteristics, such as Computer Self-Efficacy (CSE) and Internet Experience (IE). In addition, some factors belong to personal characteristics, including Computer Anxiety (CA) and Enjoyment of e-learning system usage. If a learner is comfortable and confident using an e-learning system, this may increase their future use of that system. Moreover, the literature asserts that society may play positive and negative roles in predicting the attitude of acceptance and rejection of such a system. Therefore, social influence, as measured by the Subjective Norm (SN), is another important factor in the literature that may influence e-learning adoption and continued use. Furthermore, this study attempts to investigate System Characteristics (SC) consisting of system functionality, interactivity, and response, which may influence their adoption and usage. SC may play a positive role in predicting learners’ intention as it provides the desired functionality. Moreover, the literature supports the fact that Organizational Accessibility (OA) is another significant external element in e-learning adoption. The relationships between these external

factors of e-learning acceptance, which may influence the PEOU, PU, and attitude are used to develop the hypotheses of this study. The overall conceptual model is presented in Fig 1 and the sections that follow justify and explain the relationship in light of prior findings from the literature.

A. COMPUTER SELF-EFFICACY

CSE is referred to as an individual’s ability to perform information technology related activities using a computer system [33]. CSE has been validated as the key determinant of IS acceptance and continued use. In the context of e-learning, empirical evidence indicates that higher CSE leads to increased confidence and motivation in an individual’s attitude towards adoption and acceptance. Moreover, individuals with higher CSE are more willing to use e-learning systems and invest effort to overcome difficult obstacles as compared to individuals with low CSE [26]. Prior research has asserted that personality variables, such as self-efficacy [11], [22], [26], [29], are important predictors of technology adoption that significantly influence the PEOU and PU. Hence, it is hypothesized that CSE significantly affects PEOU and PU.

H1: CSE will positively affect the PEOU of e-learning systems.

H2: CSE will positively affect the PU of e-learning systems.

B. INTERNET EXPERIENCE

Sandra [34] discussed how success depends on technical skills in computer tasks and internet navigation in distance learning. The empirical evidence of behavioral intention found on the impact of internet experience on users’ intention [35]. This study incorporated experience with the direct relationship of intention to use internet technology. The findings suggested that level of experience plays a significant role in learners’ intention. In the literature, IE is also considered a significant predictor that may affect the adoption and continued use of e-learning systems [13]. Another study explored how learners with more experience of technology can make use of web based learning systems more easily than less experienced learners [36], [37]. Furthermore, the direct influence of IE on PEOU has been investigated [30]. Thus, it is hypothesized that:

H3: IE will positively affect the PEOU of the e-learning system.

C. ENJOYMENT

Venkatesh [37] stated that enjoyment is defined as the extent of using a specific system as enjoyable in its own way apart from any consequences of using the system. In the context of e-learning systems, if the e-learning system provides interactive entertainment functions along with chat rooms and message boards, this may lead to user engagement [39]. Moreover, it has been argued that lack of enjoyment may lead to a greater effort to use the system [40]. The causal relationship between enjoyment and PEOU has been validated [38]. Furthermore, the integration of enjoyment as an

external factor into the base model of TAM may provide a better explanation of the adoption and use of e-learning systems [2], [12]. For this study, it is hypothesized that:

H4: Enjoyment will positively affect the PEOU of the e-learning system.

D. COMPUTER ANXIETY

Computer anxiety refers to an individual's fear or nervousness when interacting with computer systems [41]. It is defined as a general negative perception about computer use [37]. Despite the rapid growth of information technology, computer anxiety towards using new interfaces and performing system related tasks is a significant challenge. In the context of e-learning, the role of computer anxiety has been discussed and validated by many researchers. Previous research demonstrates that PEOU is highly influenced by computer anxiety [42]. Consistent with previous research findings [2], [12], it is hypothesized that:

H5: CA will negatively affect the PEOU of e-learning systems.

E. ORGANIZATIONAL ACCESSIBILITY

Organizational accessibility (OA) is defined as the degree of ease of accessing and using e-learning systems in the university [9]. Previous research has reported that higher information accessibility may lead to higher ease of use [43]. According to Lee [44], the ability of an individual to access hardware and software within the university for online learning is internal equipment accessibility. Furthermore, it has been discussed that online learning requires access to the internet, computer hardware, and related software. Moreover, OA profoundly influences learners' use of information technology and significantly influences attitude and adoption intention via PEOU [30]. In this study, e-learning accessibility refers to the degree of ease with which a university student can access and use e-learning systems within the university campus and is considered an organizational factor. Hence, it is hypothesized that:

H6: OA will positively affect the PEOU of the e-learning system.

F. SYSTEM CHARACTERISTICS

System characteristics are also considered a significant external factor in predicting users' attitudes and adoption behavior in e-learning. Researchers posit and validate that system factors such as system functionality, system interactivity, and system response may positively influence the adoption of technology [13], [45]. The system functionality of an e-learning system is the ability to provide flexible access to the system [13]. In addition to this, another important system characteristic is interactivity. The system should be interactive as e-learning systems provide the collaboration of learners with other members in addition to faculty [32]. Furthermore, the system integrates different assessment media presentation types such as audio, video, and text, and creates an interactive environment [32]. Hence, e-learning attitude

was analyzed by the TAM insofar as three of these system characteristics, i.e., functionality, interactivity, and response, are important predictors of technology adoption and positively influence PEOU and PU [2], [13], [46]. Thus, it is hypothesized that:

H7: SC will positively affect the PEOU of the e-learning system.

H8: SC will positively affect the PU of the e-learning system.

G. SUBJECTIVE NORM

Subjective norm or social influence refer to the perception that the people who are important think that one should either use the system or not [12]. In an e-learning context, learners believe that people who are important think they should use e-learning systems [45]. Considering the e-learning environment, many learners choose to use e-learning because their friends are doing so, and they recommend it to them. Some studies have found that the subjective norm is directly related to attitude in the TAM [25], whereas other studies have found that the subjective norm indirectly influences attitude and adoption intention via PU [12], [45]. Moreover, it has been found that SN significantly affects PU, which leads to an individual's attitude and adoption behavior [9]. In this study, it is hypothesized that:

H9: SN will positively affect the PU of the e-learning system.

H. PERCEIVED EASE OF USE

PEOU refers to "the degree to which a person believes that using a particular system would be free of effort" [47]. Previous research in the field of e-learning has shown that PEOU positively and significantly affects attitude towards intention and PU to use systems [2], [46], [48]. PEOU similarly affects the intention to accept the system either directly or indirectly through PU. Thus, it is hypothesized that:

H10: PEOU will significantly affect the PU of the e-learning system.

H11: PEOU will significantly affect the attitude towards the e-learning system.

I. PERCEIVED USEFULNESS

PU refers to "the degree to which a person believes that using a particular system would enhance his/her job performance" [47]. Prior research reveals that PU has a significant influence in predicting attitude towards adoption of an e-learning system [2], [7], [9], [30], [49]. Moreover, previous studies have asserted that PU positively influences users' behavior intention (BI), either directly or attitudinally [25]. In addition, PU reflects learners' subjective probability that using new technology will benefit them in the future. Thus, it is hypothesized that:

H12: PU will significantly affect attitude towards the e-learning system.

H13: PU will significantly affect the BI of the e-learning system.

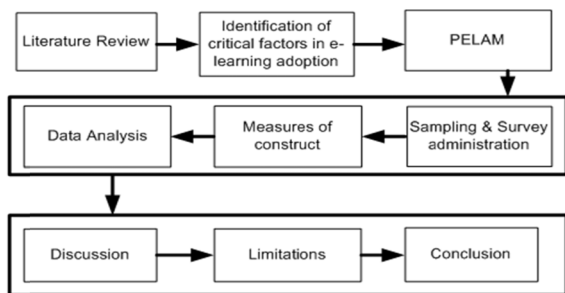


FIGURE 2. Research methodology.

J. ATTITUDE TOWARDS BI

Attitude refers to the degree to which a person has a positive or negative feeling towards e-learning systems [47]. Individuals with a positive attitude towards e-learning have a stronger intention to adopt the system and thus are more willing to use it [9], [25], [39]. Thus, it is hypothesized that:

H14: Attitude will significantly affect the BI of the e-learning system.

III. METHODOLOGY

This research study aims to evaluate the critical factors in e-learning adoption and perception related to learners’ intention to use e-learning systems. To carry out the specified task, the quantitative approach of research methodology is used. In this approach, an online survey was used to collect data. Statistical analysis was then performed to evaluate the results. Fig. 2. represents the research methodology used in this research:

A. METHOD

SPSS 21.0 was used to test the reliability and validity of the PELAM model. The Confirmatory Factor Analysis (CFA) was adopted to measure the convergent and discriminant validity.

AMOS 20.0 was employed to test the PELAM. The maximum likelihood method was adopted to estimate the parameters of the model based on variance-covariance matrices [56].

B. SAMPLING AND SURVEY ADMINISTRATION

To collect data, an online questionnaire was distributed to the students of the Virtual University (VU) of Pakistan to investigate their attitudes towards e-learning systems usage. The target population in this study were graduate and postgraduate students enrolled in the discipline of Information Technology, Computer Science, and Business Administration at VU.

C. MEASURES OF CONSTRUCT

The measures for the survey construct were obtained from prior studies. The questionnaire consisted of two parts. The first part used nominal scales to collect the respondents’ demographic information. The second part consisted of a subjective measure to evaluate the respondents’ perception regarding the constructs of PELAM. All questionnaire items

TABLE 1. Demographic profile of the respondents.

Demographics	Responses	%
Punjab	295	83
Sindh	35	10
KPK	21	6
Baluchistan	3	1
Male	253	71
Female	101	29
Post Graduate	184	52
Graduate	170	48
1-2 years	178	50
3-4 years	120	34
5 years	56	16

were measured using a five-point Likert scale ranging from “strongly disagree” to “strongly agree.” The measures of PEOU, PU, and Behavioral intention to use systems were adapted from [50]. CSE and IE were adapted from [51]. Enjoyment and CA were adapted from [38] whereas SN was adapted from [52]. Organizational accessibility was adapted from [53] and measure of system characteristics, such as system functionality, system response, and system interactivity, were adapted from [13].

IV. RESULTS

A. DATA ANALYSIS

The data analysis in this study was conducted in two phases. The first phase examined the demographic statistics of the data and mainly focused on a measurement model to examine reliability and validity. The second phase consisted of testing the hypothesis and analysis of the structural model.

B. SAMPLE DESCRIPTIVE ANALYSIS

The questionnaire collected demographic information along with the posed questions related to the learners’ attitudes and e-learning experience. Of the 354 responses collected, no response was discarded from the final study. Among the 354 responses, 71% were male and 29% were female. Most of the respondents were from Punjab (83%) followed by Sindh (10%), KPK (6%), and Baluchistan (1%). A detailed profile of respondents is given in Table 1.

C. ANALYSIS OF MEASUREMENT MODEL

To assess the measurement model, reliability, convergent, and discriminant validity were measured via CFA. The reliability analysis was conducted to test the internal validity and consistency of the constructs used for each variable. To measure the internal consistency of the construct, Cronbach’s α was used. A Cronbach’s α of greater than 0.70 indicates the recommended threshold value [54]. Table 2 shows the Cronbach’s α for each of the variable ranges from .72 - .89, indicating the high reliability and internal consistency of the instrument items.

Convergent validity of the scale items is measured by composite reliability and the average variance extracted [55].

TABLE 2. Reliability analysis and convergent validity.

Construct	Cronbach's α Value (> 0.70)	Composite Reliability (> 0.60)	Average Variance Extracted (> 0.50)
SC	.876	0.852	0.536
CSE	.718	0.756	0.509
IE	.797	0.765	0.522
Enjoyment	.890	0.875	0.701
CA	.884	0.893	0.736
SN	.866	0.869	0.689
OA	.787	0.797	0.570
PU	.923	0.924	0.803
PEOU	.742	0.743	0.591
Attitude	.783	0.789	0.558
BI	.831	0.833	0.714

TABLE 3. Fit indices.

Fit indices	Recommended values	PELAM values
χ^2/df	<5 preferably <3	1.592
GFI	>0.90	.894
AGFI	>0.80	.868
CFI	>0.90	.964
RMSEA	<0.08	.041
NFI	>0.90	.910
PNFI	>0.60	.775

The composite reliabilities of all the factors exceeded the recommended threshold value of 0.60. Moreover, the AVE values should exceed the threshold value of 0.50. Hence, conditions for convergent validity were achieved as shown in Table 2.

D. ANALYSIS OF THE STRUCTURAL MODEL

A Structural Equation Model (SEM) approach was used to test the PELAM. SEM is considered to be a better approach for examining multiple equations of dependence relationship and testing the theories. It provides insight that allows simultaneous examination of a series of dependent relationships among the constructs of the model [56].

In order to assess the research model, a variety of fit indices should be considered as recommended for SEM applications. The seven fit indices used and the threshold values indicate the acceptable model fit. First of all, degree of freedom was used, with a value less than 3 indicating acceptable fit. Other fit indices are: the Goodness of Fit Index (GFI), the Adjusted Goodness of Fit Index (AGFI), the Comparative Fit Index (CFI), the Normed Fit Index (NFI), the Parsimony Normed Fit Index (PNFI), and the Root Mean Square Error of Approximation (RMSEA). Table 3 indicates the level of acceptable fit and the fit indices for the PELAM in this study. Table 3 shows that the fit indices are within the acceptable

TABLE 4. Hypotheses testing results.

Hypotheses	Path	β	p-value	Results
H1	CSE→PEOU	.135	.050	Supported
H2	CSE→PU	-.024	.852	Not supported
H3	IE→PEOU	-.110	.013	Supported
H4	Enjoyment→PEOU	.209	.000	Supported
H5	CA→PEOU	.006	.745	Not supported
H6	OA→PEOU	-.091	.099	Not supported
H7	SC→PEOU	.786	.000	Supported
H8	SC→PU	-	.005	Supported
		1.184		
H9	SN→PU	.023	.680	Not supported
H10	PEOU→PU	2.249	.000	Supported
H11	PEOU→Attitude	.627	.000	Supported
H12	PU→Attitude	.174	.009	Supported
H13	PU→BI	-.691	.000	Supported
H14	Attitude→BI	2.169	.000	Supported

Note: $p < .001$, $p < .01$, $p < .05$

range except that the GFI was slightly below the recommended value. The GFI value was close enough to the recommended value; thus, it is better to state that the model is a reasonably good fit for the sample used in this study.

The next step of data analysis in this study was to analyze the significance of the hypothesized relationships in the research model. Table 4 illustrates the results of the hypothesized relationships. Overall, 10 out of 14 hypotheses were supported by the data. The results indicate that the endogenous variables in this study are as follows: PEOU significantly influences both attitude ($\beta = 0.627$ and $p < .001$) and PU ($\beta = 2.249$ and $p < .001$). Thus, H10 and H11 are supported. In addition, PU was found to be significant in influencing BI ($\beta = -0.691$ and $p < .001$) and attitude ($\beta = 0.174$ and $p < .01$). Hence, H12 and H13 are also supported by the data. Moreover, attitude significantly influences BI ($\beta = 2.169$ and $p < .001$), thus supporting hypothesis H14.

SE was found to be significant in influencing PEOU ($\beta = 0.135$ and $p < .05$) but not PU ($\beta = -0.024$ and $p = .852$), thus supporting H1 but not H2. IE ($\beta = -0.110$ and $p < .05$) and Enjoyment ($\beta = 0.209$ and $p < .001$) were found to be significant in influencing the PEOU supporting H3 and H4. CA ($\beta = 0.006$ and $p = .745$) and OA ($\beta = -0.091$ and $p = -.091$) were not found to be significant in influencing the PEOU, thus rejecting H5 and H6. SC ($\beta = 0.786$ and

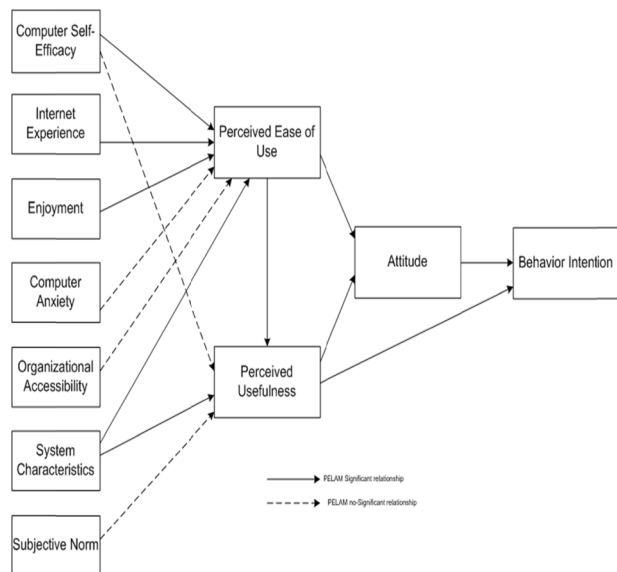


FIGURE 3. PELAM – structural model.

$p < .001$) and SC ($\beta = -1.184$ and $p < .01$) were significant in influencing the PEOU and PU respectively, supporting H7 and H8. SN ($\beta = 0.023$ and $p = .680$) is not significant in influencing PU. Thus, H9 is not supported by the data. Fig 3 depicts the structural model of PELAM.

V. DISCUSSION

This study aimed to explore learners’ intention to use an e-learning system with the TAM and focused on the antecedents for the acceptance of e-learning systems in Pakistan. This study investigated the effects of computer self-efficacy, internet experience, computer anxiety, and enjoyment along with organizational accessibility, subjective norms, and system characteristics as external factors in the TAM. The participants were learners from Pakistan VU who were already making use of e-learning systems. Three hundred and fifty-four valid responses were collected and SEM was employed to test the research hypotheses.

The results of the study clearly indicated that the TAM has proved to be a robust and concise theoretical model to predict the learners’ intention to use e-learning systems.

The findings of this study exhibit that the relationship between PEOU and CSE is significant in the adoption of the intention to use an e-learning system. This finding is consistent with the results of previous studies conducted in developed countries like Korea and Taiwan [2], [9], [26], [30], [46]. A higher level of computer self-efficacy leads to ease of use of an e-learning system and enhances learners’ intention towards adoption. Another hypothesis (H3) was also found to be significant. Internet experience is a direct predictor of PEOU and the findings are consistent with the previous research of [2] and [30]. E-learning required skills at using the internet to effectively and efficiently use the e-learning systems. In addition, confidence in computer-related and

internet-related tasks and knowledge may play a significant role in affecting intention as learners with higher self-efficacy in using computers and the internet are more likely to use the system more easily than those who have low proficiency with computers and the internet. Therefore, the HEIs should ensure that learners have some training sessions as a pre-requisite before starting their degree programs.

The results indicate that the relationship between CSE and PU is not significant for the intention to adopt use of the e-learning system. This finding is consistent with the results of previous research conducted in different countries [2], [13], [30]. The non-significance of this relationship indicates that the target audience of this study were highly educated and their intention towards usefulness was less apprehensive.

The findings of this study exhibit that the relationship between enjoyment and ease of use is significant for learners’ intention to adopt an e-learning system. The finding is consistent with the results of previous studies [2], [38]. It is evident that if the users experience involvement and enjoy the pleasure aspect of interacting with e-learning systems, they may find them easier to use. Therefore, the developers should ensure that the learning materials and content of e-learning systems are aided with the latest technology in audio and video streaming to engage learners in learning activities.

The relationship between anxiety and ease of use is not significant for the adoption of e-learning systems. This finding is consistent with the results of previous studies [57]. The reason for this is that higher computer self-efficacy of e-learning users reduces computer anxiety. The targeted population in this study were learners who were skilled at using computers and the internet. Therefore, their computer capability level was high, which, in turn, reduced their anxiety towards computers and use of e-learning systems.

The hypothesis regarding the relationship between OA and PEOU was examined and found not to be significant in this study regarding the intention to adopt e-learning systems. This finding is consistent with the results of previous studies [9], [58]. However, the results may contradict the research conducted by [30]. The reason is that VU has a developed infrastructure throughout Pakistan and has also established its own virtual private network to facilitate learners. The learners can access and use the resources anytime; therefore, the policy makers and practitioners should ensure that HEIs have the required infrastructure of e-learning implementation prior to the launch and integration of e-learning systems in the traditional infrastructure of education. However, HEIs need to develop their strong infrastructure before implementing e-learning.

This study examines two hypotheses: the effect of system characteristics on PEOU and PU. The results illustrate that SC are significant for PEOU and PU in the adoption of e-learning systems. The results of this research study are consistent with previous studies [2], [13], [46] and reveal that functionality, interactivity, and response collectively enhance learners’ motivation and attitudes in their adoption of e-learning

systems. System functionality should meet with learners' requirements to increase the acceptance and adoption of e-learning systems. In addition, developers and designers should take care to increase the interactivity of the contents of e-learning systems. The contents of the course are not sufficient to engage learners; rather, the learning materials should be interactive. Moreover, course contents should have audio and visual aid, animated simulation, and videos of experiments to involve learners in the learning contents. Besides the above mentioned concerns, the response of the system should be fast and consistent. The results also illustrate that system features should meet with the users' requirements to increase their adoption and in turn behavioral intention towards e-learning. System developers and designers should design e-learning systems according to users' needs. Moreover, systems should be interactive in order to foster users' intention to use them, while response time to the system should be high to cultivate users' interest in the learning process.

This study has examined the relationship between SN and PU and found it to be non-significant in the intention to adopt e-learning systems. This finding contradicts the results of previous studies [9], [12], [60]. The results indicate that the target audience is self-independent and experienced in making use of technology and less influenced by peers. In addition, the opinion of other referents is a gradual process that decreases with the increase in experience of using a system [2]. Thus, opinion becomes the salient feature of belief in using a system [38].

The results of this study demonstrate that the relationship between ease of use and usefulness and between ease of use and attitude are significant and may affect learners' intention in determining their acceptance of e-learning systems in Pakistan. The results are consistent with the findings of previous studies in diverse cultures of developed and developing countries [2], [26], [46], [57], [59]. It is reasonable to conclude that if the system is relatively free of effort, it will enhance the performance and productivity and in turn positively affect the attitude towards adopting the system. Therefore, developers and designers should design the system and its interface in a way that is easy to use, which may enhance the intention to accept and adopt e-learning.

In addition to PEOU, PU has been found to be a significant predictor of learners' intention to use the system. Usefulness is positively and directly associated with BI and has been proved a significant predictor of attitude. The results of this study are consistent with the previous findings of the original work of [21] and with previous studies [9], [57], [59] investigated in different countries. The results illustrate that if learners perceive a system to be useful and that using a system will not only increase their performance but also benefit them in the future, it will increase their intention to use the system. Moreover, learners' intention to adopt the system may increase if they predict that e-learning systems will become more useful in enhancing their performance. Hence, practitioners should provide a clearer vision of understanding regarding how e-learning usage will benefit learners. Attitude

is a direct predictor of intention to adopt an e-learning system. Therefore, the intention to adopt and accept e-learning systems could be enhanced by ease of use and usefulness by incorporating the critical external factors that may affect the intention either directly or indirectly.

VI. THEORETICAL AND MANAGERIAL IMPLICATIONS

This study has some theoretical and managerial contribution. Firstly, the TAM is proved to be significant in Pakistan's educational environment like many other developed countries. TAM is widely tested in many developed countries having cultural differences whereas dearth of empirical evidences in the context of developing countries. The results of this study better explained the usage intentions irrespective of the cross-cultural biasness [51]. The present results showed that perceived usefulness and perceived ease of use is the strong predictors of attitude directly and behavior intention indirectly in using e-learning systems. Practitioners and researchers can better suggest new strategies for enhancing the behavior intention of e-learning system usage. The results not only proved the TAM construct but also indicate the effect of external factors on the usage intention.

Government plays important role in providing and ensuring the quality education. To increase the literacy rate in urban areas, GoP should promote electronic education by focusing on infrastructure prior the implementation of e-learning systems. To attract more learners, HEIs should provide the facilities of lab resources to learners for better performance in digital era. Government should provide enough bandwidth to HEIs for delivering multimedia contents. Policy makers and HEIs should highlight the design and expansion of curricula and provide richness of course material to learners. This enhancement increase the learners' capabilities and positively affect the attitude towards use of e-learning systems.

This study validated PEOU and PU as strong predictors of usage intention. Hence, developer are responsible to build a system that is easy to use. System developers and designers should design e-learning systems according to learners' needs. Developers and designers should take into consideration the systems interactivity, response and functionality. The contents of the course are not sufficient to engage learners; rather, the learning materials should be interactive. Moreover, course contents should have audio and visual aid, animated simulation, and videos of experiments to involve learners in the learning contents. The developers and designers should design the system and its interface in a way that is easy to use, which may enhance the intention to accept and adopt e-learning. The response of the system should be fast and consistent to foster learners' intention towards technology usage. The quick response of the system helps to cultivate users' interest in the learning process. The results also illustrate that system features should meet with the users' requirements to increase their adoption and in turn behavioral intention towards e-learning.

VII. LIMITATIONS AND FUTURE RECOMMENDATIONS

Although a rigorous research procedure was adopted in this study, there remain some potential limitations that could be identified and discussed in future studies.

Firstly, the response rate of participants from Sindh, KPK, and Baluchistan provinces was very low. The findings and implications are inferred from the population of Punjab that use e-learning systems. Thus, the generalizability of the findings should be treated with caution due to cross-cultural differences among these provinces.

Secondly, this study focused on learners' intention to adopt an e-learning system, whereas the role of faculty in predicting intention to adopt is equally important. Future studies can incorporate the role of faculty in the adoption of e-learning systems.

Finally, this research is cross-sectional and measured intention at a single point of time. Individuals' perceptions may change over time and this must be noted. Therefore, longitudinal research is required so that evidence would help to enhance the understanding of causality and interrelationships among variables that are critical to the acceptance of e-learning systems in Pakistan.

VIII. CONCLUSION

E-learning helps to enhance the literacy rate of urban and rural users. There is a need to successfully implement e-learning systems in developing countries like Pakistan. This research was conducted to identify the critical factors in e-learning adoption and acceptance in Pakistan. The statistical analysis of the critical factors concluded that computer self-efficacy, internet experience, and enjoyment have a positive and significant influence on ease of use. In addition, system characteristics were found to be significant in influencing ease of use and usefulness. Moreover, computer anxiety and organizational accessibility were found not to be significant. Subjective norm was also found not to be significant for usefulness. This study contributes to identifying and investigating the influential factors of learners' attitudes towards the adoption and acceptance of e-learning systems. The findings of the study provide greater insight into the external factors and provide valuable recommendations for policy makers, practitioners, developers, and designers in successful implementation of e-learning systems.

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