

A Model of Information System Interventions for e-Learning: An Empirical Analysis of Information System Interventions in e-Learner Perceived Satisfaction



Asif Ali and Jaya Bhasin

Abstract Innovations in pedagogy and technology have lead to a new paradigm in teaching particularly in higher education. At the nexus of this new paradigm is blended learning and e-learning. Blended learning refers to combination of synchronous and asynchronous learning activities. While e-learning refers to learning system that utilize electronic means or information communication technology (ICT) to deliver information for education or training purposes. Though in infancy e-learning in India has garnered pace in last decade, introduction of SWAYAM portal for offering massive open online courses (MOOCs) has been an important initiative by Government of India in this direction. The present study conceptualizes various factors of e-Learner Satisfaction into one model. The data for study was collected from students of north Indian universities. A total of 266 responses were recorded out of which 25 responses were eliminated due to incomplete information. Final data analysis was conducted using 241 responses using structural equation modeling (SEM) (Amos 20). From the data, it was observed the constructs (predictors) namely Instructors Attitude, Learners Attitude, Course Quality, Technology Quality, Assessment Quality and Perceived ease of use explained 66.2% variance (adjusted $R^2 = 66.2\%$ and $p < 0.05$) in Perceived e-Learner Satisfaction.

Keywords Information systems · e-Learning · e-Learner Satisfaction

1 Introduction

Innovations in pedagogy and technology have lead to a new paradigm in teaching particularly in higher education. At the nexus of this new paradigm is blended learning and e-learning. Blended learning refers to the combination of synchronous and asynchronous learning activities. Blending learning is an approach to learning in which traditional face-to-face learning is complemented with online learning. The two most

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P. K. Singh et al. (eds.), *Proceedings of ICRIC 2019*, Lecture Notes
in Electrical Engineering 597, https://doi.org/10.1007/978-3-030-29407-6_66

common definitions of blended learning prevalent in literature are (i) combination of online and face-to-face instructions [11 and 23] (ii) combining instructional methods [9, 25].

While e-learning refers to learning system that utilizes electronic means or Internet communication technology (ICT) to deliver information for education or training purposes. e-learning is defined as learning assisted by utilization of digital tools and content that involves interactivity that includes online interaction between teacher and learners or peers [17].

The institutions of eminence (Harvard, MIT) of higher education in world have started to offer most of the courses in online mode with India being no exception [14, 22]. Though in infancy e-learning in India has garnered pace in last decade, introduction of SWAYAM portal for offering massive open online courses (MOOCs) has been an important initiative by Government of India in this direction. e-learning has not remained confined to the higher education industry only; however of late many global organizations have started to incorporate online training modules to employees as part of their overall training programmes [21].

2 Theoretical Framework

e-learning is delivery of education through various electronic media (activities pertinent to instructing, learning, and teaching) [13]. “e-learning is an approach to teaching and learning, representing all or part of the educational model applied, that is based on the use of electronic media and devices as tools for improving access to training, communication and interaction” [24].

e-learning being ubiquitous offers array of benefits to make learning possible any time anywhere at learners convenience as it cuts across the barriers of space and time. Being cost-efficient, it has received a wide acceptance across the world in higher education dissemination [1]. On account of high utility and other benefits, the adoption of e-learning has been on increase with 7% CAGR in last decade. e-learning industry was \$107 Billion in 2015, and it has been forecasted to grow to \$ 325 Billion in 2025 (Forbes, Jul 2018). Despite this high growth, adoption, and success of e-learning, the failures in e-learning do exist [5, 19]. The reasons for such failures can be varied sometimes learner centric other time instructor or environment centric. From the literature, numerous models have been proposed to access the success and adoption of information systems [8, 28]. Among various proposed models, user satisfaction emerges as one of the most important factors for adoption and success of information systems [8]. In e-learning context, various factors have been found associated with user satisfaction. With regard to present research per se, e-learning and blended learning have been used interchangeably. And the factors associated with user satisfaction have been clubbed into six dimensions: Learner, Instructor, Course, Technology, Course Design, and Environment as identified by Sun et al. [26].

3 Research Model and Hypotheses

From simple application software acceptance like spreadsheet applications [16] to complex e-learning [22], various factors in literature have been identified that determine user satisfaction. However, not much attention has been paid to integrate these factors into one framework/model. An attempt in this regard was made by Sun et al. [26]. Drawing inferences from previous studies and using model proposed by Sun et al. [26], the present study uses six dimensions, namely learner, instructor, course, technology, course design, and environment dimensions to access user satisfaction of e-learning. However, a little modification has been done to the model as each dimension is reduced to a factor. The learner dimension takes into account Learners Attitude/impression toward the e-learning activities by usage of computers. A positive attitude toward ICT will result in effective and efficient learning thus more satisfied users/learners [20]. Thus, we hypothesize

H1: Learners Attitude will positively influence Perceived e-Learner Satisfaction.

The Instructor dimension takes into account Instructors Attitude/impression toward the e-learning, and we hypothesize

H2: Instructors Attitude toward e-learning positively influences Perceived e-Learner Satisfaction (Fig. 1).

The course dimension takes into account the e-learning course quality, technology dimension takes into account the technology quality, design dimension takes into account perceived ease of use of e-learning platform, and environment dimension takes into account diversity in assessment (quality of assessment) of e-learning. Thus, we hypothesize

H3: Course quality positively influences Perceived e-Learner Satisfaction.

H4: Technology quality positively influences Perceived e-Learner Satisfaction.

H5: Perceived ease of use of e-learning positively influences Perceived e-Learner Satisfaction.

H6: Diversity in assessment of e-learning positively influences Perceived e-Learner Satisfaction.

The actual simplified model used in the present study is reproduced in Fig. 2.

4 Research Methods

4.1 Instrument Development

Based on the research in the field of information systems and technology adoption, a questionnaire was adopted and modified to measure the various factors of the hypothesized model. The instrument with 30 items under 7 factors was adopted

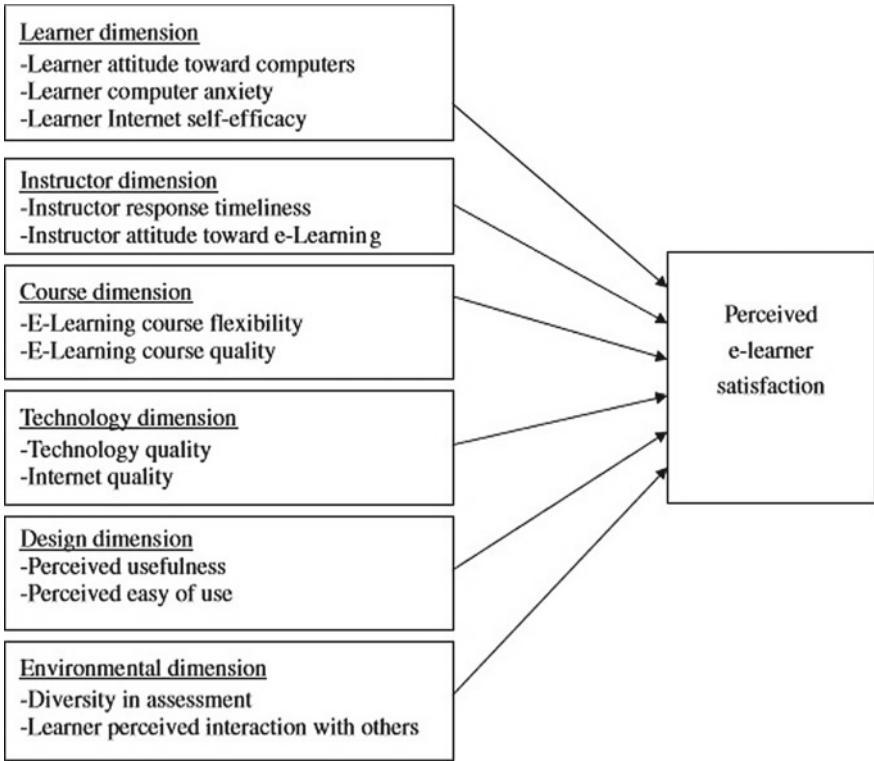


Fig. 1 Dimensions and antecedents of e-learner satisfaction (adapted [26])

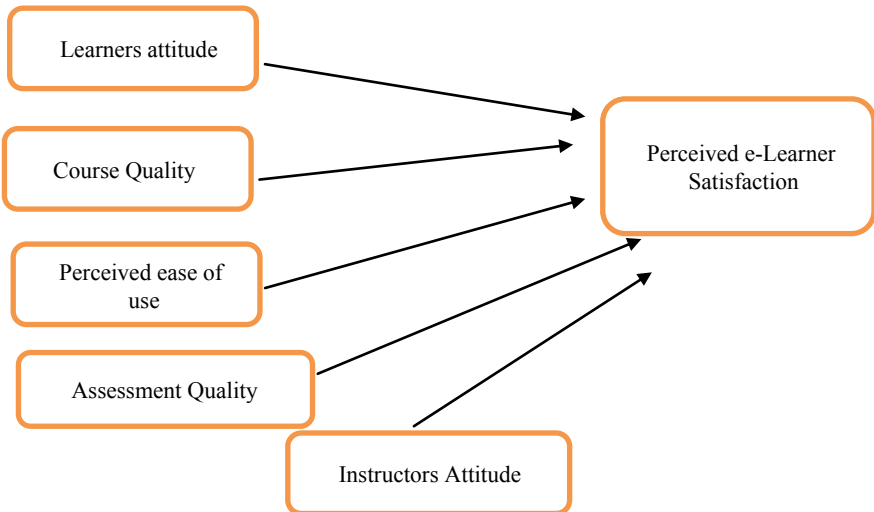


Fig. 2 Simplified proposed research model

from Sun et al. [26] with modification by putting reverse order questions straight-forward and by adding two additional items. The questionnaire consisting of 32 items measured under 7 factors is presented in Table 1 along with the references. Each measurement item on the scale was measured using seven-point Likert scale with (1) representing “very strongly disagree”, (2) representing “strongly disagree”, (3) representing “disagree”, (4) representing “neutral”, (5) representing “agree”, (6) representing “strongly agree” and (7) representing “very strongly agree”. The questionnaire was presented to two experts in information technology and marketing for expert comments and feedback. A pilot study was conducted with 30 postgraduate students with prior experience with e-learning systems.

Table 1 Measurement instrument

Construct	Item	Wording	Reference
Learners Attitude (LA)	LA1	I believe that working with computers...is very easy	Gattiker and Hlavka [10]
	LA2	is not complicated	
	LA3	requires high technical skills	
	LA4	does not give me psychological stress	
	LA5	requires knowledge of programming language such as basic	
	LA6	does not require patience	
	LA7	makes a person more productive at his/her job	
	LA8	is for people of any age	
Instructors Attitude (IA)	IA1	Compared to traditional classrooms, how useful do you think your instructor considers web-based learning	Webster and Hackley [29]
	IA2	Do you feel your instructor is comfortable with use of technology	(Self) Arbaugh [3]
Course Quality (CQ)	CQ1	Conducting the course via the Internet improved the quality of the course compared to other courses	
	CQ2	The quality of the course compared favorably to my other courses	
	CQ3	I feel the quality of the course I took was largely not effected by conducting it via the Internet	
Technology Quality (TQ)		I feel the information technologies used in e-Learning	Amoroso and Cheney [2]
	TQ1	are very easy to use	
	TQ2	have many useful functions	
	TQ3	have good flexibility	
	TQ4	are easy to obtain	

(continued)

Table 1 (continued)

Construct	Item	Wording	Reference
Perceived ease of use (PE)	PE1	Learning to operate an e-Learning system is easy for me	Davis [7]
	PE2	It's easy for me to gain skill to operate e-Learning system	
	PE3	I found e-Learning easy to use	
	PE4	Overall e-Learning is easy to use	
Assessment Quality (AQ)	AQ1	e-Learning course offered a variety of ways of assessing my learning (quizzes, written work, oral presentation, etc.)	Thurmond et al. [27]
	AQ2	I am satisfied with diverse assessment options in e-Learning	
Perceived e-Learner Satisfaction (PS)	PS1	I am satisfied with my decision to take this course via the Internet	(Self) Arbaugh [3]
	PS2	If I had an opportunity to take another course via the Internet, I would gladly do so	
	PS3	My choice to take this course via the Internet was a wise one	
	PS4	I was very satisfied with the course	
	PS5	I feel that this course served my needs well	
	PS6	I will take as many courses via the Internet as I can	
	PS7	I was disappointed with the way this course worked out	
	PS8	If I had it to do over, I would not take this course via the Internet	

4.2 Data Collection

For collecting data, an online survey was developed using online survey tools. The link to survey was emailed to postgraduate students of north Indian universities. The link to survey was also shared in three WhatsApp groups. A total of 275 links to survey were e-mailed. After initial and follow-up round of email, a total of 223 responses were generated. And 43 responses were also obtained from WhatsApp group. Out of the total responses, 25 responses were omitted due to incomplete information. A total of 241 responses (response rate = 87.63%) were put to analysis.

The demographic profile of the respondents is presented in Table 2. Out of total 241 respondents, 100 were females and 141 males with 23 years as an average age, while all the students were attending postgraduate course with most postgraduating students from management background followed by engineering and science background.

Table 2 Demographic profile

Category		Frequency	Percentage
Gender	Male	141	58.51
	Female	100	41.49
	Total	241	100
Age	21–25	210	87.13
	26–30	21	8.71
	>30	10	4.14
	Total	241	100
Course	Management	102	42.32
	Science	41	17.01
	Engineering	75	31.12
	Others	23	9.54
	Total	241	100

Statistical Package for the Social Sciences version 23 (SPSS v.23.0) and Amos (V 20) was used for the statistical analysis in this research. Stepwise regression analysis was used wherein 6 constructs, namely Instructors Attitude, Learners Attitude, Course Quality, Technology Quality, Assessment Quality and Perceived ease of use were used as repressors, and Perceived e-Learner Satisfaction were used as regress.

Kaiser-Meyer-Olkin (KMO) and Bartlett's Tests were used to verify the factorability of the data. KMO and Bartlett's sphericity test results were both significant ($p < 0.001$), and KMO value was found more than threshold (0.92).

5 Data Analysis and Results

5.1 Factor Analysis (Exploratory and Confirmatory Factor Analysis)

For scale development and validation, data was analyzed using two step process. In first step, an exploratory factor analysis was done on data. In exploratory factor analysis, data was subjected to principal component analysis with varimax rotation. All factor loadings above ± 0.50 and with eigenvalues greater than 1 were considered. Item LA5, LA6, PS7, and PS8 had factor loadings less than 0.5 thus were dropped from further analysis. Seven (7) stable factors emerged with least or no cross loadings. Together, these 7 factors explained 65.6% variance (Table 3) in the dependent variable, namely Perceived e-Learner Satisfaction.

Table 3 Exploratory Factor Analysis

	Component						
	1	2	3	4	5	6	7
LA1	0.702						
LA2	0.712						
LA3	0.780						
LA4	0.856						
LA7	0.821						
LA8	0.788						
IA1					0.788		
IA2					0.876		
CQ1							0.703
CQ2							0.653
CQ3							0.683
TQ1						0.724	
TQ2						0.642	
TQ3						0.688	
TQ4						0.768	
PE1		0.752					
PE2		0.732					
PE3		0.658					
PE4		0.742					
AQ1				0.862			
AQ2				0.881			
PS1			0.742				
PS2			0.821				
PS3			0.862				
PS4			0.642				
PS5			0.668				
PS6			0.924				
Eigen value	>1	>1	>1	>1	>1		
Cumulative variance (%)			65.6%				

5.2 *Reliability and Validity*

The instrument developed was shared with experts to improve the face and content validity of instrument. Also, reliability/internal consistency of data was measured using Cronbach's Alpha values for each construct. The Cronbach alpha coefficient of 0.7 or higher suggests high data reliability but a coefficient lower than 0.35 indicates poor reliability [6, 18]. All the values of Cronbach's alpha were found to be more than 0.8 which is higher than the minimum threshold thus indicating high reliability.

The construct validity refers to the extent to which two constructs are separate. Since seven stable constructs emerged in factor analysis using PCA with varimax rotation with all factor loads on the respective construct more than 0.6, the constructs thus exhibit convergent validity [12]. The discriminatory validity has been verified by checking the correlation between different constructs. In none of the cases, correlation greater than 0.85 between constructs was reported, indicating discriminating validity among the constructs.

5.3 *Structural Model and Hypotheses Testing*

To test the hypothesized research model among various constructs, regression analysis was performed to determine casual relations. Among the demographic variables namely gender, age, and course, no significant differences or correlations with dependent variable namely Perceived e-Learner Satisfaction were found; thus, demographic variables were not considered for further analysis. For regression analysis, six variables namely Instructors Attitude, Learners Attitude, Course Quality, Technology Quality, Assessment Quality and Perceived ease of use were used as independent variables (repressors), and Perceived e-Learner Satisfaction was used as dependent variables (regress).

For testing proposed hypothesized model, structural equation modeling (SEM) has been used as our sample size was greater than 200 respondents [15]. SEM Amos 20 with maximum likelihood method was used for model estimation. The various structural model indices results are shown in Fig. 3. The various model fit indices found are NFI = 0.954, GFI = 0.966, CFI = 0.921, AGFI = 0.942, RMSEA = 0.052, RMR = 0.031. With all good fitness indices above 0.9 in model [4], thus these path coefficients (standardized) can be used to test hypotheses.

Among the proposed hypotheses after testing, following hypotheses were found significant among various constructs. Learners Attitude was found significantly effecting Perceived e-Learner Satisfaction (H1). Instructors Attitude was found significantly effecting Perceived e-Learner Satisfaction (H2). Course quality was found significantly effecting Perceived e-Learner Satisfaction (H3). Technology quality was found significantly effecting Perceived e-Learner Satisfaction (H4). Perceived ease of use of e-learning was found significantly effecting Perceived e-Learner Satisfaction (H5). Diversity in assessment of e-learning was found significantly effecting

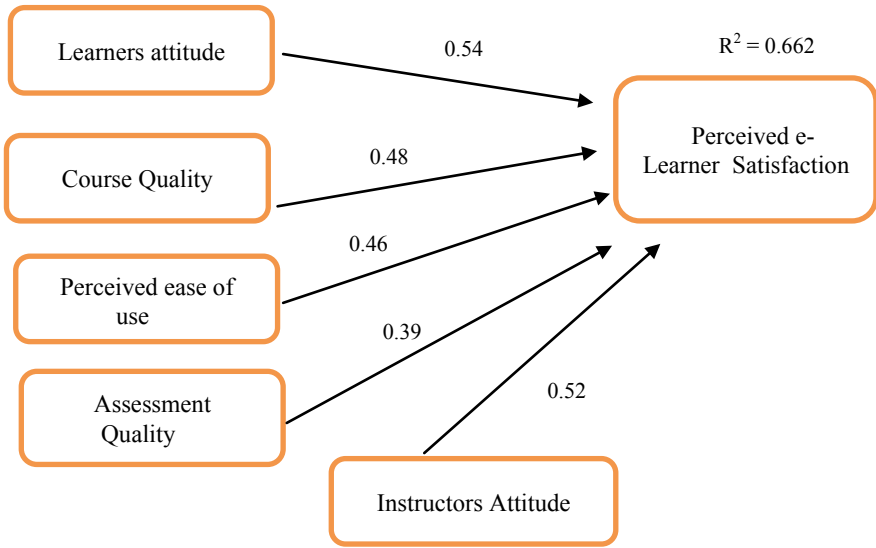


Fig. 3 Structural model testing results ($p < 0.001$ in all relationships)

Perceived e-Learner Satisfaction (H6). The constructs (predictors) namely Instructors Attitude, Learners Attitude, Course Quality, Technology Quality, Assessment Quality, and Perceived ease of use explained 66.2% variance (Adjusted $R^2 = 66.2\%$ and $p < 0.05$) in Perceived e-Learner Satisfaction. The hypotheses results are enumerated in Table 4.

Table 4 Hypotheses results

Relationship	Hypotheses	Results
LA-PS	Technical Support is positively associated with Perceived usefulness	H1: Supported
IA-PS	Technical Support is positively associated with Perceived ease of use	H2: Supported
CQ-PS	Perceived ease of use is positively associated with Perceived usefulness	H3: Supported
TQ-PS	Perceived ease of use is positively associated with Attitude toward use	H4: Supported
PE-PS	Perceived usefulness is positively associated with Attitude toward use	H5: Supported
AQ-PS	Perceived usefulness is positively associated with Intention to use	H6: Supported

6 Discussion and Implications

In present-day times, it has become important for educationists to impart or complement traditional learning with electronic media (e-learning) as it cuts across the time and space barriers. This present study tries to examine various factors that lead to students satisfaction by use of e-learning systems for knowledge dissemination or acquisition. All the hypotheses proposed in study were verified to be true. From the model, it can be observed that all the six proposed predictors namely Instructors Attitude, Learners Attitude, Course Quality, Technology Quality, Assessment Quality and Perceived ease of use have a significant positive influence on Perceived e-Learner Satisfaction. The results indicate good model fit indices with predictors explaining 66.2% variance in Perceived e-Learner Satisfaction. The prediction formula for the proposed model is presented under

$$PS = LA(w1) + IA(w2) + CQ(w3) + TQ(w4) + PE(w5) + AQ(w6).$$

In the above formula, PS stands for Perceived e-Learner Satisfaction, IA stands for Instructors Attitude, LA stands for Learners Attitude, CQ stands for Course Quality, TQ stands Technology Quality, AQ stands for Assessment Quality, and PE stands Perceived ease of use where as $w1$, $w2$, $w3$, $w4$, $w5$, and $w6$ are empirical weights.

6.1 Limitations and Implications for Future Research

This research makes a careful attempt to integrate various factors that influence Perceived e-Learner Satisfaction reported in literature into one model. Still, the proposed model may not be the comprehensive model to explain perceived satisfaction due to time, budget, and other resource constraint. The study identifies only single factor as dependent variable and measures it subjectively only, some objective measures like student score may be used in future research. The present study uses SEM for analysis in future study other tools like (stepwise regression, LISERL, PLS) and variance in results if any can be examined. Further, the other limitation of the study includes data which was collected from north Indian universities only which makes generalization of study little difficult. A cross-cultural study across continents may also be conducted that can highlight impact of culture in e-Learner satisfaction.

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