

Empirical Study on Predictors of Student Learning Satisfaction from Web Based Learning Systems

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Abstract— This paper studies the factors that may influence students' web-based learning satisfaction. The aim of this study is to analyze the e-learning system quality, usefulness, and its impact on satisfaction level and effective-learning outcomes among students. This study was conducted at ICFAI Business School - Gurgaon, Haryana, India with MOODLE E-learning system. The stratified random sampling technique was used to select 174 samples out of 1100 population to administrate the questionnaire. This is exploratory empirical study based on primary data through administration of questionnaire with twenty one statements and five statements for background information and the responses are close ended with 4 point Likert scale. The findings indicated that the satisfaction level of students depends on effective-learning enabled by e-learning system. The results also indicate effective-learning is dependent on system usefulness and system quality. The findings of this study will help the educational institute to design the e-learning system with its best features and implement them in such a way that the end user gets the maximum benefit out of it. This study predicts that system quality, interactive sessions, flexibility, ease of use, enhanced learning curves, need of learning, accomplishments, self esteem of learners, social influence have impact on satisfaction level of learners.

Key Terms— Effective-learning, System usefulness, System Quality, Learning Satisfaction, e-learning

I. INTRODUCTION

Web-based resources or e-learning tools empower students with user friendly and flexible-learning platform. In the current decade a lot of usability issues in e-learning have been investigated by researchers and the findings help to design better e-learning systems. e-learning is the use of various technological tools that are either Web-based, Web-distributed or Web capable for the purposes of education. This technology when adapted and customized according to the end user convenience, a Learning Management System (LMS) is formed. LMS is a collection of e-learning tools available through a shared administrative interface. It can be thought as the platform in which online courses or online components of courses are assembled and used from [10].

A. E-learning System

Information and communication technologies (ICT) offer educators and learners an innovative-learning environment that can stimulate the teaching and learning process. In this

research, we conducted an empirical study using the MOODLE 2.0 and other e-learning tools like you tube, Wikipedia, Cloud technology. MOODLE provides learning information related to the course in the form of PowerPoint slides, MS Word, Acrobat PDF, documents, hypermedia and multimedia files. The discussion forums and chat boxes help interactive knowledge sharing. Assignments and quiz evaluations offer feedback for improvement of learners. MOODLE users are also provided free Cloud storage space for learning resources up to 2 GB using Drop box, 5 GB using Box.net, 5 GB using Google document sharing etc. The success of any system implication depends on the satisfaction level of the end user. Thus, this paper measures the student's satisfaction level from web based resources and e-learning tools. The understanding of satisfaction is important to improve the interface usability of the e-learning tool like clarity of design, interaction with instructors and active discussion in the context of course. The need of learning, acceptance and usage of technology, academic results from e-learning are related to Maslow's Hierarchy of Need [18] and Unified Theory of Acceptance and Use of Technology (UTAUT) [20].

B. System Usefulness

Usefulness of an e-learning system is defined as the degree of usage of the Web based resources and e-learning tools for fulfillment of learners' objectives. Usefulness depends on the facilities provided to learners over and above the traditional learning resources. The variety of contents available on particular subject, easy presentation of information, fast search engine, and storage capacity available free on web such as Drop box, Box.net, icloud etc, are the sub factors which lead to usefulness of e-learning platform. The virtual classroom features, real-time feedback, use of multimedia/videos all add to the overall usefulness of web based systems for learning. Students' use of computers and internet depends on their perceived usefulness in terms of communication and access to information in completing their projects and assignments [3].

C. Quality of system

The quality of a system is the degree to which it meets the user's expectations. According to ISO 9000 [15] Quality of a system is "degree to which a set of inherent characteristics fulfills requirements." The standard defines requirement as a need or expectation. Learner's satisfaction with quality of web based learning resources depends upon flexibility of use and authority to choose which topic or session to learn and

content of current information given to make themselves more competitive. “Interactive” web enhanced courses that promote direct contact between the instructor and students, thereby facilitating discussions and real time interactions, may be the key to insuring student satisfaction. The use of chat rooms, instant messaging, and discussion forums may assist in providing students with the interaction they would otherwise receive in a traditional classroom experience [4].

D. Effective-learning

Effective-learning is the process of knowledge generation in collaborative environment. It involves the following factors

- Knowledge sharing,
- Application of knowledge to strategies
- greater understanding of complex subjects
- action oriented approach to achieve goals
- increased learner engagement
- self motivation to learn
- Learning curve [17] enhancement by more positive emotions and affiliation to learning
- interactive knowledge community

Effective-learning is defined as [8] collaborative-learning to understand and enhance knowledge by multiple routes, which is supported by this study. Students need a platform for learning which can help them to stay update with current changes. Web based course effective-learning is supported by enhancing course flexibility, variety of content and participant interaction and collaboration [1].

Learning combines cognitive, emotional, and environmental influences and experiences for acquiring and enhancing knowledge, skills, values, and world views. Learning theories (Pavlov, 1903 & Skinner, 1938) supports the same concept and highlight the way in which information is absorbed, processed, and retained through conditioning and reinforcement. Classical conditioning (Pavlov, 1903) is a reflexive or automatic type of learning. So the e-learning tools conditioned among the students to evoke academic excellence and effective-learning like traditional learning systems. Operant Conditioning (Skinner, 1938) can be described as a process in e-learning that attempts to modify effective-learning behavior through the use of positive reinforcement like interaction, instant feedback, results and negative reinforcement like incompetency in using e-learning tools, lack of performance leading to lesser academic achievements.

E. Learning Satisfaction

Satisfaction is the feeling of a user on achieving the desired output from the use of any product or service. Learning Satisfaction is based on Quality of e-learning system and its usefulness to fulfill the need of the students to further enhance their effective learning. Earlier studies [1] recommend the increased use of a variety of media on course websites and claims that the posting of course materials in a variety of formats enhances the web-based course experience and thus, satisfaction.

Previous studies on e-learning suggest that the learner’s behavioural intention of using e-learning system depends on learning satisfaction derived from system usefulness and quality [9].

The learning Curve theory [17] -Learning Curve Theory or Experience Curve Theory is defined as learning curve is a graphical representation of the changing rate of learning (in the average person) for a given activity or tool. The effective-learning with use of web based learning resources and e-learning tools is affected by individual diversity and difference in age groups, experience, perception of students thus creating different learning curves.

The proposed e-learning system model for students’ learning satisfaction in figure 1 indicates that usefulness and quality of system, effective-learning are used as independent variables of study which affect student satisfaction levels. The-learning curve depends on individual diversities of students and their level of effective-learning which is also a factor for student satisfaction.

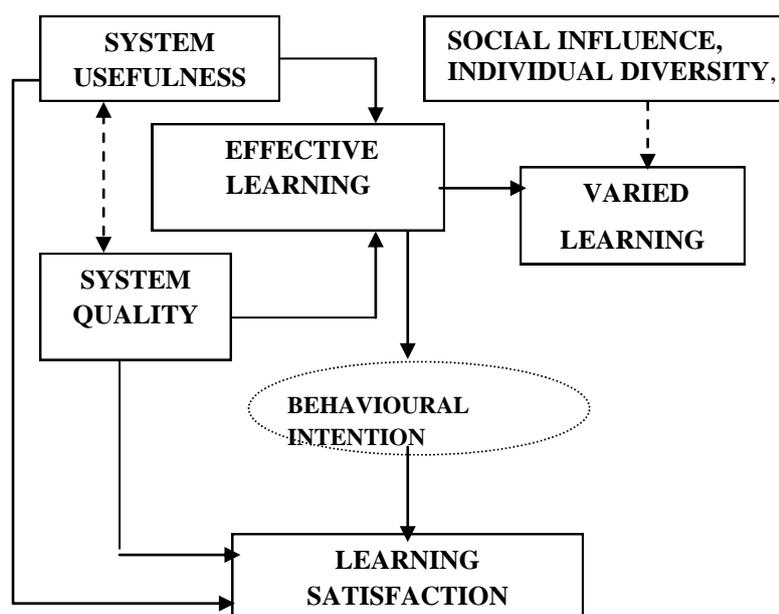


Figure 1 e-learning system model for students’ learning

F. Academical Application on E-learning Satisfaction

This paper proposes application of standard theories of Maslow’s Hierarchy of Needs [18], Figure 2, Unified theory of acceptance and use of technology (UTAUT) [20] to the students’ use of web based resources and e-learning tools. The application is discussed below

1. Maslow’s Hierarchy of needs in context of e-learning is explained by mapping in table I and figure 2.
2. UTAUT theory in e-learning context is explained by mapping in table II and figure 3

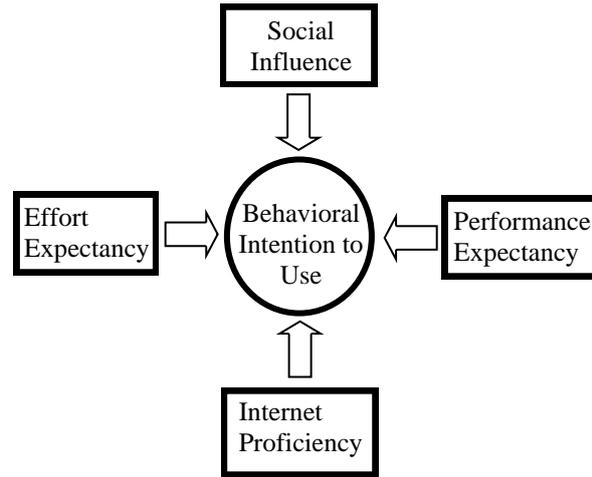
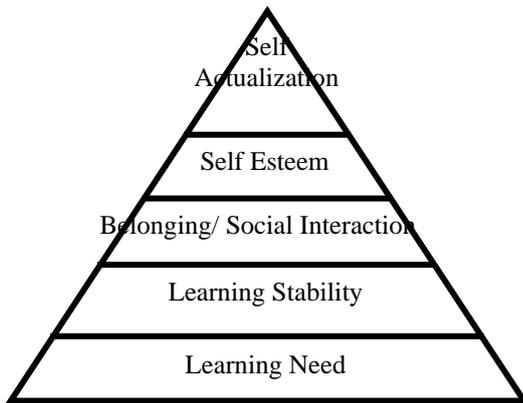


Figure 2: Maslow’s Need Theory Application

Figure 3: UTAUT Theory Application

Maslow’s Need	Learning Need	Academic Application
Self Actualization	Competency and accomplishments	Experience, Realizing competency, Accomplishments, Academic results
Self Esteem	Self confidence	Effective-learning, confidence to use boosts self esteem among peers
Belonging Need	Social interaction	Idea sharing ,Interaction, social influence on Learning curve through chats, forums
stability Need	Learning stability	Current knowledge updating, No fear of lagging in knowledge from peers
Physiological Need	Learning Need	Basic Need of Learning for students

Note: The need of learning, learning stability ,academic excellence, idea sharing, self confidence, competency provided by web based and e-learning tools facilitate effective-learning and hence satisfaction in students in a competitive educational environment.

Table I Application of Maslow’s need hierarchy

Theory	Academic Application
Behavioural Intention	Satisfaction with Quality, ease of use, Flexibility, Technology proficiency leads to behavioural intention to use Web based learning resources.
Social Influence	Interactivity leads to motivation from peers to use E-learning, knowledge sharing
Internet proficiency	Students familiarity with technology influences frequency of use of E-learning systems
Performance expectancy	Academic results, accomplishments in learning, Learning curve
Effort expectancy	Ease of use, variety of content available in few clicks

Note: Satisfaction with quality, ease of use, flexibility, technology proficiency leads to behavioural intention to use Web based learning resources.

Table II Application of UTAUT in e-learning

II. LITERATURE REVIEW

Academic findings in relation with E-learning technology and satisfaction level from previous research studies are listed in table III. Earlier research studies have analyzed impact on satisfaction based on Technology acceptance model only but our paper relates the need of learning to use of web based resources .The earlier studies have measured satisfaction in terms of usefulness, user proficiency, ease

of use, flexibility, variety of content but in comparison factors of satisfaction with e-learning systems predicted by our study are indicative of Effective-learning, usefulness, Quality of system which include interactive features, pedagogical characteristics, technical proficiency, technology acceptance, content quality, variety, flexibility of use, cost effectiveness, storage.

Authors	Findings	Variable studied	Gap Analyzed
Lemos and Pedro, 2012	This paper finds satisfaction of students affected by methodologies of learning, evaluations, course design , faculty ,technology	Independent Variable <ul style="list-style-type: none"> • course design& resource • faculty and tutor • learning methodologies • evaluation system • technological infrastructures Dependent Variable <ul style="list-style-type: none"> • Satisfaction 	The outcomes only include satisfaction and not successful implementation. However effective-learning is not considered for the dimensions of outcomes.
Šumak, et.al., 2011	The results of the analysis that the MOODLE use depends on two main factors: behavioural intentions and attitudes toward using MOODLE.	Independent Variable <ul style="list-style-type: none"> • Perceived Usefulness • Perceived Ease of Use • Behavioural Intention • Attitude Toward Using Dependent Variable <ul style="list-style-type: none"> • Actual Use 	The study is based on perceived and actual usefulness. Behavior Intentions are not gratified as satisfaction etc.
Teo, 2010	The findings of this study have the potential to help educators and researchers to be aware of the key drivers and their antecedents and how these interact to explain users' satisfaction.	Independent Variable <ul style="list-style-type: none"> • Tutor quality • Perceived usefulness • course delivery • Facilitating conditions Dependent Variable <ul style="list-style-type: none"> • Satisfaction 	The study is not based on effective-learning material for learning effectiveness.
Paechter et.al., 2010	Two aspects were considered are-learning achievements and course satisfaction.	Independent Variable <ul style="list-style-type: none"> • Flexibility Structure • Tutor expertise support • Motivation • Communication knowledge Dependent Variable <ul style="list-style-type: none"> • Satisfaction&Competency 	This study in addition supports the effect of content, pedagogy, interactivity, and multimedia, internet proficiency on satisfaction, usefulness and Quality of E-learning system.
Daneshgar et.al., 2010	The key finding is that Internet self-efficacy and Internet quality have lesser impact on learner's satisfaction. Satisfaction is more dependent on usefulness and attitude, flexibility, Quality of System.	Independent Variable <ul style="list-style-type: none"> • Computing Attitude, • Internet Self-Efficacy, • Course Flexibility, • Course Quality, • Technology Quality, • Diversity in Assessment • Perceived Usefulness. Dependent Variable <ul style="list-style-type: none"> • Perceived e-Learner Satisfaction 	Supporting the results of this study our paper also applies various theories to satisfaction and attitudes of students with E-learning based on Effective-learning.
Lau and Woods, 2009	This study contributes to the understanding of user acceptance of learning objects. Both perceived usefulness and perceived ease of use was found as significant	Independent Variable <ul style="list-style-type: none"> • Technical • Quality Content • Pedagogical • Self-Efficacy 	Our study supports Maslow's need theory and also relate E-learning Variables studied with Need to use E-learning.

	determinants.	<ul style="list-style-type: none"> • Internet Experience • Perceived Usefulness • Behavioural Intention <p>Dependent Variable</p> <ul style="list-style-type: none"> • Actual Use 	
Jong, and Wang, 2009	This paper finds that Performance expectancy, attitude toward using technology, facilitating conditions, self-efficacy, and social influence have significant influence on behaviour intention. Additionally, only behaviour intentions, attitude toward using technology, and social influence have direct impact on system usage.	<p>Independent Variable</p> <ul style="list-style-type: none"> • Performance Expectancy • Facilitating conditions • Attitude • Self-efficiency • Anxiety • Social Influence <p>Dependent Variable</p> <ul style="list-style-type: none"> • System Usage • Behavioural intention to use 	This study analyzes effect of social influence on use of E-learning system supported by application of Maslow's Theory.
Liaw, 2008	This study demonstrates perceived satisfaction and usefulness correlates with more behavioral intention among learners..	<p>Independent Variable</p> <ul style="list-style-type: none"> • Perceived satisfaction • Perceived usefulness • Behavioral intention • E-learning electiveness <p>Dependent Variable</p> <ul style="list-style-type: none"> • Perceived self-efficacy • E-learning system quality • Multimedia instruction • Interactive-learning activities 	Effective-learning and is study on the basis of Information Process Theory.
Sun et.al., 2008	The results revealed that learner computer anxiety, instructor attitude toward e-learning, e-learning course flexibility, e-learning course quality, perceived usefulness, perceived ease of use, and diversity in assessments are the critical factors affecting learners' perceived satisfaction	<p>Independent Variable</p> <ul style="list-style-type: none"> • Learner attitude • Learner computer anxiety • Learner Internet self-efficacy • Instructor response timelines • Instructor attitudes • E-learning course flexibility • E-learning course quality • Learner perceived usefulness of the e-learning system • Diversity in assessment • Learner perceived interaction with others <p>Dependent Variable</p> <p>Perceived e-learner satisfaction</p>	Our study relates satisfaction with Need to use E-learning which is affected by effective-learning materials.
Razzaq and Heffernan, 2008	The results aimed to help in developing adaptive web based learning systems. Presentation of information and interaction benefited students regardless of proficiency.	<p>Independent Variable</p> <ul style="list-style-type: none"> • Active/Passive interaction • Proficiency • Presentation of information <p>Dependent Variable</p> <ul style="list-style-type: none"> • Benefits from E-learning System to students 	This study discusses the benefits of E-learning depending on usability and quality assurance of e-learning tools.

Table III Literature Review

III. Research Approach

A. Statement of Research

The satisfaction of the learner is inevitable for successful implementation of web-based educational environment. This paper studies the factors influencing students' web-based learning satisfaction.

B. Objectives

i) To analyze the factors that influence student learning satisfaction from web based resources and e-learning tools.

ii) To understand the levels of satisfaction of student from web based resources and e-learning tools.

iii) To study the need of learning, motivation for e-learning and behavioural intention to use E-learning for

Sustained competitive advantage and accomplishments by students

iv) To analyze the usefulness and quality standards for e-learning of higher educational institute so as to design best interface for students' effective-learning.

v) To suggest improvements to system designers and mentors based on the indicators of satisfaction level and academic achievement of students.

C. Hypothesis

H1 – System quality and System usefulness of e-learning system and web based resources are significantly correlated to each other.

H2 - System quality of e-learning system is a significant predictor of the effective-learning of students.

H3- System usefulness of e-learning system is a significant predictor of the effective-learning of students

H4 - System quality of e-learning system is a significant predictor of the Students' Learning Satisfaction.

H5- System usefulness of e-learning system is a significant predictor of the Students' Learning Satisfaction.

H6 - The Effective-learning leads to behavioral intention of using e-learning system and learning satisfaction.

H7 – Varied learning curves depend on level of effective-learning of the samples.

H8- The learning curves of students varies according to individual diversities in age, gender, internet proficiency and awareness of e-learning systems.

D. Field of study

This study was conducted at ICFAI Business School - Gurgaon, Haryana, India. This campus is administrated by The Institute of Chartered Financial Analysts of India (ICFAI) established in 1984 as a not-for-profit educational society in Andhra Pradesh, India. The institution has been offering quality education to students across the country through its various programs in the field of higher education. The institution was founded by pioneers in private education – late sri N.J. Yasaswy. With the sponsoring and establishment of eleven universities across the country, the ICFAI group today has a good national presence.

Recently the ICFAI B-School has implemented MOODLE (2.0) for enhancing teaching and learning effectiveness, where both senior and junior students are using E-learning system as their primary learning assistance. The new E-learning system went live on 27 May 2012.

E. Sampling

The institute has approximately 1100 students during the year 2012 at Gurgaon campus, Haryana (India). The stratified random sampling technique was used to select 200 samples from both senior (70 students) and junior (130 students) batches including boys and girls to administrate the questionnaire. 26 students' questionnaire was not usable. The responses from 174 students were used for final analysis.

F. Research Procedure

This is exploratory empirical study based on primary data and supported by secondary data. The satisfaction attitude is quantified through application of 4 point likert scale. The 4 point likert scale (from 0=Don't know to 3=Absolutely true) was used to rate participants responses for 21 close ended questions covering users satisfaction, technology usefulness, effective-learning, quality of E-learning system. The scale includes a "Don't know" response because it will help to analyze the percentage of student population who are not familiar with any features of the E-learning system which affects their usage of web based learning and in turn the satisfaction from web based learning resources and E-learning tool. We excluded "Not True" scale response item because the E-learning system has been implemented at the ICFAI Business School, India as the primary tool of learning and so it is assumed to be essential and mandatory part of education system for all the students.

The tools used for data collection

i) Observation- Direct observation used to assess ease, frequency of accessing online resources, differences in student learning after use of MOODLE and other internet resources.

ii) Questionnaire- The questionnaire contains 21 items with close ended questions for analyzing independent variable and 4 items for background information to understand the accessibility and the awareness about E-learning systems value for learning support.

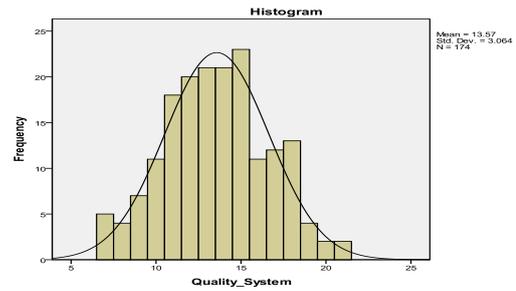
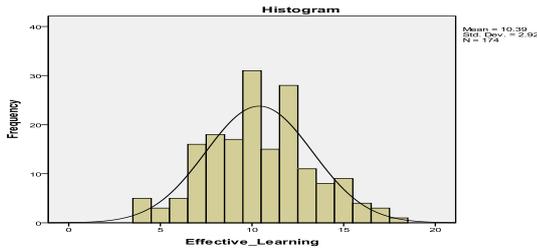
G. Research Analysis

SPSS tool was used to analyze primary data for reliability, frequencies, correlation coefficients, regression, Factor Analysis. Cronbach's alpha is used to establish reliability of research questionnaire. Mean, Median, Mode values indicate the response values scattering. Standard deviation indicates degree of deviation of variables. PCA is used to understand the predictors significant to satisfaction from e-learning and numerically related to predictor variables. ANOVA (Analysis of Variance) is used to see an association between satisfaction and each predictor variable.

IV. Results

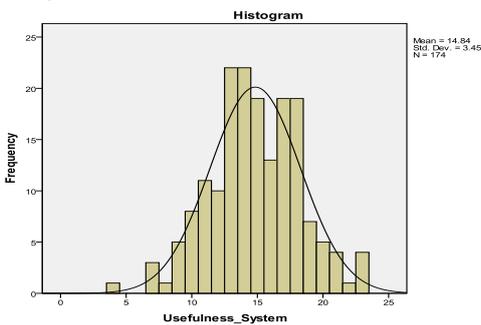
i) Reliability Statistics – Effective Learning:

Based on the students responses, the variables that indicate the 'Effective Learning' Factor from web based resources and e-learning tools are 'frequency of use', 'resources in different formats on a single platform', 'content effectiveness', 'added value as compared to traditional resources', 'current knowledge updation', and 'motivation for self learning'. The Cronbach's alpha for the Factor 'Effective Learning' is .760. It signifies that the instrument of measurement is reliable and there is consistency in variables that measure effective learning. The deviation in the responses is not so varied, assuming the items are standardized. The histogram indicated the probability distribution of frequency against weight-age of the E-learning Factor (Including contribution of all the variables under this Factor). These relative frequencies are normally distributed.



ii) Reliability Statistics – System Usefulness:

Based on students responses variables that indicate ‘System Usefulness’ factor of web based resources and e-learning tools are ‘variety of content’, ‘virtual classroom facility’, ‘instant feedback’ that helps in learners improvement, ‘automated web environment’, ‘multimedia content’, ‘cost effectiveness’, ‘mutual learning process’ between teacher-learner, ‘free storage capacity’ through cloud technology. The Cronbach’s alpha for the Factor ‘System Usefulness’ is .703. It signifies that the instrument of measurement is reliable and there is consistency in variables that measure System Usefulness. The deviation in the responses is not so varied, assuming the items are standardized. The histogram indicated the probability distribution of frequency against weight-age of the System Usefulness Factor (Including contribution of all the variables under this Factor). These relative frequencies are normally distributed.



iii) Reliability Statistics – System Quality:

Based on students responses variables that indicate System Quality factor for web based resources and e-learning tools are ‘interactive sessions’, ‘knowledge sharing’, ‘forum discussions’, ‘flexibility’ in time, location and content of learning, ‘easy to use interface’, ‘equal opportunities of learning’ irrespective of individual diversity. The Cronbach’s alpha for the Factor ‘System Quality’ is .673. It signifies that the instrument of measurement is reliable and there is consistency in variables that measure system quality. The deviation in the responses is not so varied, assuming the items are standardized. The histogram indicated the probability distribution of frequency against weight-age of the System Quality factor (Including contribution of all the variables under this Factor). These relative frequencies are normally distributed.

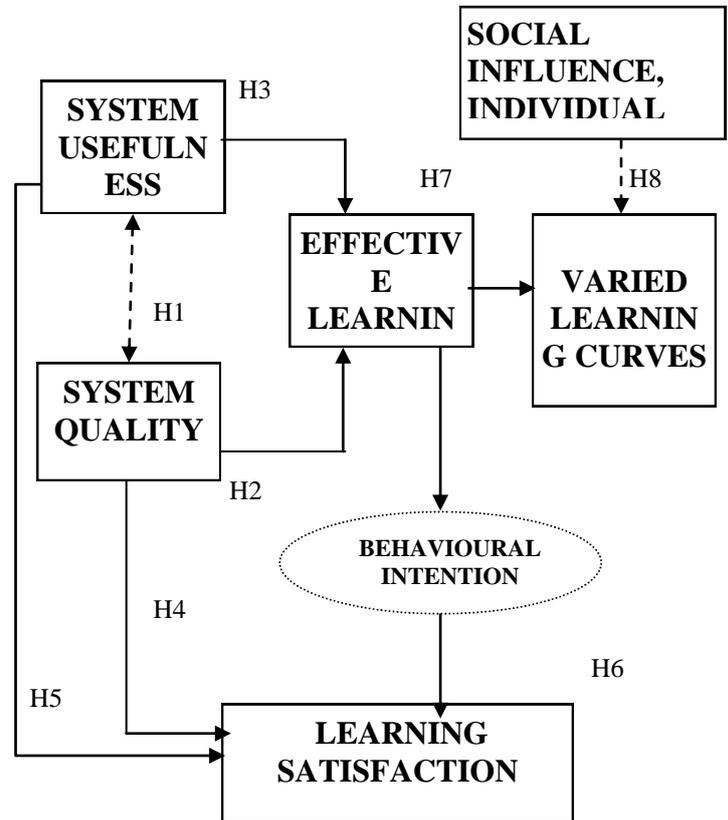


Fig 6 e-learning system model

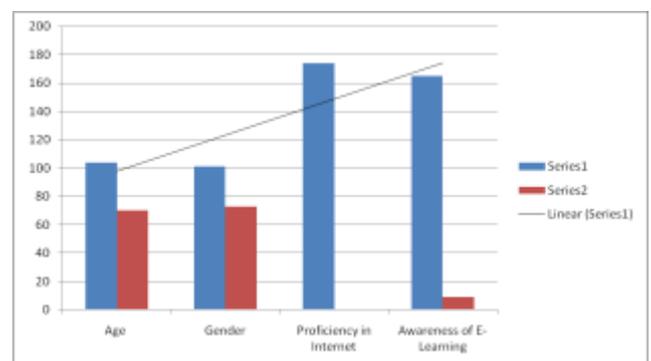


Table XVI Learning Curve

Table IV Statistical Description

Variables	Mean(N=174)	Median	Mode	SD	Standard Error of Mean
Effective Learning	10.39	10.0	10	2.920	.221
System Usefulness	14.84	15.0	13(a)	3.450	.262
System Quality	13.57	14.0	15	3.064	.232

Table V KMO and Bartlett's Test (a)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy			.708
Bartlett's Test of Sphericity	Approx. Chi-Square	196.280	
	df	3	
	Sig.	.000	

Table VI Principal Component Analysis

	Raw		Rescaled	
	Initial	Extraction	Initial	Extraction
Effective_Learning	8.528	5.464	1.000	.641
Usefulness_Pedagogy	11.905	9.571	1.000	.804
Quality_Elearning_System	9.390	7.305	1.000	.778

Note: Extraction Method: Principal Component Analysis

Table VII Total Variance Explained

	Component	Initial Eigenvalues(a)			Extraction Sums of Squared Loadings		
		Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
Raw	1	22.340	74.908	74.908	22.340	74.908	74.908
	2	4.407	14.777	89.685			
	3	3.076	10.315	100.000			
Rescaled	1	22.340	74.908	74.908	2.223	74.086	74.086
	2	4.407	14.777	89.685			
	3	3.076	10.315	100.000			

Note: Extraction Method: Principal Component Analysis.

a When analyzing a covariance matrix, the initial eigenvalues are the same across the raw and rescaled solution.

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

Table VIII Correlation Matrix

Variables	Effective-learning	Usefulness	Quality of system
Effective-learning	1		
Usefulness	.554**	1	
Quality of system	.621**	.673**	1

** Correlation is significant at the 0.01 level (1-tailed).

Discriminant Analysis**Table IX Classification Results (a)**

	Satisfaction	Predicted Group Membership		Total
		1	2	
		Original Count	100	
	2	60	62	
%	89.3	10.7	100.0	
	3.2	96.8	100.0	

Note: a 92.0% of original grouped cases correctly classified.

Summary of Canonical Discriminant Functions**Table X Eigenvalues**

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	1.404(a)	100.0	100.0	.764

Note: a First 1 canonical discriminant functions were used in the analysis.

Table XI (a) Wilks' Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	.416	149.559	3	.000

Table XI (b) Wilks' Lambda for Independent variables

Characteristics	Wilks' Lambda	Sig.
Effective_Learning	.537	.000
Usefulness_System	.452	.000
Quality_System	.416	.000

Table XII Standardized Canonical Discriminant Function Coefficients

Characteristics	Function 1
Effective_Learning	.396
Usefulness_System	.524
Quality_System	.424

Table XIII Structure Matrix

Characteristics	Function 1
Usefulness_System	.783
Quality_System	.770
Effective_Learning	.665

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions Variables ordered by absolute size of correlation within function.

Table XIV Canonical Discriminant Function Coefficients

Characteristics	Function 1
Effective_Learning	.172
Usefulness_System	.207
Quality_System	.187
(Constant)	-7.387

Unstandardized coefficients

Mathematical form of discriminant analysis model

$$Y = b_0 + b_1 X_1 + b_2 X_2 + \dots + b_k X_k$$

Where, Y = Discriminant Score of dependent variable

X_k = Independent or predictor variables

b_k = coefficients of independent predictor variables

Where

X_1 = Effective Learning

X_2 = System Usefulness

X_3 = System Quality

$$\text{Discriminant Function (Y)} = -7.387 + 0.172 X_1 + 0.207 X_2 + 0.187 X_3$$

Table XV Functions at Group Centroids

Satisfaction	Function 1
1 (Yes)	.877
2 (No)	-1.583

Unstandardized canonical discriminant functions evaluated at group means

V. Findings and Discussion

Table IV indicates values of various descriptive statistical measures. The Mean of Effective-learning, System Quality, and System Usefulness indicate the average value of total samples. The Median is very close to Mean values for all variables. The standard error of mean value is minimum for Effective learning (.221) indicating it to be most consistent variable. Standard deviation for Effective learning (2.920) is lesser than Standard deviation values for System Quality and System usefulness indicating that Effective learning has the least variance with data points very close to the average.

The KMO value (0.708 as per Table V) shows that the degree of common variance among the variables is quite high; therefore the sample is adequate enough to conduct the factor analysis. Bartlett's test of sphericity indicates that correlation coefficient matrix is significant as p value is 0.000 which is less than 0.05 (assumed level of significance). Table VI indicates that the variables of

Effective-learning, System Quality, System Usefulness have the communalities greater than 0.5. The principal component analysis indicates that the three variables have significant portion of the variance that contributes to the learning satisfaction. The communality is the sum of squares of the loadings of the variable. Therefore, the three variables can be taken in for factor analysis. As per results indicated in table VII the total variance explained by the first two factors is approximately 89% of the total variance using Varimax rotation with Kaiser Normalization. The third factor contributes only 10% of variance to the output. Correlation Table VIII indicates that the Effective-learning and System Usefulness are significantly correlated (significant at 0.01 levels) with value of .554** and thus it can be inferred that students perception about usefulness of e-learning impacts their behavioural intentions to use e-learning to gain effective learning. It indicates that higher the System Usefulness of e-learning for students', higher the effective learning for students.

Also the Effective-learning and System Quality are significantly correlated (significant at 0.01 levels) with value of .621** and thus it can be inferred that students perception about Quality of e-learning impacts their behavioural intentions to use e-learning to gain effective learning. It indicates that higher the System Quality of e-learning for students' higher is the effective learning for students. The System Usefulness and System Quality of system are positively correlated and significant at 0.01 levels with value of .673**. It indicates that higher the System Quality more is the System Usefulness of e-learning tools and web based resources and they are the two correlated predictors of the effective-learning.

Effective-learning leads to behavioural intention of using e-learning and learning satisfaction, so the System Usefulness and quality are indirectly predicting learning satisfaction of students.

Discriminant analysis is used to discriminate between two naturally occurring groups of Satisfied and Unsatisfied students. From Table IX the discriminant analysis indicates that 112 students out of the total sample size 174 are satisfied from the e-learning tools and web based resources and 62 students have indicated that they are not satisfied from the use of e-learning and web based learning resources. The reliability of the classification is 92.0%. Eigen value of the discriminant function as per Table X is 1.404 with 100 percent variation explained for learning satisfaction of students from e-learning tools and web based resources. The canonical correlation between discriminant score and corresponding respondent values (satisfied/unsatisfied students) is 0.764. From Table XI(a) the Wilks' lambda value 0.416 lies close to zero indicating significance of the discriminant function. The chi-squared transformed statistic is 149.559 and degree of freedom is 3 indicating the number of predictor variables. The p value is .000 which shows that discriminant function is significant. Wilks' lambda is minimized at each step as number of variables included increase as per table XI(b) for Effective Learning, System Usefulness and System Quality.

From Table XII it is inferred that the standardized discriminant coefficients indicate variable System

Usefulness is most important predictor of students learning satisfaction and behavioural intention to use e-learning with coefficient 0.524. System Quality is also significant contributor to learning satisfaction and coefficient 0.424 indicates that higher is system quality more useful students find e-learning tools to use and hence higher is their learning satisfaction and behavioural intention of using the e-learning tools. The variables system usefulness and system quality are the most important characteristics discriminating satisfied and unsatisfied students indicating that students are not able to fully utilize e-learning medium for effective learning though they recognize the need of high quality and useful learning interfaces. From table XIII, On comparing the structural coefficients of the predictor variables it is found that the System Usefulness with correlation coefficient 0.783 is most important predictor of students Learning satisfaction. System Quality and Effective learning with coefficients 0.770 and 0.665 respectively are other discriminating variables between satisfied and unsatisfied students, with Effective learning affecting the behavioural intention of students using e-learning to a minimum level. The relative importance of variables from structure matrix and standardized discriminant coefficients have slightly changed due to an inter correlation between predictor variables as observed from the correlation matrix in table 8.

From Table XIV the Discriminant function Y is formed which can help to calculate the Discriminant score for each respondent individually by substituting the independent variables scores. On analyzing the Discriminant function it is observed that the System Usefulness and System Quality are relatively more important contributors to learning satisfaction and Effective learning variable is less significant discriminator of Satisfied and unsatisfied students from web based learning and e-learning tools. Table XV shows the Group centroids that indicate the mean discriminant scores for classifying the satisfied and unsatisfied students. The cutoff score for classifying the satisfied and unsatisfied students groups is calculated by using following function on values of table XV

$$C = (n_2 Y_1 + n_1 Y_2) / (n_1 + n_2)$$

Where, n_1 and n_2 are sizes of group of Satisfied and unsatisfied students from e-learning

Y_1 and Y_2 are scores of mean discriminant for satisfied and unsatisfied students from e-learning.

The average of group centroids values is -0.706 indicating that respondents with discriminant scores greater than -0.706 are satisfied and those with scores less than -0.706 are unsatisfied with use of e-learning tools and web based resources.

The factors considered for the formation of the-learning curves are age, gender, internet proficiency and e-learning tool awareness. Here the graph depicts that the age, internet proficiency and e-learning tool awareness acts as the linear predictors for the effective learning of an individual. Gender prove to be insignificant in influence effective-learning.

The findings of the discriminant analysis and the Principal component analysis confirm that System Usefulness and System quality of the e-learning tools are positively correlated and their variation affects the effective-learning of the students. The Discriminant analysis results indicate that System Usefulness and System Quality are the most important discriminating variables for Satisfied and Unsatisfied students. Effective learning contribution to Learning satisfaction is significant but less than other two predictors. Thus the hypothesis H1, H2, H3, H4, H5 and H6 are accepted. The System Usefulness, System Quality and Effective Learning are contributing to students' Learning satisfaction as per Principal components analysis results supporting hypothesis H5, H4 and H6. The final schematic diagram of the proposed model is given below in Figure 6. The-learning outcomes together form the effective-learning which is contributed from e-learning system Usefulness and its System quality. However variation in the effective-learning by external factors like internet proficiency and e-learning system awareness and individual diversity such as age, gender generate variable learning curves for students supporting hypothesis H7 and H8. These variable learning curves [17] can help in future studies to quantitatively analyze impact of e-learning and

its usefulness for individual learners. Significant research on measuring student satisfaction has been conducted [7] [16] [2] [14] all considering the satisfaction level of students to improve the tool design, but never calculated the Usefulness and Quality of system, this research tried to get these predictors in the broader aspects like content design, interactive sessions, flexibility, ease of use, added value, need of learning, accomplishments, self esteem of learners, social influence have impact on satisfaction level of learners. There are studies on the behavior intention to use e-learning tools based on quality, internet proficiency, pedagogical value, perceived usefulness [6] which our findings support and extend by including factors such as Knowledge sharing, flexibility, interface complexity, equal learning opportunities, content variety, instant feedback, virtual classroom, multimedia content, motivation, cost effectiveness, Effective learning etc. The findings of this study have potential to help in evaluating the critical factors affecting perception of students about usefulness of Elearning resources over traditional learning resources.

Earlier works [5] concluded that attitude, self efficiency and anxiety to strive are indicators of behavioral intention and satisfaction. These [9] indicated behavioral intention is dependent variable and depends on system quality or interactive-learning activities which are supported by our finding that System quality and interactive collaboration lead to knowledge sharing and creation that help to achieve Effective-learning. This research confirms that the student's positive recognition of System quality and Usefulness enhance behavioural intention to use e-learning and satisfaction level. Learning satisfaction levels are the outcome of the System Usefulness and Quality which also leads to higher effective learning from web based resources and e-learning tools. Our findings relate to the UTAUT theory [20] which supports that Satisfaction with ease of use (effort expectancy), Flexibility, Internet proficiency, Academic achievements (performance expectancy) leads to behavioural intention to use Web based learning resources and e-learning tools. These findings support [9] [13] that Social influence from

Interactivity leads to knowledge sharing and motivation from peers to use e-learning tools and web based resources. When the students are able to get their expectations from e-learning tools satisfied like need of self esteem and actualization as per Maslow's theory [18] they have the behavioral intention to increase the usage of the system increasing learning satisfaction. The usage of e-learning system also gives the students a sustainable competitive advantage among their competitors, which is a volunteer process or condition learning. From this perspective the Learning theories of classical (Pavlov, 1903) and operant conditioning (Skinner, 1938) are also applied. The results of this study could be utilized to evaluate quality, usability of interfaces designed for learning and predictors of satisfaction levels of users. This helps to design better learning interfaces which motivates students for self learning. Our study can be further useful to quantitatively explore individual Effective Learning levels and Usability of e-learning interfaces through System Quality and System Usefulness. This extends the research in Human computer interaction and Usability studies where variables like reliability, content effectiveness, storage capacity, interfaces complexity and motivation etc. can be studied independently to predict individual learners Satisfaction. In future comparison of Learners' Satisfaction and behavioural intentions of using various e-learning software interfaces like Moodle, Blackboard, Sakai, eFront, Angel can be conducted based on the e learning model for learning satisfaction (Figure 6).

7. Research conclusion/suggestions

Our study predicts System Usefulness, System Quality as the highest significant factors affecting students' satisfaction with e-learning tools and web based resources. Higher System Usefulness and System Quality also help in enhancing Effective Learning from e learning tools and web based learning resources. The pedagogical value of resources, relevancy of content, reliability and quality of e-learning interfaces supporting learners' objectives can be improved based on users feedback which will further improve Effective Learning and Learning Satisfaction.

Motivation and need of learning is introduced as stimulators of behavioural intention to use e learning. The suggestions based on our study is that responses indicating "Don't know" scale item indicate that training sessions for users and awareness about the usefulness of the technology can help to increase Effective-learning and overall satisfaction. The scope of study included both web based learning resources and Moodle e learning tool, so more specific interpretation can be derived if students' perception of other e learning tools other than Moodle are also included in the study. Also for generalizability it is important that the study is conducted on different samples with diverse levels of familiarity with the issue.

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