Investigating the effect of system characteristics on user satisfaction of ERP end users

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Abstract

Enterprise Resource Planning (ERP) systems are regarded as one of the major technological advancements in the previous decade and are entering the higher education sector on a global scale. The purpose of this research is to use structural equation modelling and mediation analysis to investigate the effect of system characteristics on user satisfaction of educational ERP end users. The research followed quantitative analysis and contributes to the little research done on ERP systems in education sector so far. There are several implications about the findings related to determinants in the model that provide strategic insight regarding the factors that can enhance satisfaction of ERP end users.

Keywords: *User Satisfaction; System Characteristics; SEM; System Use; mediation analysis; end users.*

Introduction

ERP or Enterprise Resource Systems is a term for software packages having multiple module applications that are designed to support, integrate serve and support manifold business operations (Bahar Yelken 2005) and are regarded as one of the major technological advances to come up during the last decades (Chung *et al.* 2008). An extensive literature review confirms that these systems are efficient and effective in decision making due to their distinctive feature of providing real time reports thus enabling the organizations to enhance their management specific procedures and functions (Laughlin, 1999; Koch *et al*.1999).

ERP in higher education

Rising stakeholder expectations, performance and quality requirements, competition in education environment and decreasing governmental support are pressurizing universities to adopt performance improvement strategies (Fisher, 2006), thus resulting higher education sector to turn towards Enterprise Resource Planning (ERP) systems in the expectation of serving them to handle the environment changes (Swartz and Orgill,

2000), to replace legacy systems (Pollock and James, 2004) and to become more efficient (Kvavik et al, 2002).

Mehlinger (2006) states that Universities differ from other organizations mainly due to different environments and their use of ERP technologies primarily for academic purposes. Also, ERP in education sector should be responsive of real educational system requirements and mere enhancements or adjustments of legacy solutions, resulting from business practice experience are not always successful (Noaman and Ahmed, 2015). The interaction between faculty/staff, students and core institutional activities is achieved through ERPs which also cater to need of students for a highly informative and improved e-learning atmosphere. All educational institutes require a strong student management system, library management system, Human Resource system and much more functionalities from an ERP system and involves many stakeholders like students, teachers, staff, parents, and others that are directly or indirectly connected with them. In summation, this concludes that these systems are critical to the mission of educational institutions. According to Abugabah and Sanzogni, 2010, the investment in educational ERP systems is quite substantial forming a major part of educational institute's budget. Hence, it becomes quintessential to measure their success. Also, there is a lack of conceptualized frameworks for measuring ERP success/failures in education sector and asserting importance on user' perspective.

Although measuring success in terms of monetary benefits and costs seems more desirable but these measures are not possible mainly due to difficulty in quantifying the intangible system impacts and also due to problem in isolating the effects of these systems from various intervening environmental variables (DeLone and McLean, 1992) as a result of which Jacobs and Bendoly (2003) put forward the concept of using user satisfaction as a subjective measure for analysing the performance of these systems. The study aims at measuring the user satisfaction of educational ERP systems and to examine the effect of ERP system characteristics on user satisfaction.

Literature and Theoretical Background

ERP systems

Abugabah, Sanzogni and Alfarraj (2015) in their study of higher educational institutes studied the impact of ERP systems on user performance and identified system and information quality as major factors influencing

user performance. Kalema, Olugbara and Kekwaletswe (2014) studied various factors and identified 37 critical success factors (CSF) influencing effective usage of ERP systems in higher educational institutes. According to Mehlinger (2006), about 60-80% of ERP projects have failed owing to deficiency in meeting stakeholder's expectations. The above facts and the high side of organizational resource investment committed to adopting ERP system, researchers have held an ardent longing to find and explicate the causes and the aspects leading to reliable ERP systems performance (Kositanurit et al. 2006) and to explain factors influencing success and failure of ERP systems implementation (Al- Mashari 2003; Zhang et al. 2005). Soliman and Karia (2015) studied the role of ERP as innovative technology implementation of ERP systems in Egypt, while Qian, Schmidt and Scott (2015) proposed pre-implementation framework for ERP in Purdue University. Although the implementation of ERP systems in education sector is increasing, and higher educational institutes are now emerging as chief target market for ERP vendors, scarce literature was found related to determining the stakeholder adoption of these systems. Also, no research was found that studied the influence of ERP system characteristics which are critical for the success of ERP systems.

ERP and User Satisfaction

The concept of using user satisfaction as system success surrogate was first asserted by Cert and March in 1963 (Au *et al*., 2002) and has been used by many other researchers (Doll and Torkzadeh 1988; DeLone and McLean 1992; Igbaria and Tan 1997; Bano and Zowghi 2015; Abelein and Paech, 2015). There are numerous instruments and studies that calculate user satisfaction and measure acceptance of the systems by the users. Bailey and Pearson (1983) defines user satisfaction as, "sum of one's feeling's or attitudes toward a variety of factors affecting that situation in a given situation". Venkatesh *et al.* (2003) proposed Universal Theory of Acceptance and Use of Technology (UTAUT) and later on in 2012 developed UTAUT2 as an extension to UTAUT, where the UTAUT model was extended to other contexts, such as the context of consumer technology acceptance and use. The study considers UTAUT constructs to measure the usefulness of ERP systems. Calisir and Clasir (2204) found Performance expectancy (PE) to be the unsurpassed forecaster of ERP end-user satisfaction. Davis, 1989; Davis, Bagozzi, and Warshaw, 1989; Igbaria, Guimaraes, and Davis, 1995; Zaviran *et al.* 2004, also established the relationship among satisfaction and perceived usefulness. Effort expectancy (EE) derived from the perceived ease of use determines end-user's aim for usage of information

system (Venkatesh et al., 2003). Various studies also support relationship between effort expectancy - behavioral intention (Amaoko-Gyampah and Salam, 2004; Lean *et al.,* 2009; Hsu et al, 2017) and perceived ease of use – user satisfaction (Calisir and Calisir, 2004).

The study also considers Social influence and Hedonic Motivation derived from Venkatesh *et al*., (2003) and strong evidence supports that behavior and attitudes of people who are in the social circle of the user directly impact user's actions related to adaption of technology (Fulk *et al.,* 1990; Kraut *et al*., 1998; Rice *et al*., 1990; Schmitz and Fulk, 1991; Yuan *et al*., 2005). Both Scheeper's *et al.* (2006) and Ong and Day (2010) supported the effect of social influence over user satisfaction respectively with mobile technology and social media services. Hedonic Motivation (HM) (also conceptualized as perceived enjoyment) defined as the fun or pleasure resulting from using a technology plays a vital part to determine and influence acceptance of technology and use (Brown and Venkatesh, 2005; Thong et a., 2006).

Chen, Gillenson and Sherrell (2002) noted that technology adoption research often produces conflicting findings and the major reason for this is focus on a single theory which excludes consideration of some other important determinants. An extensive literature review was done to avoid this problem and the key constructs were identified.

System Characteristics: The concept of system characteristics directly affecting user beliefs was proposed by Davis (1993). Since then, system characteristic's role in forecasting acceptance of technology and user beliefs has been corroborated by more than a few researchers (Ruth, 2000; Igbaria *et al.* 1995; Venkatesh and Davis, 1996; Lucas and Spitler, 1999). This study considers four critical ERP system characteristics and the first of the characteristics is system integration (Brown, 2001; Markus, 2001; Barki and Pinsonneault, 2002, 2003) that denotes the capability of ERP systems to offer interconnections and interactions between various processes and functions of an organization. Seethamraju and Sundar (2013) identifies integration as the most frequently identified capability of ERP system while Markus (2001) considers integration of processes as one of the key reasons why organizations implement ERP systems.

Technological complexity of system is another characteristic of ERP system which is defined by Aiman-smith and Green (2002) as the degree of complicatedness of the new technology compared to previous technology for the user when the new technology is used for similar/same kind of work in similar conditions and signifies

rise in number of acts to be done by user at the same time. Higher the complexity, lower the information that users can absorb before actually using the system (Yi and Davis, 2003), higher the workload and mental stress (Sokol, 1994) and negative is the attitude of the users towards usage of these systems (Chang et al., 2008; Basoglu, Daim, and Kerimoglu, 2007).

The next characteristic is system compatibility that is defined as the degree of consistency of an innovation with the existing values and needs of probable users (Rogers, 1983). This study considers compatibility as one of the ERP system characteristics that effects the usage of ERP systems which in turn affects user's satisfaction. According to Erensal and Albayrak (2008), technology incompatibility affects the system efficiency, productivity, employee's satisfaction, motivation and commitment. Greater the innovations compatibility with existing values, belief systems, operating practices and technical systems of the adopting unit, more favorable is the adoption of the innovation (Cooper and Zmud, 1990; Prem kumarand Ramamurthy 1995)

User Characteristics: The second characteristics set considered in the study is the user characteristics. According to Szajna (1993), there is an empirical relationship between the information system user's individual characteristics and different levels of usage of information systems. Also, behavioral intention is impacted by user characteristics (Davis et al. 1989). In the context of information technology and use of computers, computer self-efficacy, defined as one's computer usage capability judgement and play a vital part in explaining intention to use as an antecedent of perceived usefulness (Compeau and Higgins, 1995; Agarwal and Karahanna, 2000).

The outcomes: The usefulness constructs – PE, EE, SI and HM are foremost determining factors of behavioral intention to use and systems usage. Also looking into the financial resources that are being employed in implementing ERP systems, it is reasonable on the part of those making investment decisions to know if the users intend to use such systems and are actually using the systems and also if these systems have been successful or not. The success of these systems is generally measured in terms of user satisfaction and it is among the most widely used measure for IS evaluation and has been used by several researchers to measure IS success (Doll and Torkzadeh 1988; DeLone and McLean 1992; Igbaria and Nachman 1990; Igbaria and Tan 1997; Etezadi-Amoli and Farhoomand 1996). Rouibah et al. (2009) proposed a model that supported the

previous work done by Al-Gahtani (2004) and Khalil and Elkordy (1999) that increase in system usage will lead to increase in user satisfaction.

Research Model: The review of literature shows that although there have been studies related to ERP systems, but the research on acceptance of ERP systems in education setting and their effect on user satisfaction is still at nascent stage. Based on this research gap, we propose the following research model (Figure 1) to study the effect of individual and technological characteristics on usage of ERP systems and its impact on user satisfaction.

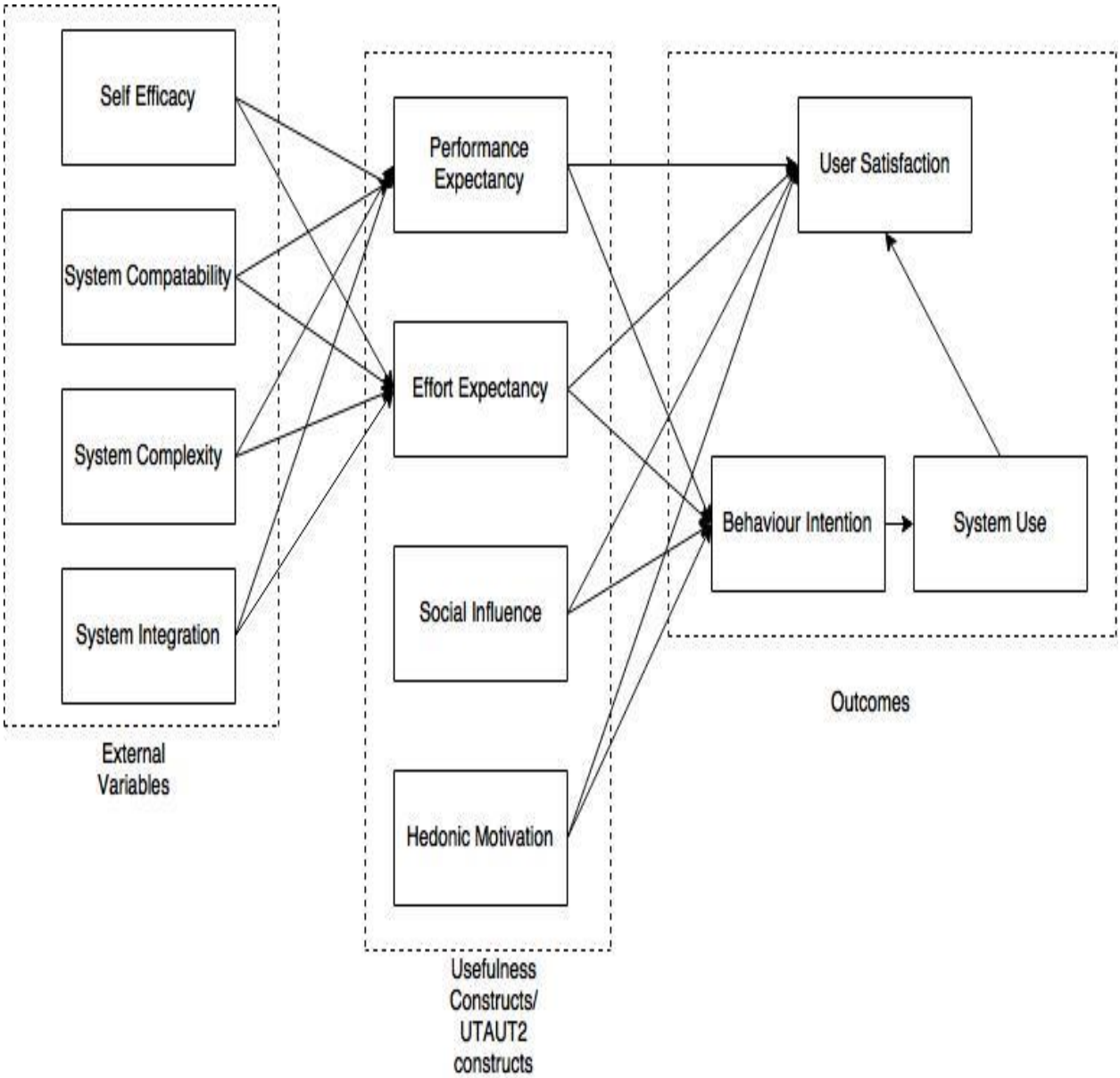

Figure 1: Proposed Research Model

On the basis of the discussion the following hypotheses were proposed:

H1a/b: System Integration will affect performance expectancy/ effort expectancy

H2a/b: System Compatibility will affect performance expectancy/ effort expectancy

H3a/b: System Complexity will affect performance expectancy/ effort expectancy

H4a/b: Self-Efficacy will affect performance expectancy/ effort expectancy

The relationships between UTAUT2 variables are replicated in our research model. These have been taken from the context of ERP systems. Apart from these, the model also studies the relationships between UTAUT2 variable and user satisfaction.

H5a/b: Performance Expectancy will affect users' Behavioral Intention/User Satisfaction

H6 a/b: Effort expectancy will affect user's Behavioral Intention/User Satisfaction.

H7 a/b: Social influence will affect user's Behavioral Intention/User Satisfaction.

H8 a/b: Hedonic Motivation will affect users' Behavioral Intention/User Satisfaction.

H9: Behavior intention will positively affect ERP system use.

H10: ERP System use will positively affect user satisfaction

Constructs and Measures: The constructs taken for the study were used to develop the survey instrument and to fit ERP systems context. Most of the items for the given constructs have been taken from existing literature except for system integration for which we were not able to locate any previously validated items and hence the items were self-developed based upon the features required for ERP systems. The instrument was developed using five-point Likert scale with 1 for 'strongly agree' and 5 representing 'strongly disagree'.

Self-Efficacy (SE)	ITM1	I can complete the job using ERP system: if there was nowhere around to tell me	Tan and Teo (2000)
	ITM2	If there were software manuals provided	

	ITM3	If I have seen someone else using it	
	ITM4	If someone else showed me how to do it first	
System Compatibility (SYS COM)	ITM5	The format of reports from ERP system is compatible with my existing needs	Pituch and Lee (2006)
	ITM6	The system is compatible with other technologies I use	
	ITM7	ERP system matches my current processes	
	ITM8	ERP system is compatible with Organization's IT structure	
System Complexity (SYS CPX)	ITM9	Understanding how to use ERP system does not lot of time from my normal duties	Pituch and Lee (2006)
	ITM10	Working with ERP system is very simple	
	ITM11	Using ERP systems does not involve much time doing mechanical operations	
	ITM12	It takes less time to learn how to use ERP system	
System Integration (SYS INT)	ITM13	Different organizational processes are integrated with ERP system	Self-Developed
	ITM14	ERP system provides interactions between different functional areas	
	ITM15	ERP system is integrated with other applications/systems used in organization	
	ITM16	ERP system manages information flow between all business functions	
Performance Expectancy	ITM17	Using ERP system makes me do my tasks quickly	Venkatesh et al. (2012)
	ITM18	Using ERP system is useful for my job	

(PE)	ITM19	Using ERP system increases my job performance	
	ITM20	Using ERP system increases my job efficiency	
	ITM21	Using ERP system increases my productivity	
Effort Expectancy (EE)	ITM22	I find ERP system easy to use.	Venkatesh et al. (2012)
	ITM23	Learning to use ERP system is easy for me.	
	ITM24	My interaction with ERP system is clear and understandable.	
	ITM25	It is easy for me to become skillful at using ERP system.	
Social Influence (SI)	ITM26	People who are important to me think I should use ERP system.	Venkatesh et al. (2012)
	ITM27	People who influence my behavior think I should use ERP system.	
	ITM28	People whose opinions I value prefer that I use ERP system	
Hedonic Motivation (HM)	ITM29	Using ERP system is fun	Venkatesh et al. (2012)
	ITM30	Using ERP system is enjoyable	
	ITM31	Using ERP system is very entertaining	
Behavioral Intention (BI)	ITM32	I intend to continue using ERP system in future	Venkatesh et al. (2012)
	ITM33	I will always try to use ERP system in my job routine	
	ITM34	I plan to use ERP system continually	
User Satisfaction (US)	ITM35	The ERP system is reliable	Ives et al (1983)
	ITM36	The ERP system is relevant	
	ITM37	The ERP system is Accurate	
	ITM38	The ERP system is complete	
	ITM39	The ERP system is precise	
	ITM40	My relationship with the people who implement ERP	

		system is good	
	ITM41	My communication with the people who implement ERP system is harmonious	
	ITM42	The attitude of people who implement ERP system is cooperative	
	ITM43	The people who implement ERP system resolve my queries quickly	
	ITM44	My feeling of participation in ERP system is positive	
	ITM45	The degree of training provided to me is good	
	ITM46	My understanding of ERP systems is complete	
	ITM47	I am satisfied with my ERP system	
System Use (SU)	ITM48	I am dependent on ERP system	Venkatesh et al. (2012)
	ITM49	The frequency of use with ERP system is high	
	ITM50	I use ERP system on daily basis	
	ITM51	I use ERP systems to make my decisions	
	ITM52	I use ERP system to share information	
	ITM53	I use ERP system to record knowledge	

Table 1: Constructs and Items (with references)

Research Methodology

Participants and procedure: The research followed a quantitative approach that involved designing of questionnaire and administration of survey. The survey instrument was developed to measure the constructs primarily based on previously validated instruments that relate to ERP systems context and it comprised of 53 items. Participants in this study primarily consisted of students, faculty and staff of management colleges in North India where ERP system has been implemented and is currently in use. Participation in this study was

voluntary and from 650 physically administered questionnaires, 512 were returned. After eliminating those with missing information, 500 usable responses were taken forward for the analysis.

Data Analysis:

Demographics and descriptive statistics: 500 responses were taken forward for analysis,which shows a response rate of 76.9 %. Table 2 shows the demographic characteristics of the sample under consideration. About 53.6 % of the users were female and 46.4 % were male. Most of the respondents lie in the age group of 18-25 years (79.8%). The respondents were the users of ERP systems in management institutes that include students (72%), faculty (20%) and staff (8%). The above segmentation lies in accordance with the normal ERP usage pattern in educational institutions where students form a major part of ERP end users. About 52.6 % of users were having a computer experience of 1-5 years and about 36.4 % have been using ERP systems from the past 1-2 years. About 14.8% of the respondents have computer experience of more than 5 years but only 2.8% of the respondents have ERP experience of more than 5 years which clearly shows that ERP implementation in education sector is relatively a new phenomenon and very few people in education sector have experience of using ERP systems.

Demographic Attributes of Respondents		
Variables	Frequency	Percentage
Gender		
Male	232	46.4
Female	268	53.6
Age		
18-25 yrs.	399	79.8
26-45 yrs.	95	19
Above 45 yrs.	6	1.2
Education		
High School	4	0.8

Bachelor's	408	81.6
Master's	84	16.8
Doctoral	4	0.8
Computer Experience		
< 1 yr.	163	32.6
1-5 yr.	263	52.6
> 5 yr.	74	14.8
Profile		
Student	360	72
Faculty	100	20
Staff	40	8
ERP Experience		
< 1 yr.	176	35.2
1-2 yr.	182	36.4
2-5 yr.	128	25.6
> 5 yrs.	14	2.8

Table 2: Demographic Analysis

Analysis and Results: Anderson and Gerbing (1998) two step approach foranalysis of the data using Partial Least Square (PLS)-SEMwas used that involves two stages - a) Measurement Model Assessment (including validity and reliability) – to determine scale properties b) Structural Model Assessment – to establish inter variable relationships.SEM has been one of the most widely used techniques for analysis of data and is used by many researchers recently like Park and Kwon (2016)and Hsu et al (2017).

Measurement Model Assessment: Convergent and discriminant validity of model are measured to judge the strength of measurement model (Hair *et al.*, 1998). Convergent validity refers to the degree to which two

measures of constructs that are supposed to be related are actually related. A model has convergent validity if it fulfils the below mentioned criteria.

- The composite reliability is greater than 0.7. (Hair et al, 1998)
- Average Variance Extracted exceeds 0.5 for each factor. (Fornell and Larker, 1981)
- Standardised path loadings are greater than 0.7. (Gefen, Straub, Boudreau, 2000)

Majority of the items had significant loadings except ITM5, ITM8, ITM42, ITM52 and ITM53. Since these items did not satisfy the above-mentioned criteria, hence they were deleted and PLS algorithm was run again and the results compiled in Table 3. Also, Cronbach's alpha was calculated which came out to be above 0.7 level for most of the items except for system compatibility. In accordance to Chin et al (1996), the composite reliability (CR) is a better estimate than Cronbach's alpha and since the value of CR for system compatibility was 0.831, so it was taken forward for further analysis.All variables showed acceptable results for CR and AVE, thus showing convergent validity.

Convergent Validity				
ITEMS/Variable	Factor Loadings	Cronbach's alpha	Composite Reliability	Average Variance Extracted
ITM1 <- SE	0.783	0.083	0.883	0.655
ITM2 <- SE	0.869			
ITM3 <- SE	0.824			
ITM4 <- SE	0.757			
ITM6 <- SYS COM	0.883	0.599	0.831	0.711
ITM7 <- SYS COM	0.801			
ITM9 <- SYS CPX	0.765	0.798	0.868	0.622
ITM10 <- SYS CPX	0.800			
ITM11 <- SYS CPX	0.792			
ITM12 <- SYS CPX	0.796			

ITM13 <- SYS INT	0.740	0.833	0.889	0.667
ITM14 <- SYS INT	0.824			
ITM15 <- SYS INT	0.819			
ITM16 <- SYS INT	0.879			
ITM17 <- PE	0.763	0.88	0.912	0.676
ITM18 <- PE	0.848			
ITM19 <- PE	0.850			
ITM20 <- PE	0.841			
ITM21 <- PE	0.807			
ITM22 <- EE	0.760	0.812	0.876	0.639
ITM23 <- EE	0.779			
ITM24 <- EE	0.853			
ITM25 <- EE	0.802			
ITM26 <- SI	0.804	0.814	0.89	0.73
ITM27 <- SI	0.880			
ITM28 <- SI	0.877			
ITM29 <- HM	0.867	0.848	0.909	0.768
ITM30 <- HM	0.924			
ITM31 <- HM	0.836			
ITM32 <- BI	0.886	0.818	0.892	0.734
ITM33 <- BI	0.846			
ITM34 <- BI	0.837			
ITM35 <- US	0.776	0.948	0.955	0.64
ITM36 <- US	0.852			
ITM37 <- US	0.823			
ITM38 <- US	0.846			

ITM39 <- US	0.837			
ITM40 <- US	0.822			
ITM41 <- US	0.884			
ITM43 <- US	0.738			
ITM44 <- US	0.799			
ITM45 <- US	0.729			
ITM46 <- US	0.759			
ITM47 <- US	0.714			
ITM48 <- SU	0.862	0.865	0.908	0.712
ITM49 <- SU	0.892			
ITM50 <- SU	0.824			
ITM51 <- SU	0.794			

TABLE 3: Convergent Validity

Discriminant Validity means that the constructs that are not supposed to be related are not related (Campbell and Fiske, 1969). It was examined by comparing the square roots of AVE with the factor correlation coefficients based on the criteria by Fornell and Larcker (1981). The square root of AVE should be larger than the corresponding correlation coefficients. Table 4shows the results of discriminant validity, which shows that the two factors are statistically different, thus showing adequate discriminant validity.

Discriminant Validity											
Variable	BI	EE	HM	PE	SE	SI	SU	SYS COM	US	SYS CPX	SYS INT
BI	**0.857**										
EE	0.684	**0.799**									
HM	0.707	0.646	**0.877**								
PE	0.656	0.726	0.661	**0.822**							

SE	0.716	0.695	0.864	0.668	**0.809**						
SI	0.715	0.671	0.739	0.638	0.722	**0.854**					
SU	0.742	0.682	0.669	0.659	0.716	0.718	**0.844**				
SYS COM	0.405	0.419	0.415	0.458	0.430	0.395	0.417	**0.843**			
US	0.683	0.680	0.727	0.666	0.710	0.701	0.748	0.485	**0.800**		
SYS CPX	0.581	0.651	0.645	0.560	0.667	0.666	0.616	0.422	0.721	**0.788**	
SYS INT	0.678	0.615	0.695	0.603	0.726	0.704	0.642	0.371	0.717	0.733	**0.817**

Table 4: Discriminant Validity

The discriminant validity was also supported by the HTMT ratio and all the result values were below 0.9, hence discriminant validity was established between two reflective constructs (Hensler *et al.* 2015).Multicollinearity among variables was checked via collinearity statistics (VIF), the results for which are shown in table 5. Since all the values were below 3, hence the problem of multicollinearity did not exist among variables.

Collinearity Statistics (VIF)											
Variable	BI	EE	HM	PE	SE	SI	SU	SYS COM	US	SYS CPX	SYS INT
BI							1.000				
EE	2.549								2.683		
HM	2.592								2.657		
PE	2.481								2.560		
SE		2.400		2.400							
SI	2.610								2.909		
SU									2.616		

SYS COM		1.278		1.278							
US											
SYS CPX		2.436		2.436							
SYS INT		2.767		2.767							

Table 5: Collinearity Statistics (VIF)

Structural Model Measurement: The model was tested with SmartPLS using Structural Equation Modelling approach (SEM) where the model is differentiated into two sub models. The first is the inner model that specifies the relationships between dependent and independent variables. The second is the outer model that specifies the relation between latent variables and their identifiers. Path coefficients were analyzed to evaluate the significance and relevance of relationships between independent and dependent variables and R^2 was calculated to evaluate the predictive accuracy of the model, which explains the variance or the explanatory power of latent endogenous variable (Hair et al., 2013). Bootstrap resampling method (Henseler *et al.*, 2009) was used to estimate path coefficients and R. This approach is useful for mediation analysis and can be applied to small size and also there is no assumption regarding the sampling distribution.

The PLS path analysis results are shown in Table 6. As is clear from the results, system usage is highly influenced by BI (β=0.742, p<0.001), which itself is influenced by SI (β=0.282, p<0.001) followed by HM (β=0.260, p<0.001) thus supporting hypothesis H9, H7a and H8a.US is mainly influenced by SU (β=0.330, p<0.001) followed by HM (β=0.273, p<0.001), thus supporting H10 and H8b. UTAUT2 usefulness variables PE and EE are significantly related to behavior intention with β=0.142 and β=0.224 at p<0.001, supporting H5a and H6a. Also, SI and HM show support for hypothesis H7a and H8a, as they are significantly related to behavior intention at β=0.282 and β=0.260 at p<0.001. The external variables (self-efficacy, SYS COM, SYS INT and system compatibility) affecting usefulness constructs (PE and EE) showed support for most of the proposed hypothesis except for H3a and H1b.

Path Analysis		
	Path Coefficient	P Values
BI -> SU	0.742	0.000
EE -> BI	0.224	0.000
EE -> US	0.130	0.003
HM -> BI	0.260	0.000
HM -> US	0.273	0.000
PE -> BI	0.142	0.000
PE -> US	0.104	0.010
SE -> EE	0.412	0.000
SE -> PE	0.403	0.000
SI -> BI	0.282	0.000
SI -> US	0.109	0.015
SU -> US	0.330	0.000
SYS COM -> EE	0.096	0.004
SYS COM -> PE	0.184	0.000
SYS CPX -> EE	0.281	0.000
SYS CPX -> PE	0.077	0.095
SYS INT -> EE	0.074	0.133
SYS INT -> PE	0.186	0.000

Table 6: Path Analysis

The evaluation of the outer structural model was also done by evaluation of the variance explained in endogenous constructs by all the exogenous constructs, which is done by measuring coefficient of determination (R^2).It represents the combined effects of exogenous variables on the endogenous variables.The value of coefficient of determination (R^2) is 0.680 for US which means that 68% of variance in US is being explained by the model. In case of behavior intention, a variance of 63.2% is being explained by the

corresponding latent variables while in case of SU it is 54.9%. This shows that the proposed structural model has predictive relevance.

R square	
BI	0.632
EE	0.555
PE	0.508
SU	0.550
US	0.680

Table 7: R square

Mediation Analysis*:*According to Hair *et al.* (2013), Mediation analysis is done to study the effect on causal relationship between exogenous and endogenous variable with the inclusion of a third mediator variable. The first step in mediation analysis is to find the direct effect of exogenous variable on endogenous variable (without the presence of any mediator). The main criterion for mediation to occur is that this effect should be significant (Zhao *et al.,* 2010). In this study the role of usefulness constructs (PE and EE), BI and SU have been taken as mediators. The direct effect of system characteristics on US was studied followed by usefulness constructs, BI and SU as mediators at each step and then the full path PLS model was assessed, incorporating the combined effect of the mediators. The effect of mediators was calculated by finding the indirect effect, which if significant means that the mediator absorbs some of the direct path. VAF (Variance Accounted For) was calculated to assess the amount of direct path absorbed.

VAF = Indirect Effect / (Direct Effect + Indirect Effect)

The results (shown in table 8) show that external variables (system and user characteristics) are significantly related to US with the direct effects of SE, SYS COM, SYS CPX and SYS INT on user satisfaction are significant, which satisfies the main mediation criteria given by Zhao *et al.*, (2010).When usefulness constructs (EE and PE) were taken as mediators, both SE and SYSCOM show partial mediation at VAF = 0.34 and VAF = 0.25 respectively. However, whenmore mediators (BI and SU) were added, the value of VAF decreases as shown in table 8. For SYS CPX (VAF=0.19) and SYS INT (VAF=0.16), both show no mediation, which means that no mediators absorb any effect of these variables on US.

In the next step, the relationship between the UTAUT2 constructs and US was studies with and without mediators. The direct effect of UTAUT2 constructs (PE=0.164, EE=0.203, SI=0.221 and HM=0.324) on US was found to be significant. Then we added BI as a mediator and found that all UTAUT2 constructs exhibit partial mediation (VAF_{PE}=VAF_{EE}=VAF_{SI}=VAF_{HM}=0.50), which means that BI absorbs some effect of the constructs on US. Next, we added SU as mediator and observed its effect, it was found that all constructs except PE show partial mediation, but PE (VAF=0.11) shows no mediation with SU. Also, the role of SU as mediator for BI-US was studied and it was found that SU exhibit partial mediation for BI-US.

External Variables (system and user characteristics) - US					
Variable	Mediator	Direct Effect	Indirect Effect	VAF	Mediation
SE	Nil	0.283	-	-	-
SYS COM	Nil	0.152	-	-	-
SYS CPX	Nil	0.296	-	-	-
SYS INT	Nil	0.234	-	-	-
SE	Usefulness Constructs	0.283	0.149	0.34	Partial Mediation
SYS COM	Usefulness Constructs	0.152	0.05	0.25	Partial Mediation
SYS CPX	Usefulness Constructs	0.296	0.07	0.19	No Mediation
SYS	Usefulness	0.234	0.046	0.16	No Mediation

INT	Constructs				
SE	BI	0.283	0.15	0.35	Partial Mediation
SYS COM	BI	0.152	0.05	0.25	Partial Mediation
SYS CPX	BI	0.296	0.07	0.19	No Mediation
SYS INT	BI	0.234	0.045	0.16	No Mediation
SE	SU	0.283	0.132	0.32	Partial Mediation
SYS COM	SU	0.152	0.043	0.22	Partial Mediation
SYS CPX	SU	0.296	0.063	0.18	No Mediation
SYS INT	SU	0.234	0.039	0.14	No Mediation
UTAUT2 Constructs - US					
Variable	Mediator	Direct Effect	Indirect Effect	VAF	Mediation
PE	Nil	0.164	-	-	-
EE	Nil	0.203	-	-	-
HM	Nil	0.324	-	-	-
SI	Nil	0.221	-	-	-
PE	BI	0.164	0.163	0.50	Partial

					Mediation
EE	BI	0.203	0.205	0.50	Partial Mediation
HM	BI	0.324	0.326	0.50	Partial Mediation
SI	BI	0.221	0.217	0.50	Partial Mediation
PE	SU	0.283	0.035	0.11	No Mediation
EE	SU	0.152	0.055	0.27	Partial Mediation
HM	SU	0.296	0.064	0.18	No Mediation
SI	SU	0.234	0.069	0.23	Partial Mediation
BI – US					
Variable	Mediator	Direct Effect	Indirect Effect	VAF	Mediation
BI	Nil	0.245	-	-	-
BI	SU	0.245	0.241	0.50	Partial Mediation

Table 8: Mediation Analysis

Discussion: The primary objective of this study was to find out the effect of external variables (system characteristics and user characteristics) on user satisfaction. The study considers beyond the belief proposed by Davis*et al.* (1983), where the system characteristics and the technology characteristics effect the use of technology through usefulness constructs (perceived ease of use and perceived usefulness). In this study we considered that these external variables not only affected the usefulness constructs but also directly influence

the use of technology which further effects the user satisfaction. The direct effect of these variables over user satisfaction was studied and it was found to be significant which indicates the effect of external variables on user satisfaction was partially and not completely mediated by usefulness constructs.

Most of the results support the proposed relationships in the model which were even consistent with the previous results. The relationship between external variables and usefulness constructs was found to be significant and self-efficacy was the major determinant of both performance expectancy and effort expectancy, thus supporting Venkatesh and Davis (1996). Among the system characteristics, system complexity is a major determinant of effort expectancy while system integration determines performance expectancy. This supports Igbaria *et al.*, (1995), that ERP systems are complex systems and their complexity affects the attitude towards using the system. System integration effects on both performance expectancy and effort expectancy, which means that a highly integrated ERP system will lead to increase in system use and thus leading to increase in user satisfaction.

The study replicated the relationships of UTAUT2 model, which have been found to be significant and are consistent with findings of Venkatesh *et al.* (2003, 2012), Park and Kim (2013) and Hsu et al (2017). Also, Sun *et al.* (2009), has criticized models that reflect usage as an end. The study found that system usage has a significant effect on user satisfaction, which supports the findings of Khalil and Elkordy (1999), Al-Gahtani (2004) and Rouibah (2008). This means that usage of ERP system will affect the satisfaction of the users. The effect of UTAUT2 variables over user satisfaction was also studied and it was found to be significant, supporting Davis et al (1989), Scheeper's*et al.* (2006) and Ong and Day (2010), with Hedonic motivation a major determinant of user satisfaction.

Implications, Limitations and Conclusion:

Since more and more educational institutes are adopting ERP systems these days and a huge part of their budget is allocated for ERP systems, they can refer to the results of this study in order to increase satisfaction among the user's and also to run a successful system. The study also contributes to the little research done on ERP systems in education sector so far. In addition, there are several implications about the findings about the determinants in the model. First,this study gives support to the well-established importance of the UTAUT2 constructs. That is, the UTAUT2 constructs (performance expectancy, effort expectancy, social influence and

hedonic motivation) are important determinants of ERP system use.An ERP system should have high performance expectancy where the users can expect a high level of performance from the system and the system should demand a low level of effort to use from the user. Also, the social surroundings of the user that include those who are important to the user or whose opinions the user values the most, that can include the faculty, the head of departments, the management who are influential for ERP user in determining the usage of ERP system. In addition, the more fun or pleasure the user derives from using ERP system, the more he/she is intended to use the system. This is of great importance to the organizations who plan to purchase these systems.

Second, after considering the external variables (system characteristics and individual characteristics), the usefulness constructs and user satisfaction, it can be found that self-efficacy of the ERP user should be taken into account and those who believe that they can use ERP system should be encouraged to use the system and others should be provided more motivation and training that help them to achieve self-efficacy, ultimately leading to system use and user satisfaction. Also, the system should be less complex and highly integrated, which is to be taken care by the developers of these systems, as these characteristics lead to increase in user adoption of the new system.Finally, the UTAUT2 constructs and user satisfaction are directly related which means that if a user finds that the ERP system is easy to use and helps in gaining job performance, then he/she will be more satisfied with the system. Also, the effect of social surroundings will give more satisfaction if the important others feel that the user should use the system. This requires a positive and an encouraging organizational environment.

Despite the careful approach followed, the research can be improved in the following areas. First, the study can be conducted in a longitudinal approach, where different phases of ERP implementation can be undertaken. Secondly, the sample size of the study was small. Since the model had many variables, so a large sample size was required to achieve some concrete results. We suggest that samples can be drawn from other regions and the sample size be increased that can lead to more generalized results. Thirdly the sampling was done on the basis of convenience which can lead to sample bias.

The complexity involved in implementing ERP systems makes the different from other IT innovations. This research has implications for the vendors as well as customers in education sector. The findings of the study

provide insights for the vendors to efficiently develop educational ERP system and for the educational institutes to effectively manage ERP system adoption. The educational institutes should have the goal of not just making system usage but also making the users satisfied with the system. The findings about the external variables suggest that vendors and institutional purchasers of ERP systems should carefully consider the needs of ERP users and ensure that the system meets these demands. They should understand and identify different external variables that ultimately affect the satisfaction of end users. According to Davis et al., (1989), such compatibility between user requirements and system features has been one of the reasons for technology adoption and this has been proved by the results of the study with respect to ERP systems.

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