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AN ANALYSIS OF MOBILE LEARNING ACCEPTANCE BY COLLEGE STUDENTS

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Abstract

Mobile technologies, applications and ease of Internet access have significantly increased the convenience of accessing information and bridging the digital divide. This research focuses technology acceptance, proposes an extended model and investigates the determinants associated with college students' acceptance of mobile learning. The behavioral intention to use mobile learning by students is a critical success factor of mobile learning implementation process. In this context, it's essential to enlighten the factors that affect college students' intention to use mobile learning. This research is based on related technology acceptance literature and the Unified Theory of Acceptance and Use of Technology (UTAUT) model.

The purpose of this study is to examine the indicators of the behavioral intention to use mobile learning by college students and to explore differences according to various demographics. The results indicate that performance expectancy, facilitating conditions and social influence were all significant factors of behavioral intention to use mobile learning. Effort expectancy and personal propensity to learning were not found to be significant predictor variables. This paper provides useful information about the triggers of mobile learning acceptance in order to take precautions for students who have difficulty adopting mobile learning.

Keywords: Mobile learning, m-learning, technology acceptance, college students, UTAUT.

INTRODUCTION

In every field of our lives, communication technologies have become much more indispensable and humanity changes to keep pace with them. While in 1995, less than %1 of the world population has an internet connection, when it comes to 2014 the percentage has become around 40% (ITU, 2014). As the amount of available data grows, accessing the information has become easier and the use of mobile devices has become common among a wide range, due to the affordability and availability (Newhouse, Williams, & Pearson, 2006; Baran, 2014). According to Gartner (2014), smartphone sales in 2018 will reach 88% of global mobile phone sales, compared to 66% in 2014. Thanks to the mobile devices and their integration with the internet, everybody especially the youth has chance to carry their own encyclopedia, vocabulary, favorite books and whatever they need in their pockets which is known as mobility. In today's standard, become 24 x 7 available and being mobile in not an option instead they have both become necessity. According to Deloitte Global

Mobile Consumer Survey 2013, Smartphones penetration among the youth (aged 18-24) in the developed countries is 72% (Deloitte, 2013) and raised up to 88.6% in 2015 (Marketing Charts, 2015).

This increase of ownership of smartphones among the youth is the main reason prompting researchers to come up with ideas of how to use them for educational concept (Igbal & Bhatti, 2015). For integrating the mobile devices into learning environment, some investments and alterations have been made includes infrastructure, content and resources (Johnson et al., 2011), thus developing the field of new educational approaches. In recent years, traditional face-to-face teaching methods have started to give place to another more modern methods like electronic learning (e-learning) and mobile learning (m-learning). M-learning is defined as a form of e-learning that specifically uses mobile devices to integrate with ubiquitous computing technologies to deliver learning contents and supports (Muyinda, 2007; Hwang & Chang, 2011). M-learning is a subset of e-learning and their relationships are given below:

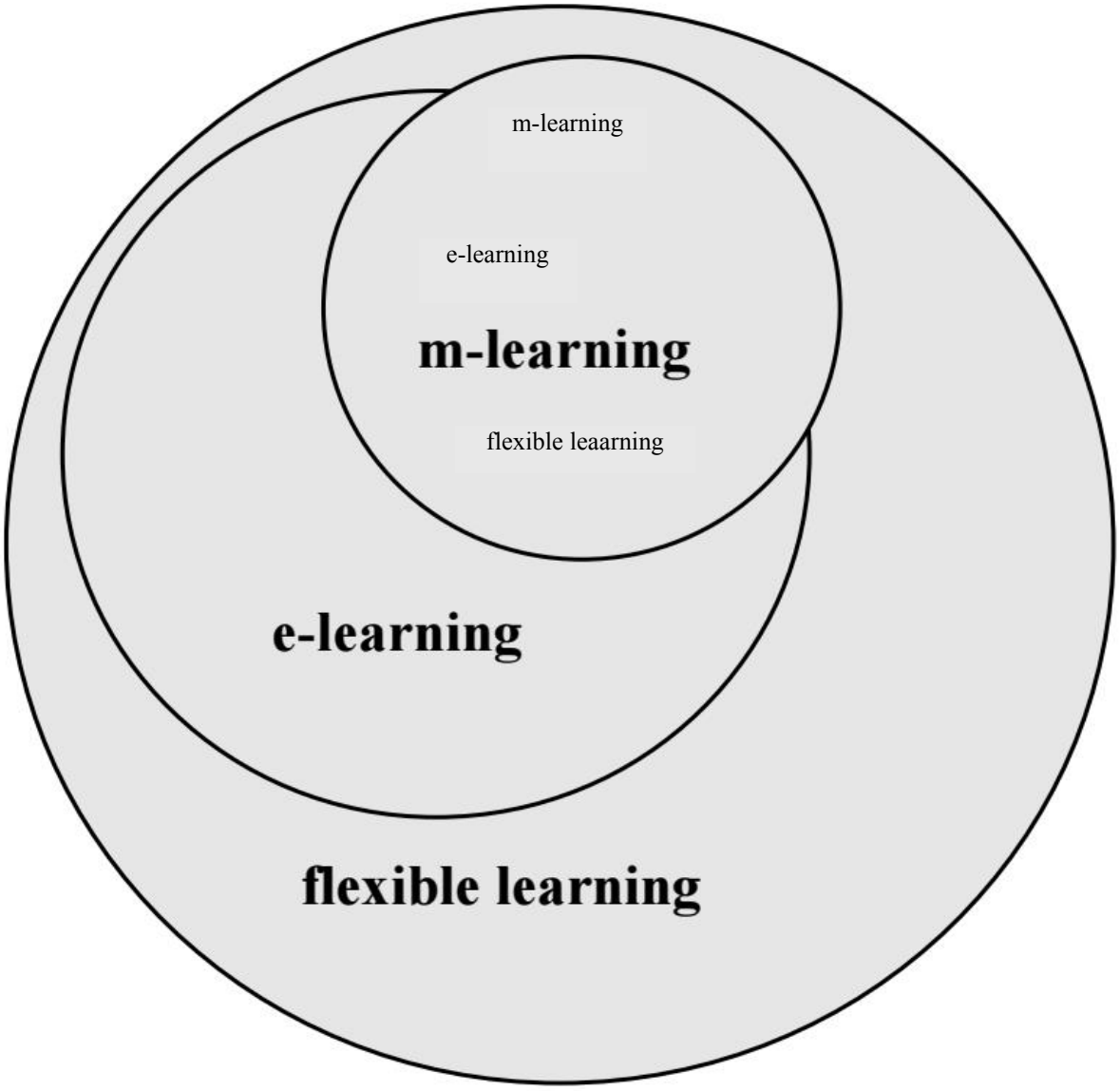

Figure 1: Relationships of e-learning and m-learning (Low & O'Connell, 2006)

Although e-learning seems to cover m-learning, there are many advantages of m-learning. Anyone with mobile phone or smartphone can benefit m-learning opportunities. First of all mobile learning has the supportive parts of mobility and its platforms. It encompasses many facets of mobility and it brings together both the

pedagogical innovation of m-learning and the pragmatic streamlining of administration in schools through mobile data collection and management (GSMA, 2014). Another one is as a novel educational approach, m-learning encourages flexibility; students do not need to be a specific age, gender or geography to participate learning environment. In a world of restrictions of time, sapce and place have been lifted (Behera, 2013). While e-learning is asynchronous, scheduled and passive; m-learning is synchronous, spontaneous and instant. Looked at from a different perspectives, there are some technical, social and educational challenges that m-learning has to be overcome. O'Leary, Cil, Lehane, and Corrigan (2013) pointed out that EL2 (second generation e-learning) user may face security and privacy issues. Wang, Wu and Wang (2009) claimed that mobile devices suffer from several difficulties such as having small screens, limited processing power, and small keyboards and so, adopting the mobile learning become a challenge.

While there is still differences between national perspectives, academia, industry, higher education and lifelong learning sectors in m-learning literature (Singh, 2010); it is generally accepted that m-learning play an extremely significant role in education concept where it can make significant contributions to learners' learning performance (Fang, Huang, & Lu, 2007). For instance, a project called "Apps for Good" in UK challenged students to design and build appropriate mobile applications to solve real-world problems. Obviously, students may learn to think critically and creatively (Wang, 2015). According to Althunibat (2015), mobile learning enables the higher education institutes to fulfill the demands of advanced digitalization of the internetworking that are posed by the generation. (Althunibat, 2015).

Cabot, Marcos and Lopez (2015) stated that m-learning is an effective way for learning but adaptation is also has the potential impact on learning performance too. So it can been said that the presence and accessibility of mobile technologies do not guarantee their potential will be realized in educational context (Liu et al., 2010). The need to understand the critical factors that influence the behavioral intention to use mobile learning, we try to investigate different factors like performance expectancy, facilitating conditions and social influence with the help of Unified Theory of Acceptance and Use of Technology (UTAUT). In this study, the appropriate model is determined as UTAUT. The literature inspiring us to apply this study is as following:

Birch and Irvine (2009) inquired about pre-service teachers' acceptance of Information and Communication Technology (ICT) in Canada. Their study showed that a 70% variation in users' intentions could be attributed to the UTAUT variables. Pullen, Swabey, Abadooz and Sing (2015) were to investigate and examine the behavior intention of pre-service teachers in acceptance of m-learning with UTAUT. The results revealed that performance expectancy, effort expectancy, social influence, attitude and self-efficient were all significant determinants of behavioral intentions to use m-learning. Another study was conducted with 823 students selected from five higher learning institutions from East Africa (Mtebe & Raisamo, 2014). At the end of the analyses it was noted that all four construct (performance expectancy, effort expectancy, social influence, and facilitating conditions) had has significant positive influence towards students' behavioral intention to use m-learning which is similar to findings by Wang et al. (2009). Thomas et al. (2013) aimed to compare UTAUT model in explaining m-learning adoption in higher education. The data were obtained from a web sruvey of university students and the model was estimated in a structural equation modeling framework. At the end, facilitating conditions and attitude were found to be the important factors on behavioral intention to use m-learning.

The only reason why we have chosen UTAUT as an analysis method of our study is that this model is very rare in m-learning literature conducted through the perspective of developing country, while there are numerous researches using Technology Acceptance Model (TAM) (Lindsay, Jackson, & Cooke, 2011; Wu, 2011; Igbal & Bhatti, 2015).

METHOD

UTAUT seems promising with regard to understanding of behavioral intention to accept and use technology. Researchers have demonstrated it to be a valid and reliable theory for the acceptance and use of information technology. Venkatesh et al., (2003) provide empirical evidence that it explains up to 70% of information technology use and acceptance. The initial UTAUT study focused on large organizations. Venkatesh et al.,

(2003) encouraged future research to explore and test the theory in different contexts. This dissertation seeks to gain in-depth understanding of community college student behavioral intentions to use and usage of mobile learning and to identify the implications that understanding has for increasing student access to library-related information, learning resources, and course-related information. Therefore, this study investigates the determinants in the process of adopting mobile learning in higher education using UTAUT as the theoretical basis.

However, previous research has suggested that UTAUT's fundamental constructs may not fully reflect the specific influences of mobile learning that may alter a user's behavioral intentions to use and actual usage of mobile learning (Wang & Shih, 2008). Pedersen and Ling (2003) also suggest that traditional IS adoption models may be modified and extended when researching technology adoption of mobile Internet services. For these reasons, this research also examines an additional construct self-management of learning. Wang et al., (2009) also found self-management of learning as a significant determinant of behavioral intention for mobile learning.

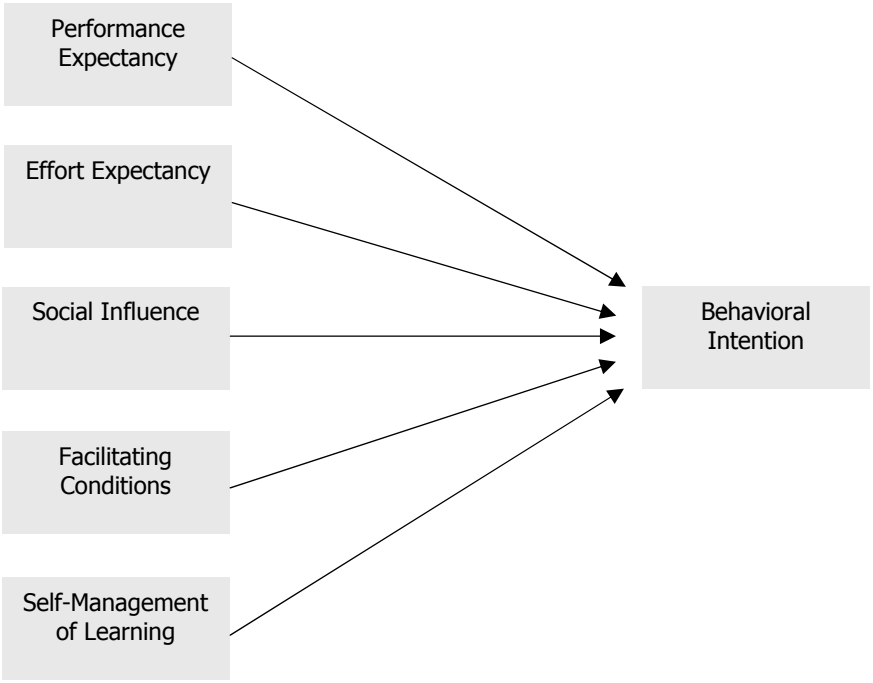

Figure 2: Research Model

Performance expectancy (PE) is defined as "the degree to which an individual believes that using the system will help him or her to attain gains in job performance" (Venkatesh et al., 2003: 447). This research examines the relationship between behavioral intention to use and the independent variable performance expectancy. Behavioral intention (BI) is a measure of a person's relative strength of intention to perform a certain behavior (e.g. listening to podcasts on a mobile device). Effort expectancy is defined as "the degree of ease associated with the use of the system" (Venkatesh et al., 2003: 50). Social influence (SI) is defined as "the degree to which an individual perceives that important others believe he or she should use the new system" (Venkatesh et al., 2003, pg. 451). Facilitating conditions (FC) is defined as "the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system" (Venkatesh et al., 2003: 453). Self-management of learning (SML) is "the extent to which an individual feels he or she is self-disciplined and can engage in autonomous learning" (Wang, et al., 2009: 10).

Questionnaire survey method is adopted in this research for collecting quantitative data. This research is restricted by researchers' manpower, time and funds, therefore, samples are selected mainly using convenience sampling method.

The survey instrument was based on the survey instrument developed by Venkatesh et al., (2003) and Wang et al. (2009). The UTAUT instrument has been used by numerous researchers (Anderson & Schwager, 2004; Moran, 2006; Wang & Shih, 2008) and is composed of questions adapted from previous IS surveys used to measure the constructs included in the model (Venkatesh, et al., 2003; Wang & Shih, 2008; Wang, et al., 2009). We chose to modify the instrument to make the questions relevant to the context of mobile learning and the participant population (e.g., the word "system" is replaced with "mobile learning"). Other research has made similar modifications the UTAUT instrument (Anderson & Schwager, 2004; Moran, 2006; Seal, 2006; Wang & Shih, 2008).

The questionnaire includes questions regarding the UTAUT constructs as self-management to determine college students' perceptions of their usage and intentions to use mobile learning. Other questions were included to collect both demographic and opinion-related data.

As in the original UTAUT survey instrument, Likert scales (1–5) with anchors ranging from "strongly disagree" to "strongly agree" were used for all construct items. Behavioral intention to use mobile learning scale was adopted from TAM and has been used extensively in previous research (Venkatesh et al., 2003). Self-management of learning was measured with Likert scales (1-5) with anchors ranging from "strongly disagree" to "strongly agree."

FINDINGS

Research is conducted on 491 college students at Sakarya University. The descriptive statistics for the participants' demographics are listed in Table 1.

Table 1: Gender and Grade Crosstabulation

			Grade				Total
			1	2	3	4	
Gender	Female	Count	141	50	34	29	254
		% of Total	28,7%	10,2%	6,9%	5,9%	51,7%
	Male	Count	90	64	41	42	237
		% of Total	18,3%	13,0%	8,4%	8,6%	48,3%
Total		Count	231	114	75	71	491
		% of Total	47,0%	23,2%	15,3%	14,5%	100,0%

Table 2 provides the descriptive statistics for the participants' responses to individual items of the scale. Mean composite scores were calculated for each of following six subscales: performance expectancy, effort expectancy, social influence, facilitating conditions, self-management of learning, and behavioral intention to use mobile learning.

Table 2: Mean Scores Of Subscales

Subscale	N	Minimum	Maximum	Mean	Std. Deviation
SML	491	1,00	5,00	3,7459	1,11265
PE	491	1,00	5,00	3,7678	1,05148
EE	491	1,00	5,00	3,6034	1,00351
SI	491	1,00	5,00	3,1074	,94991
FC	491	1,00	5,00	3,6991	,85994
BI	491	1,00	5,00	3,5187	,92278

Several Cronbach's alphas were calculated to assess the level of internal consistency reliability of the eight subscales. Cronbach's alpha is based upon the average correlation among the items in a scale. The reliability coefficients (Table 3) reveals that all of the subscales demonstrate sufficient levels (alpha .70 or greater) of internal consistency reliability.

Table 3: Reliability Coefficients

Subscale	N of items	Cronbach's Alpha
SML	4	,825
PE	4	,962
EE	4	,911
SI	4	,836
FC	4	,716
BI	4	,972

The means and standard deviations of subscale scores for both gender groups are listed in Table 4. According to the findings most similar scores are achieved for the behavioral intention subscale. That means female and male participants' responses are very similar for relevant items. On the other hand, the biggest difference between responses is seen on facilitating conditions subscale. An independent samples t-test was conducted to determine if there was a significant difference between male and female students in terms of subscale responses.

Table 4: Group Statistics

	Gender	N	Mean	Std. Deviation
SML	Female	254	3,7648	1,10516
	Male	237	3,7257	1,12262
PE	Female	254	3,7205	1,08010
	Male	237	3,8186	1,01976
EE	Female	254	3,5876	1,04822
	Male	237	3,6203	,95519
SI	Female	254	3,1644	1,01510
	Male	237	3,0464	,87270
FC	Female	254	3,6112	,89695
	Male	237	3,7932	,80975
BI	Female	254	3,5066	,93800
	Male	237	3,5316	,90799

The intention scores were standardized by group and the resulting z-scores were used to identify outliers. A participant is considered an outlier when the standardized z-score is greater than 3. This process did not reveal any outliers. The mean differences of subscales and t-test scores are listed in Table 5. The t-test revealed a significant difference between the females and males on facilitating conditions scores. The males scored significantly higher than the females on the items about "the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system". For the other subscales there were no significant differences between the males and females' responses.

Table 5: Independent Samples T-test

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	Sig. (2-tailed)	Mean Difference
SML	Equal variances assumed	,885	,347	,388	,698	,03903
	Equal variances not assumed			,388	,698	,03903
PE	Equal variances assumed	,317	,573	-1,033	,302	-,09809
	Equal variances not assumed			-1,035	,301	-,09809
EE	Equal variances assumed	,472	,493	-,360	,719	-,03265
	Equal variances not assumed			-,361	,718	-,03265
SI	Equal variances assumed	11,244	,001	1,376	,169	,11796

	Equal variances not assumed			1,383	,167	,11796
FC	Equal variances assumed	3,580	,059	-2,355	,019	-,18203
	Equal variances not assumed			-2,363	,019	-,18203
BI	Equal variances assumed	,392	,532	-,301	,764	-,02508
	Equal variances not assumed			-,301	,764	-,02508

A multiple regression was conducted to test if the independent variables in the research model are significant predictors of the behavioral intention to use m-learning. The descriptive statistics for the independent variables are listed in Table 6. The data were screened for outliers prior to analysis in the same manner described for the t-test. The standardized residuals reveal 3 outliers in the data. Review of the variance inflation factors and tolerance levels reveals no evidence of multicollinearity; a plot of standardized residuals reveals no model heteroscedasticity.

Table 6: Regression Analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson	Regression (p)
1	,797[a]	,635	,631	,56029	1,972	,000

a. Predictors: (Constant), FC, SI, SML, EE, PE
b. Dependent Variable: BI

Regression analysis scores revealed that the suggested variables were significant predictors of the behavioral intention to use mobile learning and the model is statistically significant, $p < .001$, $R2 = .635$. This indicates that together the predictors make a significant amount of variation in the dependent variable (BI). The regression coefficients, in the table 7, reveal that all the variables are all significant positive predictors within this model. This indicates that the intention to use mobile learning increases with increasing levels of all these subscales.

Table 7: Regression Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	,295	,118		2,502	,013
SML	,160	,039	,193	4,063	,000
PE	,418	,047	,389	8,860	,000
EE	,193	,048	,210	4,034	,000
SI	,077	,032	,080	2,411	,016
FC	,038	,048	,043	1,791	,043

a. Dependent Variable: BI

DISCUSSION AND CONCLUSION

Mobile learning in higher education is still in the beginning stages of implementation. The concepts and instructional issues surrounding mobile learning are still evolving (Kukulska-Hulme, 2007). The findings from this research add to existing technology acceptance literature and propose a framework for understanding, explaining, and predicting factors influencing individual acceptance of mobile learning. The study provides valuable baseline data for future studies on student acceptance and intention to use mobile devices for learning. The research model also establishes a foundational framework that administrators and educators can use to evaluate success factors for implementing mobile learning. By understanding the determinants of mobile learning acceptance, these stakeholders are able to incorporate these factors into the design and implementation phases of a mobile learning initiative. Institutional preparation requires careful planning in infrastructure and strategy development necessary for implementing a mobile learning initiative to benefit college students. The results of this study identify factors that favor college students' mobile learning.

Overall, the results from this study indicated that together the UTAUT predictors (performance expectancy, effort expectancy, social influence, and facilitating conditions) and the added predictor self-management of learning account for .635 percent of the variance in behavioral intention to use mobile learning. This is higher than was found in the research by Wang et al. (2009) (58%). Consistent with Venkatesh et al., (2003), performance expectancy and social influence had a significant, positive influence on behavioral intention to use mobile learning. As shown by both Venkatesh et al., (2003) and Wang, et al., (2009), performance expectancy was found to be the strongest predictor of behavioral intention, and effort expectancy and social influence were found to be significant positive predictors. Facilitating conditions was also found to be a significant positive predictor of behavioral intention. This is in contrast to the UTAUT model where facilitating conditions was identified as a predictor for usage or the Wang et al., (2009) model which did not include facilitating conditions. As in previous research, this study confirmed self-management of learning (Wang et al., 2009) to be a significant positive predictor of behavioral intention. Thus, this study has in part successfully extended the application of UTAUT in the college mobile learning context by adding self-management of learning as a predictor for behavioral intention. Justifying and validating our explanations for the similarities and differences in the findings in this research need further investigation in future studies. The findings of this research will help educators and administrators to promote mobile learning and provide insights into future research on mobile technology acceptance.

These findings present implications for different approaches to supporting mobile learning. Understanding the determinants of students' acceptance and use of mobile technology for learning is essential to the successful delivery of academic, organizational, library, and instructional information. Before investing in development of mobile services and content, an institution must anticipate factors that influence students' technology acceptance. If students fail to accept mobile technology offered then they will not use it to seek and exchange information. The outcome will be wasted budgetary expenses.

The data from this study suggests that there is student interest in mobile learning. Given the integration of mobile devices into students' daily lives, faculty and instructional design staff can support mobile learning by identifying ways in which mobile devices can be utilized to support both classroom and remote learning. The literature suggests that this social influence will be strongest during the initial stages of mobile learning and will decrease over time as mobile device use becomes more integrated with learning (Morris, 2000; Venkatesh, et al., 2003). Faculty and learning support staff can influence the use of mobile learning by providing content and information on resources formatted for mobile devices and by educating students on its benefits. The key factor is to understand student needs, concerns, and the factors affecting their acceptance.

Mobile learning research is rapidly growing and expanding. However, there is limited research on mobile learning in higher education using technology acceptance as the theoretical foundation. Mobile learning research in higher education needs to take heed both of the determinants of student usage and of the resources students wish to access. This research contributes to the body of knowledge in technology acceptance and mobile learning and provides a foundation for similar research in the future.

In the context of a college setting, this study confirms the ability of the UTAUT's independent variables performance expectancy, effort expectancy, social influence, facilitating conditions, and the additional construct self-management of learning in predicting students' behavioral intent to use mobile devices for learning. More research is needed to determine significance of "self-management of learning" as a predictor. College administrators and educators can also use this information as a foundation for IT and instructional decision making for a mobile learning initiative.

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