

# The Effect of Digital Literacy on Learning in Higher Education

Penjuree Kanthawongs<sup>1</sup>, Sasithorn Suwandee<sup>2</sup>, Felicito Angeles Jabutay<sup>3</sup>, Chaisak Chitcharoen<sup>4</sup>, Penjira Kanthawongs<sup>5</sup>, Tan Limpachot<sup>6</sup>

<sup>1, 2, 3, 4, 5, 6</sup>Department of Business administration, Kasembundit University, Bangkok

Email address: <sup>1</sup>penjuree.kan@kbu.ac.th, <sup>2</sup>sasithorn.suw@kbu.ac.th, <sup>3</sup>felicito.jab@kbu.ac.th, <sup>4</sup>chaisak.chi@kbu.ac.th, <sup>5</sup>penjira.k@bu.ac.th, <sup>6</sup>doublet1223@gmail.com

**Abstract**— The current paper investigates the influence of student technology competency on learning in higher education. We focus on applying email as part of medium of class instruction and communication. Building on digital literacy framework and technology acceptance model (TAM), we focus on technology competency of learner rather than system evaluation (i.e. perceived ease of use, perceived usefulness). The study found that student technology competency positively effect on student attitude, learning effectiveness, perceived satisfaction, and intention to use email for course delivery. Therefore, determining student technology competency would enhance course delivery effectiveness in designing the instruction medium.

**Keywords**— Digital literacy; technology acceptance model; email; learning effectiveness; higher education.

## I. INTRODUCTION

Increasing number of internet accessibility impact on learning environment in higher education. Blended learning was introduced for integrating internet technology to face-to-face learning (Garrison & Kanuka, 2004). Internet information and communication tools reduce the time and place limitation while enhance the utilization of face-to-face and online learning (Garrison & Kanuka, 2004). Previous researches investigate adoption of e-learning system (Novo-Corti, Varela-Candamio, & Ramil-DíAz, 2013), e-textbooks (Hsiao, Tang, & Lin, 2015), online learning (Saadé & Bahli, 2005) using Technology acceptance model (TAM). TAM (Davis, Bagozzi, & Warshaw, 1989) was developed to provide a basis for locating the impact of external factors on internal beliefs, attitudes, and intentions. It focuses on system evaluation by user in the dimension of perceived ease of use and perceived usefulness. However, technology competency of user may impact on the degree of evaluation. We argue that digital literacy in technology dimensions impact on learning effectiveness, perceived satisfaction of using the system, and intention to use the system. Ozkan and Koseler (2009) suggested that learner perspective, instructor attitudes, system quality, information quality, service quality, and supportive factors impact on evaluating effectiveness of the system. Previous researches explore the influence of the system on learning effectiveness while limited researches investigate on the technology competency of learner.

We propose the effect of digital literacy model and examine the relationships with 139 undergraduate students in Thailand. Hybrid learning or blended learning (i.e. email and face-to-face) was employed for course delivery. The findings confirm the proposed model. Digital literacy has positive direct effect and indirect effect on learning effectiveness and perceived satisfaction in using email for learning. Attitude toward using email for email mediate relationship between digital literacy and learning effectiveness as well as between

digital literacy and perceived satisfaction. However, relationship between digital literacy and intention to use is not mediated by attitude toward using email for learning.

The proposed model extends TAM to explore the effect of learner's technology competency. It contributes to learning environment in higher education to include information communication technology for course delivery, particularly, in designing teaching and evaluation methodology to match with learner technology competency.

## II. LITERATURE REVIEW

### *Digital Literacy*

Technology competency is new standard of graduating student in applying technology in various setting (Greenhow, Robelia, & Hughes, 2009). The current paper refers to digital literacy as multiplicity of literacies related to the use of digital technologies. Digital literacy enhances adaptability to new technologies and comprehension of new semiotic language for communication (Ng, 2012). Ng (2012) assert that digital literacy reflect in three dimensions: (1) technologies (i.e. ability to operate technologies adequately); (2) cognitive (i.e. critical thinking skill in evaluate appropriate software program); (3) social-emotional (i.e. respect and using appropriate language, not disclose unnecessary personal information, ability to deal with threat). This paper focuses on technologies dimension in examining learner technology competency because operational skill is the basic skill that required cognitive dimension and social-emotional dimension to fulfill system adoption.

Interactivity (i.e. hybrid learning) can improve learning effectiveness (Zhang, Zhou, Briggs, & Nunamaker, 2006) while learner characteristics contribute to developing hybrid learning (Liaw, 2008). Thus, impact of digital literacy of learner on learning in higher education should be investigated further.

### Technical Acceptance Model (TAM) and Hybrid Learning

Hybrid learning with web 2.0 technology enhance the principles of collaboration and participation (Greenhow et al., 2009), therefore, it was adopted in higher education. Previous researches apply TAM to investigate the effect of technology on education in diverse dimensions. For instance, social media (Evans et al., 2014), e-textbook adoption (Hsiao et al., 2015), learning management system adoption (Fathema, Shannon, & Ross, 2015).

Technical acceptance model (TAM) was developed to provide a basis for locating the impact of external factors on internal beliefs, attitudes, and intentions (Davis et al., 1989). We extend TAM (Davis et al., 1989) that suggest perceived usefulness and perceived ease of use impact on attitude toward using information system while attitude influence on behavioral intention to use.

### Research Model and Hypotheses

We adapt TAM (Davis et al., 1989) to explore the influence of digital literacy on learning that includes learning effectiveness, perceive satisfaction, and intention to use while examining the mediating role of attitude toward using email for learning. Previous research asserted that computer skill of learner contributes to learner attitude toward the system. Therefore, we adapt digital literacy of learner as external variable in TAM to the proposed model in figure 1. The present study investigates the effect of digital literacy on attitude toward using email for learning and intention to use email for learning.

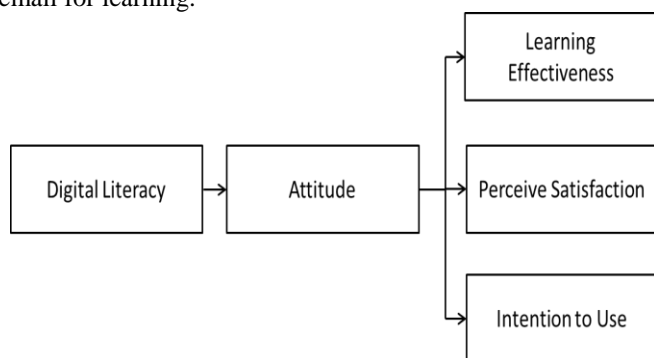


Fig. 1. Effect of digital literacy framework.

Furthermore, learner computer anxiety has a negative effect on perceived e-Learner satisfaction (Sun, Tsai, Finger, Chen, & Yeh, 2008). Thus, digital literacy in using online tool influence on learning satisfaction (Sahin & Shelley, 2008). Digital literacy in technology also has positive effect on learning effectiveness (Johnson, Hornik, & Salas, 2008). Furthermore, learner attitude toward technology has positive effect on overall learner satisfaction (Ozkan & Koseler, 2009). Therefore, we examine the mediating role of attitude using email for learning on learner satisfaction. Thus, the current research examines the effect of digital literacy in following of four hypotheses.

**Hypothesis1:** Digital literacy positively effect on attitude toward using email.

**Hypothesis2:** Positive relationship between digital literacy and learning effectiveness is mediated by attitude toward using email.

**Hypothesis3:** Positive relationship between digital literacy and perceived satisfaction is mediated by attitude toward using email.

**Hypothesis4:** Positive relationship between digital literacy and intension to use is mediated by attitude toward using email.

### III. METHODOLOGY

#### Participants and Procedure

The participants are 150 undergraduate students from Thailand. The surveys were administered during regular class after hybrid learning had been applied in class for 16 weeks. Extra credits were given as incentive for participation. Trained instructors provided the study objectives and assure the confidentiality and anonymity, then, distribute questionnaire to students. Respondents were thanked and dismissed after finished all required task. 139 respondents complete the questionnaires which accounted for 92.69 % response rate. 48.2% of the respondents are male and 51.8 % of them are female. Most of the respondents were aged between 18 and 22.

#### Measurement

We employ five-point Likert-type scale, with anchors from “strongly disagree” to “strongly agree”. The measure of digital literacy in technology dimensions adapted from Ng (2012) comprised of six items includes: (1) I know how to solve my own technical problems; (2) I can learn new technologies easily; (3) I keep up with important new technologies; (4) I know about a lot of different technologies; (5) I have the technical skills I need to use email for learning and to create artifacts (e.g. presentations, digital stories, wikis, blogs) that demonstrate my understanding of what I have learnt; (6) I have good IT skills. Attitude measures individual attitude toward using email for learning. We adapted from Sánchez and Hueros (2010) comprise of three items includes: (1) Learning with email is fun; (2) Email is an attractive way to learn; (3) Overall, I like using email.

Perceived satisfaction and learning effectiveness were adapted from Novo-Corti et al. (2013) based on Liaw (2008). Perceived satisfaction measured respondent satisfaction toward using email for learning. Four measurement items are: (1) I am satisfied with using email as a learning assistant tool; (2) I am satisfied with using email functions (3) I am satisfied with learning contents though email; (4) I am satisfied with multimedia instruction. Learning effectiveness measures effectiveness in using email for learning. Three measurement items are: (1) I believe email can assist learning efficiency; (2) I believe email can assist learning performance; (3) I believe email can assist learning motivation. Intention to use measured respondent intention to use email for learning. Three measurement items for intention to use adapted from (Escobar-Rodriguez & Monge-Lozano, 2012) are: (1) I intend to use email in my studies when it becomes available in all subjects; (2) I intend to use email in my studies as often as

needed; (3) To the extent, I would use email to do different things.

#### Measurement Assessment

We establish individual reliability for each item and convergent and discriminate validity of the constructs. Cronbach's alpha was used to test the internal consistency reliability of each constructs. All construct exceed Nunnally and Bernstein (1994)'s recommendation of 0.6 includes digital literacy (0.849), attitude (0.826), perceived satisfaction (0.910), learning Effectiveness (0.889), and intention to use (0.686). Indicators are reliable with item to total correlation is greater than 0.3. The measurement items loaded significantly onto their respective constructs with loadings ranging between 0.638 and 0.933, suggesting convergent validity of the theoretical constructs. The lowest correlation values of items in the same construct are higher than correlation with items of other constructs. These confirm discriminant validity of constructs.

#### IV. RESULT AND ANALYSIS

##### Hypotheses testing

We examined paths in the digital literacy effect model adapted from TAM. The finding suggested that all paths in the proposed model are statistically significant as illustrated in table I. Digital literacy has positive effect on attitude toward using email for learning ( $\beta = 0.54$ ,  $p < 0.01$ ). Thus, hypothesis 1 is supported.

TABLE I. Path analysis.

| Paths                                     | Standardized Coefficients | R Square | p-value | t-value |
|---|---------------------------|----------|---------|---------|
| Digital Literacy → Attitude               | 0.540                     | 0.291    | 0.00    | 7.500   |
| Digital Literacy → Learning Effectiveness | 0.366                     | 0.134    | 0.00    | 4.610   |
| Digital Literacy → Perceive Satisfaction  | 0.373                     | 0.139    | 0.00    | 4.705   |
| Digital Literacy → Intention to use       | 0.482                     | 0.232    | 0.00    | 6.440   |
| Attitude → Learning Effectiveness         | 0.489                     | 0.239    | 0.00    | 6.556   |
| Attitude → Perceive Satisfaction          | 0.501                     | 0.251    | 0.00    | 6.778   |
| Attitude → Intention to use               | 0.627                     | 0.393    | 0.00    | 9.414   |

##### Testing the Mediating Role of Attitude

We tested the mediating effects of attitude on learning effectiveness in three steps of Baron and Kenny (1986) based on Wong, Lai, and Ngai (2009). We first tested whether digital literacy influence on attitude toward using email and found that this relationship is significant ( $\beta = 0.54$ ,  $p < 0.01$ ) with R Square of 0.291. Next, we assessed whether digital literacy impact on learning effectiveness and found that this relationship is significant ( $\beta = 0.366$ ,  $p < 0.01$ ). Then, we tested if attitude affects learning effectiveness with the control of

relationship between digital literacy and attitude, as well as the relationship between attitude and learning effectiveness. We found that the relationship between digital literacy and learning effectiveness was not significant. These suggest that attitude mediate the relationship between digital literacy and learning effectiveness. Therefore, hypothesis 2 is supported. Similar steps were applied to relationship between digital literacy and perceived satisfaction as well as relationship between digital literacy and intention to use. The result suggested that attitude also mediate relationship between digital literacy and perceived satisfaction. We found statistically significant relationship between digital literacy and perceived satisfaction ( $\beta = 0.373$ ,  $p < 0.01$ ). Hence, hypothesis 3 is supported. However, attitude did not mediate the relationship between digital literacy and intention to use. Therefore hypothesis 4 is not supported. Still, the result show statistically significant relationship between digital literacy and intention to use to email ( $\beta = 0.482$ ,  $p < 0.01$ ).

#### V. DISCUSSION AND CONCLUSION

The current study aims to investigate the impact of digital literacy on learning in the proposed model. We focus on technologies dimension in digital literacy construct. We included the effect on learning effectiveness, perceived satisfaction, and intention to use email for learning. The mediating role of attitude toward using email for learning on learning effectiveness, perceived satisfaction, and intention to use email for learning was also observed.

The findings supported hypothesis 1, hypothesis 2, and hypothesis 3. We found that digital literacy has positive effect on attitude toward using email for learning. The result also show that digital literacy has positive direct effect and indirect effect on learning effectiveness and perceived satisfaction in using email for learning. In testing the mediating role of attitude toward using email for email, we found that it mediate relationship between digital literacy and learning effectiveness as well as between digital literacy and perceived satisfaction. However, relationship between digital literacy and intention to use is not mediated by attitude toward using email for learning. Thus, hypothesis 4 is not supported.

The finding relating to mediating role of attitude between digital literacy and intention to use can be expected. This finding coincide with Davis et al. (1989) suggestion that attitude is partially mediate the causal link between belief and intentions in TAM. Even though attitude did not mediate relationship between digital literacy and intention to use, both digital literacy and attitude have positive direct effect on intention to use.

The proposed model confirmed the effect of digital literacy on learning effectiveness, perceived satisfaction, and intention to use email for learning. We reflect the role of learner characteristic that impact on using system for learning. Digital literacy of learner is significant for achievement in higher education. Thus, education environment should enhance digital literacy of learner while matching the teaching methodology to learner competency.

The current paper focuses on the operational skill of learner in using technology. However, future research should investigate the effect other dimension (i.e. cognitive dimension and social-emotional dimension) in digital literacy framework on learning. Furthermore, other dimensions of learner characteristics such as their roles or engagement in social media should be explored.

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