Technology Acceptance of Thai Primary Student on Outdoor Learning Activity Using Mobile Device

Pradorn Sureephong, Piriyamart Sirichai and Sompon Winya

Abstract Nowadays, technology plays very important role on the learning activity. Especially, it enables the mobile learning mode, which allows the learner to get access to the knowledge anywhere and anytime. In 2013, Thailand had adopted nearly millions of tablets as a learning tool for primary school students. Although this policy brought a great change for Thai's education, the methodology to integrate the tablet into regular classroom teaching is still ambiguous for Thai's educators. Moreover, the effect of newly adopted technology on the primary school student is still under argument between technologists and educators. Hence, this research aims at analyzing the technology acceptance of 100 primary students on the mobile technology. The outdoor learning activity was set up by using the tablet as a learning tool. After the activity, the questionnaire that adopted the Technology Acceptance Model (TAM) was used for analyzing how students perceive, accept, and adopt the mobile technology to use. The result shows that student's attitude (ATT) very according to three factors [i.e., perceived of usefulness (PU), perceived ease of user (PEU), and perceived enjoyment (PE)]. Moreover, the result also shows that the behavioral intention (BI) of students on mobile learning is not affected by the attitude of the students. The comparison of the results with other related studies also confirms that the TAM of primary school student is unique and different from higher education.

Keywords Mobile learning · Technology acceptance model · Behavioral intention

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O. Sourina et al. (eds.), *Subconscious Learning via Games and Social Media*,
Gaming Media and Social Effects, DOI 10.1007/978-981-287-408-5_8

1 Introduction

Educating in the twenty-first century will become a huge phenomenon which reform the traditional teacher-centered classroom with paper-based learning to child-centered learning that more diversified learning environment to support student lifelong learning (Ministry of education 2010; OTPC project 2012). In the third-generation (3G) era, which is availability of data coverage of infrastructure and multimedia data transmission, also 3G mobile service could be used as an efficient learning tool. Thus, Thai government introduced one tablet per child policy into the primary education sector in May, 2012, namely "One Tablet Per Child (OTPC)." Tablets were used to create equality in educational opportunities and improvement between urban and rural children and also have attracted various users including teachers, educators, and administrators (Ministry of education 2010; OTPC project 2012). In Thai, schools have approximately 8 million students (Ministry of education 2010). A total of 900,000 tablets are providing around 2700 million THB. Market capacities of tablet costs would be reduced following the product life cycle so that demand for tablet usage would be increasing in the future. At this point, authors will follow up this policy by studying the effective of mobile learning as a new instructional for academician. The purpose is to enhance the understanding of the use acceptance of mobile learning. The M-learning is still in its development stage; this crucial motivational variable that will affect its adoption by user needs to be explored. The research question is to examine determinate factors relationship of Technology Acceptance Model (TAM) on mobile learning and study the behavioral intention (BI) of Thai primary student on outdoor learning activity through mobile device for the development of knowledge creatively.

2 Literature Review

The acceptance of technology has been studied actively for a couple of years. To better understanding on the methodology, these two learning theories which are mobile learning and TAM are reviewed as the background information.

2.1 Mobile Learning

Mobile learning (M-learning) is a new educational method and more flexible than previous e-learning applications (Mathieson et al. 2001). The definition of M-learning is the delivery of electronic learning content to learner utilizing mobile computing device such as tablets PC, mobile phone, and smartphone (Devaraj et al. 2002). Learner is able to access anytime and anywhere learning experiences (Gao 2005) because mobile devices allow learner to access the information

outside their classroom, also able to encourage learning in the real-world context and home environment (Mobl21 2013). It is a new educational method and more flexible than previous e-learning applications (Henderson and Divett 2003). The context awareness has the potential to revolutionize the mobile social application—these new applications not only increase the profile of friends but also build new friendships. While many studies have demonstrated the benefits of applying these technologies to learning as others, authors explained that students can learn the sensing technology that can detect and record the student's behaviors in both the real and the digital world. In contrast, not all learners are similarly. Learning methodology should be adaptable to individual and divers learners, which are significant opportunities for genuine support, autonomous, and individuals learning through mobile devices (Mobl21 2013). In concern with this research, authors have studied in-depth on aspects of mobile learning such as framework, usefulness, application, evaluating, and so on and adopted M-learning as a learning tool for primary students along with the outdoor activities. This paper will support M-learning for continuously developing.

2.2 Technology Acceptance Model (TAM)

Technology acceptance can be defined as how user perceive, accept, and adopt some technology to use (Davis et al. 1989). TAM descripted the prior of the adoption of information technology (IT) and considered a strong tool for extent the adoption of new technology by users (Agarwal and Prasad 1999; Davis et al. 1989; Doll et al. 1998; Henderson and Divett 2003; Segars and Grover 1993). TAM was developed by Davis et al. (1989). TAM is derived from theory of reasoned action (TRA) as a backdrop (Ajzen and Fishbein 1980). TAM is a behavioral model that explains the antecedents of adoption of IT and is considering a robust tool for evaluating of IT by user (Davis et al. 1989). Figure 1 shows TAM which included six factors, namely external variable, perceived usefulness, perceives ease of use, attitude toward use, BI, and actual usage. It shows that user behavior was determined by perceived of usefulness (PU), perceived ease of use, and attitude (Davis et al. 1989). This study investigates the future acceptance of the emerging M-learning. In education term, use of TAMs to study technology acceptance situation would be a useful tool for understanding and managing technology initiatives. Gao (2005)

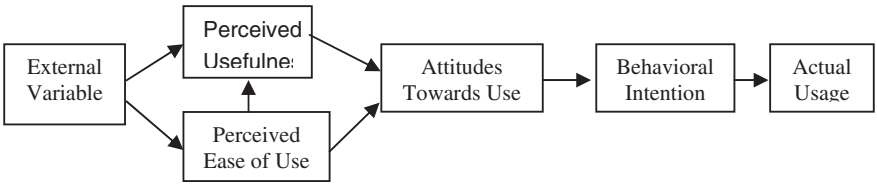

Fig. 1 Original technology acceptance model (Davis et al. 1989, p. 985)

stated that "*TAM can serve the purpose of evaluate computing products such text books, technology system and provide a valuable tool to educators.*" Therefore, this research studies adapted TAM to investigate M-learning with Thai primary student.

The following sections describe the constructs of TAM in details and relate the relationship of this study.

2.2.1 External Variable

Davis et al. (1989) observed the external variable enhances the ability of TAM to forecast future acceptance technology. However, the construct of TAM still has to extend by incorporating additional factors. The external factor chosen depends on the target of each technology study, main idea, and context (Moon and Kim 2001). In addition to more understand this study of user perception of mobile learning, two variables, namely "perceived mobility" and "perceived enjoyment," are presented in the model (Agarwal and Prasad 1999).

Perceived mobility value (*PMV*) stands for user awareness of the mobility value of mobile learning. It gains access to service information anywhere at anytime through mobile devices such as smartphone, tablets, and so on. The mobility supports user for convenience to learn when and where it is necessary. The mobility is a main advantage of M-learning. Therefore, PMV is a critical factor of individual differences affecting user's behaviors. Thus, this study uses PMV as a new variable for this TAM model.

Perceived enjoyment (*PE*) (Davis et al. 1989) is defined as the activity of using the consequences that may be anticipated. PE in this study explains that an individual finds the interaction in mobile learning as intrinsically enjoyable or interesting. It has been found to influence user acceptance significantly. Igbaria et al. (1995) and Yi and Hwang (2003).

2.2.2 Behavior Intention

Definition of behavior is a person's perceived probability that will engage in the behavior (Davis et al. 1989). BI was affected by attitude toward the behavior, subjective norm, and perceived behavioral control. The major moderator of the BI consists of four dimensions of behavior influence as following: perceived behavioral control, complexity, social desirability, and social involvement. In term of technology means that intention behavior is ready to use in technology.

3 Research Framework and Hypotheses

The research objective aims at examining the factors of students' behavior intention as shown in Fig. 2. Because Thai students have low learning intentions in the classes, their classes are still traditional teaching that teacher is the center. The mobile learning

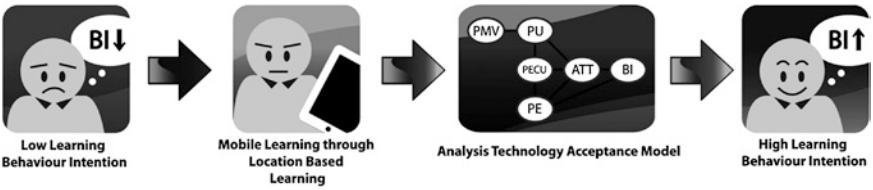

Fig. 2 Research concept

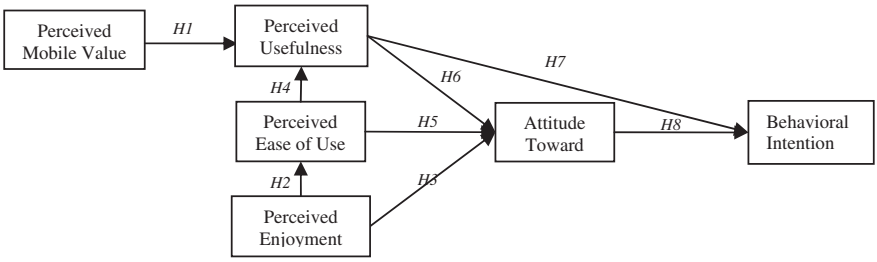

Fig. 3 Proposed extended TAM model (Davis et al. 1989 sited; Huang et al. 2006)

is a solution tool that changed traditional teaching to modern teaching through new technology. TAM investigates the factor analysis of this research concept. The outcome of the study in students will increase their high learning behavior intention in their class and accept the new media for their learning.

The causal relationship between the factors proposed original TAM from Davis et al. (1989) and also applied the proposed TAM on M-learning from Huan and Lin (2007). They increased two individual difference variables which are perceived mobility and PE. It is for more understanding of user perception of M-learning as shown in Fig. 3. On the other hand, actual usage is not a cogent measure of the value of M-learning, as indicated in previous studies (Lu et al. 2003). So, the boxes represent the factors which were measured by items and arrows representing hypotheses 1–8. In accordance with the previously stated objectives and consistent with related literature, this study tested the following hypotheses:

The mobility associated with time-related needs will encourage users to adopt mobile technology since accessibility will affect dynamic interaction and high levels of engagement. So, user who received the value of mobility also understands the uniqueness of M-learning and strong perception of its usefulness. This study treats PMV as a direct antecedence of PU.

H1 PMV has a positive effect on perceived usefulness. PE is the extent to which an individual finds the interaction of M-learning intrinsically enjoyment or interesting. Prior research role of enjoyment suggested the importance of enjoyment on users' attitude and behavior (Igbaria et al. 1995; Yi and Hwang 2003).

H2 PE has a positive effect on perceived ease of use.

H3 PE has a positive effect on attitude. The influence of perceived ease of use (PEOU) is where user feels that minimal effort is required to learn in M-learning. PU refers to the users' belief that using M-learning would help them in better learning and improve her/his performance (Davis et al. 1989). This belief creates a positive attitude toward learning, thereby increase the user's intention to use M-learning.
H4 PEOU has a positive effect on perceived usefulness.
H5 PEOU has a positive effect on attitude.
H6 Perceived usefulness has a positive effect on attitude.
H7 Perceived usefulness has a positive effect on BI. BI is the user's intention to use the M-learning to help them to perform the actual task. BI is influenced both by PU and attitude. This relationship has been examined by many prior studies (Davis et al. 1989; Venkatesh and Davis 2000).
H8 Attitude has a positive effect on BI.

4 Research Methodology

4.1 Research Framework

The research framework is illustrated in Fig. 4 on bringing knowledge testing and questionnaire validate. The authors also concentrated Thai primary students to the outdoor activities and provided the mobile learning ability through tablet. Firstly, fifteen teachers in eight core subjects were brought to the Chiang Mai Zoo to create the questions which are related to the situation location and eight core subjects. Secondly, Pre-M-learning event was studied with 30 Thai primary students from grade 4 for refining the questions. Lastly, post-M-learning event was studied with 100 Thai primary students also from grade 4, who were studying both in private and government school, by responding to the questionnaire which is based on TAM constructs validated relating to M-learning in prior research (Davis et al. 1989; Huan and Lin 2007) and then adapted to the context of the questionnaire. The participants were guaranteed confidentiality of their individual response. Before post-event, the questionnaire was assured content validity by 50 students. Authors used Cronbach's alpha (Cronbach 1951) to test the reliability of all items

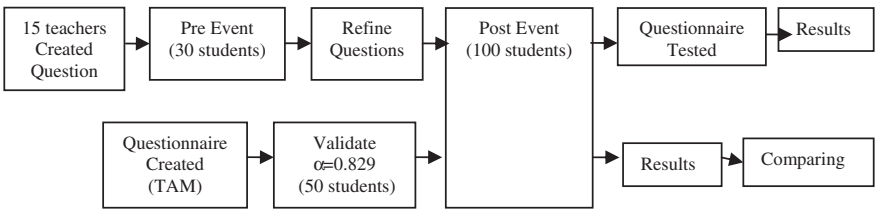

Fig. 4 Research framework

in six factors. The internal consistency of reliability coefficients in this study is well accepted because degree of reliability with statistic value is above 0.70. Later on, the questionnaire was tested by 100 students and acquired the results for discussion and conclusion in hypotheses testing. In addition, the factor analysis was conducted by LISREL to test path analysis of TAM on M-learning.

4.2 Measurement Scales

The completed instrument consisted of two sections. First section was for identifying demographic attributes of the participants. It contained demographic items such as name, year, grade, gender, and education. Second section was based on mobile learning usage and subsequently developed from TAM scales by adapted from Davis et al. (1989) and Venkatesh and Davis (2000). The questionnaire consists of 30 items that measured PMV (5 items), PEOU (5 items), PU (5 items), PE (5 items), ATT (5 items), and BI (5 items). The response scale for all items was a 5-point Likert scale ranging from strongly disagree (1) to strongly agree (5).

4.3 Data Collection

Paper version of the mobile learning questionnaire was administrated to 100 participants to fill out all items. Thai language was used in this questionnaire to make it easier and more understandable the mobile learning questions for grade 4 Thai students. The data collected from 100 participants was analyzed to provide evidence for the validity and reliability of the questionnaire.

5 Research Results

5.1 Descriptive Statistics

The majority of the questionnaire was answered by female participants 58 % compared to the male participants 42 %. The high number of students aged was between 10 and 11 years old. The experience of mobile device usage is 74 % with device 1–2 times per week, and also its usage period was 82 % in 1–2 h per week. The factor analysis was conducted by LISREL to test path analysis. As Fig. 3 shows the relationship between the original constructs proposed (Doll et al. 1998) and the proposed TAM that includes two external variables, which are perceived mobility and PE. Moreover, the description statistics of the six factors are shown in Table 1. All means are above 4.30. The standard deviations range from 0.63 to 1.012 indicating a narrow spread around the mean. Moreover, the factors were

Table 1 Summary of means, standard deviations, and reliabilities

Factors	Measurement instrument	Mean	STD	Alpha (α)
Perceived mobility value	M-learning is my new equipment	4.43	0.868	0.722
	It is convenient to access M-learning anywhere at anytime	4.62	0.632	
	Mobility makes it possible to get the real-time data	4.37	0.747	
	M-learning able to take everywhere	4.47	0.870	
	Mobility is an outstanding advantage of M-learning	4.56	0.641	
Perceived enjoyment	M-learning would make me feel relax	4.31	0.748	0.629
	M-learning would be boring	4.37	1.012	
	I would have fun using M-learning	4.74	0.579	
	I feel excited when I learn through M-learning	4.32	0.931	
	I feel enjoy when I use mobile learning	4.56	0.729	
Perceived usefulness	It helps me do homework done faster	3.97	1.029	0.686
	Using M-learning help me to increases my scores	3.74	1.031	
	It is an advantage of my learning	4.31	0.825	
	M-learning would enhance my effectiveness in learning	4.44	0.686	
	Using M-learning would save me much time	3.95	0.999	
Perceived ease of use	My interaction with M-learning would be clear and understand	4.35	0.642	0.645
	Using M-learning would be easy to use	4.43	0.590	
	Using M-learning often, it is easy to know more about the new program	4.46	0.744	
	I know that M-learning able to do many thing	4.43	0.820	
	M-learning is easy	4.21	0.935	
Attitude	In my opinion, it would be not very desirable to use M-learning	4.50	0.882	0.465
	Learning through M-learning do not need much memories	4.41	0.726	
	I would like to use M-learning	4.87	0.367	
	M-learning made me to create more new things	4.06	0.776	
	I hold a negative evaluation of M-learning	4.56	0.925	
Behavioral intention	I want to use mobile learning both outdoor and indoor	4.72	0.637	0.772
	I want to use mobile learning each my subjects	4.38	1.013	
	I want to use mobile learning every term	4.44	0.715	
	I intend to use M-learning as much as possible	4.26	0.872	
	In the further, I intend to use M-learning routine	4.20	0.995	
Overall	**TAM**	**4.381**		**0.872**

Table 2 Assessment of discriminant validity

Factors	PE	PMV	PEOU	PU	ATT	BI
Perceived enjoyment (PE)	**1.00**					
Perceived mobile value (PMV)	0.478	**1.00**				
Perceived ease of use (PEOU)	0.196	0.584	**1.00**			
Perceived usefulness (PU)	0.332	0.495	0.440	**1.00**		
Attitude (ATT)	0.517	0.315	0.125	0.370	**1.00**	
Behavioral intention (BI)	0.273	0.423	0.313	0.341	0.258	**1.00**

analyzed using Cronbach's alpha (Cronbach 1951). The pre-questionnaire test of 50 students is 0.829. It describes that the questions are reliable and able to use for the study. All of the measure employed of 100 participants in this study demonstrated internal consistency, ranging from 0.632–0.870. The overall is 0.872. Thus, the reliability estimates ($\alpha = 0.70$) recommended by Nunnally (1967).

5.2 Discriminant Validity

This study was assessed by inspecting the correlations between the six factors as Bogozzi et al. (1991) referred. Covariance among manifest variable of the TAM is presented in Table 2 and illustrates the average variance extracted (AVE) for each factors. The questions are for each factor correlated with each other but were below for inter-correlating with other factors. Thus, the results indicate that discriminant and convergent validity of the measure are reasonable.

5.3 Hypotheses Testing

This study employed a structural equation modeling approach to develop a model that represents the relationship among the six factors such PMV, PU, PE, PEOU, ATT, and BI to use M-learning. Hypothesis testing found four of eight hypotheses were significant at 0.01 level tests. It is shown in Table 3. H1, H3, H5, and H6 were all supported. The higher the *t*-value is, the stronger the relationship is, indicating that PEOU was significantly affecting attitude ($t = 16.577$) which supports H5, whereas PE has a direct effect on attitude ($t = 12.359$), which refers H3. This result show PE factor is importance for user acceptance of a new technology (Davis et al. 1989). H1 shows PMV significantly an individual's awareness of usefulness ($t = 7.046$). It means user appreciates the value of mobility and will perceive that M-learning is useful. Moreover, PU has an effect on attitude ($t = 12.359$) that means PU is influencing their attitude of using M-learning.

The structural model and hypotheses were tested by examining the path coefficients and their significance. The path coefficients are present in Fig. 5. Consistent

Table 3 The results of hypothesis testing

Hypotheses	Path	Path coefficient	*t*-value***	Results
H1	PMV → PU	0.495	7.046**	Accepted
H2	PE → PEOU	0.508	**−0.838***	Rejected
H3	PE → ATT	0.424	14.348**	Accepted
H4	PEOU → PU	0.440	**−1.917***	Rejected
H5	PEOU → ATT	0.479	16.577**	Accepted
H6	PU → ATT	0.206	12.359**	Accepted
H7	PU → BI	0.342	**−4.481***	Rejected
H8	ATT → BI	0.242	**−17.733***	Rejected

*Significant at a 0.05 level test
**Significant at a 0.01 level test
****t*-value > 1.96 was accepted at confidential level 95 %

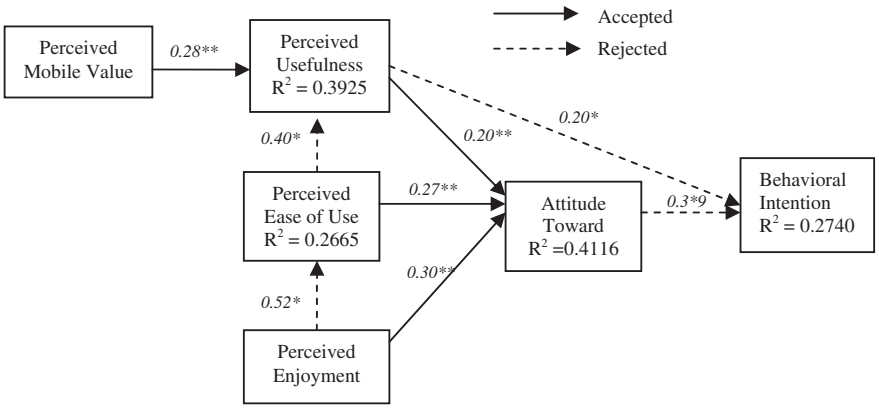

Fig. 5 Path coefficient of TAM model. *Note* R^2 represents the proportion of the variance of the variable that could be explained by its causing variable. *Significant at 0.05 level. **Significant at 0.01 level

with the hypotheses, PMV has a positive effect on PU (Path = 0.495, $t = 7.046$) as well as PE has a positive effect on ATT (Path = 0.424, $t = 14.348$), whereas PEOU and PU also have a positive effect on ATT (Path = 0.479, 0.206 and $t = 16.577$, 12.359). It illustrated the strength of the relationship in two multiple regression analyses (MRS) that were conducted between PMV to PU and PU to ATT. The significant factors to attitude were PU, PEOU, and PE. On the other hand, ATT was insignificant to BI. Hence, it is the difference from other research that BI was primarily affected by PU and attitude, which are critical factors (Gentry and Calantone 2002; Van der Heijden 2003).The results indicate attitude is indeed a mediator between belief and BI.

6 Discussion and Conclusion

This study examined the user's technology acceptance. The authors also found that users' attitude is directly positive affected from each 3 factors. In contrast, the hypotheses H:2, H:4, H:7, and H:8 were rejected from statistic testing, which against are previous study (Armitage and Conner 2001; US National Institutes of Health 2013; Huang et al. 2006; Davis et al. 1989). Results from correlation analysis accepted showed that PU and ATT were not significant factors in determining the intention to M-learning. This study found that the intent of students perceived is more influenced by attitude. The results also showed that users' attitude is directly positively affected by 4 factors, which are PMV, PU, PEOU, and PE, similar to Davis et al's. (1989) research that PEOU has a significant effect on ATT. It descripts that when students perceived the M-learning as one that is easy to use and nearly free of mental effort and favorable attitude toward the usefulness. The role of ATT was modest in predicting technology acceptance, and it is possible that user may use a technology even if they do not have a positive attitude toward the technology as long as it is perceived as useful and easy to use. Its concern with this study results. Yildirim (2000) also suggested that user's positive feeling toward the ease of use technology is associated with sustained use of the technology. Additional, PMV is a key of an individual's acceptance of M-learning that enables students to access learning information at anytime and anywhere. It is an important channel which provides learning material, thereby advantage of mobility is crucial to users. Thus, it could explain that 4 factors affect student's attitude in M-learning. They are easy to use, happiness, pleasure, and satisfaction from enjoyment experience (Yu et al. 2005); M-learning could enhance their learning performance (Davis et al. 1989) and recognize that mobile user valued efficiency and availability as the advantages of M-learning (Hill and Roldan 2005). However, the result is in contrast with other TAM finding that positive attitude affects BI of M-learning (Huan and Lin 2007; Jairak et al. 2009) because this research is studied primary students, but research by both Huan and Lin (2007) and Jairak et al. (2009) is studied in higher education students. It differed in age, education, and experience in sample from each study between college and primary students. So, students were from different backgrounds of digital literacy practices both in and outside school (Lyndsay Grant 2010).

This research studied both theoretical and practical contributions by developing technology-based initiative in education, analyzing, adopting, and evaluating student's learning and teaching effectiveness. The finding able to explain that the researchers, scholars, educators, or policy maker need to take into account the process of development and implementation in term of supporting perceived usefulness, PEOU, and attitude toward of primary students learning in technology to increasing BI in primary student. Furthermore, the subject of this study is primary student who are relatively homogenous as compared with the general population. Future work should conduct the testing in different population such as gender, various background, and different experiences.

Acknowledgments The authors would like to thank acknowledge Knowledge Innovation Center (KIC) at College of Arts, Media and Technology, Chiang Mai University, Thailand, for financially supporting this research, and Rockmoon Pte.Ltd for offering the Trail shuttle application and tablet devices. The authors also appreciate the help from the research team, Dr. Teeraporn Saeheaw and Ms. Boondhrikaan Vaidyanuvatti.

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