Hierarchical Stepwise Multiple Regression Analysis of Technology Acceptant Through the Mobile Cloud Learning of Vocational and Technical Education

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Abstract **– This research aimed to study correlation of variables and create an equation for predicting actual use of mobile cloud learning. The participant sample comprised 1,080 vocational students from 27 vocational and technical schools. Data analysis involved descriptive statistics, correlation and hierarchical stepwise multiple regression. This research found the independent variables of actual use of mobile cloud learning were Basic ICT skill (BAS), System Quality (SYS), Convenience (CON), Perceived Ease of Use (PEOU), and Perceived Usefulness (PU) which were related to actual use of mobile cloud learning at a significance level of 0.05 and explained 61.90 percent of the variance. The raw score equation was "ACU = .258 + .094 BAS +.434SYS + .129 CON + .023PEOU + .536PU". The standardized score was "ZACU = .099ZBAS + .429ZSYS + .113ZCON + .192ZPEOU + .562ZPU".**

Keywords **–Mobile cloud learning, technology accept model (TAM), convenience, basics ICT skill, system quality.**

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1. Introduction

Technology developments have been changing rapidly which have fundamentally reshaped every aspect of human lives, including education. Using technology as a learning tool to support their academic achievement enables students to learn anywhere anytime [1]. Moreover, developing technology to be more accessible and easily [2] used can also broaden students' learning strategies, motivate them to learn more, and help them to interact with other students and teachers in the classroom [3], [4]. Students can collaborate with each other and share useful information in a more engaging environment. Technology can prepare students for the future career and become lifelong learners [2].

As mentioned above, every type of academic institution, especially vocational and technical schools that specialize in practical aspects of technology, is affected by their ability to meet the demands of 21st century entrepreneurs [5].

Vocational and technical schools have to adapt to the current situation as soon as possible. Thus, the office of the vocational education commission has published 'Vocational Development Plan for 2017-2036' which aims to improve desired characteristics, general skills, and professional skills of students under the six strategies which are 1. vocational school management to ensure national and social stability, 2. human resource improvement and development through vocational education to increase the competitive advantage of the country,

3. human resource improvement and development through vocational education to create competency that conforms to the need for national development, 4. creating opportunity and equality in vocational education, 5. vocational education management for improving the quality of an eco-friendly life, and 6. vocational education management system improvement helps to enhance the quality of vocational education and management through innovative management that supports national development. Following the stated two strategies, the office of the vocational education commission has placed EchoVE software on the mobile cloud for lecturers, students, and other vocational institute officers, given that the mobile cloud is an important learning and teaching tool in this digital age [26].

The technology acceptance model (TAM) was developed in 1985 by Davis [7] by implementing the theory of reasoned action (TRA) and the theory of planned behavior (TPB) [8]. The TAM is commonly used to forecast actual use and acceptance of communications technology (ICT) on the part of each person [9] in order to understand user behavior and satisfaction with regard to the actual use of ICT [10]. Moreover, TAM theory is widely utilized for checking the personal behavior in terms of the technology acceptance of other information technology systems [8]. TAM has 2 main variables that are used to predict actual use and the acceptance of information communication technology - perceived usefulness and perceived ease of use [7].

According to the above, the researcher had the idea in conducting a research study involving the hierarchical stepwise multiple regression analysis of technology acceptance through the mobile cloud in terms of vocational and technical education. The researcher was interested in studying the following variables: basic ICT skills (BAS), system quality (SYS), convenience (CON), perceived ease of use (PEOU), perceived usefulness (PU), and actual use of mobile cloud learning.

2. Research Question

1) What are the independent variables related to actual use of mobile cloud learning?
2) What is the relationship between independent variables and actual use of mobile cloud learning?
3) What are the characteristics of the equation for predicting actual use of mobile cloud learning?

3. Research Objectives

1) To investigate the independent variables related to actual use of mobile cloud learning.
2) To study the relationships of the independent variables and actual use of mobile cloud learning.
3) To create an equation that can be used to predict actual use of mobile cloud learning.

4. Concept Framework

This paper studied five independent variables that affected the actual use of mobile cloud learning: Basic ICT skill (BAS) [19], [20], [6] : System Quality (SYS) [1], [11], [12] : Convenience (CON) [13], [14] : Perceived Ease of Use (PEOU) [15], [16], [17], [13], [14], [18], [11], [19], [20], [21], and Perceived Usefulness (PU) [13], [14], [11], [19], [20], [18], [12].

5. Research Methodology

For research methodology, the researchers conducted the research the research by using research hypotheses, population and sample data, and research findings. The details are as follows:

5.1. Research Hypothesis

This research has 2 hypotheses:

1) The independent variables were positively related to the actual use of mobile cloud learning.
2) The independent variables predict the actual use of mobile cloud learning.

5.2. Population and Samples

Students from the Office of Vocational Education Commission conducted the population research. Students can utilize mobile cloud learning. The total samples were 1,080 students of twenty-seven vocational and technical education selecting by multistage random sampling. This research can keep the questionnaires from only 960 students (88.88%).

5.3. Research Finding

5.3.1. Chapter 1: Results of Fundamental Data Analysis.

In this chapter, the researcher divided the results into 2 parts: a) the results of respondents' characteristics, and b) the fundamental data analysis of variables

a) The results of respondents' characteristic.

The majority of the samples respondents (58.50 percent) were male and 41.50 percent of the samples were female. There was 54.20 percent of respondents who had used the Internet for more than 6 years, 24.70 percent of respondents had used the Internet for 5-6 years, 12.80 percent of participants had used the Internet for 3-4 years, and 8.30 percent of samples had used Internet for 1-2 years.

Additionally, 960 students used the Internet for learning, 733 internet users used it for entertainment (Ex. playing games and listening to music), 711 respondents used the Internet for social networks, and 419 participants used the Internet to send e-mails. The analysis results are illustrated in Table 1.

b) The fundamental data analysis of variables.

The fundamental analysis results in this part revealed the findings with regard to 6 variables basic ICT skills (BAS), system quality (SYS), convenience (CON), perceived ease of use (PEOU), perceived usefulness (PU), and actual use of mobile cloud learning (ACU). These 6 variables were included in order to study the distribution and variance of each variable. The basic statistical tools that were used in this study were mean, standard deviation (SD), max, min, coefficient of variation (CV), skewness, and kurtosis and Kolmogorov–Smirnov in order to test how different the variables' statistical distribution is from the normal curve. The mean of the 6 variables was moderate (3.75-4.00) with limited variation (0.151-0.193), and a significance value greater than 0.05. The variables' negative skewness was -0.183 to -0.667. However, only system quality (SYS), convenience (CON) and perceived ease of use (PEOU) had a positive kurtosis value lesser than 0.05 (from 0.355 to 1.671). This means that the variables' left skewness and Kurtosis were slightly higher than the normal curve, with the exception of system quality (SYS), convenience (CON) and perceived ease to use (PEOU) had left skewness and Kurtosis were the normal curve.

Table 1. The demographic sample size and percent

Demographic Factors	Group	Amount	Percent
1. Gender	1. Male 2. F emale SUM	562 398 960	58.50 41.50 100.00
2. Internet experience	1. 1-2 years 2. 3-4 years 3. 5-6 years 4. More 6 years SUM	80 123 237 520 960	8.30 12.80 24.70 54.20 100.00
3. Activity Usage	1. Learning and Teaching 2. Sending-Receiving e-mail 3. Participating in social network 4. Playing games, watching movies, and listening to music	960 419 711 733	- - - -

Furthermore, the Kolmogorov-Smirnov test results for all variables displayed a significance value of 0.05, indicating an assumption violation.

The research included a sufficiently large sample size (n > 100), comprising 960 samples, of which more than 100.

Therefore, the statistical distribution of the mean value was near that of a normal curve [22]. In addition, the 'Robust Statistical Test' was used in this statistical analysis. Hence, the researcher could use all the above-mentioned variables for further analysis as shown in Table 2.

Table 2. The results of basic statistics for variables

Variables	Mean	S.D.	Max	Min	C.V.	Skewness	Kurtosis	Kolmogorov-Smirnov	Sig.
BAS	3.75	0.725	5.000	1.000	0.193	-0.388**	0.218	0.112	0.000
SYS	3.78	0.678	5.000	1.000	0.179	-0.402**	0.376*	0.147	0.000
CON	4.00	0.604	5.000	1.000	0.151	-0.667**		0.125	0.000
PEOU	3.79	0.650	5.000	1.000	0.172	-0.426**	0.355*	0.110	0.000
PU	3.75	0.718	5.000	1.000	0.192	-0.385**	0.255	0.134	0.000
ACU	3.76	0.685	5.000	1.000	0.182	-0.183**	0.019	0.127	0.000

Note : SE of skewness = 0.079; SE of kurtosis = 0.158

5.3.2. Chapter 2: Hierarchical stepwise multiple regression analysis findings

The data analysis presented in this chapter is the result of the hierarchical stepwise multiple regression analysis, which was used to determine the impact of the six independent variables (BAS, SYS, CON, PEOU, and PU) on the actual use of mobile cloud learning (ACU). Thus, the researcher has divided the results into 2 sub-parts: a) The correlation between variables, and b Hierarchical stepwise multiple regression analysis findings. The 2 sub-parts are as the follows:

a) The results of the correlation between variables.

The results in this part relate to the results of the correlation between those variables, to find out whether or not these variables had multicollinearity to be used in the hierarchical stepwise multiple regression analysis in the next step.

Finding the correlation between the variables can be separated into 2 sub-parts: 1) the results of the correlation between the 5 independent variables (basic ICT skills (BAS), system quality (SYS), convenience (CON), perceived ease of use (PEOU), and perceived usefulness (PU), and 2) the results of the correlation between the 5 independent variables and a dependent variable (actual use of mobile cloud learning: ACU).

1. With regard to the results of the correlation between 5 independent variables: basic ICT skills (BAS), system quality (SYS), convenience (CON), perceived ease of use (PEOU), and perceived usefulness (PU), the correlation values of 10 pairs of variables were different from zero at a significance level of 0.05. The correlation value was between 0.550 and 0.789, and the relationships of these variables were positive. The highest correlation value was 0.789 which was found between perceived ease of use (PEOU) and perceived usefulness (PU). The lowest correlation value was the relationship between system quality (SYS) and convenience (CON).

2. The findings in terms of analyzing the relationships of 5 independent variables and the actual use of mobile cloud learning (ACU), indicated that 5 independent variables were found to be related to the actual use of mobile cloud learning (ACU) at a significance level of 0.05 and supporting hypothesis 1. Table 3 shows that the highest relationship is system quality (SYS), with a correlation value of 0.732. The second highest correlation value was 0.689 between perceived ease of use (PEOU) and actual use of mobile cloud learning (ACU).

Table 3. Mean, standard deviation: SD and correlation matrix for independent variable dependent variable

Variable	BAS	SYS	CON	PEOU	PU	ACU
BAS	1.000					
SYS	0.684**	1.000				
CON	0.580**	0.550**	1.000			
PEOU	0.777**	0.694**	0.617**	1.000		
PU	0.689**	0.664**	0.586**	0.789**	1.000	
ACU	0.655**	0.732**	0.564**	0.689**	0.660**	1.000
Mean	3.75	3.78	4.00	3.79	3.75	3.76
S.D.	0.725	0.678	0.604	0.650	0.718	0.685

Matrix of 5 iv's and ACU
Bartlett's Test of Sphericity Chi-Square = 5872.706; df = 10, p = 0.000
Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0.778

b) Hierarchical stepwise multiple regression analysis findings.

In this part, the researcher would like to explain the effect of the independent variables on actual use of mobile cloud learning. To obtain the outcome of the hierarchical stepwise multiple regression analysis, 3 steps were followed. Firstly, the independent variables basic ICT skills (BAS), system quality (SYS) and convenience (CON) had to be inserted into the equation.

Then, perceived ease of use (PEOU) also needed to be added into the equation. Lastly, perceived usefulness (PU) had to be added. The details of this analysis are as follows:

In model 3, the researcher entered 5 variables that could explain the variance of actual use of mobile cloud learning (ACU)' at 61.90 percent. After considering standardizing the regression coefficients (β) of 5 independent variables, the value of the regression coefficients of every variable was seen to be significant at 0.05.

The set of independent variables could be used to predict actual use of mobile cloud learning (ACU)' which was the same as the stated hypothesis 2. The highest regression coefficients were perceived usefulness (PU) (β = 0.562), following by system quality (SYS) with 0.429. The independent variable with the lowest regression coefficients was basic ICT skills (BAS) (β = 0.099).

Following the analysis presented in Table 4 and researchers could conclude that the regression equation is as follows:

Raw scores

ACU = 0.258 + 0.094 BAS +0.434SYS + 0.129 CON + 0.023PEOU + 0.536PU

Standard scores

Z^_ACU = 0.099ZBAS + 0.429 ZSYS + 0.113 ZCON + 0.192 ZPEOU + 0.562 ZPU

Table 4. Outcome of hierarchical stepwise multiple regression analysis for actual use of mobile cloud learning.

Variable	Model 1			Model 2			Model 3		
	b	***SE$_b$***	***β***	***b***	***SE$_b$***	***β***	***b***	***SE$_b$***	***B***
constant	0.378	0.098		0.277	0.097	-	0.258	0.096	
1. BAS	0.214	0.028	0.226**	0.106	0.032	0.113**	0.094	0.131	0.099*
SYS	0.491	0.029	0.486**	0.468	0.031	0.456**	0.434	0.030	0.429**
CON	0.188	0.030	0.165**	0.138	0.030	0.121**	0.129	0.030	0.113**
2. PEOU	-	-	-	0.241	0.037	0.229**	0.023	0.038	0.192**
3. PU	-	-	-	-	-	-	0.536	0.134	0.562**
R	0.773			0.784			0.788		
R2	0.597			0.614			0.621		
Adjusted R2	0.596			0.613			0.619		
Δ R2	0.597			0.017			0.006		
Δ F	472.925			41.932			16.101		
df1, df2	3, 956			1, 955			1, 954		
Sig. Δ F	0.000			0.000			0.000		

6. Discussion

The 5 independent variables could explain the variance of actual use of mobile cloud learning (ACU) at 61.90 percent which passed the criteria at 'good' level but there was also an unexplained 38.1 percent variance of actual use of mobile cloud learning (ACU). There are other variables that were not studied in this research but could explain the variance of the actual use of mobile cloud learning (ACU) such as social cloud [23] and information quality [24].

Basic ICT skill (BAS) was the independent variable with the lowest effect size in terms of actual use of mobile cloud learning (ACU) (β = 0.099). This variable was statistically significant, so it could impact practically. Education for the 21st century implies that basic ICT skills are really important because these skills help students to use different kinds of technology such as mobile phones and IPads.

Furthermore, basic ICT skills support education in the 21st century [25] while complying with the research of MacCallum et al. [20] study about the impact of students' ICT skills on their use of mobile learning.

System quality (SYS) was a variable that had a moderate ‘effect size’ (β = 0.429) towards actual use of mobile cloud learning (ACU). It explains that the institutes’ system had to be improved to be more effective by improving the quality of information technology and communication technology, and by implementing this type of technology as the learning tool to efficiently expand the educational opportunities for every learner at any level of education, allowing them to be able to access high-quality education services via the information technology network. This would result in an innovative education system that could thoroughly satisfy the needs and aspirations of users and learners. Moreover, this would also support government policy.

The Thailand Digital Economy and Society Development Plan: Digital Thailand 2016 – 2037 was published by the Ministry of Information and Communication Technology of Thailand in order to creatively improve and utilize digital technology implementation in the country, in order to develop innovation, improve human resources, increase knowledge, develop the basic infrastructure, etc. [26].

Convenience (CON) was a variable with a low effect size on the actual use of mobile cloud learning (ACU) ($\beta = 0.113$). This variable was statistically significant, which implied that learning and teaching in the 21st century helped students to access online learning via cloud learning, meaning that they could choose their preferred place and time for studying. This complied with the results of a study by Bosamia and Patel [28] offering an overview about e-learning by cloud and highlighted its main advantages which stated that convenience was an important factor for online learning in this century.

Perceived ease of use (PEOU) was a variable with a low effect size towards the actual use of mobile cloud learning (ACU) ($\beta = 0.192$). However, this variable was statistically significant, which could be explained by the possibility that, after the operational functions were recognized by the students, they would regard them as simple to use. Therefore, the system of cloud learning's utilization would correspondingly increase. Furthermore, this variable is a part of the technology acceptance model (TAM) theory which explained and revealed the actual use of information technology in terms of the acceptance factors [29]. This variable complied with the research by Iqbal and Ahmed [30] which used a technology acceptance model to examine university students' preparedness for m-learning.

Independent variable that had the highest effect size in terms of the actual use of mobile cloud learning (ACU) was perceived usefulness (PU) ($\beta = 0.562$). This could be inferred from the fact that if the lecturer desired to improve the actual use of mobile cloud learning (ACU) by students, he or she had to make student understand the benefits of learning via mobile cloud learning. This variable complied with the TAM, which stated that the perceived usefulness of technology would increase the adoption of technology [7]. The previous statement also concurred with the study by Shin and Kang [31] and Seyal et al. [27].

The standardized coefficients of the 5 independent variables decreased in amplitude according to model 2 and model 3, respectively. Thus, these 5 variables did not only directly influence the actual use of mobile cloud learning (ACU), but also indirectly affected the actual use of mobile cloud learning (ACU). Hence, the researcher could examine data using structural equation modeling (SEM).

7. Conclusion

The outcome of this study revealed that 5 independent variables were related to actual use of mobile cloud learning (ACU). Perceived usefulness (PU) was considered the most important variable. System quality (SYS), perceived ease of use (PEOU) and convenience (CON) were the second most important variables. The third important variables were basic ICT skill (BAS), perceived usefulness (PU) and perceived ease of use (PEOU) were a part of the technology acceptance model (TAM), which could be stated that the technology acceptance model (TAM) was beneficial since this paper explained different variables that affected the decision and acceptance towards technology or innovation. System quality (SYS) was the factor that organizations must improve, develop and utilize to be the most efficient for usage. Basic ICT skill (BAS) was referred to the 21st century basic skill that students already had because the technology was a part of their daily life. Moreover, convenience (CON) was a variable that was derived from mobile cloud learning implementation to support learning and activity anywhere and anytime.

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