Factors influencing high school STEM students' intention and use behaviour of eLearning in International Schools, Thailand

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Abstract

This study aimed to explore the factors affectingacceptance and use behaviour of eLearning among international school students of STEM. Study was conducted using the influence of performance expectancy, effortexpectancy, social influence, facilitating conditions, Habit, on e-learning use behaviour and moderated by behavioural intention. Study was conducted among 500 high school students of STEM from international schools in Thailand. A questionnaire was developed centered on the Unified Theory of Acceptance and Use of Technology (UTAUT). Data collection was done from 500 STEM studying high school students from various international school students in Thailand. Research used Multistage quantitative approach of probability & non-probability technique. Statistical tool of "Structural Equation Modelling" (SEM) and "Confirmatory Factor Analysis" (CFA) of IBM SPSS, was adopted inexploring the collected data, analysis of the model fit, check reliabilityand validity of different variables. Results endorsed a strong link among behavioral intention and use behavior of eLearning and also Performance& Efforts Expectancy, Facilitating Conditions, and Habit on the Behavioral Intention.

Keywords: e-Learning, International Schools,STEM, Thailand, UTAUT

1.0 Introduction

Rapid developments in mobile and wireless technologies, has given easy and cost-effective access toinformation to individuals.Furthermore, withthe advancement in technological development and high speed of internet connectivity through wireless networks at schools, both students and teachers are able to use their mobile devices viz., smartphones, tablet computers, and laptops in classroomsfor teaching and learning. This digitization and advancements have revolutionizedthe know-how in education and led to theemergence of the concept of eLearning (electronic-learning) (Hamidi and Chavoshi2018) [1]. eLearning has been extensivelyreceived as a useful tool in imparting educationwith wide range of unique features. In order to increasethe acceptance of eLearning at school level, it is inevitable to determine and examine thefactors that affect learners' acceptance of eLearning.

Thailand is one among the south east Asian countries, which has incorporated eLearning in many of the schools. The number of international schools have shown an increasing trend in Thailand. OPEC (2021) [2]"Office of the Private Education Commission". International schools in Thailand offer a variety of curriculum, like American,

British, International Baccalaureate (IB) and other national syllabi of other countries such as Korea, Canada, France, Japan, Germany, Singapore, Switzerland, Australia, India, etc. (International Schools Association of Thailand [ISAT], 2021). [3]

Research and Markets (2017) [4] predicts risein eLearning to emerge as a $325 billion industry by 2025 due to development in standards, technical innovations and advancements in trends. In this study, the high school students specifically enrolled with international schools in Thailand have been reached out to.After studying many established frameworks, the Unified Theory of Acceptance and Use of Technology (UTAUT) model by Venkatesh et. al. (2003)[5] was used for this research study.Research Objectives for this study are as below:

1.   To identify the relationship between Performance-Expectancy and behavioural-intention

2.   To identify the relationship between Effort-Expectancy and behavioral-intention.

3.   To identify the relationship between social-influence and behavioral-intention

4.   To identify the relationship between facilitating-conditions and behavioral-intention.

5.   To identify the relationship between habit and behavioral-intention to use   eLearning.

6.   To identify the relationship between Facilitating-conditions and Use-Behavior

7.   To identify the relationship between Habit and actual use and Use-Behavior.

8.   To identify the relationship between of behavior-intention and actual usage

The framework identified five independent variables, one mediating variable and one dependent variable with total of eight hypotheses to be analyzed. Data for quantitative analysis was collected by distributing 500 questionnaires among high schoolers in international schools in Thailand. Study results can be made use of by academic's field –like school management and authorities, the community of teachers and tutors on up-skilling to teach the Gen Z (Generation Z) to name a few.

2.0 Literature Review and Hypotheses

2.1 eLearning Technology

eLearning refers to a set of dynamic technologies that involve several technological components and devices that aid information and communication. Among such devices are broadcasting media, telecommunication technologies such as telephone, cellular networks, cable, satellite, TV and radio, computer-mediated conferencing and video conferencing. It also includes other digital technologies such as computers, the Internet, World Wide Web, Intranets and Wi-Fi networks, extranets and software applications. An academic process that wholly or moderately pivots on using online media and tech as modules for escalating the convenience of learning, connectivity, and pursuit, embracing current ways is eLearning(Muhammad Safuan et al., 2022) [6]. Many models have been created and developed to analyze and understand the factors affecting the acceptance of eLearning among school students. The theoretical models employed to study user acceptance, adoption, and usage behaviour include the Theory of Reasoned Action – TRA(Ajzen & Fishbein, 1980)[7], the Technology Acceptance Model (Davis, 1989; Davis et al., 1989) [8] [9]the Theory of Planned Behaviour – TPB(Ajzen, 1991; Mathieson, 1991) [10] [11]the Model of PC Utilisation(Thompson, Higgins, & Howell,1991) [12]the Decomposed Theory of Planned Behaviour,(Taylor & Todd, 1995) [13] , Innovation Diffusion Theory(Agarwal

& Prasad, 1997; Rogers, 1995),[14][15],Integrated Technology Adoption and Diffusion Model (Sherry, 1998)[16]and recently the Moguls Model of Computing(Ndubisi et al., 2004) [17]. After going through various framework and proper research work the model narrowed down was the Unified Theory of Acceptance and Use of Technology (UTAUT) model by Venkatesh et. al. (2003) [5] for this research study.

2.2 Unified Theory of Acceptance and Use of Technology (UTAUT)

A unified theory of acceptance and use of technology (UTAUT) was proposed by Venkatesh et al. (2003) [5] .UTAUT has four main constructs that directly influence user acceptance and behavior, namely, performance expectancy, effort expectancy, social influence, and facility conditions.

Performance expectancy is the expectancy of individual technology users who believe that the use of technology will increase the productivity and performance of their work. In other words, it is the expected benefits of using technology.

Effort expectancy explains the possibility of using certain technology without much effort. This illustrates the level of simplicity and ease of use of a particular technology.

Social influence is related to the users' perception reference of the reaction of others to themselves and social groups if certain technology users are used. This is a consideration of technology users who can convince other people in his/her group whether or not users should use the technology.

*Facilitating conditions*explain that users believe concerning the need for facilities to use new technology in an organization.

*Behavioral intention*is defined as the likelihood of someone's plan to use technology. It also shows a direct effect on the actual use of behavior.

Use behavior is using behavior in information and communication technology related to how and when people use technology, indicated by the frequency and the objective of use.

2.3 Hypotheses

Using the literature review and various contributions, the research framework was designed and designates the below research hypotheses:

H-1: (PE) PerformanceExpectancy has a positive impact on Behavioral intention (BI)

H-2: (EE) Effort Expectancy has a positive impact on behavioralintention

H-3: (SI) Socialinfluence has a positive impact on (BI) behavioral ̇intention

H-4: Facilitatingconditions (FC) has a positive impact on behavioral ̇intentions (BI)

H-5: Habit has a positive impact on significantly (BI) behavioral intentions

H-6: Facilitatingconditions (FC) have a positive impact on the UseBehavior (UB)

H-7: (HB) Habit has a positive impact on (UB) UseBehavior

H-8: (BI) behavioralintention has a positive impact on their (UB) use behavior
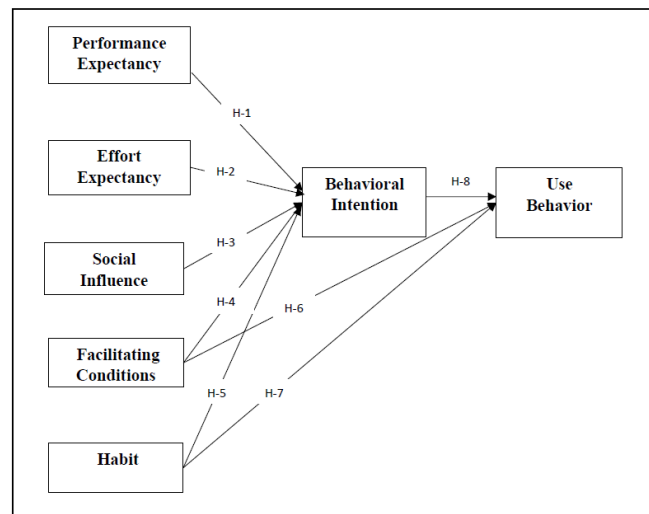
Figure 1: Conceptual Framework

3. Research Approach

3.1 Research Method

This researchwork implemented the Positivism Quantitative Deductive approach. whence hypotheses and questionnaire are designed meaningfully, administered and tested based on the designed conceptual framework. Quantitative descriptive design process wasused for study purpose. The study plans to identify factors impacting the (BI) behavioralintention and (UB) usebehavior of eLearning.

3.2 Target Population and Data Collection

Targeted population were the STEM students from high school from International Schools in Thailand. 500 questionnaires were distributed in various ways to collect the data for analysis. Students were approached directly by going to schools in Thailand.

3.2.2 Sampling Technique

Following sample techniques were engaged for this research study:

Step 1 - Judgmental or Purposive Sampling (Non-Probability)

Step 2 - Stratified Random Sampling (Probability Sampling

Step 3 - Convenience Sampling (Non-Probability)

3.3 Data Analysis

Inferential Statistics draws out samples from entire data and aims to interpret and conclude for the entire population. Methods commonly engage hypothesis testing, ANOVA- Analysis of variance etc.Inferential Statistics used for this research was with CFA (Confirmatory Factor Analysis) and SEM (Structural Equation Modelling) of SPSS & AMOS.

4. Results and Discussion

4.1. Demographic Profile Summary

Table 1: Demographics of the Respondents

Demographic	Factor	Percentage (N=500)
Gender	Male	45%
	Female	50 %
	Others	05 %
Year / Grade	Year 12 (Grade11)	48 %
	Year 13 (Grade 12)	52 %
Pursuing STEM in school	Yes	100 %
	No	0 %

4.2 Descriptive Analysis

The mean scores of seven constructs were higher than 1.0 or middle of scale and standard deviation (Tabachnick & Fidell, 2007) [18]. The results of analyses presented in below "Table 3" indicate that the variable Performance Expectancy, with a mean ±standard deviation (SD) of 3.63±0.708, indicates the largest mean value, and the variable Effort Expectancy, with Mean M± SD of 3.21±0.883 had the least of values. All constructs calculated a SD value that was less than one, implying a fairly consistent measure from respondents

Table: 2Descriptive Statistics

Variables	# of Indicators	Cronbach's Alpha Coefficient (α)	Mean (M)	Std Dev (SD)
Performance Expectancy -PE	4	0.834	3.63	0.708
Effort Expectancy -EE	5	0.907	3.21	0.883
Social Influence -SI	4	0.802	3.33	0.700
Facilitating Conditions -FC	4	0.806	3.24	0.691
Habit -HB	3	0.866	3.45	0.904
Behavioural Intention -BI	5	0.894	3.50	0.748
Use Behaviour -UB	5	0.914	3.59	0.745

4.3 Confirmatory Factor Analysis (CFA)

Present researchused the "Confirmatory Factor Analysis" - CFA. All scale items in each construct indicated significance and represented the factor loading to identify/test discriminant validity. The factor loading implies each construct to have fully admissible values indicating the GOF - goodness of fit (Hair, Black, Babin, Anderson, & Tatham, 2006) [19].Factor loadings values are greater value than 0.30 and p-value of lower than 0.05. The construct reliability (CR) is larger than the cut-off value of 0.7 and the average variance extracted (AVE) was higher than the cut-off point of 0.5 (Fornell and Larcker, 1981) [20] in "Table 3". Thus, all the estimates are significant. The square-root of the extracted average variance determined that all the correlations are more than the corresponding correlation values for that variable as of "Table 5".

Table: 3Confirmatory Factor Analysis Result, Composite Reliability (CR) and Average Variance Extracted (AVE)

Constructs	# of Indi-cators	Factor Loading	CR	AVE
Performance Expectancy (PE)	4	0.619~ 0.871	0.84	0.56
Effort Expectancy (EE)	5	0.711 ~0.893	0.92	0.69
Social Influence (SI)	4	0.665~ 0.822	0.81	0.51
Facilitating Conditions (FC)	4	0.628~ 0.848	0.82	0.54
Habit (HB)	3	0.801 ~ 0.855	0.87	0.69
Behavioural Intention (BI)	5	0.751~ 0.881	0.89	0.63
Use Behaviour (UB)	5	0.772 ~ 0.857	0.92	0.68

Table: 4Discriminant Validity

	PE	EE	SI	FC	HB	BI	UB
PE	**0.75**						
EE	0.033	**0.83**					
SI	0.064	0.07	**0.72**				
FC	0.054	0.092	0.095	**0.73**			
HB	0.055	0.09	0.139	0.144	**0.83**		
BI	0.375	0.322	0.237	0.288	0.415	**0.79**	
UB	0.215	0.201	0.184	0.334	0.458	0.668	**0.83**

Note: The diagonally listed value is the AVE square roots of the variables

Table 5: Goodness of Fit for Confirmatory Factor Analysis (CFA)

Index	Acceptable Values	Statistical Values
CMIN/DF	< 3.00 Hair et al. (2006)	2.495
GFI	≥ 0.85 (Sica&Ghisi, 2007)	0.889
AGFI	≥ 0.80 (Sica&Ghisi, 2007)	0.865
NFI	≥ 0.80 (Wu & Wang, 2006)	0.897
CFI	≥ 0.80 (Bentler, 1990)	0.935
TLI	≥ 0.80 (Sharma et al., 2005)	0.927
RMSEA	< 0.08 (Pedroso et. al., 2016)	0.055

Note: CMIN/DF = The ratio of the chi-square value to degree of freedom, GFI = Goodness-of-fit index, AGFI = Adjusted goodness-of-fit index, NFI = Normed fit index, CFI = Comparative fit index, TLI = Tucker-Lewis index, and RMSEA = Root mean square error of approximation

4.4 Structural Equation Model (SEM)

The goodness of fit (GOF) indices for Structural Equation Model (SEM) is measured as indicated in Table 6.

Table 6: Goodness of Fit for Structural Model

Index	Acceptable Values	Statistical Values
CMIN/DF	< 3.00 Hair et al. (2006)	2.502
GFI	≥ 0.85 (Sica&Ghisi, 2007)	0.885
AGFI	≥ 0.80 (Sica&Ghisi, 2007)	0.865
NFI	≥ 0.80 (Wu & Wang, 2006)	0.893
CFI	≥ 0.80 (Bentler, 1990)	0.933
TLI	≥ 0.80 (Sharma et al., 2005)	0.926
RMSEA	< 0.08 (Pedroso et. al., 2016)	0.055

The results of the SEM model are presented in the "Fig.2". Both "Table 7" and "Fig.2" illustrate the relationship between the endogenous variables (performance expectancy, effort expectancy, social influence, facilitating condition, habit, behavioural intention) with the exogenous variables (use behaviour). Behavioural Intention being the mediating variable. The results indicated students' behavioural intention to engage with eLearning tools is positively and significantly impacted by performance expectancy (β=0.387, $p<0.05$); effort expectancy (β=0.325, $p<0.05$); social influence (β=0.156, $p<0.05$); facilitating condition (β=0.224, $p<0.05$); habit (β=0.393, $p<0.05$. Similarly, behavioural intention by the students to use behaviour towards eLearning indicates a significant positive effect on actual use of eLearning (β=0.619, $p<0.05$).
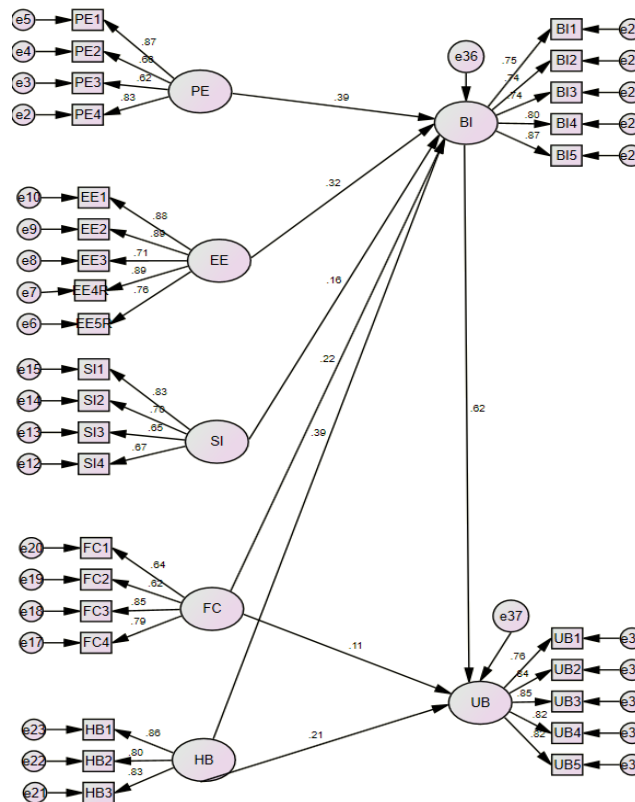
Figure 2: SEM Results

4.5 Research Hypothesis Testing Result

The path coefficients (β), t-statistics, and p-value used in order toensure the direct effects or hypotheses in a structural model. The conclusion are shown in "Table 7" and "Fig 3" and proven that all hypotheses were enhancedby a significance at $p < 0.05$. Habit of all parameters indicates the strongest influence (with $\beta = 0.393$) on Intention to adopteLearning. Performance Expectancy is the next bestvariable on BI with a $\beta = 0.387$. The actual use moderated by Use Behavior (UB) has the strongest influence on behavioral intention with $\beta = 0.619$ and t values = 11.591

Table 7: Hypothesis testing

Path of Hypothesis	Standardized path coefficient (β)	t-value	Testing result
H1: Performance Expectancy (PE) -> Behavioural Intention (BI)	0.387	8.735*	Supported
H2: Effort Expectancy (EE) -> Behavioural Intention (BI)	0.325	7.679*	Supported

H3: Social Influence (SI) -> Behavioural Intention (BI)	0.156	3.695*	Supported
H4: Facilitating Conditions (FC) -> Behavioural Intention (BI)	0.224	5.308*	Supported
H5: Habit (HB) -> Behavioural Intention (BI)	0.393	8.875*	Supported
H6: Facilitating Conditions (FC) -> Use Behaviour (UB)	0.106	2.733*	Supported
H7: Habit (HB) -> Use Behaviour (UB)	0.206	4.908*	Supported
H8: Behavioural Intention (BI) -> Use Behaviour (UB)	0.619	11.591*	Supported

Note: *=p-value <0.05

Table 8: Direct, Indirect and Total Effect

Path	Direct Effect	Indirect Effect	Total Effect
PE -> BI	0.387	-	0.387
EE -> BI	0.325	-	0.325
SI -> BI	0.156	-	0.156
FC -> BI	0.224	-	0.224
HB -> BI	0.393	-	0.393
FC -> UB	0.106	-	0.106
HB -> UB	0.206	-	0.206
BI -> UB	0.619	-	0.619

The results of the path analysis, path coefficient, and determinant coefficient (R^2) are presented in the form of an eLearning acceptance model shown in "Fig.3" below.
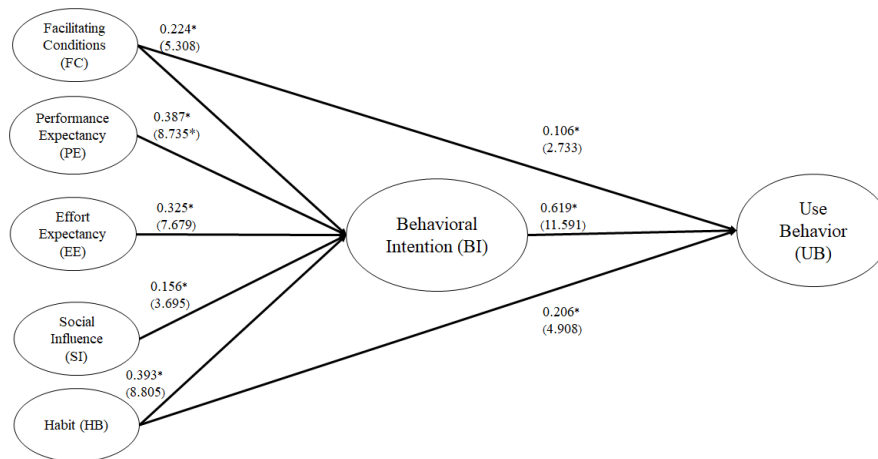
Figure 3: The Results of Structural Model

Note: Solid line reports the Standardized Coefficient with * as p<0.05, and t-value in Parentheses; Dash line reports Not Significant

5.0 Discussion and Conclusion

The results of the study affirmed thatall eight hypotheses of the conceptual model (using UTAUT) significantly establish STEM student's behavioural intention to use eLearning adoption and use behaviour. The path coefficients (β), t-statistics, and p-value were sought to measure and compute the significance of all the direct effects or hypotheses in the structural model. The conclusion for each variable is depicted in "Table 7" and "Fig.3" and propounded that all hypotheses were strengthened with a significance at p < 0.05. Habit among the variables has the strongest influence (with β = 0.393) on Behavioral Intention to use eLearning. Performance Expectancy happened to be the next strong influencer with a β = 0.387 on BI. Continuity to use eLearning and the actual use illustrated by Use Behavior (UB) has the strongest influence on behavioral intention with β = 0.619 and t values = 11.591.

The factors impacting eLearning among STEM students in international schools in Thailand was established using constructs and indicators evolved from the UTAUT model. The model utilized core variables in UTAUT: "performance-expectancy, effort-expectancy, social- influence, facilitating -conditions, habit, behavioural-intention and use -behaviour".

The results were affirmedby hypothesis test which emphasised that performance -expectancy, effort-expectancy, facilitating-conditions, and social-influence and habit all had positive, direct and significant impacts on behavioural-intention for eLearning. Facilitating-conditions, habit and behavioural-intention also showed significantly direct and   positive impact on eLearning use behaviour. Variables that had the maximum effect towards eLearning (see "Table 8") are Performance-Expectancy and Habit and Behavioural Intention.

5.1 Limitation and Future Research

The current research was focused on the STEM students from international schools in Thailand. The research can be expanded to students from other academic sectors and SE Asian countries to assess. UTAUT was used as the main model for this research and other frameworks can be used as well.Other aspects like digital

distraction, FoMo, health issues can also be researched upon. Main impact of this study are the School administration, teachers and tutors, and students as well.

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