TECHNOLOGY ACCEPTANCE MODLE (TAM) TO USE GOOGLE APPLICATION FOR TEACHING AND LEARNING INNOVATION DEVELOPMENT : A CASE STUDY OF HUMANITIES FACULTY SRINAKHARINWIROT UNIVERSITY

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Abstract. The purpose of this study was to study the factors that affect the adoption of Google applications technology for the development of teaching and learning innovations: A case study of Humanities Faculty Srinakharinwirot University. The study used a five rating scale questionnaire to develop the Technology Acceptance Model (TAM). The samples were 6 experts, 5 teachers, and 250 students from Humanities Faculty Srinakharinwirot Universities. The Structural Equation Modeling (SEM) was employed to explain the adoption process. The general structural model, which included Google applications technology self-efficacy, subjective norm, system accessibility, perceived ease of use, attitude, and behavioral intention to use Google applications technology, the proposed model was developed based on the technology acceptance model (TAM). The result showed that TAM and SEM was efficient theoretical tool to understand users' acceptance of Google applications technology for the development of teaching and learning. Google applications technology attitude was the most important construct, followed by subjective norm in explicating the causal process.

Keywords: Technology Acceptance Model, Structural equation modeling, Google applications technology

Introduction

In the technological trends of the 21st century, all member countries of the South East Asia Ministers of Education Organization (SEAMEO), including Thailand, have begun to focus on the benefits of Information and Communications Technology (ICT) to improve teaching and learning.

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In the era of education reform, they have included computer technology as an integral part of students' learning experiences and as a way to equip them with the skills and knowledge necessary to succeed in the 21st century. The Ministry of Education (MOE) has expressed the need to use technology in creating classroom-to-classroom connections via the internet (Ministry of Education, Thailand, 2018). The education in Thailand has been to set up online learning systems that provide students with online access and learning content. There are many on the Internet. The classroom instructional tools may help the teaching and learning to learn the knowledge effectively. These tools include Model Student Organizer, **Massive Open Online Course (**MOOCs) and Google Apps for education. What drive this trend are changes in normal classroom to online learning classroom. Many universities implement online learning in the university's digital media for various reasons. It is obvious that the number of online learning opportunities provided by university's digital media continue to Education 4.0: make use of own digital media teacher. However, little reliable research existed to indicate whether these tools were an appropriate or effective recruitment resource for universities to use.

Merely, offering any conceivable course and attempting to replicate classroom experience online cannot meet the students' needs and may cause unexpected failure (Kilmurray, 2003). University students' persistent frustration in web-based education is another problem in terms of online learning. This drives more student-centered research of online education (Hara, 2000). With the growing reliance on information systems and increasing rapidity of the introduction of new technologies into learning environment, identifying the critical factors related to user acceptance of technology continues to be an important issue (Yi & Hwang, 2003).

The dynamic fast changing world has led to transformation from normal classroom to online learning classroom and implements online learning in the university's digital media for various reasons. Universities have begun incorporating online learning in the university's digital society tools to connect with everyone.

Trend in higher education has been to set up online learning systems that provide students with online access and learning content. However, little reliable research existed to indicate whether these networks were an appropriate or effective recruitment resource for universities to use. It is obvious that the number of Google applications technology for the development of teaching and learning innovations opportunities provided by higher educational institutes continues to grow in Thailand. The use of digital media by institutions of higher education to market themselves to potential teachers is a relatively new phenomenon. Varsity(2011)surveyed 2,000 colleges and universities to determine if they were using Facebook to recruit new students. More than half of the respondents considered Facebook a "very important" admissions tool. Colleges and universities further reported using other social

networking platforms including Twitter, YouTube, and blogs. Finally, the findings also provided some reasons as to why institutions of higher education are not using Google Classroom as a recruiting tool.

Stageman (2011) conducted a case study to understand how prospective teachers use digital media to communicate with higher education institutions from the beginning of the application process up to the decision-making point. Stageman's study also revealed that incoming freshmen find university-sponsored social media useful in helping them to establish two-way communication with university officials, build a network of friends, establish a personal identity, and make a smooth transition from home life to campus life.

Consequently, both developers and users of learning innovations need more understanding of how teachers perceive and react to elements of learning innovations through university's education technology website along with how to most effectively apply learning innovations approach to enhance using and understanding. Therefore, it is necessary to conduct research that deals more intensively with students' perception of, attitude towards, and intention to use Google application in the university's learning innovations.

Objectives

This study proposed an integrated theoretical framework of university teaching and learning innovation development to use based mainly on the technology acceptance model (TAM). The objectives of the study were to analyze the relationship of university students' intention to use Google applications technology for learning innovation development in the university, a case study of Humanities Faculty Srinakharinwirot university's to use Google applications technology with selected constructs such as their attitude, perceived usefulness, perceived ease of use, self-efficacy of Google applications technology, subjective norm and system accessibility, and to develop a general linear structural model of Google applications technology acceptance of university students that would provide an education with implications for better development Google applications technology.

Research hypotheses

In accordance with the previously stated objective and consistent with related literature, this study tested the following hypothesis;

H_1: University students' behavioral intention to use Google applications technology is affected by Society Influences (H_{11}), perceived usefulness (H_{12}), perceived ease of use (H_{13}), Google applications technology self-efficacy (H_{14}), subjective norm (H_{15}), and system accessibility (H_{16}).

H_2: University students' Google applications technology attitude is affected by

their perceived usefulness (H_{21}), perceived ease of use (H_{22}), Google application self-efficacy (H_{23}), subjective norm (H_{24}), and system accessibility (H_{25}).

H_3: University students' perceived usefulness of Google applications technology is affected by their perceived ease of use (H_{31}), Google applications technology self-efficacy (H_{32}), subjective norm (H_{33}), and system accessibility (H_{34}).

H_4: University students' perceived ease of use of Google applications technology attitude is affected by their Google applications technology self-efficacy (H_{41}), subjective norm (H_{42}), and system accessibility (H_{43}).

Literature review

It is critical to begin by attempting to understand the terms used in this research. One of the well-known models related to technology acceptance and use is the technology acceptance model (TAM), originally proposed by Davis in 1986. TAM has proven to be a theoretical model in helping to explain and predict user behavior of information technology (Legris, Ingham, & Collerette, 2003). TAM is considered an influential extension of theory of reasoned action (TRA), according to Ajzen and Fishbein (1980). Davis (1989) and Davis, Bagozzi, and Warshaw (1989) proposed TAM to explain why a user accepts or rejects information technology by adapting TRA. TAM provides a basis with which one traces how external variables influence belief, attitude, and intention to use. Two cognitive beliefs are posited by TAM: perceived usefulness and perceived ease of use. According to TAM, one's actual use of a technology system is influenced directly or indirectly by the user's behavioral intentions, attitude, perceived usefulness of the system, and perceived ease of the system. TAM also proposes that external factors affect intention and actual use through mediated effects on perceived usefulness and perceived ease of use. Figure 1 depicts the original TAM (Davis, 1989).

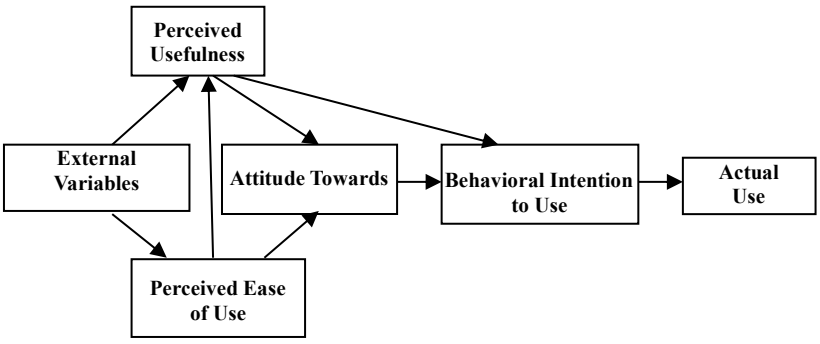

Figure 1: The original Technology Acceptance Model (TAM).

Several studies have examined TAM as a model to explain how people adopt and use online learning in the university's digital media. Selim (2003) stated that there was a need to investigate TAM with web-based learning. He put forward the course website

acceptance model (CWAM) and tested the relationships among perceived usefulness, perceived ease of use and intention to use with university students using the structural equation modeling techniques of the LISREL program. He concluded that the model fit the collected data and that the usefulness and ease of use turned out to be good determinants of the acceptance and use of a course website as an effective and efficient learning technology. Perceived usefulness can be defined as the extent to which a university student believes using online learning will boost his or her learning. Meanwhile perceived ease of use is defined as the extent to which one believes using online learning will be free of cognitive effort. In this study, online learning refers to pure, web-based, asynchronous learning through an Internet site operated by the university. It is also supported by the learning management system (LMS) of the university.

Mungania and Reio (2005) found a significant relationship between dispositional barriers and e-learning self-efficacy. They argued that educational practitioners should take into consideration the learners' dispositions and find ways through which e-learning self efficacy could be improved. In this study, e-learning self-efficacy is generally represented as the personal confidence in finding information and communicating with an instructor within the online learning system and the necessary skills for using the system.

Venkatesh and Davis (1996) focused on understanding the antecedents of the perceived ease of use. They concluded that computer self-efficacy acts as a determinant of perceived ease of use both before and after hands-on use and that the objective usability was found to be a determinant of ease of use only after direct experience with a system. In the meantime, Grandon, Alshare, and Kwan (2005) insisted that online learning self-efficacy was found to have indirect effect on students' intentions through perceived ease of use.

In general, variables related to the behavioral intention to use information technology or to the actual use of information technology could be grouped into four categories: individual context, system context, social context, and organizational context. While social context means social influence on personal acceptance of information technology use, organizational context emphasizes any organization's influence or support on one's information technology use. Thong, Hong, and Tam (2002) identified relevance, system visibility, and system accessibility as organizational context variables. They reported that the organizational context affects both perceived usefulness and perceived ease of use of a digital library. Lin and Lu (2000) similarly reported that higher information accessibility brings about higher use of information and higher perception of ease of use. In this study, online learning accessibility refers to the degree of ease with which a university student can access and use a campus online learning system as an organizational factor.

Methodology

Based on the previous research, a proposed model was developed (See Figure 2). The latent variables (arrows' linking constructs) specify hypothesized causal relationships in the direction of arrows. The observed variables (arrows between constructs and indicators) symbolize measurement validity. Cognitive constructs are perceived ease of use and perceived usefulness. Attitude is considered an affective construct. Intention to use Google application can be regarded as a behavioral construct. In the proposed model, S, N, and Y represent observed exogenous indicators and A, B, C, and D represents observed endogenous indicators.

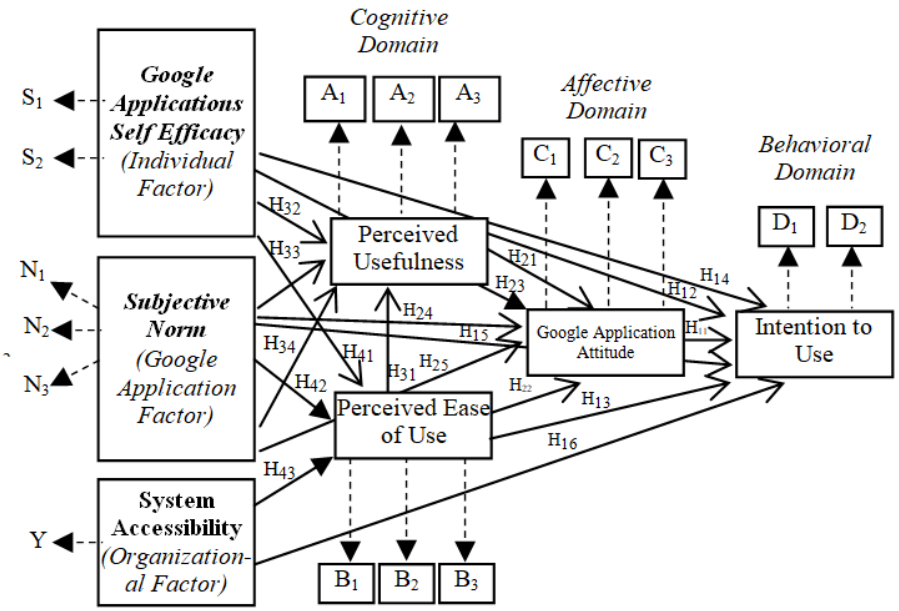

Figure 2: Theoretically interesting model based on the original TAM.

Sample and Procedure

The population in the study consists of university students at Humanities faculty Srinakharinwirot University in Bangkok, Thailand. There were 250 undergraduate students in the 2nd semester of the academic year.

The population in the study consists of university students at Humanities faculty Srinakharinwirot University in Bangkok, Thailand. There were 2,145 undergraduate students at the Humanities faculty. A sample size of 200 subjects would be an appropriate minimum, if one wanted to use LISREL (Marsh, Balla, & MacDonald, 1988). Similarly, Newcomb (1992) insisted that no one should use LISREL with fewer than 100 subjects. Considering those statements and the number

of parameter estimates, the number of sample subjects was set at 250, about 8 percent of the 2,145 students who were taking Google application.

After deciding the number of sample subjects, the researcher adopted a cluster sampling method to choose Google Application. 250 questionnaires were distributed to the students with the aid of professors in charge of each Google Application in the 2nd semester of the academic year. The number of times respondents used or accessed Google Applications per day was equal or higher than 3 times. They have ever had prior experience of using Google Applications either personally or professionally. The frequency of using Google Applications for learning or study purposes was high. Out of total 250 samples size of the cases chose "high or highest" to use Google Applications for search purposes. Almost a "rather fair" number of teachers currently were aware of the existence of Google Applications at they are class. They showed more interest to created classroom on the internet and search information via Google Applications.

Instrumentation

The instrument was developed by the researcher based on the objectives of the study and previous literature review. Part I was designed to identified demographic attributes of the respondents. It contained demographic items such as gender, academic year, the meanings of Google Applications, the number of times respondents used or accessed Google Applications per day, prior experience of using Google Applications in the university's classroom, the frequency of using Google Applications in the Google classroom or studying purposes, awareness of the existence of at their Google classroom, created, shared, post, question, assignment, announcement and/or exchanged information and ideas and from the Google classroom in everyday life. Part II consisted of 4 sub-sections as follows: perceived usefulness, perceived ease of use, attitude, and behavioral intention. The questions in Part III were developed by the group of researcher to measure Google Applications in the university's Google classroom self-efficacy. It was measured by 2 important indicators: confidence in searching information in the Google Applications and degree of essential skills for using Google Applications in the university's Google Classroom. The questions in Part IV consisted of 2 sub-sections: subjective norms and system accessibility. All constructs were measured on five-point Likert-type scales, from 1 (strongly disagree) to 5 (strongly agree).

Statistical Procedure

Data collected by the questionnaire were coded by a group of researcher. Descriptive statistical analyses such as mean, standard deviation, frequency, percent, and correlation between variables were implemented using the Statistical Package for the

Social Sciences (SPSS) software. LISREL Windows version 9.1 was employed in order to test the hypotheses by the Structural Equation Modeling (SEM).

Results

Two types of reliability tests were carried out to secure accuracy and consistency. Composite reliability (α) was obtained for each construct. Another measure of reliability computed was the variance extracted measure (ρ). Guidelines recommend that the variance extracted value should exceed 0.50. A commonly used threshold value for acceptable composite reliability is 0.70. In this study, all measures fulfill the suggested levels. Variance extracted value ranges from 0.71 to 0.82 and composite reliability ranges from 0.80 to 0.94. Table 1 shows summary of means, standard deviations, construct loadings, and reliabilities.

Table 1: Summary of means, standard deviations, construct loadings and reliabilities.

Construct	Inquiry	S.D.	Loading	α/ ρ
Perceived Ease of Use	- Does Google applications technology in the university's Google applications technology easy to use for you? (E1)	5.88 (1.26)	0.94	0.94/ 0.81
	- Do you think that the ease of use of too Google applications technology is affects the intention to use Google applications technology in the university? (E2)	5.15 (1.38)	0.85	
	- Do you think that the ease of use Google applications technology affects the perceived usefulness of using Google applications technology in the? (E3)	5.87 (0.96)	0.97	
Perceived Usefullness	- Would Google applications technology improve your classroom performance? (U1)	5.13 (1.52)	0.85	0.86/ 0.84
	- Would Google applications technology give you useful academic information? (U2)	5.80 (1.62)	0.98	
	- Do you think that the perceived usefulness of using Google applications technology affect the intention to use Google applications technology in the university? (U3)	5.28 (1.32)	0.81	

Construct	Inquiry	S.D.	Loading	α/ ρ
Attitude	- Is receiving information/feedback through Google applications technology a good idea? (A1)	6.13 (1.38)	0.96	0.95/ 0.86
	- Is posting information/feedback through Google applications technology a good idea? (A2)	5.95 (1.58)	0.94	
	- Are you positive toward Google Aplications for academic purposes? (A3)	5.71 (1.65)	0.86	
Behavioral Intention	- Do you intend to receive or check information/ announcements/ comments/ feedback from Google applications technology in the university? (B1)	5.98 (1.49)	0.89	0.86/ 0.74
	- Do you intend to post information/ announcements/ comments/ feedback from Google applications technology? (B2)	5.84 (1.18)	0.86	
Self-Efficacy	- Do you feel confident searching/ posting information in the Google applications technology in the university? (S1)	5.22 (1.74)	0.88	0.81/ 0.72
	- Do you have the necessary skills for using Google applications technology in the university? (S2)	4.89 (1.92)	0.82	
Subjective Norm	- What Google applications technology stands for is important for you? (N1)	4.73 (1.62)	0.81	0.83/ 0.71
	- Do you like using Google applications technology based on the similarity of society values and your values underlying its use? (N2)	4.94 (1.24)	0.83	
	- Is it necessary for you to participate Google applications technology in order to take advantage of Google applications technology or community? (N3)	5.20 (1.58)	0.82	
System Accessibility	Do you have dificulty accessing and using Google applications technology in the university? (SA)	5.47 (1.54)	1.0	-

Scale: 1 (Strongly disagree) to 7 (Strongly agree). All loadings were significant based on t-values.

Table 2: Summarizes the parameter estimates for the hypothesized paths, the t-values, and result of hypotheses.

Hypotheses	Direct Effect	t-value	Indirect Effect	Total Effect	Result of Hypotheses
AT → BI (H_{11})	0.280	2.92		0.299	Supported
PU → BI (H_{12})	-0.076	-0.74	0.115	0.05	Not supported
PE → BI (H_{13})	0.005	0.19	0.060	0.069	Not supported
SE → BI (H_{14})	0.589	6.47	0.064	0.68	Supported
SN → BI (H_{15})	0.290	3.90	0.085	0.37	Supported
SA → BI (H_{16})	0.001	-0.24	0.08	0.096	Not supported
PU → AT (H_{21})	0.471	12.47		0.468	Supported
PE → AT (H_{22})	0.209	6.00	0.058	0.258	Supported
SE → AT (H_{23})	0.051	1.51	0.342	0.379	Not supported
SN → AT (H_{24})	0.291	4.84	0.248	0.538	Supported
SA → AT (H_{25})	-0.039	-0.4	0.047	0.007	Not supported
PE → PU(H_{31})	0.230	2.86		0.230	Supported
SE → PU(H_{32})	0.273	4.10	0.046	0.309	Supported
SN → PU (H_{33})	0.410	3.89	0.338	0.735	Supported
SA → PU (H_{34})	-0.002	7.61	0.028	0.002	Not supported
SE → PE (H_{41})	0.549	4.65			Supported
SN → PE (H_{42})	-0.046	-3.3			Not supported
SA → PE (H_{43})	0.250	4.87			Supported

In the context of behavioral intention, key constructs of the study, all the relationships among the constructs were significant except parameter estimates from perceived usefulness, perceived ease of use, and system accessibility to behavioral intention to use. According to the direct effect estimates, the strongest magnitude was found in a relationship between Google Applications in the university's Google Class room self-efficacy and university students' behavioral intention to use Google Application (γ_{14} = 0.589) followed by university teachers' perceived ease of use of online learning in the university's digital media and se online learning in the university's digital media lf-efficacy (γ_{41} = 0.549). Perceived usefulness and perceived ease of use were significant in affecting students' attitude. Perceived usefulness had the largest impact on students' attitude. The subjective norm was identified as the largest determinant to perceived usefulness, and Google Applications in the university's Google Classroom self-efficacy had the largest impact on perceived ease of use.

In contrast, perceived usefulness was found non-significant in affecting behavioral intention to use Google Applications in the university's Google Classroom. System accessibility was found to be non-significant to all constructs

except perceived ease of use. The subjective norm had non-significant effect on perceived ease of use.

The findings showed that Google applications technology in the university's Google Classroom self-efficacy was the most important factor, followed by subject norm, in effecting behavioral intention to use Google Applications. Figure 3 shows all parameter estimates of the proposed model.

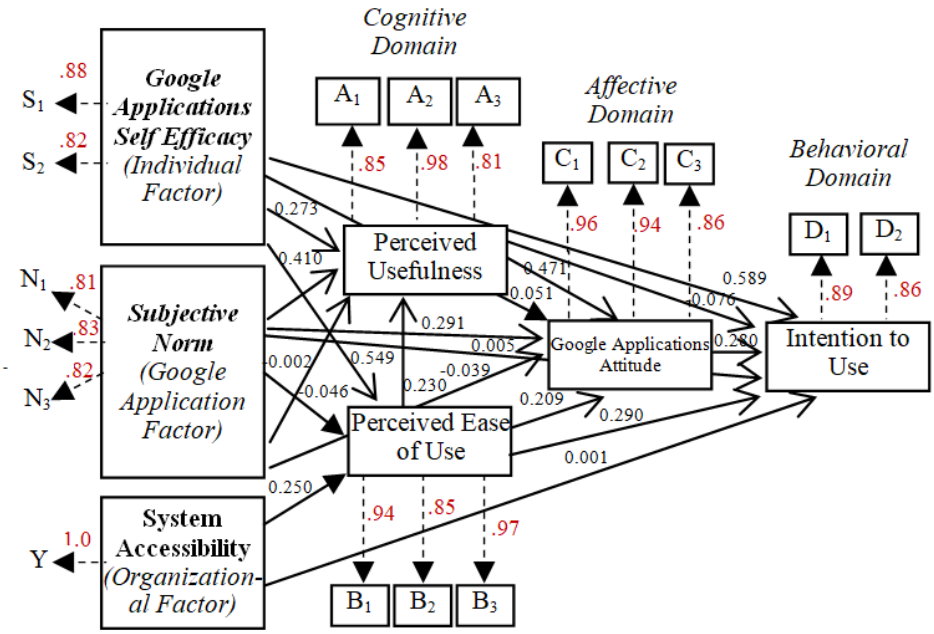

Figure 3: Parameter estimates of the proposed model.

Discussion

Similar to earlier studies (Legris, Ingham, & Collerette, 2003, Ajzen and Fishbein, 1980, and Davis,1989) and the study of Davis, Bagozzi, and Warshaw (1989), this study confirmed TAM to be a useful theoretical model in helping to understand and explain behavioral intention to use Google Applications. For that reason, there is potential for practical application in the development and management of Google applications technology in the university.

One of interesting results of the study is that both Google applications technology self-efficacy and subjective norm play an important role in affecting attitude towards Google applications technology and behavioral intention to use Google applications technology.

One possible explanation for this may be justified by motivational theory.

Google applications technology self-efficacy may be considered an intrinsic motivational factor and subjective norm may be an extrinsic motivational factor that could help the university students self-regulates their motivation on Google applications technology. On the other hand, subjective norm under the social influence factor pertains to behaviors that are engaged in response to recognition of other people. University students may want to adopt Google applications technology because they think Google applications technology experience will be beneficial for future job preparation. In the context of endogenous constructs, neither perceived usefulness nor perceived ease of use had a significant direct effect on behavioral intention to use Google applications technology. According to the original TAM, perceived usefulness is hypothesized to affect intention to use, and perceived ease of use is not hypothesized to directly affect intention. Some parts of this research were consistent with previous research, whereas some parts were contrary to previous results.

One possible clue is, nowadays, learning to use the Internet is normally considered easy and the benefits from learning through Internet are already well known to students in Thailand. Therefore, both cognitive constructs could not directly affect the university students' intention to use Google applications technology. Rather, those constructs affected attitude towards Google Applications and their attitudes affected intention to use.

Conclusion

The result of the study demonstrated that some TAM constructs had a direct and indirect effect on university students' behavioral intention to use Google Applications. For that reason, there is potential for practical application in the development and management of Google Applications in university. First, educators and managers should make an effort in boosting university students 'Google applications technology self-efficacy. Both on- and off-line support should be provided to build up e-learning self-efficacy. In Humanities Faculty, Srinakharinwirot University, Google applications technology introduction, Google applications technology manuals, and an Google applications technology strategy developed by the Center for Teaching and Learning would be good examples.

Second, subjective norm is the second most important construct that affects both behavioral intention and attitude towards Google applications technology. Therefore, it is necessary for the university to put more emphasis on Google applications technology by offering a greater variety of Google Applications the benefits of Google applications technology to attract students.

Third, even though perceived usefulness and ease of use had no direct effect on university students' intention to use Google applications technology, these constructs were related to the attitudes toward Google applications technology.

Overlooking these constructs could have detrimental effects on the user's acceptance of information technology. Thus, it is necessary that managers and developers of Google applications technology help students confirm or increase their perception positively through Google applications technology. One possible solution is to develop more user-friendly and user-oriented Google applications technology content. This kind of system will add new perception to the previous attitude and thus bring about more satisfaction. This satisfaction in turn encourages students to optimistically make further use of Google applications technology.

Finally, this type of research needs to be implemented in other online learning circumstances or infrastructures. Since the result of the study was limited to only 100 percent asynchronous Google applications technology, researchers may conduct similar studies to deal with blended Google applications technology or synchronous Google applications technology. Since little research has been done with those types of Google applications technology in the university, it is highly recommended to carry out research employing TAM.

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