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# USING THE INTERNET AS A LEARNING MEDIUM: UNIVERSITY STUDENT ADOPTION OF FABWEB

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## Abstract

*The Internet has created a new medium for teaching and learning. Despite its benefits, the study of IT-based learning adoption is still scarce. In this research, an augmented Technology Acceptance Model (TAM) (Taylor and Todd, 1995) was employed to investigate students' adoption of Internet-based learning innovation. The learning innovation in question was known as "FabWeb" (<http://fabweb.cityu.edu.hk/>), which was created as an Internet learning portal containing lecture notes, chat-room facilities, and streaming videos of lectures to provide out-of-classroom support to the regular campus-based students at a local University. In this study, a self-administrated questionnaire was distributed to students from the Faculty of Business in the university and a total of 554 usable questionnaires were collected. Psychometric properties of the measurement model and the structural model were examined using structural equation modeling techniques through LISREL VIII. Results indicated that most of the measures in the instrument had a high degree of reliability and validity. In addition, the model provided a good fit to the data with a moderate degree of variance explained. All path coefficients were found significant as hypothesized. Among all the determinants of Behavioral Intention (BI), Perceived Usefulness (PU) exhibited the strongest total effect at 0.42, whilst Attitude (A), Subjective Norm (SN), and Perceived Behavioral Control (PBC) had a moderate effect at 0.29, 0.22, and 0.20 respectively.*

## Introduction

The Internet has created a new medium for education and training. Students can make use of the Internet to access and download teaching materials including both text and video. Also, with the use of online chat room or video conferencing, students can communicate with their instructors and fellow students. The specific features of the Internet provide benefits to students in the following aspects:

- Students can access information anywhere, anytime, in or out of the classroom.
- Students can learn in a self-paced and interactive way.
- Students can have more instruction time with fewer resources.
- Students can access the most current information on their topics.

Hirt and Limayem (2000) stated that previous studies on Internet-based learning mainly focused on the learning outcomes and learning processes, but rarely explored the factors affecting students' adoption and usage. Therefore, the purpose of this study is to investigate the antecedents influencing students' adoption and use of the Internet-based learning medium. For this purpose, the augmented TAM (Taylor and Todd, 1995) is well tested and it provides a good theoretical framework to guide our investigation. The result of our investigation will, on the one hand, improve our understanding of students' perception on the Internet-based learning, and on the other hand, help instructors and academic institutions to effectively apply the Internet to facilitate students' learning.

This paper is presented as follows. Section 2 presents the research model and research propositions. Section 3 outlines the research methodology, whilst Section 4 presents the statistical results. Finally, Section 5 discusses research implications and limitations.

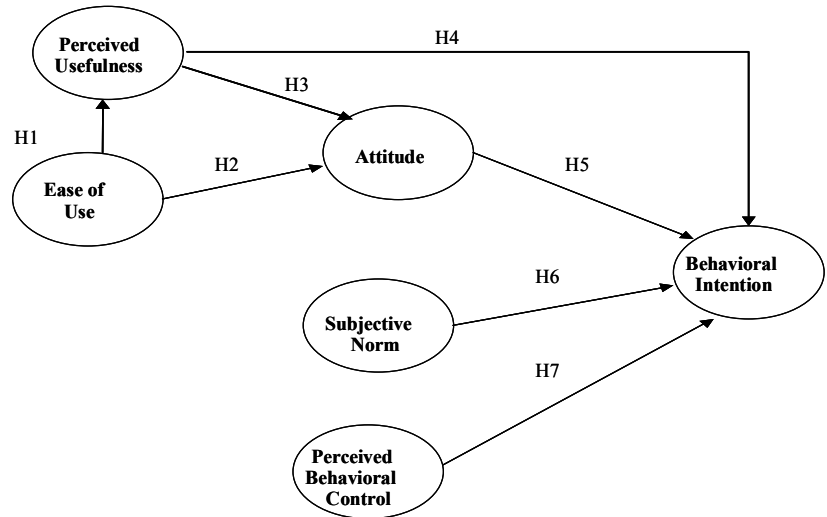
## Research Model and Research Propositions

Technology Acceptance Model (TAM) is the most well known model among a variety of behavioral models in explaining IT usage (Taylor and Todd, 1995), and it has been widely used in IS research (i.e., Chau, 1996; Straub, Keil, and Brenner, 1997; Venkatesh and Davis, 2000).

“The goal of TAM is to provide an explanation of the determinants of computer acceptance that is general, capable of explaining user behavior across a broad range of end-user computing technologies and user populations, while at the same time being both parsimonious and theoretically justified.” (Davis, Bagozzi, and Warshaw, 1989, p. 985)

In TAM, computer usage is determined by behavioral intention. Behavioral intention, in turn, is affected by attitude toward using, as well as the direct and indirect effects of perceived usefulness and perceived ease of use, whilst both perceived usefulness and perceived ease of use are jointly affecting attitude. Finally, perceived ease of use has a direct impact on perceived usefulness.

Taylor and Todd (1995) has proposed an augmented TAM, which includes Subjective Norm (SN) and Perceived Behavioral Control (PBC) as another two important antecedents to IT usage behavior. Many studies have shown that these two antecedents significantly affect IT usage behavior (Compeau and Higgins, 1991; Moore and Benbasat, 1991). Therefore, augmented TAM (Taylor and Todd, 1995) was employed in this study to investigate university students’ adoption of Internet-based learning medium of a local university– FaBWeb. The proposed research model is shown in Figure 1.



**Figure 1. Model of University Students’ Adoption of the FaBWeb**

According to the proposed research model, the easier the students perceive the use of the FaBWeb to be (Ease of Use), the more useful it is perceived to be, and the better the feeling (Attitude) towards it. At the same time, the more useful (Perceived Usefulness) the students’ view the FaBWeb to be, the higher their intention of using it. Therefore, the propositions are:

- H1: There is a positive relationship between EOU and PU
- H2: There is a positive relationship between EOU and A
- H3: There is a positive relationship between PU and A
- H4: There is a positive relationship between PU and BI

In addition, students’ intention of using the FaBWeb is influenced by the student’s own attitude (i.e., the positive feeling towards such use), subjective norm (i.e., the perceived significant referents, such as instructors, friends, or parents, desiring the students to use or not to use it), and perceived behavioral control (which reflects students’ perception on the internal or external constraints of using the FaBWeb). Thus, additional propositions are:

- H5: There is a positive relationship between A and BI
- H6: There is a positive relationship between SN and BI.
- H7: There is a positive relationship between PBC and BI.

## Research Method

### Setting and Procedure

A self-administrated questionnaire was distributed to students from the Faculty of Business in a local university. A total of 554 usable questionnaires were collected. There were 35.92% males and 63.18% females in the sample.

## Instruments

Research model constructs were measured using the instruments reported in Taylor and Todd (1995). Measures of each dimension were phrased as questions on a seven-point Likert scale, from 1 = strongly disagree to 7 = strongly agree. Appendix 1 shows the sample items of this study.

## Results

Both psychometric properties and model testing were examined within the LISREL VIII (Joreskog and Sorbom, 1993) framework. Covariance matrix of the items is attached in Appendix 2.

### Instrument Validity and Reliability

In this study, the assessment of reliability of the scales included composite reliability ( $\alpha$ ) and average variance extracted ( $\rho$ ). Composite reliability measures the internal consistency of a construct and the acceptance value is 0.70 (Hair et al., 1998). As shown in Table 1, all constructs exhibit a high degree of internal consistency as the composite reliability of the constructs ranges from 0.79 to 0.92.

Another reliability measure, average variance extracted, reflects the overall amount of variance in the items accounted for by the latent construct. According to Fornell & Larcker (1981), average variance extracted is a more conservative measure than composite reliability and their suggested acceptable level of average variance extracted is 0.50 or above for a construct. As reported in Table 1, except Perceived Usefulness (0.49), all average variance extracted of constructs are greater than 0.50.

**Table 1. Psychometric Properties of Instrument**

Construct	$\alpha$	$\rho$
PU	0.79	0.49
A	0.92	0.75
BI	0.88	0.70
EOU	0.80	0.57
SN	0.87	0.78
PBC	0.83	0.62

Bollen (1989) stated that factor loadings to latent variables can assess the validity of the scales. Appendix 1 shows that all items have a high loading to their respectively construct. Except for two items in the construct "Perceived Usefulness" with factor loading 0.47 and 0.66, all the other items have factor loadings 0.74 or above.

Fornell and Larcker (1981) suggested that average variance extracted can also be used to evaluate discriminant validity. To demonstrate the discriminant validity of the constructs in this study, the square root of average variance extracted for each construct should be greater than the correlations between the constructs and all other constructs. Table 2 shows the correlation matrix of the constructs. In this study, the assessment of discriminant validity does not reveal any problem.

**Table 2. Correlation Matrix of the Constructs**

(Note: Diagonal elements are square roots of the average variance extracted)

Construct	PU	A	BI	EOU	SN	PBC
PU	<b>0.70</b>					
A	0.69	<b>0.86</b>				
BI	0.45	0.46	<b>0.84</b>			
EOU	0.49	0.47	0.26	<b>0.75</b>		
SN	0.00	0.00	0.22	0.00	<b>0.88</b>	
PBC	0.00	0.00	0.20	0.00	0.00	<b>0.79</b>

**Model Testing**

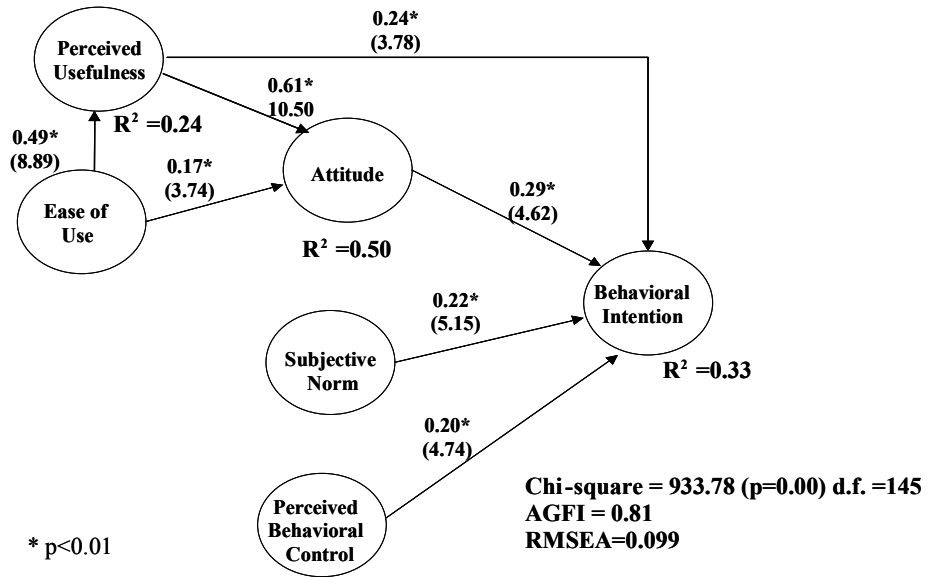
**Overall Model**

With reference to Figure 2, the fit statistics indicate that the research model provides a good fit to the data ( $\chi^2_{145} = 933.78, p=0.00$ ; AGFI = 0.81; RMSEA = 0.099). Though  $\chi^2$  is found significant, all other fit statistics are within the range of suggestive of a good model fit.<sup>1</sup> In addition, the model accounts for 24% of the variance in Perceived Usefulness (PU), 50% of the variance in Attitude (A) and 33% of the variance in Behavioral Intention (BI).

**Path Coefficients**

Figure 2 shows the estimated path coefficients, as well as the associated t-value of the research model. All significant paths ( $p < 0.01$ ) are indicated with an asterisk and all path coefficients were as hypothesized.

Table 3 shows that Attitude (A) exhibited the highest direct impact on Behavioral Intention (BI) at 0.29. Perceived Usefulness (PU), Subjective Norm (SN), and Perceived Behavioral Control (PBC) had moderate effects on Behavioral Intention (BI), with path coefficients at 0.24, 0.22, and 0.20 respectively. However, in terms of total effect, Perceived Usefulness (PU) had the strongest effect to Behavioral Intention (BI) at 0.42.



**Figure 2. Result of Testing the Proposed Research Model**

Both Perceived Usefulness (PU) and Ease of Use (EOU) had substantial effects to Attitude (A), with 0.61 and 0.47 respectively. Ease of Use (EOU) was found to be a significant determinant of Perceived Usefulness (PU), with path coefficient of 0.49.

**Table 3. Direct, Indirect, and Total Effect on Behavioral Intention, Attitude, and Perceived Usefulness**

Path	Direct Effect	Indirect Effect	Total Effect
EOU -> BI		0.05	0.05
PU -> BI	0.24	0.18	0.42
A -> BI	0.29		0.29
SN -> BI	0.22		0.22
PBC -> BI	0.20		0.20
PU -> A	0.61		0.61
EOU -> A	0.17	0.30	0.47
EOU -> PU	0.49		0.49

<sup>1</sup>According to Browne and Cudeck (1993), acceptable fits are indicated by values of: AGFI >0.80, RMSEA <0.10.

## Research Implications and Limitations

The intent of this study was to investigate students' adoption of an Internet-based learning medium through a rigorous application of the augmented TAM (Taylor and Todd, 1995). The results indicated that the augmented TAM was indeed suitable for investigation of this type, and the specific findings of applying the augmented TAM to the research problem at hand provided useful insights to the problem.

### Implications

The findings of this study show that perceived usefulness (PU) had the strongest total effect on students' behavioral intention (BI) of using Internet-based learning medium. As discussed by Taylor and Todd (1995), a direct link from PU to BI is obviously important. On the other hand, students' perception of the usefulness of this medium significantly enhances their favorable feeling on it, which in turn, increases their intention of using. Among the three direct antecedents of behavioral intention (BI), attitude (A) exhibited the highest impact on students' intention of using this learning medium. Unlike the usage in workplace settings (Davis 1989, Taylor and Todd, 1995), students' feeling on this medium is more important than perceived significant referents or perceived constraints of using. Therefore, instructors and academic institutions should focus on the usefulness of the Internet-based learning medium when designing it. At the same time, they should be concerned about students' feeling towards such a medium.

### Limitations

Though we have found that Attitude (A) and Perceived Usefulness (PU) are important factors affecting Behavioral Intention (BI), the low variance explained in Behavioral Intention (33%), indicates that some important factors in explaining students' behavioral intention of Internet-based learning technology are still missing. On the other hand, low variance explained in Perceived Usefulness reflects that apart from Ease of Use (EOU), vital factors on forming Perceived Usefulness have been neglected. It should be noticed that these attributes are important for instructors and academic institutions in designing Internet-based learning medium, so as to enhance and facilitate students' learning experiences. Identifying these factors from both a theoretical and an empirical perspective will be a fertile area of future investigation.

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### Appendix 1

	Factor Loading
<b>Perceived Usefulness</b>	
ILM would be of no benefit to me	0.47
Using ILM will improve my course grades	0.66
The advantages of ILM will outweigh the disadvantages	0.77
Overall, using ILM will be advantageous.	0.85
<b>Ease of Use</b>	
Instructions for using ILM will be hard to follow.	0.76
It will be difficult to learn how to use ILM.	0.84
It will be easy to operate ILM	0.65
<b>Attitude</b>	
The idea of using ILM is: (Very Bad – Very Good)	0.89
The idea of using ILM is: (Very Foolish – Very Wise)	0.86
Using ILM would be: (Very Unpleasant – Very Pleasant)	0.86
Using ILM is an idea: (Dislike Very Much – Like Very Much)	0.85
<b>Subjective Norm</b>	
People who influence my behavior would think that I should use ILM.	0.83
People who are important to me would think that I should use ILM.	0.93
<b>Perceived Behavioral Control</b>	
I would be able to use ILM.	0.78
Using ILM is entirely within my control.	0.84
I have the resource and the knowledge and the ability to make use of ILM	0.74
<b>Behavioral Intention</b>	
I intend to use ILM regularly next semester	0.83
I intend to use ILM next semester to assist me to prepare projects, papers, and assignments	0.83
I intend to use ILM frequently next semester.	0.85

### Appendix 2

	pu1	pu2	pu3	pu4	a1	a2	a3	a4	bi1	bi2	bi3	eu1	eu2	eu3	sn1	sn2	pbc1	pbc2	pbc3
pu1	1.99																		
pu2	0.55	1.42																	
pu3	0.55	0.64	1.31																
pu4	0.63	0.68	0.79	1.29															
a1	0.58	0.46	0.49	0.66	1.35														
a2	0.53	0.46	0.46	0.59	0.98	1.14													
a3	0.56	0.45	0.47	0.63	0.93	0.82	1.18												
a4	0.64	0.48	0.55	0.66	0.90	0.78	0.95	1.20											
bi1	0.42	0.47	0.51	0.51	0.63	0.57	0.61	0.65	1.57										
bi2	0.43	0.50	0.47	0.51	0.67	0.62	0.62	0.62	1.22	1.58									
bi3	0.50	0.56	0.50	0.53	0.63	0.59	0.67	0.66	1.29	1.32	1.73								
eu1	0.37	0.28	0.35	0.38	0.47	0.42	0.46	0.46	0.37	0.39	0.36	1.74							
eu2	0.42	0.37	0.35	0.34	0.44	0.40	0.46	0.46	0.30	0.28	0.23	1.09	1.80						
eu3	0.31	0.42	0.41	0.43	0.39	0.32	0.38	0.45	0.38	0.36	0.29	0.72	0.85	1.56					
sn1	0.14	0.30	0.19	0.25	0.32	0.28	0.36	0.30	0.38	0.32	0.46	0.13	0.06	0.15	1.11				
sn2	0.14	0.27	0.21	0.22	0.35	0.37	0.40	0.33	0.44	0.40	0.48	0.11	0.05	0.21	0.83	1.14			
pbc1	0.40	0.34	0.39	0.39	0.49	0.47	0.52	0.61	0.50	0.48	0.53	0.39	0.57	0.50	0.25	0.27	1.23		
pbc2	0.33	0.27	0.37	0.34	0.42	0.38	0.46	0.52	0.43	0.39	0.43	0.41	0.57	0.57	0.20	0.21	0.85	1.61	
pbc3	0.33	0.41	0.38	0.36	0.35	0.28	0.47	0.50	0.52	0.40	0.54	0.48	0.60	0.68	0.31	0.27	0.76	1.00	1.73