Determinant factors of information use or misuse in Wikipedia
Fatores determinantes do uso ou desuso da informação na Wikipédia

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Resumo: A Wikipédia, maior enciclopédia multilíngue de conteúdos livres na Internet, é muito popular entre os estudantes. No entanto, fica a questão: a Wikipédia é uma bênção ou uma desgraça para os alunos da sociedade contemporânea? Este trabalho descreve um estudo empírico com o propósito de investigar os fatores determinantes do uso ou desuso da informação na Wikipédia. Optou-se aqui por se desenvolver um modelo de pesquisa com base na Teoria Unificada de Aceitação e Uso de Tecnologia (Uataut). Setenta e três estudantes de uma universidade local tomaram parte na pesquisa. Os resultados indicam que a expectativa de desempenho dos entrevistados, a expectativa de esforço e a influência social foram aspectos significativos na promoção da utilização da informação. O artigo se conclui com implicações para os educadores.

Palavras-chave: Wikipédia, uso da informação, uso da tecnologia.

Abstract: Wikipedia, biggest multilingual free-content encyclopedia on the Internet, is popular with students. Is Wikipedia a wane or bane for our students? This paper describes an empirical study to investigate determinant factors of information use or misuse in Wikipedia. We developed a research model based on the Unified Theory of Acceptance and Use of Technology (UATAUT). Seventy-three students of a local university took part in the survey. Findings indicate that respondents' performance expectancy, effort expectancy, and social influence were significant in encouraging information use. The paper concludes with implications for educators.

Keywords: Wikipedia, information use, use of technology.

INTRODUCTION

Wikipedia, launched in January 2001 by Wades and Sanger, has become the biggest multilingual free-content encyclopedia on the Internet, fulfilling the initial goal to become a free-content encyclopedia (ALMEIDA, et al., 2007). Wikipedia has grown rapidly into one of the largest reference web sites, and in 2008, it attracted at least 684 million visitors yearly (WIKIPEDIA WEBSITE, 2008). Unique to Wikipedia, it allows collaborative contribution and moderation from the user communities. As an information source, Wikipedia has many advantages: (I) it is easy to access online; (II) contents are free; and (II) contents can be added very quickly. Compared to printed encyclopedias which may take years to get their contents updated, Wikipedia contents can be updated quickly.

Many argue that Wikipedia content lacks reliability and stability, since anyone can add or change content. Authors of articles may not necessarily be experts on the topics they write about, leaving a lot of room for errors, misinformation, and bias (ERIC, 2008). Hence, schools and universities do not encourage Wikipedia as a major source of information. James Wales, founder of Wikipedia, also shared similar sentiments that it is not suitable for academic uses, acknowledging that it pretty good, but one has to discern the correct use of information found in Wikipedia (JASCHIK, 2007).

However, not everyone agrees that Wikipedia lacks of reliability and stability. In fact, the contents of Wikipedia were highly regarded among the online communities. Nature conducted a comparison of the Wikipedia and other encyclopedias, the articles in Wikipedia were of quality comparable to those in the other encyclopedias (GILES, 2005). Rosenzweig (2006), Director of the Centre for History and New Media at George Mason University, did an analysis on the accuracy of Wikipedia for the Journal of American History, and he found that in many entries, Wikipedia was as accurate as or even more accurate than those traditional encyclopedias.

The Wikipedia website (2008) also argued that any encyclopedia is a starting point for research, not an ending point. An encyclopedia is a good resource to get a general understanding of a subject, but we do need books or other articles for more detailed, precise, and careful reasoned information. Therefore, all sources need to be evaluated. Jaschik (2007) argued that it is not the right way to just tell students "don't use it", as students face "an ocean of information" today, much of it of poor quality. Students should instead be teaching students how to use other sources and equip students with critical thinking skills to evaluate information.

The question we want to ask is: Is Wikipedia a wane or bane for our students? This paper describes an empirical study to investigate determinant factors of information use or misuse in Wikipedia. The remaining part of this paper is organized as follows. In the following section, the conceptual framework based on the Unified Theory of Acceptance and Use of Technology (UATAUT) is described and discussed. Next, we explain the research objectives and hypotheses. Finally, the results obtained from analysis are shown, conclusions drawn and implications for pedagogy and education of information.

Related Studies and Unified Theory of Acceptance and Use of Technology (UATAUT)

In this section, we review eight previous widely accepted models in understanding factors that influence the use of information systems (IS):

1. Theories of Information System (IS) Adoption.

IS research has long studied how and why individuals adopt new information technologies. There are various theories or models for information system (IS) adoption studies. They are the Theory of Reasoned Action (TRA), the Technology Acceptance Model (TAM), the Motivational Model (MM), the Theory of Planned Behavior (TPB) and Decomposed Theory of Planned Behavior (DTPB), Combined TAM and TPB (C-TAM-TPB), the Model of PC Utilization (MPCU), the Innovation Diffusion Theory (IDT), the Social Cognitive Theory (SCT), and the Unified Theory of Acceptance and Use of Technology (UTAUT).

2. Theory of Reasoned Action (TRA).

Drawn from social psychology, Theory of Reasoned Action (TRA) is one of the most fundamental and influential theories of human behavior. It has been used to predict a wide range of behaviors (Sheppard Hartwick and Warshaw, 1988). It was proposed by Fishbein and Ajzen (1975) in a book "Belief, attitude, intention, and behavior: An introduction to theory and research" published by Addison-Wesley Publishing Company. The theory posits that individual behavior is influenced by his/her behavioral intentions where behavioral intentions are influenced by his/her attitude toward the behavior and subjective norms related to performing the behavior. There are various researches about the TRA theory.

3. Theory of Planned Behavior (TPB).

TPB extended TRA by adding the construct of perceived behavioral control (PBC). The extension was reasoned as the limitation of TRA in dealing with behaviors over which people have incomplete volitional control (Ajzen, 1991). The theory posits that individual behavior is influenced by perceived behavioral control and behavioral intentions where behavioral intentions are a function of an individual's attitude toward the behavior, the subjective norms related to performing the behavior, and the perceived behavioral control.

4. Decomposed Theory of Planned Behavior (DTPB).

DTPB is an extension of the TRA and TPB. Taylor and Todd (1995) decomposed the constructs of the TPB into more detailed components. Attitudes were decomposed into perceived ease of use, perceived usefulness, and compatibility. Subjective norms were decomposed into peer's influence and superior's influence. Perceived behavioral control was decomposed into self-efficacy, resource facilitating conditions, and technology facilitation conditions.

5. Technology Acceptance Model (TAM).

TAM is an adaptation of the Theory of Reasoned Action (TRA) to the field of IS. TAM has been widely applied to a diverse set of technologies and users. Davis (1989) proposed this theory after his study of 152 subjects of 4 application programs. The theory posits that perceived usefulness and perceived ease of use determine an individual's intention to use a system, and the intention to use will cause an actual system use.

The TAM is supported by another study done by Davis, Bagozzi and Warshaw (1989). Venkatesh and Davis (2000) extended TAM into TAM2 by adding subjective norm as an additional predictor of intention in the case of mandatory system use, and other additional constructs including social influence processes and cognitive instrumental processes. The variables in TAM2 included: usage, intention to use, perceived ease of use, perceived usefulness, experience, social influence processes (subjective norm, voluntariness, and image), cognitive instrumental processes (job relevance, output quality, results demonstrability).

6. Motivational Model (MM).

A significant body of research in psychology has supported general motivation theory as an explanation for behavior. The Motivational Model (MM) comes from self-determination theory by Deci and Ryan (1985). The motivational model posits that intrinsic motivation and extrinsic motivation determine the use behavior. Deci and Ryan (1985) included the third construct "amotivational style" into the model. Figure 2.6 shows the diagram of the motivational model. Davis, Bagozzi, and Warshaw (1992) used this model to study 240 students using the word processing and business graphics programs. They depicted intrinsic and extrinsic motivations into a model using enjoyment and perceived usefulness constructs. The model also included perceived ease of use and output quality. The dependent variables were intention and usage. The results indicated that the perceived usefulness (extrinsic motivations) and enjoyment (intrinsic motivations) were both significant on intention. And perceived usefulness and enjoyment were found to mediate fully the effect of perceived ease of use and output quality on both intention and usage.

7. Model of Personal Computers Utilization (MPCU).

Landis, Triandis, and Adamopoulos (1978) studied 77 teachers using classroom observation technique on their intention and habits affecting behavior. The results indicated that habit was stronger than intention in predicting behavior. Later, Triandis (1980) proposed the MPCU model which claimed that a behavior intention was determined by three aspects: the attitude aspect, the social norms aspect, and the habitual aspect. Thompson, Higgins, and Howell (1991) excluded the habitual part because of the difficult distinction between habits of PC use and the behavior of PC use.

Finally, the model was concluded into that the behavior of the PC use was determined by job-fit, complexity, long term consequences, affect towards use, social factors, and facilitating conditions. Figure 2.7 shows the diagram of the model of PC utilization. Thompson, Higgins, and Howell (1991) did a study using 278 knowledge workers on their PC usage. The results indicated that job-fit, complexity, long term consequences, social factors, and facilitating conditions were all significant to PC use, but affect was not significant.

8. Innovation Diffusion Theory (IDT).

Grounded in sociology, Innovation Diffusion Theory (IDT) has been used since the 1960s to study a variety of innovations, ranging from agricultural tools to organizational innovation (Rogers, 1995). Within information systems, Moore and Benbasat (1991) adapted the characteristics of innovations presented in Rogers and redefined a set of constructs (voluntariness, relative advantage, compatibility, image, ease of use, result demonstrability, visibility, and trial ability) that could be used to study individual technology acceptance. Plouffe, Hulland and Vandenbosch (2001) tested sets of antecedent constructs drawn from both TAM and the innovation diffusion theory, and compared with one another. The dependent variable was intention to use. The results indicated that the IDT constructs explained 45% of the variance in intention, and TAM explained 32.7%. The authors concluded that the IDT provided more detail than TAM, and TAM was simple and might be misleading in certain situations. Fitzgerald and Kie (2002) tested a comprehensive model which integrated IDT and some other proposed models. The study was done by a survey of 128 respondents about online purchasing. The IDT constructs were used as antecedents of attitude. The results indicated that attitude was a strong predictor of intention to use. For adopters, result demonstrability and risk were significant. While for non-adopters, risk was significant.

9. Social Cognitive Theory (SCT).

This theory identifies human behavior as an interaction of personal factors, behavior, and the environment (Compeau and Higgins, 1995a). Compeau and Higgins (1995a) tested it and the results indicated that all the relationships were significant except the other users' effect on personal outcome expectations. Compeau and Higgins (1995b) tested a comprehensive model which integrated SCT and some other proposed models in another study at the same year. The study validated an instrument to measure the computer self-efficacy (CSE). The results indicated that computer self-efficacy would affect usage, outcome expectations, anxiety, and affect. Encouragement by others and others' use will affect computer self-efficacy and outcome expectations.

Locke, Frederick, Lee and Bobko (1984) concluded that self-efficacy was a strong predictor of goal and performance in their study of 209 students' behavior. Ability and past performance also determined the goal. An interesting finding of this study was that self-efficacy was more strongly related to past performance than future performance, but self-efficacy was still a strong predictor of future performance. The findings in this study were consistent with the findings by Harrison, Rainer, Hochwarter, and Thompson, (1997) in testing the computer usage of 776 university employees.

10. Unified Theory of Acceptance and Use of Technology (UTAUT).

Venkatesh, Morris, Davis, and Davis (2003) formulated the Unified Theory of Acceptance and

Use of Technology (UTAUT) to integrate the main computing user acceptance models. The UTAUT aims to explain user intentions to use an IS and subsequent use behavior. The theory holds that four key constructs (performance expectancy, effort expectancy, social influence, and facilitating conditions) are direct determinants of usage intention and behavior. Gender, age, experience, and voluntariness of use are posited to mediate the impact of the four key constructs on usage intention and behavior.

The theory was developed through a review and consolidation of the constructs of 8 models from earlier researches to explain IS usage behavior. These 8 models are theory of reasoned action (TRA), technology acceptance model (TAM/ TAM2), motivational model (MM), theory of planned behavior (TPB), a combined theory of planned behavior/technology acceptance model (C-TPB- AM), model of PC utilization (MPCU), innovation diffusion theory (IDT), and social cognitive theory (SCT). The UTAUT supported that the effect of performance expectancy on behavioral intention was stronger for men and younger users. And the effect of effort expectancy on behavioral intention was stronger for women, older users, and users with less experience. The effect of social influence on behavioral intention was stronger for women, older users, under conditions of mandatory use, and users with less experience. Finally, facilitating conditions were not significant to behavioral intention, but the effect of facilitating conditions on usage was stronger for older users and users with more experience.

One of the important findings of Venkatesh et al. (2003) was that self-efficacy and anxiety was not direct significant to the behavioral intention. Another important finding was that facilitating conditions were not significant to behavioral intention and direct determined the usage behavior.

This unified model was able to explain 70% of the variance in behavioral intention, while the previous models can only account 40% of the variance (Venkatesh et al., 2003). Also, this model was built from other widely accepted models. Thus, the UTAUT model was selected for the particular research of the acceptance and use of Wikipedia.

THE STUDY

Research Model

The research model was formulated based mainly on the UTAUT model with four constructs (Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions) adapted from the UTAUT model, and three constructs (Self-efficacy, Anxiety, Attitude) from other models.

Protocol

The undergraduate and postgraduate students of a local university were selected for this study. The sample was a random sample. The data for this research was collected by a survey instrument. The questionnaires were given to the students outside of the university library and collected immediately after completion. The time required to complete the survey was about five to ten minutes. Responses were collected between 12 July 2008 and 20 July 2008. A total of seventy-three students responded to the survey.

Measurement Items in Survey Instrument

Measurement Items in Survey Instrument Using a seven-point Lickert scale, respondents were asked to indicate levels of agreement to each item indicated. Each item question was simplified and related to educational setting. For each variable, there are 3-5 questions to measure it. To ensure content validity, the survey questions are adapted from previous studies of the UTAUT (Vankatesh et al. 2003) and the other 8 models, and modified to suit the study of Wikipedia used by university students. Table 1 shows measurement items of the constructs.

To make the data "readable and analyzable" (Bryman & Cramer, 2005, p.201), this seven-point Likert scale ranged from "1"=Strongly Agree to "7"=Strongly Disagree" was scaled down into three categories representing responses as Agree, Neutral, and Disagree. These categories were used to achieve the purpose reducing the amount of information summarized by using contingency tables produced by cross-tabulation.

To investigate the aggregate measures, the Statistical Package for Social Sciences (SPSS) was used to recode the aggregate contiguous values

Table 1: Measurement Items

Constructs	Models	Items
Performance Expectancy	UTAUT (Venkatesh et al., 2003)	Q1. I would find Wikipedia useful in my researches or assignments as an information source. Q2. Using Wikipedia would enable me to do researches or assignments more quickly. Q3. Using Wikipedia would increase my productivity in mu researches or assignments. Q4. Using Wikipedia would increase my chances to get better academic results.
Effort Expectancy	UTAUT (Venkatesh et al., 2003)	Q5. I would find Wikipedia casy to use. Q6. Learning to use Wikipedia is easy. Q7. My interaction with Wikipedia would be clear and understandable. Q8. It would be easy for me to become skillful using Wikipedia.
Social Influence	UTAUT (Venkatesch et al., 2003)	Q9. My classmates use Wikipedia as an information resource in their researches or assignments. Q10. My friends use Wikipedia as an information resource in their researches or assignments. Q11. My teachers think l should use Wikipedia as an information resource in my researches or assignments. Q12. My University support to use Wikipedia as an information resource in the researches or assignments.
Facilitating Conditions	MPCU (Thompson et al., 1991)	Q13. I have the resources necessary to use Wikipedia. Q14. I have the knowledge necessary to use Wikipedia. Q15. The Wikipedia is always available for me to use. Q16. The system is stable to use (no system failure).
Self-efficacy	DTPB (Taylor and Todd, 1995; Tan and Teo, 1998)	Q17. I could use Wikipedia if no one around to tell me what to do. Q18. I could use Wikipedia if l could call someone if I fot stuck. Q19. I could use Wikipedia if only can use the built-in help of Wikipedia. Q20. I could use Wikipedia if l have a lot of time to study it first.
Anxiety	SCT (Compeau and Higgins, 1995b)	Q21. I feel apprehensive to use it. Q22. I worry that the information in Wikipedia may be not correct or complete. Q23. I worry about using it as a reference may cause a low grade for my paper.
Attitude Toward Behavior	TAM (Davis et al., 1989)	Q24. Using Wikipedia as information source is a good idea. Q25. Using Wikipedia as information source makes my research or assignment more enjoyable. Q26. Using Wikipedia is interesting. Q27. I prefer to use the Wikipedia compare to the traditional library. Q28. I prefer to use the Wikipedia compare to the online databases.
Behavioral Intention	TRA (Sheppard et al., 1988)	Q29. I used Wikipedia in my researches or assignments as an information source for the past 12 months. Q30. I intend to use Wikipedia in my research and assignments as an information source for the next 12 months. Q31. I plan to use Wikipedia in my researches or assignments as an information source for the next 12 months. Q32. I am willing to use Wikipedia in my research or assignment.

into distinct categories as "1"<= Agree <= "3.5" < Neutral <= "4.5" and "4.5" < Disagree <= "7". For non-aggregated responses, SPSS was also used to recode and reassign these discrete variables value to the new scale as "1"<= Agree <="3", "4" = Neutral, and "5" <= Disagree <= "7".

After completing data preparation, cross-tabulation was used to test the research hypotheses. Statistical significance was tested using the Pearson Chi-Square (÷2) test. This test confirms the probability of the observed relationship between two variables happened by chance. Test with p-values of 0.05 or less were statistically considered as significant, that means, a relationship exists in the test variables and that the null hypothesis of independence between test variables could safely be rejected. The notation "÷2" refers to the value of the Pearson Chi-Square test.

FINDINGS AND ANALYSES

Descriptive Statistics

Seventy-three students participated in the survey. More than 60% of respondents are male, with more than half of them did not have working experiences. About 80% had less than three years' and 72.6% were undergraduates. More than half of the respondents (53.7%, n=197) owned desktop personal computers and (53.5%, n=193) spent more than 15 hours in computing activities. Most of the respondents (93.7%, n=338) accessed computers for studies at home and other places, with 69.8 % (n=252) of them used computers for studies at home alone. There was a reported high rate of Internet access at home (99.4%, n=359). Major respondents (22.7%, n=82) spent 6~10 hours and 11~15 hours on Internet/World Wide Web for their studies. When accessing SLVC, the 77.3% (n=279) of the respondents also spent their time on other activities.

The study found that only 17.8% of the respondents did not have the behavior intention to

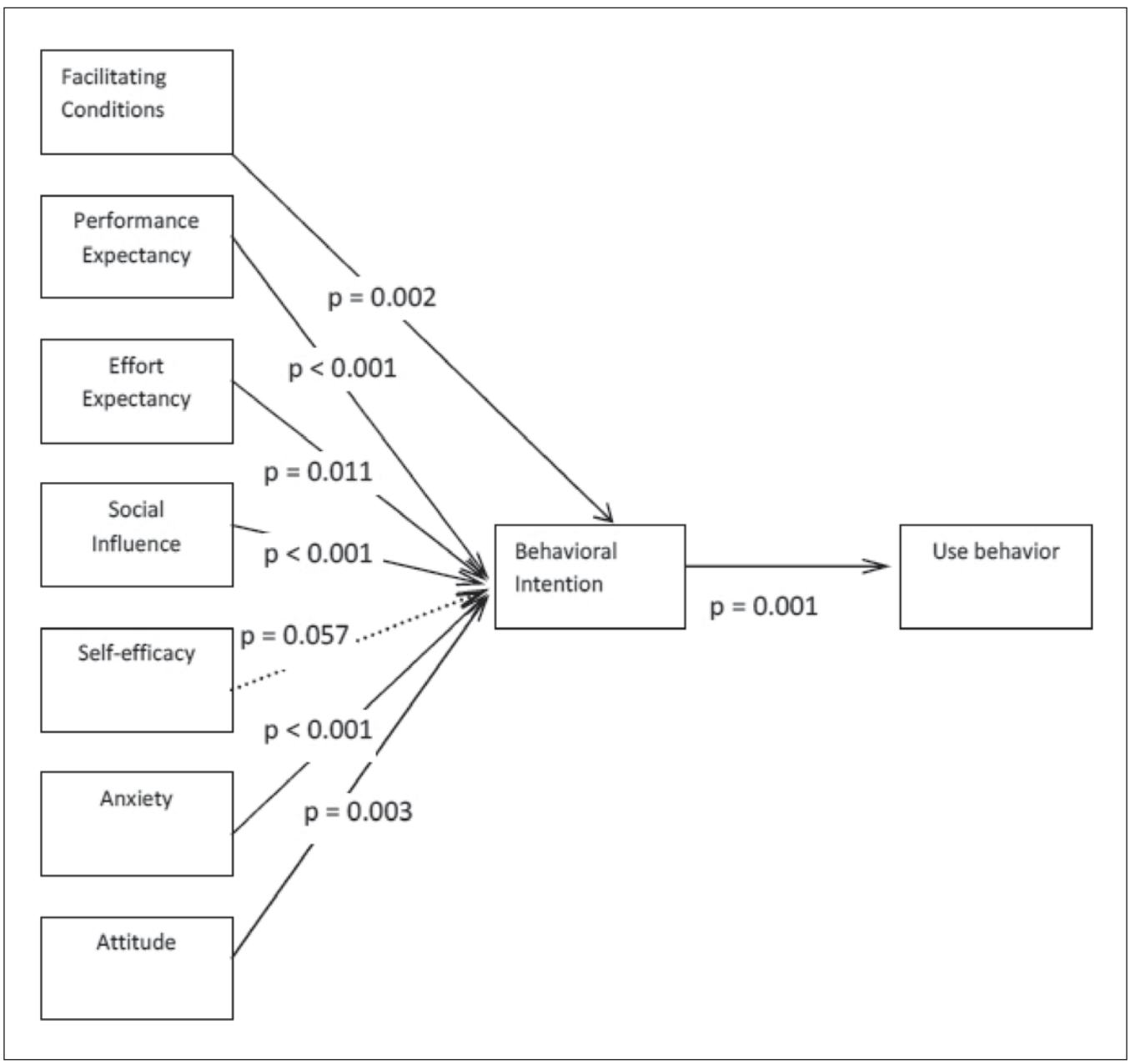

Figure 1: Testing Results of the Research Model

use Wikipedia, and only 6.9% did not have the use behavior listed in the questionnaire. However, there were 26% of the respondents choose neutral for behavior intention, and 28.8% for use behavior. Thus about a quarter of the respondents were not sure if they intend to use Wikipedia, or not so often to use Wikipedia as a major information source.

Chi-Square Tests of Significance

After the data preparation is completed, the hypotheses are tested using cross-tabulations. In SPSS, go to "Analyze->Descriptive Statistics-> Crosstabs" to run the cross-tabulation. Before running the cross-tabulation, the "chi-square" in the statistics setting must be enabled. This process results two tables. One is the cross-tabulation, which shows the relationship between two variables. Another is the chi-square tests table, which shows the significance between two variables. In the chi-square tests table, there are two important values. One is "$\chi 2$", which refers to the value of the Pearson Chi-Square test for the contingency table indicated. Another is "p", which refers to the p-value that indicates the level of statistical significance of the Chi-Square test. Tests with p-value less than 0.05 are considered significant. Figure 1 shows the testing results of the research model.

CONCLUSION

This study investigated the factors influencing on the behavior intention and the use behavior to use Wikipedia as a major information source. The research model was generated mainly based on the UATAUT model, and some other previous widely accepted models. According to UTAUT, behavioral intention was determined by performance expectancy, effort expectancy, and social influence, and use behavior was determined by facilitating conditions and behavioral intention. According to some other models, the behavior intention was also determined by self-efficacy, attitude, and anxiety.

The study found that the constructs from UTAUT (performance expectancy, effort expectancy, and social influence) were all significant to behavior intention. However, self-efficacy was found not significant to behavior intention. The other two constructs (attitude, and anxiety) from other previous models were significant to behavior intention. The use behavior was found determined by facilitating conditions and behavioral intention. It was surprising that facilitating conditions was found significant to both behavioral intention and use behavior. However, one of the items (if I having the resources necessary to use Wikipedia) of facilitating conditions was found not efficiently. If this item was ignored, the results would be that facilitating conditions was significant to use behavior, but not behavior intention.

Based on the findings, we identify a number of implications for Wikipedia use by local university students.

- The findings suggested that performance expectancy was an important reason for the students to use Wikipedia. If the students believed that Wikipedia was useful and helpful for their assignment or research, they would intend to use it.
- The findings suggested that the effort expectancy was also a reason for the students to use Wikipedia. The students would intend to use Wikipedia if they believed that it was easy to use.
- Social influence was also suggested by the findings as a reason for the students to use Wikipedia. The students would intend to use Wikipedia if the people around them (teachers, friends, classmates, etc.) also used Wikipedia or thought the students should use Wikipedia as a major information source. Thus, if the practitioners of Wikipedia want more people to use their system, they should try to make more people accept Wikipedia and then these people will affect more people. The educators can also affect the students by their own advices or the university suggestion.
- The findings suggested that facilitating conditions was not significant to behavior intention, but significant to use behavior. Thus, even though there was not enough hardware or software supporting the students

to use Wikipedia, they still intended to use it if they think they need it. But, facilitating conditions are important in influencing decision to use Wikipedia.

- Self-efficacy was found not to be significant to behavior intention in this study. Thus, even the students did not have the ability to use Wikipedia, they might still have the intention to use it. Therefore, lack of the ability to use Wikipedia is not a problem for students. They can learn if they need it.
- The positive feeling did help the students to increase the intention to use. Therefore, if the educators or practitioners of Wikipedia want to encourage the students to use Wikipedia, they should make it interesting or enjoyable.
- Anxiety was also suggested by the findings as a reason to use Wikipedia as a major information sources. If the students feel apprehensively, or even fear, to use Wikipedia, they would have the intention to use it. Therefore, if the educators or practitioners of Wikipedia want to encourage the students to use Wikipedia, they should solve the problems that the student may worry about
- Behavior intention was suggested by the findings as an important reason to use Wikipedia as a major information sources. Thus the intention to use might cause an actual use.

Certainly, more can be done. Firstly, the findings and implications were generated based on a specific user group. The respondents of this survey were undergraduate and graduate students from a local university.

Future research could use a larger sample, the respondents from different backgrounds, experiences, and countries. Secondly, this research did not test the effects of the moderators like age, gender, experiences, and voluntariness of use.

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