

Intention to Use Digital Library based on Modified UTAUT Model: Perspectives of Malaysian Postgraduate Students

Abd Latif Abdul Rahman, Adnan Jamaludin and Zamalia Mahmud

Abstract—Unified Theory of Acceptance and Use of Technology (UTAUT) model has demonstrated the influencing factors for generic information systems use such as tablet personal computer (TPC) and mobile communication. However, in the context of digital library system, there has been very little effort to determine factors affecting the intention to use digital library based on the UTAUT model. This paper investigates factors that are expected to influence the intention of postgraduate students to use digital library based on modified UTAUT model. The modified model comprises of constructs represented by several latent variables, namely performance expectancy (PE), effort expectancy (EE), information quality (IQ) and service quality (SQ) and moderated by age, gender and experience in using digital library. Results show that performance expectancy, effort expectancy and information quality are positively related to the intention to use digital library, while service quality is negatively related to the intention to use digital library. Age and gender have shown no evidence of any significant interactions, while experience in using digital library significantly interacts with effort expectancy and intention to use digital library. This has provided the evidence of a moderating effect of experience in the intention to use digital library. It is expected that this research will shed new lights into research of acceptance and intention to use the library in a digital environment.

Keywords—Intention to use digital library, UTAUT model, performance expectancy, effort expectancy, information quality, service quality.

I. INTRODUCTION

THE acceptance of any information systems (IS) by users is always determined by certain factors. These acceptance factors have been studied by previous researchers [1],[2],[3] and several theories [1],[4] have been developed to explain the intention and usage of IS including theory of reasoned action (TRA) [4], technology acceptance model (TAM) [2], motivational model (MM), theory of planned behaviour (TPB) [1] and Unified theory of Acceptance and Use of Technology

(UTAUT) [5]. Among these theories, UTAUT has become the latest and most powerful theory to predict and explain an information systems usage intention [5].

Due to their interdisciplinary nature, definitions of digital libraries are abundant [6]. According to [7], the phrase “digital library” means different things to different people. According to [6], digital library can be defined as electronic collections that are much richer in content and more capable in functionality than databases or information retrieval systems. It can also be visualized as a computer-based system for storing, acquiring, organizing, searching and distributing digital materials for end user access. It requires less space and the data can be made available through communication networks to anyone anywhere while facilitating searches with speed [8]. Even though digital libraries bring many advantages, but success from technical perspective alone does not determine the acceptance of the system developed. Thus this research is important to investigate the affecting factors for intention to use digital library.

II. PROBLEM STATEMENT

Even though a digital library is part of an information system, there has been very little effort to investigate the intention to use digital library from the UTAUT perspective. Since the nature of digital library is quite new and a unique phenomenon to the library services, it is crucial to investigate the factors that could influence the use of digital library so that new approaches to library services can be implemented and benefit both users and the provider of the library services.

III. RESEARCH MODEL AND HYPOTHESES DEVELOPMENT

The model comprises of intention to use digital library as the criterion variable while performance expectancy, effort expectancy, information quality and service quality are the explanatory variables. Experience in digital library, gender and age are moderating variables. These information quality and service quality constructs are adapted from [9], [10] who claimed there were significant relationship with intention to use of information systems. Undeniably there are other potential and possible antecedent factors that could be included into the model but in this model the researcher is interested in investigating four specific factors as illustrated in Figure 1. These factors are chosen because of their strong

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support from previous studies and their applicability and suitability in the context of digital libraries.

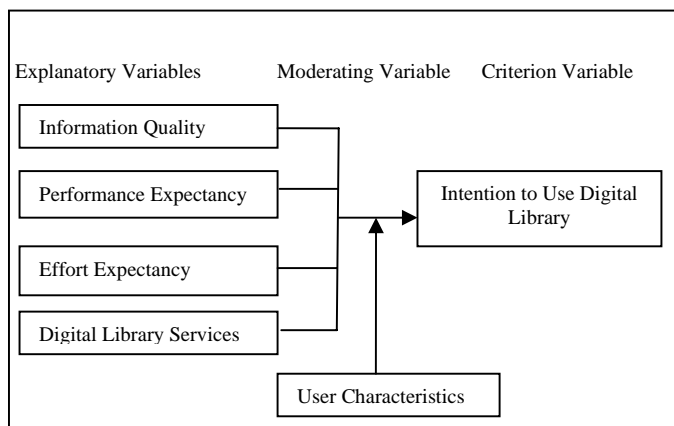


Fig. 1 Research model

A. Intention to Use

Intention to use digital library refers to the strength of digital library users' intensity to use digital library for obtaining digital information resource for his/her study/research. Based on previous research, information systems usage is largely influenced by behavioural, hence intention to use digital library play an important role in predicting future usage of digital library. Therefore, intention to use digital library is chosen as the criteria variable for this research.

B. Performance Expectancy

Performance expectancy (PE) is defined as the degree to which an individual believes that using a system will help him or her to attain gains in job performance [5]. The five constructs that pertain to performance expectancy are perceived usefulness, extrinsic motivation, job-fit, relative advantage, and outcome expectations.

According to [5], gender and age moderates the relationship between performance expectancy and behavioural intention. Male users tend to be more comfortable with new information systems than female users and they tend to spend more time using new information system, thus obtaining benefit from the systems [5], [11]. On the other hand, [12] found that female end-users found the system to be more useful than their male counterparts.

Even though, there were some contradictions in the previous findings, we are still confident with the result from [5], thus this research proposes the following hypothesis:

H1: Performance Expectancy has a positive affect on the Intention to Use Digital Library

H2: The relationship between Performance Expectancy and Intention to Use Digital Library are moderated by gender of users

In the context of age, previous researchers found that older end users tend to find new information systems such as digital libraries difficult to use and find them less useful when performing their task or assignments [13]. Study conducted by [16] also produced the same result as [5], who claimed that

older end users have difficulties and uncomfortable when retrieving information from information system such as digital libraries. This scenario may lead to lower performance expectancy among them where they perceived the system as not useful and cannot satisfy their job. Thus, based on the above findings by previous researchers, this research then propose the following hypothesis:

H3: The relationship between Performance Expectancy and Intention to Use Digital Library are moderated by age of users

C. Effort Expectancy

Effort expectancy (EE) is defined as the degree of ease associated with the use of the system [5]. Three constructs from the existing models capture the concept of effort expectancy, namely perceived ease of use, complexity, and ease of use.

According to [5],[14], female end users of new information systems such as digital libraries have higher level of computer anxiety and their level of effort expectancy tend to be lower than the male counterpart. Also, women are very concern in the ease of use of information systems, and perceived a stronger ease of use compared to men [14]. Therefore this research then proposes the following hypotheses:

H4: Effort Expectancy has a positive influence on the Intention to Use Digital Library

H5: The relationship between Effort Expectancy and Intention to Use Digital Library are moderated by gender of users

In the context of experience as moderating the effort expectancy, previous researchers [5] have found that the longer the users use the information system, the more confident they are towards that information system. This finding is also supported by [15], which claimed that increased direct use of information systems will enhance the end-user's confidence in their ability to understand and use the information systems in performing their tasks. Other researchers [5], [11] found that longer experience in the information system can influence end-user beliefs in the information systems. As end-users' direct-use experience with information systems increases over time, their perceptions and adoption intentions change substantially. Thus this research proposes the next hypothesis:

H6: The relationship between Effort Expectancy and Intention to Use Digital Library are moderated by Experience of users

Result of [16] study found older end-users with different capabilities have difficulties in retrieving information from information systems, and these capabilities decreases as age increases. Older end users needs to struggle more to adjust to the new environment compared to younger end users. Article [5] has identified age as a moderating variable for the relationship between effort expectancy and behavioural intention, and this relationship is stronger for older users. This finding is also supported by [13] where age is a significant moderating factor between effort expectancy and usage intention. Therefore this research proposes the following hypothesis:

H7: The relationship between Effort Expectancy and Intention to Use Digital Library are moderated by age of users

D. Information Quality

From the literature, definition of information quality varies among the researchers. According to [17] information quality represents a user's reaction to the characteristics of output information versus the user's information requirements; meanwhile other researchers defined information quality as the criteria of relevance, accessibility (validity), interpretability, and integrity (composed of accuracy and completeness) [18]. According to [20], information quality concerns three sources of information quality measurements namely intrinsic, relational and reputational. On the other hand, [10] refers information quality according to dimension of accuracy, relevance, understandability, completeness, currency, dynamism, personalization, and variety. According to [21] information qualities constructs included an information accuracy, information relevance, and information completeness and information time. According to [9], [10], information quality has the potential to directly affect both behavioural intention and perceived usefulness [22] of information system. Hence, this lead to the next research hypothesis:

H8: Information Quality has a positive influence on Intention to Use Digital Library

E. Service Quality

In general, service quality is an evaluation of how well a digital library provides a service, resource, or program. Service quality approaches include evaluation from the digital library and user perspectives, of libraries as a field, and of the library as an institution.

According to [9], [10] service quality has the potential to directly affect both behavioural intention [9] and satisfaction of information system. Besides that, previous research has found that services quality has a positive relationship with behavioural intention use of information systems [5]. Thus, this study expects that overall service quality will have a positive relationship with intention to use digital library. Thus, this lead to the next hypothesis:

H9: Services Quality has a positive influence on Intention to Use Digital Library

IV. METHODOLOGY

A. Sample and Methods

Sample for this study comprises of five hundred and thirty four (534) postgraduate students (Masters and Doctorate) from four public intensive research university in Malaysia namely, UM (143), UKM (135), UPM (138) and USM (118). Postgraduate students at these universities are chosen because they require digital library services to actively seek information and resources so they could get access to both current and high quality information. Questionnaire was developed and distributed to the students at their respective university locations. Wherever possible, face-to-face structured interview was used to elicit detail information from

the students. Data collected was then analyzed using SPSS software version 16.0 where selected variables are subjected to exploratory, descriptive and inferential statistical analysis which include tests of differences and relationships between selected variables.

B. Instrument

This section describes the dimensions and items or constructs that are used in the questionnaire and how they are operationalized in this study. A seven-point summated rating scale is used to indicate the response for each item within each dimension and between the dimensions. The items asked the respondents to rate the extent to which they agreed with the features described by the statements on a scale of 1 to 7, where 1 refers to "strongly disagree" and 7 "strongly agree." Confirmatory factor analysis (CFA) was performed to determine the underlying factors and identify the structure of a particular domain or dimension. The result of CFA produces five domains as follows.

Intention to Use Digital Library (IUDL)

IUDL refers to the intention to use digital library as a result of their prior experience in using the digital library. IUDL dimension comprises seven (7) items.

Effort Expectancy (EE)

Effort expectancy is defined as the degree of ease associated with the use of the digital library. EE dimension comprises twelve (9) items.

Information Quality (IQ)

Information quality is defined as the degree in which digital library users perceive that digital information resource in digital library repository is usable for their study/research. IQ dimension comprises 10 items.

Performance Expectancy (PE)

Performance expectancy is defined as the degree to which digital library users believe that using the digital information resources in the digital library will provide them with the advantages in their study or/and research. PE comprises five (5) items.

Service Quality (SQ)

Service quality is defined as the availability of the digital library services for the users to use the digital library in order to obtain digital information resources for their study or/and research. SQ comprises five (5) items.

Moderating factors for this research is defined as follow:

Age

Age in which it relates to the age of the particular users which is measured by years.

Gender

Gender in which it relates to sexual categories of the digital library users which is either male or female.

Experience (EXP)

Experience in which it relates to the number of years of using digital library.

C. Data Evaluation

The data was subjected to reliability and validity test to ensure that measures are free from error and yield consistent results. Construct validity is to ensure that the measure behaves the way it is supposed to, based on pattern of intercorrelations. To assess the reliability of the measurement instrument, Cronbach's alpha was used. The Cronbach's alpha values of the five dimensions show consistent results in the responses given by Table 1. To identify the underlying factors and determine the appropriateness of factor analysis, Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's Test of Sphericity (BTS) were used. The KMO measure of 0.963 indicates that all measures of sampling adequacy are well above the acceptable level of 0.5. The BTS was significant at 0.01, thus factorability is assumed. All results are shown in Table 2.

TABLE I
CRONBACH'S ALPHA FOR RELIABILITY

Constructs	Number of Item	Value of Cronbach's Alpha
Performance Expectancy	5	0.920
Effort Expectancy	9	0.918
Information Quality	10	0.962
Service Quality	5	0.871
Intention to Use Digital Library	7	0.928

TABLE II
CHECKS FOR CORELATION MATRIX IN FACTOR ANALYSIS

Kaiser-Meyer-Olkin Measure of Sampling Adequacy				.963
Bartlett's Sphericity	Test	of	Approx. Chi-Square	20180.726
			Degree of Freedom	1081.000
			Significance	.000

V. ANALYSIS AND RESULTS

Data was subjected to several exploratory, descriptive and inferential analyses. Hierarchical regression analysis was used to determine the effects between the criterion and predictor variables based on the hypotheses developed in the theoretical framework. The multiple regression model for the Intention to Use Digital Library is shown in (1).

$$IUDL = 2.384 + .326 (PE) + .213 (EE) + .258 (IQ) - .145 (SQ) + .007(EE*EXP) \quad (1)$$

The adjusted R-square from the regression model in (1) shows an increase in the variation of Intention to Use Digital Library (IUDL) from 29.9% to 38.3%. This reflects an additional 8.4% increase in the total variation for IUDL as explained by the predictor variables in (1).

Hypothesis 1 claims that there is a relationship between Performance Expectancy (PE) and Intention to Use Digital Library (IUDL). The result found that performance expectancy was significantly and positively related to

intention to use digital library. Specifically, the result implied students who acknowledged the advantages and benefits of digital library would be more intention to use digital library. This was proven in the hypothesis that performance expectancy has a significant positive influence on intention to use digital library. This relationship is consistent with previous researchers who agreed that performance expectancy is the most influential predictor for intention to use digital library [5], [11]. In fact, [1] confirmed that performance expectancy is the best single predictor of intention to use digital library. This study finding is also consistent with [3], [23] study on Hong Kong students' performance expectancy appeared to be the most significant variable in predicting students' use of digital library. In similar vein, this is supported by [24] who postulates that students who are have high perceived usefulness (performance expectancy) would be more inclined to use digital library. Thus, the result implies that postgraduate students of Malaysian Research University who have high level of performance expectancy are more likely to use the digital library.

Hypothesis 2 posits that there is interaction between gender and performance expectancy has positive effect on Intention to Use Digital Library (IUDL). This result however, contradicted with UTAUT [5] who found that gender moderate the relationship between performance expectancy and behavioral intention where male users tend to be more comfortable, spend more time and thus benefit from the new information systems [5],[11]. One possible explanation for this inconsistent result with UTAUT finding is the influence of the culture factor

TABLE III
COEFFICIENTS OF MULTIPLE REGRESSION
(ENTER METHOD)

Model	Unstandardized Coefficients		Standardized Coefficients	Collinearity Statistics			
	B	Std. Error		Tol	VIF		
1 (Constant)	2.384	.209				11.430	.000
PE	.326	.044	.365	7.391	.000	.474	2.109
EE	.213	.050	.202	4.237	.000	.509	1.963
IQ	.258	.060	.224	4.277	.000	.422	2.370
SQ	-.145	.035	-.179	-4.187	.000	.634	1.578
EE*EXP	.007	.003	.076	2.115	.035	.904	1.106

a. Dependent Variable: IUDL

[25], [26]. UTAUT findings were based on sample from developed country such as Northern America, which is culturally different from developing countries such as Malaysia. Previous studies have reported that gender and age are significant moderators for behavioral intention in most samples of developed countries but were found not significant in developing countries sample [27]. This result implies that male and female postgraduate students of Malaysian research universities did not differ in their behavioral intention towards

digital library. Neither male nor female postgraduate students of Malaysian research universities have significant influence on the relationship between performance expectancy and intention to use digital library.

Hypothesis 3 posits that interaction between age and performance expectancy has positive effect on Intention to Use Digital Library (IUDL). This result, however contradicted with UTAUT [5] who found that age moderates the relationship between performance expectancy and behavioral intention. It stated that older user tend to find new information systems difficult to use and find them less useful when performing their task. This scenario may lead to lower performance expectancy among them and hence perceived the system as not useful and not satisfying. In this study, older and younger postgraduate students of Malaysian research universities did not differ significantly in their perceptions. Both gender groups perceived digital library as difficult to use and less useful when performing their tasks. The possible explanation for this inconsistent result may be due to the influence of culture factors from developed and developing countries [26], [27]. Therefore, gender does not significantly moderate the relationship between performance expectancy and intention to use digital library.

Hypothesis 4 posits that effort expectancy will have a positive relationship with intention to use digital library. The study has proven the above claim that effort expectancy is significantly and positively related to intention to use digital library. This implies that students who perceived highly on the ease of use of digital library would have high intention to use digital library. This result is consistent with UTAUT [5], [11] and [23] study which stated that effort expectancy or perceive ease of use is a significant predictor for intention to use digital library.

Hypothesis 5 posits that interaction between gender and effort expectancy has positive effect on Intention to Use Digital Library (IUDL). Result from this study found that interaction between gender and effort expectancy has no significant influence on the Intention to Use Digital Library (IUDL). This indicates that gender does not moderate the relation between effort expectancy and intention to use digital library. This result contradicts with [5] and the possible reason for this inconsistency is also due to culture factor [26], [27]. This result implies that male and female postgraduate students did not differ in their perceptions. Both groups tend not to have high level of computer anxiety and find no difficulty in using digital library.

Hypothesis 6 posits that interaction between experience and effort expectancy has positive effect on Intention to Use Digital Library (IUDL). Result from this study found that interaction between experience and effort expectancy significantly influence the Intention to Use Digital Library (IUDL). This finding indicates that experience moderates the relationship between effort expectancy and intention to use digital library. This result is consistent with [5] and [15] where the longer the users make use of information system, the more confident they are towards the information system. This finding also supports the claim that increase in direct use of information systems will enhance the end-user's confidence in their ability to understand and use the information systems in performing their tasks. Other researchers found increase

experience in the information system influence end-user beliefs in information systems [5], [11], [28], [29]. As end-users' direct-use experience with information systems increases over time, their perceptions and adoption intentions change substantially. Thus, experience has a significant influence on the relationship between effort expectancy and intention to use digital library.

Hypothesis 7 posits that interaction between age and effort expectancy has positive effect on Intention to Use Digital Library (IUDL). Result from this study found that interaction between age and effort expectancy have no significant influence on the Intention to Use Digital Library (IUDL). This finding indicates that age does not moderate the relationship between effort expectancy and intention to use digital library. This result also contradicted with [5], and the explanation of this contradictory is related to culture factor as described by [25], [26]. Thus, this study found that older postgraduate students did not find difficulty in using digital library compared to younger postgraduate students. Both age groups have no significant influence on the relationship between effort expectancy and intention to use digital library.

Hypothesis 8 posits that there is a positive relationship between information quality and intention to use digital library. This relationship was not tested by UTAUT [5] as information quality is not considered as one of the predictor for behavioural intention. This result found that information quality is significantly and positively related to intention to use digital library. This implies that students who perceived highly on information quality would have the intention to use digital library. This finding is in line with [9] and [10]. This finding also is in agreement with [31] study who reported that information quality has a significant and positive influence on the intention use of online communities.

Hypothesis 9 posits that there is a positive relationship between service quality and intention to use digital library. Partially supporting the research hypothesis, the findings showed that service quality has significant negative effect on the intention to use digital library. This means that even though there is poor digital library service quality, students still display a positive attitude towards the digital library service quality and the intention to use the digital library remains. However, this finding contradicted with the earlier work of [10], who suggested that improvement in service quality would contribute to the increasing intention to use the information systems. However, this finding is consistent with [32] work on knowledge management systems, which reported that service quality is not significantly related to intention to use knowledge management systems. One possible explanation for this phenomena is that although students perceived the digital library service quality as being poor (i.e.: not available all the times, always breakdown, not provide prompt assistant, take much time), they still have strong intention to use digital library. This new emerging phenomena could be accepted by local users of digital library as service breakdown due to poor internet connections, or malfunction of software and hardware are commonly reported by users of digital library. Hence, students who used to encounter with breakdowns and poor internet services may have higher intention to use digital library and do not see this as major constraint.

The findings indicated that five (5) out of nine (9) hypotheses were supported. Performance Expectancy (PE), Effort Expectancy (EE), and Information Quality (IQ) were all found to be significant predictors and positively related to IUDL while Service Quality (SQ) was significant but negatively related to IUDL. Factor interactions between Gender and PE; Gender and EE; Age and PE; Age and EE were found not significant to explain any additional observed variations on IUDL.

Astonishingly, interactions between Experience (EXP) and Effort Expectancy took a different direction. This interaction factor was found to be significant and positively related to IUDL. Interaction between EE and EXP were able to explain an additional 0.7% observed variations on IUDL. On the other hand, IQ was significant and positively related to IUDL and had explained an additional 2.2% of the observed variations on IUDL.

VI. CONCLUSION

This study had addressed the effect of four supporting domains (PE, EE, IQ and SQ) and several interaction factors on the Intention to Use Digital Library. Nine hypotheses were tested and five hypotheses were supported in this study. The results have partially supported the work of [5]. The two major predictor variables (Performance Expectancy and Effort Expectancy) were found to be most influential predictor for IUDL. However, differences were identified with respect to the moderating effects. Both gender and age do not significantly moderate the relationship between PE, EE and IUDL. The study however, found two additional predictors namely, IQ and SQ to be important for IUDL.

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