Viable or vital? Evaluation of IM services from patrons' perspectives

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Abstract

Purpose – The goal of this study is to gather information from library patrons to answer the questions of whether real-time reference services (instant messaging, IM) are beneficial to patrons and how valuable they are to fulfilling their task needs. The study was designed to elicit information about how patrons were dealing with the rapidly changing technological environment, and how helpful they felt IM reference services were to them.

Design/methodology/approach – The investigation uses the technology acceptance model (TAM) as the basic framework and extends it by the variable of perceived relevance (PR) which intends to extend understanding of the adoption of IM services. The sample consisted of three university libraries' patrons on the basis of convenience, and 323 usable responses were obtained.

Findings – This research found general support for TAM. Specifically, the findings show that perceived ease of use of IM services is the key factor for the patrons' attitudes about the IM service. Overall, the model explained 58 percent of the variance in behaviour intention. Thus, the results show that the proposed model does satisfactorily explain the adoption of the IM service.

Originality/value – The findings of this research provide some useful insights into a patron's behavioural intention toward adoption of an IM service which will stimulate thought about real-time reference services that could be offered by other libraries. And it will be valuable for better understanding of factors affecting the determinants of IM acceptance, which allows libraries to devise more effective approaches to improving the patrons' perceptions of a target system and thereby boost subsequent acceptance of the system.

Keywords Instant messaging, Reference services, Relevance, Digital libraries, Data communication systems, Academic libraries

Paper type Research paper

1. Introduction

Librarianship is experiencing rapid change. Information technology (IT) is radically changing the structures of academic libraries and the manner in which they deliver services to their users (Heinrichs *et al.*, 2007). New information and communications technologies (ICT) require librarians to re-evaluate the way they develop, manage and deliver services (Sharifabadi, 2006). With the increasing availability of computers and internet access both within libraries and in modern society at large, online services have become among the most heavily used services libraries offer (Pomerantz and Luo, 2006). The emergence of the real-time reference services over the last decade has had an undeniable effect on the ways that patrons seek information, as well as on the ways

that patrons think about libraries. Therefore, the questions of whether real-time reference via the internet is beneficial to patrons and how valuable it is toward fulfilling their task needs have been a primary concern for librarians providing the service.

Today, digital information is becoming ever more popular. The huge quantity and diversity of digital information are its main features (Tsai and Chen, 2008). As more and more patrons go to the Internet first to meet their information needs, the library identified a need to be more available to serve the patrons in real-time, via the internet, when and where their users need assistance. Since academic libraries are being asked to provide greater services with fewer resources (Jankowska, 2004), the implementing of web-based services such as synchronous reference services have become increasingly common and are now familiar features on library home pages (Radford and Kern, 2006).

As a convenient internet communication technology, instant messaging (IM) has become an indispensable part of cyber users' lives (Lu *et al.*, 2009). Commercial IM systems such as ICQ and AOL Instant Messenger have attracted millions of daily users in recent years and the IM phenomenon has also attracted many researchers (Premkumar *et al.*, 2008; Lu *et al.*, 2009). The use of IM in libraries' reference service increases the availability of services to patrons, offers an alternative method of communication and brings the library to the community (Kajewski, 2007). More and more libraries are offering some form of IM reference and patrons increasingly expect to be able to get help online (Desai, 2003). The trends and pressures mandate an assessment of the quality and effectiveness of reference service with a particular focus on patron need and preference.

Traditionally, the evaluation of academic libraries was performed primarily by assessing the extent of the physical library use and the patron satisfaction with the academic library's printed collection (Heinrichs *et al.*, 2007). While the online experience became more mature, libraries need to look at ways of measuring and evaluating the provision of reference services and ensure that their patrons are receiving the same level of service online as they are in the more traditional reference models. Many researchers have suggested that user satisfaction is one of the key influencers leading to information system (IS) success (Tong, 2009; Chen *et al.*, 2009). The concept of a user-cantered library service is widely discussed in library literature as an antidote to a systems-cantered approach. Research on digital libraries has moved from the technical aspects of building digital libraries to analysing how to design digital libraries to satisfy patron needs (Heinrichs *et al.*, 2007). Although published research on digital libraries has increased, it mostly focuses on technical issues and digital library use patterns, but little has been done on the identification of evaluation criteria, especially from the patrons' perspectives (Xie, 2006; Goh and Liew, 2009).

As Saracevic and Covi (2000) point out, the evaluation of digital libraries is a complex undertaking that is conceptually and pragmatically challenging. Borgman *et al.* (2001) further suggest that technical complexity, variety of users and the lack of evaluation methods contribute to the problem. To investigate this problem, this study applied the theory of a technology acceptance model (TAM) as the research framework to outline the propositions which could enhance our understanding of information behaviour from patrons' perspectives. The results of this study offer some original

ideas from the portions' part, which will stimulate thought about real-time reference services that could be offered by other libraries.

2. Literature review
The adoption and diffusion of information technology has been studied in great detail by researchers in the information systems area. In this section, a review of the technologies and application of library reference services is given to depict the background and motivation of this study.

2.1 The changing role of library and reference services
Technology has revolutionized the information production, acquisition and retrieval processes. The role of the traditional library as the primary provider of information to its community is less and less unique (Sharifabadi, 2006; Fane and McMillan, 2003). The core processes of organizing information will diversity into creating user focused and personalized systems. As the information on the web is so vast, patrons are interested in obtaining useful information in an efficient manner (Tsai and Chen, 2008). There is evidence that increasing numbers of people are turning to the internet as their preferred source of information, and they are reflected in library reference desk statistics (Lipow, 2003; Williams, 2010). In responding to this changing era, libraries have had to re-align their priorities and make adjustments in their infrastructure while customizing their services and resources for patrons.

Reference services refer to the personal assistance provided to users in the pursuit of information (Bunge, 1999). In the past several years, reference services are continually evolving fields in library and information services. While library reference work has encountered many changes brought on by the advent of technologies, it has grown from print resource-oriented services to a diversified service portfolio (Luo, 2008). However, the fundamental principle of reference services stays the same across all media that assists users in fulfilling their information needs (Luo, 2008). Bunge (1999) categorized reference services into three broad groups: information assisting services, information literacy skills and user guidance. Ward and Barbier (2010) outline the factors which contribute to the professional development of reference librarians. A good implication of SMS reference services can be found in the reports by Herman (2007); Goh and Liew (2009); and Li *et al.* (2010), Stock (2010) further points out the reference commitment to user services.

Saracevic and Kantor (1997) concluded that users' reasons for using library services fall into three categories: category one is for a task or a project, category two are for personal reasons, and category three are to obtain an object, information, or perform an activity. Since reference services have taken a central place in the library and information services, it is reasonable to assume that the reference service should fall into the same categories that motivate use of library services in general (Pomerantz and Luo, 2006). The reference service can then be defined as a series of activities that brings together collections, services and people in support of a full lifecycle of creation, dissemination, use, and preservation of data, information, and knowledge (Sharifabadi, 2006).

2.2 IM services in the library

Today online sources have become so ubiquitous that most patrons have seldom used a printed index (Desai and Graves, 2008). The increasing digital content in academic libraries demand the information and support for those resources through digital means (Buckland and Godfrey, 2010). According to Estabrook and Rainie (2007), almost 60 per cent of respondents would consult the internet when they need to address problems, while just over 10 per cent would consult the public library. Hence, the library faces an immense competition from the Internet and commercial information providers which recognize the advantages of offering the user convenience and speed.

Virtual reference, which allows users to connect easily with librarians online, is becoming highly popular. Instant messaging (IM), or online chat, is one of the most popular forms of computer communication. It is good for quick messages, remains anonymous and extended discussion between two or many people. Many libraries, particularly academic libraries, have begun offering some form of live online reference services within the last couple of years (Desai, 2003). Some librarians and researchers have offered professional and practical recommendations on using IM reference services (Pomerantz and Luo, 2006). Buckland and Godfrey (2010) found that patrons rated IM references highly due to the convenient access to a reference librarian and the users' ability to remain anonymous.

Early studies of IM reference focused on the technology: the choice of software, features, and system requirements (Lipow, 2003; Radford and Kern, 2006). Later studies focused on policy issues such as staffing, costs and trade-offs (Pomerantz and Luo, 2006). Some studies have dealt with the quality and completeness of the reference transaction, and conventions and techniques for improving the online communication between patron and librarian (Richardson, 2009; Stock, 2010). Lippincott (2006) summed up four positive aspects of the IM service: the ability to co-browse, the speed of the interaction, the transcripts created by the interaction, and the appearance of being technologically adept. Recently, many studies addressing the quality of virtual references refer implicitly to its ability to enhance information literacy (Yang, 2009; Williams, 2010). Waller (2009) further offered analysis data to confirm the IM service as meeting the user's information needs.

A review of the literature found several interesting and pertinent articles that employed various techniques to analyse and illustrate how an IM service can be effectively used to improve the quality of a virtual reference service (White, 2001). Researchers that have dealt specifically with IM references as a tool for offering task instruction from the patrons' view is still rare. It is the apparent correlation between the technology and the perceived information seeking habits of today's patrons for libraries to add this virtual tool as their reference toolkit (Buckland and Godfrey, 2010). The goal of this study is to assess the effectiveness of IM reference services in meeting the patrons' information needs.

2.3 Valuing of relevance and library services

Libraries and the information services they provide have been valued for a long time. The importance and urgency of determining the value of libraries and information services in a more explicit approach have increased as the role of information is changing (Saracevic and Kantor, 1997). There are many approaches that have been applied to evaluate library services: examining the content and performance of the

system (Xie, 2006; Waller, 2009; Ward and Barbier, 2010), measuring the efficiency of the service (Saracevic and Covi, 2000), and determining the acceptance of the digital library service (Lin and Chou, 2009; Lu *et al.*, 2009).

System acceptance reflects the perception of an information system by users. Achieving the intended level of system usage is one of the key measures of successful implementation (Lin, 2010). A significant number of studies have focused on identifying various factors influencing perceived user behaviour toward technology systems. The majority of models are inspired by the technology acceptance model (TAM). The model proposed by Davis (1989) has explained acceptance of information technology. It states that an individual's adoption of information technology is dependent on their perceived ease of use and perceived usefulness of the technology. Previous studies have found that TAM has a relatively simple structure but comparable explanatory power for an individual's adoption of information technology. The model has been shown to have a good predictive validity for the use in several information technologies, including e-mail (Adams *et al.*, 1992; Karahanna and Straub, 1999; Gefen *et al.*, 2003); the world wide web (WWW) (Lederer *et al.*, 2000; Moon and Kim, 2001; Selim, 2003), short message services (SMS) (Goh and Liew, 2009; Herman, 2007; Li *et al.*, 2010), and online business management applications (Liao *et al.*, 2007). Hsiao and Yang (2010) further used document co-citation analysis to retrieve 518 documents, and concluded that there are three main trends in the applied context of TAM: task-related systems; e-commerce systems; and hedonic systems. Here, we adopt the model to test the acceptance of IM services offered by libraries.

We often refer to a variety of dimensions of value in the use of libraries and information. Value has many dimensions which predicate both theory and practice. It is hard to specify what is meant by value in relation to library and information services. Lee and Overby (2004) stated that value is subjective and is derived from the exchange of experience or individual perception and is not simply a utilitarian value. Holbrook (2000) proposed that excellence service value is generalized consumer appreciation of a service provider which demonstrates expertise and offers a reliable service performance. It is associated with whether service providers provide customers with promised services. More specifically, Ahituv and Neuman (1986) categorized the value of an information service into three approaches:

(1) *Normative value approach.* This is defined as the application of formal and rigorous models which involve information uncertainty or utility in relation to decision making.

(2) *Realistic value approach.* A before and after approach which measures the effect of information provided by new (or given type of) information services on the outcomes of decisions and/or performances of decision makers.

(3) *Perceived value approach.* Subjective valuation by users of information, of the value (or benefit) of given information. This assumes that users can recognize the value of information (or the benefits gained/lost).

Given the dynamic nature of information exchange and communication in general, relevance is a key notion in information science because it is central in design and evaluation of information retrieval (IR) systems and techniques (Saracevic and Kantor, 1997). Although there have been increased attention in understanding the value and mechanisms of web-based library services and electronic resources, more research is

needed to assess their impact on the evaluation of academic libraries (Thong and Hong, 2002). This paper then continues the perceived value approach line and adopts perceived relevance as an external factor which can be used in determining the value of the IM service.

3. Hypotheses

TAM was first proposed by Davis (1989). It was adapted from the theory of reasoned action (TRA) (Ajzen and Fishbein, 1980), which suggests that an individual's attitude toward carrying out the behaviour is an important motivator of social behaviour. As it is one of the most fundamental and influential theories of human behaviour (Venkatesh, 2000), TAM has been used in a wide range of technologies and system applications to predict acceptance (Venkatesh *et al.*, 2003). A number of studies have successfully adopted TAM to study the acceptance of internet-related technologies (Gefen *et al.*, 2003; Lederer *et al.*, 2000; Moon and Kim, 2001). A good summary of the TAM model in various domains can be found in the reports by Hsiao and Yang (2010). The current research uses the technology acceptance model as the basic framework and extends it by a variable of perceived relevance (PR) which intends to extend understanding of the adoption of IM services. The research model is depicted in Figure 1.

3.1 Technology acceptance model and user acceptance of instant messaging

The origins of the TAM came from Ajzen and Fishbein's (1980) theory of reasoned action (TRA). It describes how user's beliefs and attitudes are related to individuals' intentions to perform. Based on the belief-attitude-behaviour relationship, Davis (1989) proposed TAM for explaining and predicting user acceptance of an information system. In the past decade, a considerable amount of effort has been made in explaining and predicting user acceptance of information technology. Both theoretical and empirical evidence suggest that the technology acceptance model (TAM) is a powerful and parsimonious model for explaining usage intentions and behaviour (Davis, 1989; Karahanna and Straub, 1999; Amoako-Gyampah and Salam, 2004). TAM has also been used to explain user adoption of IM (Wang *et al.*, 2004; Lu *et al.*, 2009). Here, we adopt the technology acceptance model (TAM) as our main theory for the explanation of instant messaging (IM) service usage.

3.1.1 Perceived ease of use. Davis (1989) defined perceived ease of use (PEOU) as referring to the degree to which the prospective user expects the technology to be free of an effort direct effect of perceived ease of use on perceived usefulness of a system.
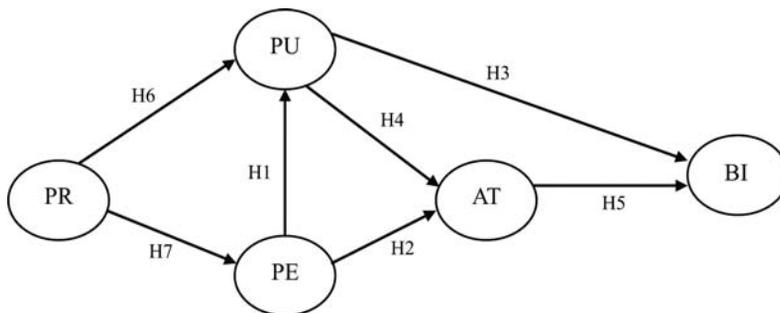
Figure 1.
Hypothesized structural model

The TAM also suggests that perceived ease of use has a direct effect on positive attitude. Much of the previous research has established that PEOU is one of the major factors that antecede behaviour attitude (AT) and that it has a positive influence on perceived usefulness (PU) (Davis, 1989; Venkatesh *et al.*, 2003). Thus, those who perceive that a particular technology application is easy to operate are likely to utilize it more extensively and perceive it to be more useful for the completion of certain tasks (Lu *et al.*, 2009). Therefore, we test the following hypothesis:

> *H1.* Perceived ease of use is positively related to perceived usefulness of an IM service.
>
> *H2.* Perceived ease of use is positively related to attitude toward an IM service.

3.1.2 Perceived usefulness (PU). Davis (1989) defined perceived usefulness as "the degree to which a person believes that using a particular system would enhance his or her job performance." Davis (1989) considered perceived usefulness to have a direct influence on user positive attitude and to be a predictor of the user's intention to use a technology (Amoako-Gyampah and Salam, 2004; Moon and Kim, 2001; Lu *et al.*, 2009). In addition, there have been strong empirical results that support perceived usefulness as having a positive relationship with attitude and behavioural intention (Davis, 1989; Venkatesh *et al.*, 2003). In keeping with this classical definition from Davis (1989), this study also highlights the perception of advantageous use to formulate the following hypotheses:

> *H3.* Perceived usefulness is positively related to a behavioural intention to use the IM service.
>
> *H4.* Perceived usefulness is positively related to attitudes toward the IM service.

3.1.3 Attitude (AT) and behavioural intention (BI). Attitude is defined as "a learned predisposition to respond in a consistently favourable or unfavourable manner with respect to a given object" (Ajzen and Fishbein, 1980). Research on information systems' attitude is defined as an individual's overall evaluation of performing a behaviour. According to the TPB, attitude impacts users' behavioural intentions. The relationship between attitude and intention in a technology-based context has been confirmed (Shin, 2007). In present research, when individuals form a positive attitude towards an IM service, they will have a stronger intention towards adopting it.

> *H5.* Attitudes toward using IM is positively related to the behaviour intention to use the IM service.

3.2 Perceived relevance (PR)
Relevance is the attribute or criterion reflecting the effectiveness of exchange of information between people and information systems in communication contacts which are based on valuation by users (Saracevic and Kantor, 1997). Saracevic (1970) defined relevant information content as an estimate of appropriateness existing between provision and information use as judged by an individual. This appropriateness is a multi-dimensional cognitive concept highly depended on user perceptions of both obtained information and that required at a specific time. From a

user's perspective, relevant content refers not only to the type of information the website offers, but also to the quality and accessibility of that information (Lin, 2010).

On review of the library and information science literature, many studies use "relevance" to measure information quality. The concept of relevance is inherent in user evaluations of the performance in information retrieval systems (Spink *et al.*, 1998; Thong and Hong, 2002). Furthermore, Spink *et al.* (1998) indicated that partially relevant information is positively correlated with information seeking behaviour. Similarly, the theoretical relationships between relevance and internet behaviour were partially confirmed by an empirical study of digital libraries (Thong and Hong, 2002). From the research mentioned above, perceived relevance was dependent on user judgments of the match between information needs and information retrieved. Our study then postulates the following hypotheses:

H6. Relevance of service content is positively related to the perceived usefulness of the IM service.

H7. Relevance of service content is positively related to the perceived ease of use for the IM service.

4. Research methodology
4.1 Participants
The sample consisted of three university libraries' patrons on the basis of convenience. They were asked to evaluate their perception of the IM service by a survey questionnaire. After eliminating the invalid responses through data filtering, 323 usable responses were obtained. There were almost an equal percentage of females (50.2 per cent) and males (49.8 per cent). Respondents were mainly young (75.9 per cent below 30 years old). Roughly, 92 per cent of our subjects did experience using the internet service and more than 72 per cent of respondents spend more than four hours on the internet per day.

4.2 Questionnaire instrument
Items selected for the constructs were primarily adapted from previous studies to ensure content validity. Most items which measured perceived usefulness and perceived ease of use were adapted from Davis (1989) to fit the IM technology we were investigating. The three items measuring behavioural intention (BI) were adapted from Moon and Kim (2001). Items measuring attitude (ATT) were adapted from Taylor and Todd (1995). We also developed a new variable (PR) to reflect the specific functions of the IM reference service. The three items were selected to measure PR from Thong and Hong (2002) and Shih (2004). The Appendix lists individual scale items which were drawn and modified from previous literature. All items were measured with a Likert-type scale ranging from 1, "strongly disagree," to 5, "strongly agree."

4.3 Measurement model testing
Following the recommended two-stage analytical procedures (Anderson and Gerbing, 1988; Hair *et al.*, 1998), a confirmatory factor analysis (CFA) using LISREL 8.51 was conducted to assess the reliability and validity of the measures. The structural model was then examined for hypotheses testing. Confirmatory factor analysis on all items showed a satisfactory fit with chi square (χ^2) of 291.67 ($df = 76$, $p < 0.001$), and other

fit indices: GFI = 0.85, CFI = 0.90, NFI = 0.87, NNFI = 0.86, RMR = 0.051. In addition, the reliabilities of the constructs (Cronbach's alpha values) ranged from 0.73 (for perceive easy of use) to 0.87 (for behaviour intention) show a satisfying requirement of reliability for research instruments (see Table I).

Convergent validity is assessed by how closely related two measures are with the same construct, and these two measures to some degree are akin to internal consistency between items of a measure (Viswanathan, 2005). In the current study, all factor loadings for items measuring the same construct are statistically significant at a level of 0.01 (the lowest t value is 8.66), suggesting that convergent validity is supported (Anderson and Gerbing, 1988). In addition, convergent validity is also assured by examining composite reliability (CR) and average variance extracted (AVE) from the measures (Hair *et al.*, 1998). As shown in Table I, the composite reliabilities (ranging from 0.59 to 0.89) and the average variances extracted (ranging from 0.51 to 0.76) all exceed the acceptable value of 0.50. Collectively, the above results suggest that convergent validity is successfully achieved.

Discriminant validity is obtained if the measure of a construct is not correlated with measures of other constructs to which it is not supposed to be related (Viswanathan, 2005). We verify the discriminant validity of our instrument by conducting a series of chi-square difference tests which allows for simultaneous pairwise comparisons (Anderson and Gerbing, 1988). The critical value of the chi-square test based on the Bonferroni method under overall 0.01 levels is χ^2 (1, 0.01/10) = 29.167 (Hatcher, 1994). Since the chi-square difference statistics for paired constructs all exceed 27.167 (see Table II), discriminant validity is successfully accomplished. Table III shows means, standard deviation, and intercorrelations for all variables. In order to examine the relationships between independent variables and the dependent variable, a further examination of hypotheses testing is reported in the next section.

By calculating the Bonferroni method under overall 0.01 levels, the critical value of the chi-square test is χ^2 (1, 0.01/10) = 10.83 (Hatcher, 1994).

4.4 Hypotheses testing
Following the validation test, this subsection assesses the explanatory power of the proposed model and the significance of our hypothesis. This study uses the technique of structured equation modelling to examine the causal structure of the proposed model herein. Again, we use LISREL 8.51 to evaluate the fitness of the proposed model and the significance of the hypothesized paths. All fit indexes have suggested an adequate model fit between the empirical data and the research model (RMR = 0.051; NNFI = 0.86; CFI = 0.90; GFI = 0.85).

Construct	AVE	CR	Cronbach's α
PR	0.76	0.78	0.80
PE	0.51	0.59	0.73
PU	0.57	0.80	0.80
AT	0.64	0.84	0.82
BI	0.73	0.89	0.87
Notes: GFI = 0.85, CFI = 0.90, NFI = 0.87, NNFI = 0.86, RMR = 0.051, χ^2 = 291.67			

Table I.
Reliability and variance explained

Construct pair	Unconstrained χ^2 (76) = 291.67 Constrained χ^2 (77)	χ^2 difference
(PR, PE)	612.59	149.1
(PR, PU)	724.40	260.91
(PR, AT)	595.61	132.12
(PR, BI)	657.20	193.71
(PE, PU)	583.45	119.96
(PE, AT)	546.86	83.37
(PE, BI)	570.74	107.25
(PU, AT)	713.60	250.11
(PU, BI)	730.27	266.78
(AT, BI)	5,026.7	4,563.21

Note: Significant at the 0.01 overall significance level by using the Bonferroni method

Table II.
Chi-square difference
tests

	Mean	STD	PV	PE	PU	AT	BI
PR	4.21	0.76	1				
PE	4.33	0.64	0.50*	1			
PU	4.17	0.70	0.46*	0.54*	1		
AT	4.36	0.66	0.70*	0.60*	0.58*	1	
BI	4.26	0.72	0.64*	0.61*	0.59*	0.72*	1

Note: $^*p < 0.01$

Table III.
Means, standard
deviations, and
correlations

By examining the standardized path coefficients of our proposed model, they are all significant at 0.01 levels and above. Based on the analysis, five out of the seven hypotheses in the model were supported. As expected, relationships of core variables of the original TAM model are strongly supported in IM service acceptance. More specifically, the perceived ease of use of IM services have a direct effect on perceived usefulness (b = 0.79; $p < 0.01$) and attitudes toward using the IM service (b = 1.94; $p < 0.01$) (*H1*, *H2* were supported). Attitude (b = 0.46; $p < 0.01$) and perceived usefulness (b = 0.41; $p < 0.01$) were significant predictors of behaviour intention to use the IM service and accounted for 58 per cent of the variance in behaviour intention (*H3*, *H5* were supported). The result is consistent with previous research (Davis, 1989; Lu *et al.*, 2009), and hypotheses that both perceived usefulness and perceived ease of use were found to be significant determinants of the intention to use the IM service. However, the relative strength of their explanatory power was different. Perceived ease of use was a much stronger predictor of the intention to use the digital library as compared to perceived usefulness. All the hypothesized predictors (*H1*, *H2*) of perceived ease of use were found to be significant in the proposed directions. Note that the effects of perceive usefulness were found to be negatively significant in attitudes toward using the IM service. *H4* was, therefore, rejected.

The results of the external variable had significant effects on perceived usefulness, supporting hypotheses *H6* (b = 0.72; $p < 0.01$). Contrary to hypothesis *H6*, perceived relevance had a negatively significant impact on perceived ease of use (b = − 0.21; $p < 0.01$), and therefore, *H7* was rejected. Overall, the model explained 58 per cent of

the variance in behaviour intention. Thus, the results show that the proposed model does satisfactorily explain the adoption of the IM service.

5. Discussion
5.1 TAM variables
The technology acceptance model (TAM) proposed by Davis (1989) has explained the acceptance of information technology. TAM claims that an individual's adoption of information technology is dependent on their perceived ease of use and perceived usefulness of the technology. This research found general support for TAM. The findings show that perceived ease of use of an IM service has a positive impact on perceived usefulness and attitudes toward using the system. Note that the coefficients for the path from perceived ease of use to attitudes toward using IM services are 1.94 which indicate the key factors of patrons' attitudes about the IM service. The result indicates that when patrons perceive the IM service to be useful in their tasks, they are more likely to use the system. Also, if patrons find that the IM service is easy to use, they will be more willing to use it for information retrieval. Therefore, the research results suggest that for an IM service to be successful, libraries need to focus their attention on designing both useful and easy to use systems.

It is worth noting that perceived usefulness has a negative relationship with behaviour attitudes toward using the IM service, and this finding contradicts with existing TAM literature which states that perceived usefulness has a significant positive relationship with attitudes toward using the system (Adams *et al.*, 1992; Davis, 1989; Gefen *et al.*, 2003; Karahanna and Straub, 1999; Venkatesh, 2000).

In this study, one possible explanation of the negative relationship is the availability of service. Horowitz *et al.* (2005) report that the single greatest reason why patrons used the IM service was its convenience: patrons did not want to or could not physically come to the library, and they believed that the service could provide them with rapid information. This was the reason given by approximately 50 per cent of all users that responded both to Horowitz *et al.* (2005) and Pomerantz and Luo (2006) studies surveys. The availability of the service at all hours of the day and night is one factor in the convenience of the reference service. But in practice, chat services which are offered by the library had limited hours of operation. Compared with search engines such as Google or Yahoo which allow users access to the information retrieval all the time, it is obviously a drawback. Our findings echo the results reported by Radford and Kern (2006) and Pomerantz and Luo (2006).

Another explanation for a negative relationship between perceived usefulness and attitudes to adopt the IM service should be a query type. Horowitz *et al.* (2005) report that a majority of users believe that IM chatting is a useful medium for simple questions. Desai and Graves (2008) concluded that few patrons used instant messaging references for in-depth research questions, preferring it for quick ready reference or specific-search questions. Kern (2003), however, reports that requests for research assistance are highest in chat services. It appears that there may be an inconsistency between users' expectations of chat reference services and what these services are actually able and best suited to provide. This raises the question of what media is most appropriate for what types of reference services, and how to encourage users to use a reference service in the most appropriate medium. It will be necessary for librarians to

identify what types of reference assistance are really best suited by IM or other types of reference services.

5.2 External variables

Relevance is a key notion in information science. As many other concepts, relevance assumes a related but more specific meaning in more specific contexts and applications (Saracevic and Kantor, 1997), since relevance is the criterion reflecting the effectiveness in exchange of information between people or the system. The present study considers it as an external variable to measure how it affects the IM service adoption. The empirical results indicate that relevance is a strong determinant of perceived usefulness. The result is consistent with Thong and Hong (2002) and Venkatesh's (2000) finding of a direct effect from task relevance to perceived usefulness of a number of management information systems. For reference services, patrons felt that their adoption of the IM service was successful and satisfactory when they could use it to seek and obtain task relevant information. Also, the IM service provided by the library to meet the patron's needs enabled positive user behaviour intentions toward IM service adoption. As Shih (2004) stated, problems with system performance are related to the relevance of the retrieval results and efficiency of the retrieval process. In general, users care more about precision than recall since they only need enough information to solve their problems. In addition, precision affects the time a user needs to spend to evaluate and find relevant information to solve his/her problems. The present study shows that IM services can provide more relevant information to meet patrons' needs and allow patrons to enhance their task performance by using the IM reference service.

However, the influence of relevance on perceived ease of use was negatively significant, which echo the findings from Thong and Hong (2002) and Radford and Kern (2006). Radford and Kern (2006) used the multiple-case study method which investigates the reasons why nine virtual reference (chat) services have failed. One of the major reasons was technical problems. Technical problems cantered on software malfunctions and connectivity difficulties. For software malfunctions and channel function characteristic, IM software cannot effectively concurrently reach large numbers of patrons. If too many patrons are engaged in a chat session, the experience can be chaotic and less effective. Furthermore, compared with many popular internet search engines such as Google, which have an easy one step query box, while many IM services require the download of software to use the service, this raises another limiting factor of ease of use on the system. The result demonstrates that some patrons are comfortable with the internet and its associated technologies, but some are not. This can add a layer of complexity that is overwhelming for some patrons. For this reason, the library should select simple and friendly software which can lower the patrons' computer anxiety. Therefore, the user would be more likely to find the IM service easy to use, and subsequently be more willing to use it. This finding also supports the proposal to design customized or flexible interfaces for users by the library and information science researchers (Meadow *et al.*, 1995; Archer *et al.*, 1996). Technology offers opportunities to be innovative, but it is important to bear in mind that not all patrons are equal when it comes to accessing computing equipment (Sharifabadi, 2006). The availability, speed, and stability of internet connections, or information skills that are needed to make optimum use of IM services.

6. Conclusions

Information technology has leveraged both new and old ways to seek resources and provide better research services to their users. Library patrons are now offered a variety of academic resources with different forms of interactivity and various levels of media richness (Chang *et al.*, 2009). Reference services have always been a significant role in the library, whereas the library used to be an obvious first port of call when seeking information, various studies show that this is no longer the case (Estabrook and Rainie, 2007; Waller, 2009). The new challenge for librarians is not only to provide reference services to a growing population of remote patrons, but also the need to measure that the resources which they offer are effective and precise. IM services allow reference librarians to provide short and sometimes detailed reference assistance to patrons in real time. This service can help enhance their patrons' positive attitudes toward library reference services as a wise use of time which is useful and valuable.

This study has proposed using an extended the technology acceptance model (TAM) to examine patrons' acceptance of IM services offered by the library, and identifies the important role of perceived relevance to predict the behaviour intention to use the IM service. Empirical testing of the extended TAM found the proposed model to be generally supported. Both perceived usefulness and perceived ease of use were found to be significant determinants of the intention to use the IM service. More importantly, external variable-perceived relevance was identified as an important predictor of perceived usefulness and intention to use the IM service. In an age where a growing number of patrons who do not see an appreciable difference between what is offered by the library reference services and web search engine, this finding becomes even more crucial.

In addition to generalizing the other findings to IM services, our results contribute to a more specific direct effect from perceived relevance to perceived ease of use (*H7*) and from perceived usefulness to behaviour attitude (*H4*). Based on the purpose of patrons' information seeking, the intention of information seeking specific resources is linked with the process of information problem-solving. Implicit in the libraries' aim to ensure "access to information for all" is the ideal of the library as trusted sources of quality information (Waller, 2009). Our findings are consistent with the OCLC's (2005) report which suggests that people searching for information in digital format tend to rate the qualities of ease of use, convenience and accessibility as highly as information quality and trustworthiness. Hence, this study suggests that by improving the fit between system usability and patrons' information needs, IM service providers should pay more attention to reduce patrons' technology anxious to ensure the service functions are easy to use. The library also needs to be attentive to patrons' expectations and requirements for the relevant content of IM services.

In the digital age, the value of libraries will be measured by the benefits that they offer to their patrons. The library will have to reassess their role and redefine their service to maintain their relevance. The findings of this research provide some useful insights into a patrons' behavioural intention toward adoption of the IM service which will stimulate thought about real-time reference services that could be offered by other libraries. And it will be valuable for better understanding of factors affecting the determinants of IM acceptance, which allows library to devise more effective ways to improve patrons' perceptions of a target system and thereby boost subsequent acceptance of the system.

The current study has a number of limitations which could be addressed by further research. First of all, this study includes only reference transactions conducted by IM services, so it may not be indicative of other virtual reference services via synchronous channels. Second, we only use perceived relevance as a predictor variable and future studies should explore the relationship between a variety of predictors and user satisfaction in a virtual environment. Third, many studies have replicated, extended, and used TAM model, but there are some aspects which remain unclear (Schepers and Wetzels, 2007). TAM is more narrowly focused on users of IT and on the common elements of the contexts in which they engage in IT but not require a separate elicitation of consequences or obstacles for each situation (Riemenschneider *et al.*, 2003; Lu *et al.*, 2009). More elaborate descriptions should be concerned in the further research. Finally, more research is needed into what affects satisfaction in the virtual reference environment and how to improve the reference service to meet various patrons' preferences.

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Appendix

Construct	Source
Attitude (AT) ATT1. . . . Using the IM reference service is a good idea ATT2. . . . I like using the IM reference service ATT3. . . . Using the IM reference service is a wise idea	Taylor and Todd (1995) Lu *et al.* (2009)
Perceived ease of use (PE) PEOU1. . . . Learning to operate the IM is easy for me PEOU2. . . . I find it easy to use the IM to obtain library service PEOU3. . . . Overall, the IM is easy to use	Davis (1989) Lu *et al.* (2009)
Perceived usefulness (PU) PU1. . . . The IM reference service is useful to me PU2. . . . The IM reference service improves my efficiency of Information task PU3. . . . The IM reference service allows me to conveniently communicate with library	Davis (1989) Lu *et al.* (2009)
Behavioral intention (BI) BI1. . . . I will try to use the IM reference service BI2. . . . I intend to use the IM reference service BI3. . . . I want to use the IM reference service	Ajzen and Driver (1992) Taylor and Todd (1995)
Perceived relevance (PR) PR1. I obtain helpful information to support my tasks by using the IM reference service PR2. I obtain enough information to performing my tasks by using the IM reference service PR3. The information content provided by the IM reference service relate well to my tasks need	Thong *et al.* (2002) Shih (2004)

Table AI.
Measures of constructs

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