Understanding information seeking in digital libraries: antecedents and consequences

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Abstract

Purpose – The purpose of this paper is to explore the antecedents of information seeking in digital libraries from the perspectives of the Technology Acceptance Model and flow experience, as well as the consequences from the perspectives of self-efficacy in getting information and individual performance.
Design/methodology/approach – A research model is developed and tested using questionnaires and, partial least squares structural equation modeling.
Findings – The effect of flow experience on information seeking in digital libraries is the largest one. Meanwhile, flow experience fully mediates the effects of ease of use and usefulness on information seeking in digital libraries which further leads to self-efficacy in getting information and individual performance.
Practical implications – Librarians should help users to experience more stable and sustainable flow by providing dependable, prompt, personalized and professional service to them. Librarians should try their best to provide diversified user training so as to guide potential users to seek information in digital libraries.
Originality/value – This study contributes to the theoretical development of the structural model exploring information seeking in digital libraries, presenting a new view for digital library research and practice alike.

Keywords Digital libraries, Technology Acceptance Model, Individual performance, Flow, Self-efficacy, Information seeking
Paper type Research paper

1. Introduction

Digital libraries deliver information collection and associated services to user communities by utilizing various information and communication technologies (ICT) (Heradio *et al.*, 2012). The number of digital library projects has continued to grow in the past decade (Zhang, 2010) and digital libraries have become one of the most typical ways for users to access many kinds of digitalized information (Frias-Martinez *et al.*, 2006). In China, digital libraries in universities have achieved substantial development since the Ministry of Education initiated the China Academic Library and Information System (CALIS) in 1998. One aim of CALIS is to produce and introduce various domestic and foreign abstract and full-text databases (Zhu, 2003).

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Information seeking is an important information behavior, referring to "the purposive seeking for information as a consequence of a need to satisfy some goal" (Wilson, 2000, p. 49). Generally speaking, there are four modes of information seeking: searching, browsing, being aware (encountering) and monitoring. The former two are active information seeking while the latter two are passive information seeking (Bates, 2002; Williamson, 1998). When individuals experience a cognitive gap which prevents them from making sense of a particular situation, they would make an effort to seek information to change their state of knowledge and satisfy their information needs (Marchionini, 1995). In this study, we focus on information seeking in digital libraries which is defined as the actual information seeking behavior in digital libraries in respect to the frequency and the amount of time involved (Kankanhalli *et al.*, 2005; Yan and Davison, 2013).

The final aim of digital libraries is to facilitate human knowledge to be fully accessed and utilized by people without any barriers (Heradio *et al.*, 2012). However, the important status of digital libraries as conventional information sources seems to be ignored by more and more people with the tremendous creation and accumulation of diversified information sources outside the library in the modern information society (Ross and Sennyey, 2008). Information seeking in digital libraries reflects the degree to which digital libraries are accepted and used by users. Davis (1989) proposed the Technology Acceptance Model (TAM) in 1989, which has been widely applied in various technology and user settings (Venkatesh *et al.*, 2003). The current study extends the TAM to explore the antecedents and consequences of information seeking in digital libraries so as to understand the key determinant that motivates people to seek information in digital libraries and the benefit brought by seeking information in digital libraries. Specifically, flow experience, which refers to an optimal and enjoyable experience, was included as an antecedent given user experience becomes salient and critical for the success of digital libraries in the modern information society. Meanwhile, we explored the consequences of information seeking behavior from the perspectives of self-efficacy in getting information and individual performance. The research questions guiding this exploration are:

RQ1. What are the effects of ease of use of digital libraries, usefulness of digital libraries and flow experience in digital libraries on information seeking in digital libraries?

RQ2. Which factor is more important in motivating users to seek information in digital libraries: ease of use, usefulness or flow experience?

RQ3. What role does flow experience play?

RQ4. Can information seeking in digital libraries lead to self-efficacy in getting information which further leads to individual performance?

RQ5. Can information seeking in digital libraries directly lead to individual performance?

We suggest this study provides a new view for digital library research and practice alike. Following this introduction, we review the research background and literature and develop the research model. Then we describe the research methodology and data collection. Finally, we present the results of the research and discuss the implications.

2. Literature review

2.1 Digital libraries and information seeking

Digital libraries are distributed systems with the capability to store various electronic resources and provide convenient access for end users via networks (Zha *et al.*, 2014).

Digital libraries have gone "from a curiosity to mainstream" during the past 30 years (Arms, 2012, p. 579) and users have higher affinity with them (Yan and Zha, 2014). Consequently, digital libraries have increasingly become a gateway for users to access library resources and services, thus significantly impacting the way people seek and gather information they need (Liu and Luo, 2011).

Many studies have examined information seeking, taking as their focus children's internet information seeking (Liu *et al.*, 2013), physicians' information seeking (Norbert and Lwoga, 2013), international students' everyday life information seeking (Sin and Kim, 2013), scientists' information seeking (Sahu and Singh, 2013), online health information seeking (McKinley and Wright, 2014), information-seeking habits (Desrochers and Pecoskie, 2014) and collaborative information seeking (Shah, 2014). Regarding information seeking in the context of digital libraries, there are a few studies available. Detlor and Arsenault (2002) examined the role of intelligent agents in facilitating information seeking and retrieval in web-based library environments. Bilal and Bachir (2007) investigated Arabic-speaking children's interaction with the International Children's Digital Library, finding that children's information seeking behavior was characterized by browsing using a single function. Chang *et al.* (2009) examined users' information-seeking intention in academic digital libraries, indicating that perceived behavioral control is a better predictor of behavioral intention than attitude and subjective norm.

2.2 TAM

The TAM was proposed by Davis (1989) who hypothesized ease of use and usefulness to be fundamental determinants of user acceptance of an information technology. Ease of use refers to users' perceptions concerning the amount of effort required to use a technology and usefulness refers to users' perceptions concerning the degree to which using a technology would improve performance (Davis, 1989). The TAM has been widely applied to a diverse set of technologies and users (Venkatesh *et al.*, 2003), such as internet banking acceptance by business graduate students (Lai and Li, 2005), learners' behavioral intention to use a multimedia-based learning system (Lee and Ryu, 2013), smart-phone adoption behavior among American college students (Kim *et al.*, 2014) and employees' acceptance and use of teleconferencing systems for work-related meetings in business settings (Park *et al.*, 2014).

Prior studies applied the TAM to the context of digital libraries. Hong *et al.* (2001) used the TAM as a theoretical framework to investigate the effect of a set of individual differences (computer self-efficacy and knowledge of search domain) and system characteristics (relevance, terminology and screen design) on intention to use digital libraries, and the results strongly supported the utilization of TAM in predicting users' intention to adopt digital libraries. Thong *et al.* (2002) explored user acceptance of digital libraries, finding that both usefulness and ease of use are determinants of user acceptance of digital libraries. Nov and Ye (2008) explored the relationship between resistance to change (RTC) and perceived ease of use of a university digital library, finding RTC is a significant determinant of perceived ease of use. Park *et al.* (2009) examined the factors that influence people's adoption and use of a digital library system in the context of developing countries, finding that perceived ease of use and perceived usefulness of the library system had significant positive impacts on behavioral intention to use.

2.3 Flow experience

Flow experience is conceptualized as the holistic sensation that people feel when they act with total involvement (Csikszentmihalyi, 1975), describing people's feelings about the perceived balance between the challenges of an activity and their skills

(Csikszentmihalyi, 1975; Csikszentmihalyi and LeFevre, 1989). The dimensions of flow experience include concentration on the task, sense of control, intrinsic enjoyment, merging of action and awareness, a loss of self-consciousness, the sense of time distortion (Csikszentmihalyi and LeFevre, 1989; Chen *et al.*, 2000). As an optimal and enjoyable experience, flow is experienced by people as a unified flowing from one moment to the next (Csikszentmihalyi, 1975). "If challenges begin to exceed skills, one first becomes vigilant and then anxious; if skills begin to exceed challenges, one first relaxes and then becomes bored" (Nakamura and Csikszentmihalyi, 2002, p. 90).

The flow theory has been applied across many settings, such as video game playing (Klasen *et al.*, 2012), work (Ceja and Navarro, 2012), virtual communities (Yan *et al.*, 2013), live music performance (Wrigley and Emmerson, 2013), sport (Schuler and Brandstatter, 2013) and online learning (Esteban-Millat *et al.*, 2014). However, flow experience in the context of digital libraries has been largely overlooked in the literature.

2.4 Self-efficacy

Self-efficacy refers to individuals' judgments of their capabilities to execute courses of action required to deal with prospective situations and attain designated types of performances (Bandura, 1977, 1982). People with a higher level of self-efficacy perceptions tend to have more patience, perseverance, resilience and energy to overcome difficulty and failure (Ren, 2000; Usluel, 2007). Four principal sources of information driving self-efficacy were proposed: mastery experiences, vicarious experiences, verbal persuasions, and physiological and affective states (Bandura, 1977). Mastery experiences are individuals' own past experiences, which are generally regarded as the most robust, authentic and influential source of self-efficacy. Vicarious experiences are gained by observing the mastery experiences of others. Verbal or social persuasions represent the persuasive messages coming from peers or other influencing people. A person's physical, mental and emotional status is important sources of self-efficacy (Bandura, 1977; Fong and Krause, 2014).

A person "may exhibit high levels of self-efficacy within one domain while exhibiting low levels within another one" (Kurbanoglu *et al.*, 2006, p. 732). Previous studies have examined self-efficacy across fields, taking as their focus health self-efficacy (Lee *et al.* 2008), creative self-efficacy (Yang and Cheng, 2009), computer self-efficacy (Lee *et al.*, 2009), academic self-efficacy (Zhu *et al.*, 2011), job search self-efficacy (Dahling *et al.*, 2013), political self-efficacy (Vecchione *et al.*, 2014) and teaching self-efficacy (Arsal, 2014). In this study, we focus on self-efficacy in getting information which is defined as individuals' judgments of their own capabilities to search, compare and evaluate information they need (Pavlou and Fygenson, 2006; Zhou, 2012).

3. Research model and hypotheses

Building on the theories of TAM, flow experience and self-efficacy, this study explores the antecedents and consequences of information seeking in digital libraries. The research model is presented in Figure 1.

3.1 Antecedents of information seeking in digital libraries

In this study, information seeking in digital libraries refers to purposive seeking for information in digital libraries as a consequence of a need to satisfy some goal, which is measured in terms of the frequency and the amount of time involved (Wilson, 2000; Kankanhalli *et al.*, 2005; Yan and Davison, 2013). Information seeking in digital libraries

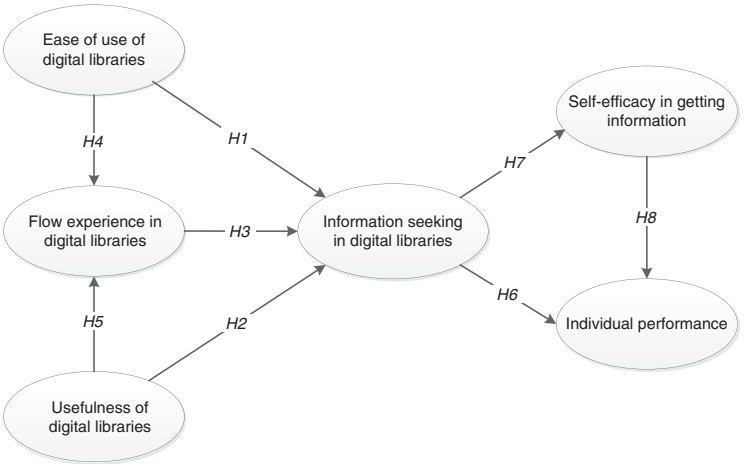

Figure 1.
Research model

essentially reflects the degree of accepting and using digital libraries to seek information. In the TAM, ease of use and usefulness were hypothesized to be fundamental antecedents of user acceptance and usage of an information technology (Davis, 1989). The TAM has been widely applied and tested in diversified technology contexts (Venkatesh *et al.*, 2003), including the context of digital libraries (e.g. Thong *et al.*, 2002; Park *et al.*, 2009). Thus, we make the following hypotheses:

H1. Ease of use of digital libraries has a positive influence on information seeking in digital libraries.

H2. Usefulness of digital libraries has a positive influence on information seeking in digital libraries.

User experience is critical to attract users to seek information in digital libraries. Specifically, flow experience can be used to measure the exact nature of users' experience about using digital libraries. In this study, flow experience in digital libraries is defined as the holistic sensation that users feel about using digital libraries with total involvement (Csikszentmihalyi, 1975). In extant literature, attention focus, control and enjoyment are the frequently used dimensions of flow experience (Koufaris, 2002; Zhou, 2013). Following extant literature (Zhou, 2013), in this study, flow was measured as a construct with three basic elements including attention focus, control and enjoyment.

Flow has been examined as antecedents of behavioral intentions and behaviors in many previous studies (Hoffman and Novak, 2009). Zaman *et al.* (2010) explored how flow experience with instant messaging (IM) can facilitate creative behaviors, suggesting that IM flow experience is positively related to exploratory behavior. Chang (2013) explored the continuance of social network sites games, suggesting that users who have better flow experiences are more likely to have continuance intentions of using social network sites games. We thus make the following hypothesis:

H3. Flow experience in digital libraries has a positive influence on information seeking in digital libraries.

Flow experience is characterized by the perceived balance between the challenges of an activity and people' skills (Csikszentmihalyi, 1975; Csikszentmihalyi and LeFevre, 1989).

In the modern information society, information seeking becomes difficult given the existence of information overload for individuals who generally have limited information processing capability (Hemp, 2009). It is reasonable to suggest that the lower level of flow experience in using digital libraries is likely to result from the case that perceived challenges exceed perceived skills. If perceived challenges exceed perceived skills, one would first become alert and then anxious (Nakamura and Csikszentmihalyi, 2002). When users can perceive the ease to use and usefulness of digital libraries, it is reasonable to suggest that the challenge perceived by users in using digital libraries would decrease. Consequently, the perceived balance between the challenges of using digital libraries and users' skills would be obtained, thus leading to the state of flow. We thus hypothesize as follows:

H4. Ease of use of digital libraries has a positive influence on flow experience in digital libraries.

H5. Usefulness of digital libraries has a positive influence on flow experience in digital libraries.

3.2 Consequences of information seeking in digital libraries

Individual performance refers to the accomplishment of a portfolio of tasks by an individual (Teo and Men, 2008). The linkage between information systems and individual performance has been a focus of research. Igbaria and Tan (1997) examined the usage of information systems in a large government research and development organization, suggesting system usage has a positive direct effect on individual performance. Teo and Men (2008) explored knowledge portals in Chinese consulting firms, suggesting utilization is positively related to individual performance. Hou (2012) examined business intelligence (BI) systems, suggesting higher levels of BI system usage will lead to higher levels of individual performance. Digital libraries are a type of information systems which utilize various ICT to deliver information collection and associated services to user communities (Heradio *et al.*, 2012; Yan *et al.*, 2014). Information seeking in digital libraries reflects the actual usage of digital libraries to seek information. For an information system to have a positive impact on individual performance, the information system must be utilized (Goodhue and Thompson, 1995). We thus make the following hypothesis:

H6. Information seeking in digital libraries has a positive influence on individual performance.

In the modern information society, people who are continuously bombarded with too much information usually suffer from the serious problem with getting the relevant information they need (Porcel *et al.*, 2010). In coping with information overload, information literacy which is defined as a set of abilities requiring individuals to "be able to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information" (American Library Association, 1989, p. 1), are receiving more attention. However, we cannot expect that people possess high levels of information literacy from the outset. Information literacy self-efficacy is the combination of information literacy and self-efficacy, which reflects what people feel confident of regarding their ability to locate, evaluate and use the needed information effectively. In this study, we examined a light-weighted scale for measuring information literacy self-efficacy, namely, self-efficacy in getting information which refers to digital library users' judgments of their own capabilities to search, compare and evaluate

information they need. We suggest using digital libraries to seek information can potentially enhance users' self-efficacy in getting information. Libraries function differently from other information providers (Kiran and Diljit, 2012), with the final aim of facilitating human knowledge to be fully utilized (Heradio *et al.*, 2012). Digital libraries are formal and conventional information sources. Compared with other informal and unconventional information sources, users perceive a higher level of information quality, system quality, service quality of digital libraries (Yan *et al.*, 2014). In this situation, it would be much easier for users to search, compare and evaluate information they need. In other words, digital libraries provide a useful platform for users to get the relevant information they need. Consequently, when users frequently seek and spend a lot of time seeking information in digital libraries, they would accumulate successful and positive experiences regarding searching, comparing and evaluating information they need. In general, individuals' own past experiences are regarded as the most robust, authentic and influential source of self-efficacy (Bandura, 1977). We thus hypothesize:

H7. Information seeking in digital libraries has a positive influence on self-efficacy in getting information.

When individuals have higher self-efficacy in getting information, they are ready to face difficulty or failure in searching, comparing and evaluating information, with more patience, perseverance, energy and resilience (Ren, 2000; Usluel, 2007). Consequently, the performance of getting information would be improved. It is reasonable to suggest that the higher performance of getting information would lead to the higher individual performance which refers to the accomplishment of a portfolio of tasks measured by the efficiency of operations, the adherence to the plan, the amount of the study/work produced, the effectiveness of the interaction, the quality of the study/work and the ability to meet the goals (Teo and Men, 2008). We thus hypothesize:

H8. Self-efficacy in getting information has a positive influence on individual performance.

4. Method and data collection

A survey method was employed to collect empirical data. All constructs and the corresponding items were adapted from extant literature given the consideration of content validity (Straub *et al.*, 2004). Specifically, the items measuring ease of use of digital libraries were adapted from Venkatesh *et al.* (2003); the items measuring usefulness of digital libraries were adapted from Venkatesh *et al.* (2003) and Zha *et al.* (2013); the items measuring flow experience in digital libraries were adapted from Zhou (2013); the items measuring information seeking in digital libraries were adapted from Kankanhalli *et al.* (2005) and Yan and Davison (2013); the items measuring self-efficacy in getting information were adapted from Pavlou and Fygenson (2006) and Zhou (2012); and the items measuring individual performance were adapted from Teo and Men (2008).

After the instrument was developed, 20 graduate students were selected for the pilot survey. Based on their feedback and comments, we adjusted wordings in several items to improve clarity and readability. The complete instrument can be found in the Appendix. The items measuring individual performance were measured with a seven-point low-high Likert scale (1 represents "very low" while 7 represents "very high"). All of the other items were measured with a seven-point disagree-agree Likert scale (1 represents "strongly disagree" while 7 represents "strongly agree"). Then, a large-scale survey was undertaken.

Digital libraries in this study specifically refer to web digital libraries accessed by users through the use of personal computers (PC) and web broadband. With the quick development of ICT, web databases, electronic journals, online services and web-based products purchased and provided by university digital libraries can be remotely accessed by users much more easily than ever before (West and Miller, 2011; Zha *et al.*, 2014). The large-scale survey data collection was conducted in a university located in central China whose library is the central China regional center of CALIS. In the questionnaire, we first described the meaning of digital libraries, indicating that the university library provides their users with various digital resources and services. Then we listed a range of digital resources including some Chinese databases such as China National Knowledge Infrastructure (CNKI), VIP Chinese Science and Technology Periodicals, CSSCI; some English abstract databases such as SCI, SSCI and full-text databases such as published by Emerald, Elsevier, Wiley, Sage, IEEE and Springer.

This study targeted users of the digital library of this university which has 3,700 teachers, 32,441 undergraduate students, 13,918 master student, 7,477 doctoral students and 1,477 foreign students (WHU, 2015). Users were invited to participate in the survey and data collection was undertaken on a voluntary basis through an online survey web site or printed paper questionnaires according to their preferences. The average response rate was approximately 50 percent. Finally, 285 valid responses were used for data analysis after dropping those with missing values. Table I presents the demographic information of these 285 respondents.

5. Data analysis and results

5.1 Validation of measurement model

The partial least squares (PLS) algorithm is a component-based structural equation modeling technique, "allowing each indicator to vary in how much it contributes to the composite score of the latent variable," thus being "preferable to other techniques" (Chin *et al.*, 2003, p. 197). PLS is essentially exploratory (Gefen *et al.*, 2011). PLS is thus appropriate for this study since we have new relationships to explore. Specifically,

Category	Item	Frequency	Percent
Gender	Male	169	59.3
	Female	116	40.7
Age	< 18	1	0.4
	18-25	195	68.4
	26-35	47	16.5
	36-45	24	8.4
	46-55	15	5.3
	> 55	3	1.1
Field	Natural sciences	120	42.1
	Social sciences	124	43.5
	Arts and humanities	32	11.2
	Others	9	3.2
Position	Undergraduate	159	55.8
	Master student	32	11.2
	Doctoral student	33	11.6
	Faculty	61	21.4

Table I. Demographic information of respondents

SmartPLS 2.0 (Ringle *et al.*, 2005) was employed to verify our measurement and theoretical models.

Measurement validity can be assessed in terms of content validity, convergent validity and discriminant validity (Straub *et al.*, 2004). Regarding content validity, all constructs and items are based on previous literature, so we believe these constructs and items each have clear and correct meanings.

Convergent validity and reliability can be established with the score of Cronbach's α and Composite Reliability (CR) exceeding the threshold value of 0.7 and the score of Average Variance Extracted (AVE) exceeding the threshold value of 0.5 (Straub *et al.*, 2004). Table II illustrates AVE, CR and Cronbach's α of each construct. The smallest value of CR is 0.916, the smaller value of Cronbach's α is 0.863, and the smallest value of AVE is 0.753, thus suggesting higher convergent validity and reliability.

Table III illustrates correlations between constructs and square roots of AVE. The square root of each construct's AVE (italic values) is bigger than the correlation between them, suggesting higher discriminant validity (Straub *et al.*, 2004).

Table IV shows the loadings (italic values) and cross loadings. All items load much higher on their specified constructs than on other constructs, further suggesting sufficient convergent and discriminant validity for all the constructs examined in this study (Straub *et al.*, 2004).

5.2 PLS structural model

The structural model with results is presented in Figure 2. Tests of significance were performed using the bootstrap resampling procedure with 1,000 samples, so as to obtain the *t*-values of the estimates. The explained variances of flow experience in digital libraries, information seeking in digital libraries, self-efficacy in getting information and individual performance are 0.497, 0.268, 0.185 and 0.272, respectively.

Regarding the antecedents, the direct effects of ease of use and usefulness on information seeking are not significant, thus *H1* and *H2* are not supported. The direct

Construct	Item	CR	Cronbach's α	AVE
Ease of use of digital libraries (EUDL)	4	0.932	0.902	0.773
Usefulness of digital libraries (UDL)	4	0.962	0.948	0.865
Flow experience in digital libraries (flow)	3	0.916	0.863	0.785
Information seeking in digital libraries (seeking)	3	0.949	0.919	0.862
Self-efficacy in getting information (SEGI)	3	0.953	0.926	0.870
Individual performance (IP)	6	0.948	0.934	0.753

Table II. Overview of measurement models

	EUDL	Flow	IP	SEGI	Seeking	UDL
EUDL	*0.897*					
Flow	0.590	*0.871*				
IP	0.391	0.383	*0.868*			
SEGI	0.596	0.542	0.478	*0.933*		
Seeking	0.376	0.509	0.365	0.430	*0.928*	
UDL	0.637	0.674	0.315	0.514	0.369	*0.930*

Note: Diagonal elements are the square roots of the AVE of each construct

Table III. Correlations between constructs and square roots of AVE

	EUDL	Flow	IP	SEGI	Seeking	UDL
EUDL1	*0.889*	0.478	0.339	0.531	0.333	0.585
EUDL2	*0.888*	0.488	0.396	0.580	0.331	0.536
EUDL3	*0.862*	0.499	0.310	0.455	0.310	0.510
EUDL4	*0.877*	0.595	0.329	0.528	0.346	0.602
Flow1	0.485	*0.913*	0.357	0.465	0.482	0.631
Flow2	0.622	*0.896*	0.341	0.581	0.429	0.613
Flow3	0.451	*0.848*	0.319	0.382	0.444	0.544
IP1	0.365	0.355	*0.874*	0.436	0.355	0.322
IP2	0.292	0.285	*0.900*	0.398	0.283	0.217
IP3	0.316	0.300	*0.886*	0.381	0.302	0.251
IP4	0.394	0.358	*0.832*	0.452	0.326	0.304
IP5	0.346	0.392	*0.867*	0.422	0.339	0.267
IP6	0.303	0.286	*0.845*	0.386	0.281	0.263
SEGI 1	0.587	0.517	0.395	*0.926*	0.400	0.550
SEGI 2	0.571	0.526	0.466	*0.952*	0.426	0.490
SEGI 3	0.512	0.475	0.474	*0.921*	0.377	0.403
Seeking1	0.377	0.502	0.327	0.403	*0.945*	0.380
Seeking2	0.364	0.493	0.372	0.438	*0.960*	0.350
Seeking3	0.301	0.417	0.315	0.352	*0.878*	0.293
UDL1	0.589	0.574	0.361	0.471	0.322	*0.913*
UDL2	0.603	0.642	0.290	0.489	0.365	*0.941*
UDL3	0.593	0.656	0.276	0.476	0.365	*0.945*
UDL4	0.586	0.630	0.249	0.476	0.319	*0.920*

Table IV.
Loadings and cross loadings

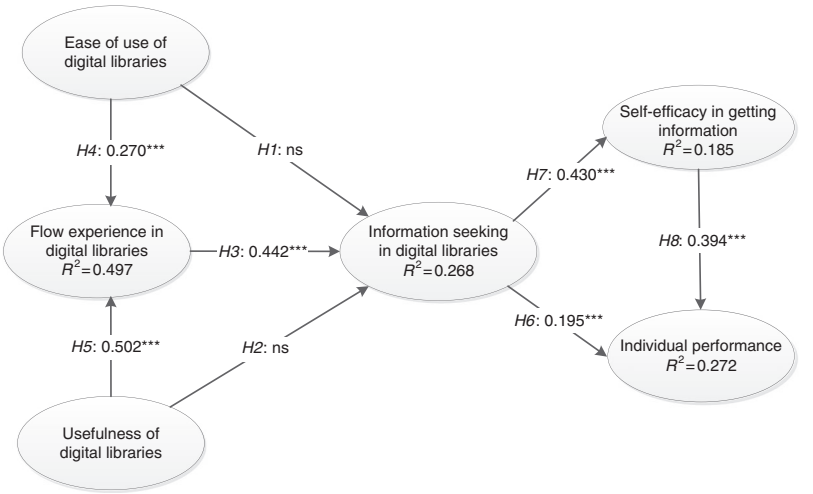

Figure 2.
Research model with results

Notes: ns, not significant. *$p<0.05$; **$p<0.01$; ***$p<0.001$

effect of flow experience on information seeking is the largest one, thus *H3* is supported. The effects of ease of use and usefulness on flow experience are significant, thus *H4* and *H5* are supported. Regarding the consequences, the effects of information seeking on individual performance and self-efficacy in getting information are

significant, thus *H6* and *H7* are supported. The effect of self-efficacy in getting information on individual performance is significant, thus *H8* is supported.

5.3 Mediating effect of flow experience in digital libraries

To test the mediating effect of flow, we followed the three-step method recommended by Baron and Kenny (1986).

- Step 1: Independent variable (IV)→dependent variable (DV) is significant.
- Step 2: IV→mediator (M) is significant.
- Step 3: IV + M→DV, if M is significant and IV is not significant, M fully mediates the impact of IV on DV; if both M and IV are significant, M partially mediates the impact of IV on DV.

The results are shown in Table V. It can be seen that both the effects of ease of use and usefulness on information seeking are fully mediated by flow experience. Specifically, ease of use and usefulness can usefully change users' flow experience which would further affect users' information seeking behavior, thus suggesting slow effects of ease of use and usefulness on information seeking in digital libraries.

6. Discussion and implications

6.1 Discussion

The effects of ease of use and usefulness on user acceptance of an information technology as suggested by the TAM have been extensively tested across a diverse set of technologies and users including digital libraries and digital library users (Park *et al.*, 2009; Thong *et al.*, 2002; Venkatesh *et al.*, 2003). From Table V, it can be seen that the independent effect of ease of use on information seeking behavior is significant, with a magnitude of 0.376; the independent effect of usefulness on information seeking behavior is significant, with a magnitude of 0.371. These results are consistent with the TAM (Davis, 1989) and many prior studies which employed the TAM in diversified technology contexts (Venkatesh *et al.*, 2003). Specifically, these results concord with the study by Thong *et al.* (2002) and Park *et al.* (2009) who employed the TAM in the context of digital libraries. Indeed, when users can easily learn to operate and interact with the university digital library and become skillful at using it, they are more likely to conduct information seeking behavior in the digital library. When users perceive using the university digital library would enable them to accomplish tasks more quickly and enhance the effectiveness on the study (work), they are more likely to seek information in the digital library. So, ease of use and usefulness should always be the fundamental consideration of digital libraries.

Digital library users tend to increase their expectations and demands for better functionality and service delivered by digital libraries (Heradio *et al.*, 2012). In addition to ease of use and usefulness, user experience has received much attention in recent years.

					IV + M→DV	
IV	M	DV	IV→DV	IV→M	IV	M
Ease of use	Flow experience	Information seeking	0.376***	0.598***	0.116	0.440***
Usefulness	Flow experience	Information seeking	0.371***	0.674***	0.048	0.478***

Note: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Table V. Mediating effects of flow experience in digital libraries

Digital libraries are "no longer islands of information, but one among many nodes through which information flows to the users" (Ross and Sennyey, 2008, p. 146). In this situation, user experience becomes salient and critical for the success of digital libraries. One contribution of this study lies in examining the mediating effect of flow experience by extending the TAM. Flow experience represents an optimal and enjoyable experience by users in using digital libraries. From Figure 2, the effect of flow experience on information seeking is the largest one with a magnitude of 0.442. Meanwhile, flow experience fully mediates the effects of ease of use and usefulness on information seeking (see Table V). So, flow experience does matter in determining whether or not users seek information in digital libraries. Flow state is one type of dynamic equilibrium where the individual operates at full capacity. Unfortunately, the dynamic equilibrium is intrinsically fragile (Nakamura and Csikszentmihalyi, 2002). In this situation, librarians should help users to experience more stable and sustainable flow by providing dependable, prompt, personalized and professional service to them. The managers of digital libraries should carefully think about how their librarians can obtain adequate knowledge and ability to provide high-quality services. This is important given users are less likely to trust librarians who provide services (Pinto *et al.*, 2010). When users can experience flow in using digital libraries, they would frequently seek and spend a lot of time seeking information in digital libraries. In order to attract users to seek information in digital libraries, flow experience should be given top priority.

From Figure 2, it can be seen that the effect of information seeking in digital libraries on individual performance is significant with the magnitude of 0.195. This result is consistent with the prior study by Teo and Men (2008) who suggest the usage of knowledge portals has a positive impact on individual performance and with the prior study by Hou (2012) who suggest BI system usage has a positive impact on individual performance. Meanwhile, the effect of information seeking in digital libraries on self-efficacy in getting information is a new relationship explored by this study and Figure 2 shows it is significant with the magnitude of 0.430. Indeed, digital libraries are worth the time users invest given that digital libraries are perceived to have higher levels of information quality, system quality and service quality (Yan *et al.*, 2014). When users frequently seek and spend a lot of time seeking information in digital libraries, they would have more confidence of their own capabilities to search, compare and evaluate information they need. Individual performance would also be high. Namely, the efficiency of the operations in and the adherence to the plan of the study/work would be enhanced. More outputs in the study/work would be produced. The effectiveness of the interaction with people, the quality of the study/work and the ability to meet the goals of the study/work would be improved. These highlight the important status of digital libraries as formal and conventional information sources.

6.2 Implications for theory

Information seeking in digital libraries is an important information behavior, measured by the frequency and the amount of time involved by users to purposively seek information in digital libraries as a consequence of a need to satisfy some goal. This study explores the antecedents and consequences of information seeking in digital libraries by extending the TAM, including the mediating effect of flow experience and the effects of information seeking in digital libraries on self-efficacy in getting information and individual performance. This study usefully contributes to the theoretical development of the structural model exploring information seeking in the specific context of digital libraries and other contexts more generally.

6.3 Implications for practice

There are diversified information sources in the modern information society. Outside the library, large-scale and continuously evolving open collaborative content creation systems such as Wikipedia have become popular, whose reliability, quality and knowledge value have increasingly been acknowledged and appreciated (Stvilia *et al.*, 2008). In China, more and more open collaborative content creation systems based on crowd wisdom such as Baidu Know, Baidu Document, Sina Microblog and ScienceNet Blog have attracted millions of active users. In this situation, more and more students have the opportunity to use unconventional information sources outside the library first before they have the opportunity to use conventional information sources inside the library. The information-seeking habits of potential library users have already been well formed before they arrive on campus (Ross and Sennyey, 2008). It is thus a huge challenge for digital libraries to attract students to use their resources and services. Indeed, "building and retaining the loyalty of library customers in the web environment poses new challenges for libraries" (Kiran and Diljit, 2012, p. 184). We thus recommend that librarians should never stop user training. They should try their best to provide various user training so as to guide potential users to seek information in digital libraries. When users are willing to frequently seek and spend a lot of time seeking information in digital libraries, they would get the positive consequences: both self-efficacy in getting information and individual performance are enhanced. Only in this way, can the final aim of digital libraries be achieved.

6.4 Limitations

There are several limitations in this study. First, this study was conducted in the context of a single Chinese university, implying that further research in other Chinese universities and western countries is invited. Second, the users in the field of Arts and Humanities were underrepresented, so the generalization of the findings of this study needs further exploration. Third, we only used three basic elements including attention focus, control and enjoyment to measure flow experience. However, in the context of digital libraries, other dimensions of flow such as the sense of time distortion, a loss of self-consciousness, merging of action and awareness should also be considered, so as to present a richer picture on the flow experience in using digital libraries.

7. Conclusion

This study extends the TAM by considering the effect of flow experience so as to understand the antecedents of information seeking in digital libraries. Flow experience not only has a direct and strong effect on information seeking but also fully mediates the effects of ease of use and usefulness on information seeking, showing the importance of user experience in the context of digital libraries. Meanwhile, this study explores the consequences of information seeking in digital libraries, finding that information seeking in digital libraries has significant impacts on self-efficacy in getting information and individual performance. This study contributes to the theoretical development of the structural model exploring information seeking in digital libraries. It highlights the important status of digital libraries as conventional information sources in practice and makes suggestions accordingly. Information seeking in the context of digital libraries is a complicated information behavior, other antecedents and consequences should be further explored so as to complement the study presented here.

References

American Library Association (1989), "Presidential committee on information literacy: Final report", Washington, DC, January 10, available at: www.ala.org/acrl/publications/whitepapers/presidential (accessed March 26, 2015).

Arms, W.Y. (2012), "The 1990s: the formative years of digital libraries", *Library Hi Tech*, Vol. 30 No. 4, pp. 579-591.

Arsal, Z. (2014), "Microteaching and pre-service teachers' sense of self-efficacy in teaching", *European Journal of Teacher Education*, Vol. 37 No. 4, pp. 453-464.

Bandura, A. (1977), "Self-efficacy: toward a unifying theory of behavioral change", *Psychological Review*, Vol. 84 No. 2, pp. 191-215.

Bandura, A. (1982), "Self-efficacy mechanism in human agency", *American Psychologist*, Vol. 37 No. 2, pp. 122-147.

Baron, R.M. and Kenny, D.A. (1986), "The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations", *Journal of Personality and Social Psychology*, Vol. 51 No. 6, pp. 1173-1182.

Bates, M.J. (2002), "Toward an integrated model of information seeking and searching", *New Review of Information Behaviour Research*, Vol. 3, pp. 1-15.

Bilal, D. and Bachir, I. (2007), "Children's interaction with cross-cultural and multilingual digital libraries. II. Information seeking, success, and affective experience", *Information Processing & Management*, Vol. 43 No. 1, pp. 65-80.

Ceja, L. and Navarro, J. (2012), "'Suddenly I get into the zone': examining discontinuities and nonlinear changes in flow experiences at work", *Human Relations*, Vol. 65 No. 9, pp. 1101-1127.

Chang, C.C. (2013), "Examining users' intention to continue using social network games: a flow experience perspective", *Telematics and Informatics*, Vol. 30 No. 4, pp. 311-321.

Chang, C.C., Lin, C.Y., Chen, Y.C. and Chin, Y.C. (2009), "Predicting information-seeking intention in academic digital libraries", *Electronic Library*, Vol. 27 No. 3, pp. 448-460.

Chen, H., Wigand, R.T. and Nilan, M. (2000), "Exploring web users' optimal flow experiences", *Information Technology and People*, Vol. 13 No. 4, pp. 263-281.

Chin, W.W., Marcolin, B.L. and Newsted, P.N. (2003), "A partial least squares latent variable modeling approach for measuring interaction effects: results from a montecarlo simulation study and an electronic-mail emotion/adoption study", *Information Systems Research*, Vol. 14 No. 2, pp. 189-217.

Csikszentmihalyi, M. (1975), *Beyond Boredom and Anxiety*, Jossey-Bass, San Francisco, CA.

Csikszentmihalyi, M. and LeFevre, J. (1989), "Optimal experience in work and leisure", *Journal of Personality and Social psychology*, Vol. 56 No. 5, pp. 815-822.

Dahling, J.J., Melloy, R. and Thompson, M.N. (2013), "Financial strain and regional unemployment as barriers to job search self-efficacy: a test of social cognitive career theory", *Journal of Counseling Psychology*, Vol. 60 No. 2, pp. 210-218.

Davis, F.D. (1989), "Perceived usefulness, perceived ease of use, and user acceptance of information technology", *MIS Quarterly*, Vol. 13 No. 3, pp. 319-340.

Desrochers, N. and Pecoskie, J. (2014), "Inner circles and outer reaches: local and global information-seeking habits of authors in acknowledgment paratext", *Information Research – An International Electronic Journal*, Vol. 19 No. 1, available at: http://InformationR.net/ir/19-1/paper608.html (accessed March 26, 2015).

Detlor, B. and Arsenault, C. (2002), "Web information seeking and retrieval in digital library contexts: towards an intelligent agent solution", *Online Information Review*, Vol. 26 No. 6, pp. 404-412.

Esteban-Millat, I., Martínez-López, F.J., Huertas-García, R., Meseguer, A. and Rodríguez-Ardura, I. (2014), "Modelling students' flow experience in an online learning environment", *Computers & Education*, Vol. 71, pp. 111-123.

Fong, C.J. and Krause, J.M. (2014), "Lost confidence and potential: a mixed methods study of underachieving college students' sources of self-efficacy", *Social Psychology of Education*, Vol. 17 No. 2, pp. 249-268.

Frias-Martinez, E., Magoulas, G., Chen, S. and Macredie, R. (2006), "Automated user modeling for personalized digital libraries", *International Journal of Information Management*, Vol. 26 No. 3, pp. 234-248.

Gefen, D., Rigdon, E.E. and Straub, D. (2011), "An update and extension to SEM guidelines for administrative and social science research", *MIS Quarterly*, Vol. 35 No. 2, pp. iii-xiv.

Goodhue, D.L. and Thompson, R.L. (1995), "Task-technology fit and individual performance", *MIS Quarterly*, Vol. 19 No. 2, pp. 213-236.

Hemp, P. (2009), "Death by information overload", *Harvard Business Review*, Vol. 87 No. 9, pp. 83-89.

Heradio, R., Fernández-Amorós, D., Cabrerizo, F.J. and Herrera-Viedma, E. (2012), "A review of quality evaluation of digital libraries based on users' perceptions", *Journal of Information Science*, Vol. 38 No. 3, pp. 269-283.

Hoffman, D.L. and Novak, T.P. (2009), "Flow online: lessons learned and future prospects", *Journal of Interactive Marketing*, Vol. 23 No. 1, pp. 23-34.

Hong, W., Thong, J.Y.L., Wong, W.M. and Tam, K.Y. (2001), "Determinants of user acceptance of digital libraries: an empirical examination of individual differences and system characteristics", *Journal of Management Information Systems*, Vol. 18 No. 3, pp. 97-124.

Hou, C.K. (2012), "Examining the effect of user satisfaction on system usage and individual performance with business intelligence systems: an empirical study of Taiwan's electronics industry", *International Journal of Information Management*, Vol. 32 No. 6, pp. 560-573.

Igbaria, M. and Tan, M. (1997), "The consequences of information technology acceptance on subsequent individual performance", *Information & Management*, Vol. 32 No. 3, pp. 113-121.

Kankanhalli, A., Tan, B.C.Y. and Wei, K.K. (2005), "Contributing knowledge to electronic knowledge repositories: an empirical investigation", *MIS Quarterly*, Vol. 29 No. 1, pp. 113-143.

Kim, D., Chun, H. and Lee, H. (2014), "Determining the factors that influence college students' adoption of smart phones", *Journal of the Association for Information Science and Technology*, Vol. 65 No. 3, pp. 578-588.

Kiran, K. and Diljit, S. (2012), "Modeling web-based library service quality", *Library & Information Science Research*, Vol. 34 No. 3, pp. 184-196.

Klasen, M., Weber, R., Kircher, T.T.J., Mathiak, K.A. and Mathiak, K. (2012), "Neural contributions to flow experience during video game playing", *Social Cognitive and Affective Neuroscience*, Vol. 7 No. 4, pp. 485-495.

Koufaris, M. (2002), "Applying the technology acceptance model and flow theory to online consumer behavior", *Information Systems Research*, Vol. 13 No. 2, pp. 205-223.

Kurbanoglu, S.S., Akkoyunlu, B. and Umay, A. (2006), "Developing the information literacy self-efficacy scale", *Journal of Documentation*, Vol. 62 No. 6, pp. 730-743.

Lai, V.S. and Li, H.L. (2005), "Technology acceptance model for internet banking: an invariance analysis", *Information & Management*, Vol. 42 No. 2, pp. 373-386.

Lee, D.Y. and Ryu, H. (2013), "Learner acceptance of a multimedia-based learning system", *Journal of Human-Computer Interaction*, Vol. 29 No. 6, pp. 419-437.

Lee, H., Choi, S.Y. and Kang, Y.S. (2009), "Formation of e-satisfaction and repurchase intention: moderating roles of computer self-efficacy and computer anxiety", *Expert Systems with Applications*, Vol. 36 No. 4, pp. 7848-7859.

Lee, S.Y., Hwang, H., Hawkins, R. and Pingree, S. (2008), "Interplay of negative emotion and health self-efficacy on the use of health information and its outcomes", *Communication Research*, Vol. 35 No. 3, pp. 358-381.

Liu, R.D., Shen, C.X., Xu, L. and Gao, Q. (2013), "Children's Internet information seeking, life satisfaction, and loneliness: the mediating and moderating role of self-esteem", *Computers & Education*, Vol. 68, pp. 21-28.

Liu, Z. and Luo, L. (2011), "A comparative study of digital library use: factors, perceived influences, and satisfaction", *The Journal of Academic Librarianship*, Vol. 37 No. 3, pp. 230-236.

McKinley, C.J. and Wright, P.J. (2014), "Informational social support and online health information seeking: examining the association between factors contributing to healthy eating behavior", *Computers in Human Behavior*, Vol. 37, pp. 107-116.

Marchionini, G. (1995), *Information Seeking in Electronic Environments*, Cambridge University Press, Cambridge.

Nakamura, J. and Csikszentmihalyi, M. (2002), *The Concept of Flow. The Handbook of Positive Psychology*, Oxford University Press, Oxford, pp. 89-105.

Norbert, G.L. and Lwoga, E.T. (2013), "Information seeking behaviour of physicians in Tanzania", *Information Development*, Vol. 29 No. 2, pp. 172-182.

Nov, O. and Ye, C. (2008), "Users' personality and perceived ease of use of digital libraries: the case for resistance to change", *Journal of the American Society for Information Science and Technology*, Vol. 59 No. 5, pp. 845-851.

Park, N., Roman, R., Lee, S. and Chung, J.E. (2009), "User acceptance of a digital library system in developing countries: an application of the Technology Acceptance Model", *International Journal of Information Management*, Vol. 29 No. 3, pp. 196-209.

Park, N., Rhoads, M., Hou, J.H. and Lee, K.M. (2014), "Understanding the acceptance of teleconferencing systems among employees: an extension of the technology acceptance model", *Computers in Human Behavior*, Vol. 39, pp. 118-127.

Pavlou, P.A. and Fygenson, M. (2006), "Understanding and predicting electronic commerce adoption: an extension of the theory of planned behavior", *MIS Quarterly*, Vol. 30 No. 1, pp. 115-143.

Pinto, M., Fernandez-Marcial, V. and Gomez-Camarero, C. (2010), "The impact of information behavior in academic library service quality: a case study of the science and technology area in Spain", *Journal of Academic Librarianship*, Vol. 36 No. 1, pp. 70-78.

Porcel, C., Morales del Castillo, J.M., Cobo, M.J., Ruiz, A.A. and Herrera-Viedma, E. (2010), "An improved recommender system to avoid the persistent information overload in a university digital library", *Control and Cybernetics*, Vol. 39 No. 4, pp. 899-923.

Ren, W.H. (2000), "Library instruction and college student self-efficacy in electronic information searching", *The Journal of Academic Librarianship*, Vol. 26 No. 5, pp. 323-328.

Ringle, C.M., Wende, S. and Will, A. (2005), "SmartPLS 2.0", available at: www.smartpls.de (accessed May 20, 2009).

Ross, L. and Sennyey, P. (2008), "The library is dead, long live the library! The practice of academic librarianship and the digital revolution", *Journal of Academic Librarianship*, Vol. 34 No. 2, pp. 145-152.

Sahu, H.K. and Singh, S.N. (2013), "Information seeking behaviour of astronomy/astrophysics scientists", *Aslib Proceedings*, Vol. 65 No. 2, pp. 109-142.

Schuler, J. and Brandstatter, V. (2013), "How basic need satisfaction and dispositional motives interact in predicting flow experience in sport", *Journal of Applied Social Psychology*, Vol. 43 No. 4, pp. 687-705.

Shah, C. (2014), "Collaborative information seeking", *Journal of the Association for Information Science and Technology*, Vol. 65 No. 2, pp. 215-236.

Sin, S.C.J. and Kim, K.S. (2013), "International students' everyday life information seeking: the informational value of social networking sites", *Library & Information Science Research*, Vol. 35 No. 2, pp. 107-116.

Straub, D.W., Boudreau, M.C. and Gefen, D. (2004), "Validation guidelines for IS positivist research", *Communications of the Association for Information Systems*, Vol. 13 No. 1, pp. 380-427.

Stvilia, B., Twidale, M., Smith, L.C. and Gasser, L. (2008), "Information quality work organization in Wikipedia", *Journal of the American Society for Information Science and Technology*, Vol. 59 No. 6, pp. 983-1001.

Teo, T.S.H. and Men, B. (2008), "Knowledge portals in Chinese consulting firms: a task-technology fit perspective", *European Journal of Information Systems*, Vol. 17 No. 6, pp. 557-574.

Thong, J.Y.L., Hong, W. and Tam, K.Y. (2002), "Understanding user acceptance of digital libraries: what are the roles of interface characteristics, organizational context, and individual differences?", *International Journal of Human-Computer Studies*, Vol. 57 No. 3, pp. 215-242.

Usluel, Y.K. (2007), "Can ICT usage make a difference on student teachers' information literacy self-efficacy", *Library & Information Science Research*, Vol. 29 No. 1, pp. 92-102.

Vecchione, M., Caprara, G.V., Caprara, M.G., Alessandri, G., Tabernero, C. and Gonzalez-Castro, J.L. (2014), "The perceived political self-efficacy scale-short form (PPSE-S): a validation study in three Mediterranean countries", *Cross-Cultural Research*, Vol. 48 No. 4, pp. 368-384.

Venkatesh, V., Morris, M.G., Davis, G.B. and Davis, F.D. (2003), "User acceptance of information technology: toward a unified view", *MIS Quarterly*, Vol. 27 No. 3, pp. 425-478.

West, W.L. and Miller, H.S. (2011), "Electronic journals: cataloging and management practices in academic libraries", *Serials Review*, Vol. 37 No. 4, pp. 267-274.

WHU (2015), "General introduction", available at: www.whu.edu.cn/xxgk/xxjj.htm (accessed March 26, 2015).

Williamson, K. (1998), "Discovered by chance: the role of incidental information acquisition in an ecological model of information use", *Library & Information Science Research*, Vol. 20 No. 1, pp. 23-40.

Wilson, T.D. (2000), "Human information behavior", *Informing Science*, Vol. 3 No. 2, pp. 49-55.

Wrigley, W.J. and Emmerson, S.B. (2013), "The experience of the flow state in live music performance", *Psychology of Music*, Vol. 41 No. 3, pp. 292-305.

Yan, Y.L. and Zha, X.J. (2014), "Comparison between user affinity with digital libraries and virtual communities", *Learned Publishing*, Vol. 27 No. 2, pp. 135-143.

Yan, Y.L. and Davison, R.M. (2013), "Exploring behavioral transfer from knowledge seeking to knowledge contributing: the mediating role of intrinsic motivation", *Journal of the American Society for Information Science and Technology*, Vol. 64 No. 6, pp. 1144-1157.

Yan, Y.L., Davison, R.M. and Mo, C.Y. (2013), "Employee creativity formation: the roles of knowledge seeking, knowledge contributing and flow experience in Web 2.0 virtual communities", *Computers in Human Behavior*, Vol. 29 No. 5, pp. 1923-1932.

Yan, Y.L., Zha, X.J., Zhang, J.C. and Hou, X.R. (2014), "Comparing digital libraries with virtual communities from the perspective of e-quality", *Library Hi Tech*, Vol. 32 No. 1, pp. 173-189.

Yang, H.L. and Cheng, H.H. (2009), "Creative self-efficacy and its factors: an empirical study of information system analysts and programmers", *Computers in Human Behavior*, Vol. 25 No. 2, pp. 429-438.

Zaman, M., Anandarajan, M. and Dai, Q. (2010), "Experiencing flow with instant messaging and its facilitating role on creative behaviors", *Computers in Human Behavior*, Vol. 26 No. 5, pp. 1009-1018.

Zha, X.J., Li, J. and Yan, Y.L. (2013), "Comparison between Chinese and English electronic resources: a survey of users of Chinese university library", *Library Hi Tech*, Vol. 31 No. 1, pp. 109-122.

Zha, X.J., Xiao, Z.L. and Zhang, J.C. (2014), "A survey of user perceptions of digital library e-quality and affinity", *Serials Review*, Vol. 40 No. 1, pp. 3-11.

Zhang, Y. (2010), "Developing a holistic model for digital library evaluation", *Journal of the American Society for Information Science and Technology*, Vol. 61 No. 1, pp. 88-110.

Zhou, T. (2012), "Understanding users' initial trust in mobile banking: an elaboration likelihood perspective", *Computers in Human Behavior*, Vol. 28 No. 4, pp. 1518-1525.

Zhou, T. (2013), "Understanding the effect of flow on user adoption of mobile games", *Personal and Ubiquitous Computing*, Vol. 17 No. 4, pp. 741-748.

Zhu, Q. (2003), "China academic library and information system: current situation and future development", *The International Information & Library Review*, Vol. 35 Nos 2/4, pp. 399-405.

Zhu, Y.Q., Chen, L.Y., Chen, H.G. and Chern, C.C. (2011), "How does Internet information seeking help academic performance? – The moderating and mediating roles of academic self-efficacy", *Computers & Education*, Vol. 57 No. 4, pp. 2476-2484.

Appendix

Constructs	Definitions	Items
Ease of use of digital libraries (adapted from Venkatesh *et al.*, 2003)	Users' perceptions concerning the amount of effort required to use digital libraries	1. Learning to operate my university digital library is easy for me 2. It is easy for me to become skillful at using my university digital library 3. My interaction with my university digital library is clear and understandable 4. I find my university digital library easy to use
Usefulness of digital libraries (adapted from Venkatesh *et al.*, 2003; Zha *et al.*, 2013)	Users' perceptions concerning the degree to which using digital libraries would improve performance	1. Using my university digital library in my study (work) enables me to accomplish tasks more quickly 2. Using my university digital library enhances my effectiveness on the study (work) 3. Using my university digital library makes it easier to do my study (work) 4. I find my university digital library useful in my study (work)
Flow experience in digital libraries (adapted from Zhou, 2013)	A holistic sensation that users feel when they use digital libraries	1. When using my university digital library, my attention is focussed on the activity 2. When using my university digital library, I feel in control 3. When using my university digital library, I find a lot of pleasure
Information seeking in digital libraries (adapted from Kankanhalli *et al.*, 2005; Yan and Davison, 2013)	The actual information seeking behavior in digital libraries in respect to the frequency and the amount of time involved	1. I often seek information in my university digital library 2. I frequently seek information in my university digital library 3. I spend a lot of time seeking information in my university digital library
Self-efficacy in getting information (adapted from Pavlou and Fygenson, 2006; Zhou, 2012)	Individuals' judgments of their own capabilities to search, compare and evaluate information they need	1. If I want to, I would be able to get useful information I need 2. If I want to, I am confident I could get useful information I need 3. I am confident of getting useful information even if there is no one around to show me how to do it

Table AI.
(*continued*) Constructs and items

Constructs	Definitions	Items
Individual performance (adapted from Teo and Men, 2008)	The accomplishment of a portfolio of tasks by an individual	Please evaluate the extent of your performance (1 – very low to 7 – very high) 1. The efficiency of the operations in my study/work 2. The adherence to the plan of my study/work 3. The amount of the study/work I produce 4. The effectiveness of my interaction with people from other projects, teams or units 5. The quality of my study/work 6. The ability to meet the goals of my study/work

Table AI.

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