

Toward an Evaluation Framework of Library Services: Re-examination of LibQUAL+™

도서관 서비스 품질평가 도구로서 LibQUAL+™에 대한 再考

Ji-Hong Park
jpark12@syr.edu
Syracuse University
School of Information Studies
Syracuse, NY 13244-4100, USA

Abstract

While LibQUAL+™ is in the headlines of many articles focusing on library service evaluations, little research has been conducted to study the relationship between the LibQUAL+™ factors and the adoption of library services. It remains unclear whether the factors of LibQUAL+™ have any effect on its adoption. A framework was adapted from Icek Ajzen's theory of planned behavior and proposed to extract factors affecting the adoption of library services. The factors were examined via data collection from a Web-based questionnaire survey with college students in the United States. Factor analyses and multiple regression analysis were conducted. Findings show that the intention to use library services is explained by attitude toward library service quality. The attitudinal factors that are significant are (1) perceived personal control, (2) perceived affect of service, and (3) perceived comprehensiveness of information. The relative importance among the factors is also represented by the numbered sequence. However, perceived timeliness of information access and the perception of library as place do not have a significant effect on the intention. This study extends the research on library service evaluation, and provides a new evaluation framework by applying adoption behaviors.

초록

도서관 서비스 품질평가 도구인 LibQUAL+™에 대한 많은 연구논문이 발표되었으나, LibQUAL+™ 요인과 도서관 서비스 이용의도 사이의 관계를 연구한 사례는 매우 드물다. 본 논문은 Icek Ajzen의 계획적 행위이론을 적용하여 도서관 서비스 이용의도에 영향을 미치는 요인을 추출하고자 하였다. 이러한 요인을 추출하기 위하여 미국 대학생을 대상으로 웹 설문을 실시하였고, 요인분석 및 다중회귀분석을 통하여 수집된 데이터를 분석하였다. 분석결과, 도서관 서비스 이용의도는 도서관에서 제공되는 서비스 품질에 대한 이용자의 태도와 관련이 있었다. 통계분석결과 유의미하게 나타난 태도요인은 이용자가 지각한 (1) 정보원 및 시스템 이용시의 주도성, (2) 서비스 제공 의향 정도, (3) 제공되는 정보의 포괄성이었다. LibQUAL+™ 요인간의 상대적 중요도를 측정하였다. 반면에, 이용의도에 유의미한 영향을 미치지 않는 요인으로는

정보접근의 적시성과 물리적인 공간으로서의 도서관을 지각하는 부분이었다. 본 연구의 의의는 도서관 서비스 품질평가에 대한 연구의 영역을 확장시키고 이용의도를 고려한 새로운 평가 체계를 제시한 점이다.

Keyword: library service evaluation, LibQUAL+™ factors, library service adoption, planned behavior theory

도서관 서비스 품질평가, LibQUAL+™ 요인, 도서관 서비스 이용의도, 계획적 행위이론

1. Introduction

To provide effective and efficient services within limited resources, an evaluation of library service quality has been requested that dates back to the early 1970s, when library funds began to shrink (Baker & Lancaster, 1991). Traditionally, library service quality has been measured by the size of library collections and the counts of its use. Today, evaluation focuses more on meeting user needs by improving and developing a high quality service (Cook & Thompson, 2001; Nitecki, 1996).

Among the user-based evaluation approaches, LibQUAL+™ has received much attention recently. Evolved from a SERVQUAL scale (Parasuraman et al., 1985, 1988) from business service marketing, LibQUAL+™ is the most widely used evaluation criteria for library service quality. It has been used or is being used by roughly 700 academic and other libraries (Kyrillidou, 2005), and also expanded internationally, with participating institutions in Canada, the United Kingdom, and Europe. The growing community of participants and its extensive dataset are rich resources from which to draw information to improve library services.

LibQUAL+™ provides well-established determinant factors of library service quality for exploring the effective delivery of library services. However, for the effective delivery of any service, user adoption must precede (Featherman & Pavlou, 2003). LibQUAL+™ assumes that a higher quality of library service necessarily leads to a higher user adoption of that service. Despite this, no empirical evidence can be found regarding this assumption. Figure 1 demonstrates the gap between user perception of library service quality and their adoption. Library service quality is determined by four factors (affect of service, library as place, information control, and access to information).

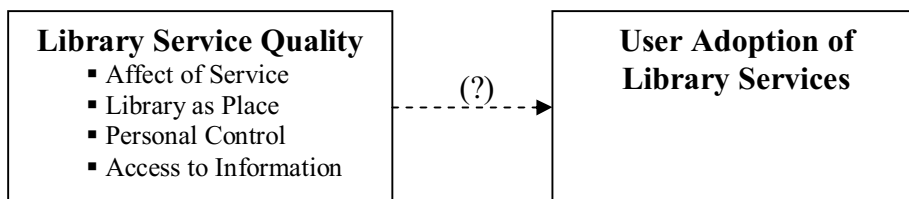


Figure 1. Empirical Gap between Library Service Adoption and Library Service Quality

Considering the research gap, this study aims at examining the relationship between the determinant factors of LibQUAL+™ and the user adoption of library services. The conceptual framework of this study is based on the theory of planned behavior (Ajzen, 1985, 1991). The framework provides a theoretical basis on which to investigate the relationship between adoption and library service quality. This study uses the same scale that appeared in LibQUAL+™ (Cook & Thompson, 2001; Thompson et al., 2002) to examine whether the library service quality evaluation criteria also determines user adoption of library service. It also examines the relative importance of the factors if they determine the adoption.

The findings help in understanding the theoretical constructs of the framework in the adoption of library services. The relationship between the constructs and the adoption may provide a new insight for evaluating library service. The findings may also provide information regarding the preferences of library users. Based on this data, practitioners may selectively apply the factors of LibQUAL+™, thereby providing better service to the users.

This study starts by introducing the theoretical background by describing previous studies on LibQUAL+™ followed by an exploration of the conceptual framework. It then discusses the research methods used. The findings of the statistical analyses are presented and discussed. Finally, conclusions, implications, and future studies are addressed.

2. Theoretical Background

This section discusses prior literature on LibQUAL+™, and the theory of planned behavior. It then addresses propositions based on the conceptual framework, which were developed by combining constructs from LibQUAL+™ and the theory of planned behavior.

2.1 Development of Library Service Quality Scale (LibQUAL+™)

Based on service quality evaluation studies in business marketing, the need for a user-based assessment of library service quality has been stressed (Nitecki, 1996; Cook & Heath, 2001). Cook and Heath (2001) qualitatively elicited five components of library service quality by using the framework of SERVQUAL as the basic set of issues. They conducted sixty interviews with users of research libraries across North America, and thirty of the sixty interviews provided the users' perceptions of their expectations of library service, as well as giving information about the use of their respective research libraries. Grounded theoretical analysis of the data provided five components of library service quality: *affect of service* (respectful and caring service), *comprehensive collections, ubiquity and ease of access* (wide and easy access to information), *library as place* (utilitarian space and symbol of intellect), and *reliability* of service.

Cook and Thompson (2001) further developed a psychometric scale for library service quality that was grounded by their interview data. The study quantitatively extracted and tested four determinant factors: *affect of service, place, access to collections*, and *reliability*. They also argued that there is a lack of user-based evaluation of library service quality even though user perception is vital for service quality. They also highlighted the limitations of collection-based library-quality evaluation. (p. 586). SERVQUAL provided a well-established twenty-two item survey for general service quality; however, it was less meaningful in the specific library service context. Web surveys were then implemented. Samples were randomly drawn from 600 faculty, 600 graduate students, and 900 undergraduate students from twelve academic institutions. For each of the forty-one LibQUAL+™ items, users were asked to rate their minimum expectations, perceptions, and desires regarding library quality.

As part of developing the scale of library service quality, Thompson and others (2002) further verified the LibQUAL+™ scale by examining reliability through factor analysis. The difference from the previous studies (e.g., Cook & Thompson, 2001) was the inclusion of both ARL (Association of Research Libraries) and Non-ARL samples. A web-based survey was implemented with 20,416 participants from forty-three universities. The four factors (*service affect, library as place, personal control*, and *information access*) proved to have very high reliability. The least reliable was "information access." There was no significant difference between ARL samples and Non-ARL samples (p.7). This study dropped off the *reliability* variable from the prior study (Cook & Thompson, 2001) and added the *personal control* variable.

Another study focused on digital library context. Heath and others (2003) described how users evaluated digital libraries using the combined dimension of LibQUAL+™ and CAPM (Comprehensive Access to Printed Materials) methodologies. They explained that CAPM methodology is based on a multi-attribute economic model that was used to evaluate the CAPM project at Johns Hopkins University. They argued that this mixed use would contribute to identifying gaps in digital library services. The CAPM approach may consider assigning monetary values (e.g., willingness to pay) for digital library services.

2.2 The Theory of Planned Behavior

The conceptual framework for this study is adapted from the theory of planned behavior (TPB). Proposed by Ajzen (1985, 1991) in social psychology literature, TPB maps the relationships among beliefs, attitudes, subjective norms, behavioral controls, intentions, and behavior (TPB is the revised version of Fishbein and Ajzen’s theory of reasoned action). The theory is based on the assumption that human beings are rational and make systematic decisions based on available information. According to this theory, the best predictor of behavior is *intention*. Ajzen (1991) states, “a central factor in the theory of planned behavior is the individual’s intention to perform a given behavior...As a general rule, the stronger the intention to engage in a behavior, the more likely should be its performance” (p. 181). Intention refers to the cognitive representation of a person’s readiness to perform a given behavior, and it is considered the immediate determinant of behavior (Fishbein & Ajzen, 1975). Such intention is determined by three factors: *attitude* (a favorable or unfavorable evaluation of the behavior), *subjective norm* (perceived social pressure to perform or not perform the behavior), and *perceived behavioral control* (self-efficacy in relation to the behavior). Generally, the more favorable the attitude and subjective norm, and the greater the perceived control, the stronger a person’s intention should be to perform a given behavior.

2.3 Conceptual Framework

This study’s framework uses the causal relationship between attitude and intention (Figure 2), which appears in TPB. Regarding the attitude variable, perceived service quality has been conceptualized as a form of attitude in business marketing (Bolton & Drew, 1991; Cronin & Taylor, 1992; Parasuraman et al., 1988). For example, Parasuraman and others (1988) described service quality as “...similar in many ways to an attitude” (p.15), and Cronin and Taylor (1992) also concluded that “perceived service quality is best conceptualized as an attitude” (p. 58).

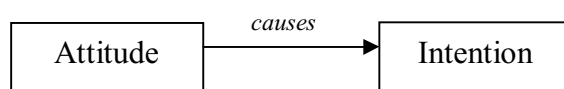


Figure 2. Causal relationship of attitude to intention

Given that service quality can be conceived as an attitude, perceived library service quality is conceptualized as an attitude in this study. It then follows that perceived library service quality might cause intention to use library services. Hence, the four variables appearing in LibQUAL+™ may also determine intention to use

library services. The graphical representation of these relationships is shown in Figure 3.

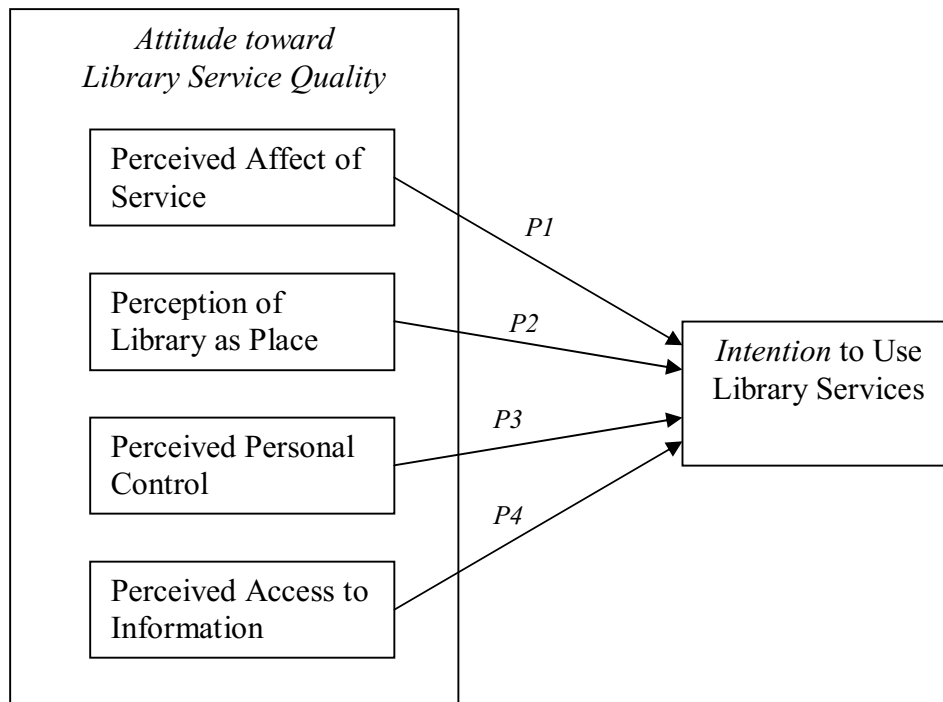


Figure 3. Conceptual Framework

The objective of this study is to examine the relationship between user adoption of library services and the four determinant factors appearing in LibQUAL+™. It also includes the relative importance among these factors in determining the intention to use library services. The following four propositions address the targeted relationships.

Proposition 1: Perceived affect of service is an antecedent of intention to use library services.

Proposition 2: Perception of library as place is an antecedent of intention to use library services.

Proposition 3: Perceived personal control is an antecedent of intention to use library services.

Proposition 4: Perceived access to information is an antecedent of intention to use library services.

The four variables (perceived service affect, perception of library as place, perceived personal control, and perceived information access) immediately determine perceived library service quality. Perceived library service quality forms attitude, and attitudes determines intention. Thus, perceived library service quality affects the intention to use library services.

Perceived affect of service appeared in several literature as a determinant of library service quality (Cook & Heath, 2001; Cook & Thompson, 2001; Thompson et al., 2002; Heath et al., 2003). It refers to perceived expectations for the delivery of respectful and caring library service. It is related to library staff's informed and courteous manners when interacting with users. The perception of library as place was also addressed as the determinant (Cook & Heath, 2001; Cook & Thompson, 2001; Thompson et al., 2002; Heath et al., 2003). It refers to library space as a utilitarian and intellectual place. This variable may apply to quiet physical library space that

encourages meditation, contemplation, or reflection. Regarding perceived personal control, Thompson and others (2002) identified its sub-dimensions as ease of navigation, convenience, and modern equipment, which affect library service quality. Heath and others (2003) refer to it as “the extent to which users are able to navigate and control the information universe that is provided.” Perceived access to information is referred to as, “an assessment of the adequacy of the collections themselves and the ability to access needed information on a timely basis regardless of the location of the user or the medium of the resource in question” (Heath et al., 2003). It includes comprehensive collections, timeliness, ubiquity, and ease of access to information (Cook & Heath, 2001; Thompson et al., 2002).

Intention to use library services refers to a willingness to use any library service, which includes reference services, circulations, inter-library loans, reading books or studying in libraries. Intention is expected to determine the actual adoption of library services. This expectation is in parallel with the idea that that behavioral intention is the strongest predictor of actual behavior (Ajzen, 1991; Fishbein & Ajzen, 1975). In the context of the framework, intention to adopt library services is thus the dependent variable, while the independent variables are perceived affect of service, perception of library as place, perceived personal control, and perceived access to information.

3. Method

3.1 Operationalization of Variables

The web-based questionnaire consisted of three parts. The first part gathered information about the respondents’ library service usage. The second part solicited respondents’ perceptions of the library services and their future intentions to use those services. The third part gathered demographic information. A seven-point Likert scale was used to elicit responses on the questionnaire.

Table 1 shows the operationalization of each variable. Statements of items measuring perceived affect of service, perception of library as place, perceived personal control, and perceived access to information were adapted from the well-established LibQUAL+™ scale refined by Thompson and others (2002). Their scale seemed to be the most recently and comprehensively tested. The statements were modified to reflect the respondents’ perceptions toward the use of their library services.

Table 1. Operationalization of Variables

ATTITUDE		
Variable	Item	Statement
Perceived Affect of Service (PAS)	PAS1	Library staff have a willingness to help me.
	PAS2	Library staff give me individual attentions.
	PAS3	Library staff deal with me caring fashion.
	PAS4	Library staff are consistently courteous for me.
	PAS5	Library staff have knowledge for answering my questions.
	PAS6	Library staff understand my needs.
	PAS7	Library staff are ready to respond to my questions.
	PAS8	Library staff instill confidence in me.
	PAS9	Library staff are dependable when I need some help.
Perception of Library as	PLP1	Library is a haven for quiet and solitude for me.
	PLP2	Library is a meditative place for me.

Place (PLP)	PLP3	Library is a contemplative environment for me.
	PLP4	Library provides a place that facilitates my quiet study.
	PLP5	Library provides a place that facilitates my reflection and creativity.
Perceived Personal Control (PPC)	PPC1	Library website enables me to locate information on my own.
	PPC2	Electronic resources are accessible at my home or at my office.
	PPC3	Access tools allow me to find information on my own.
	PPC4	Modern equipments allow me to easily access information I need.
	PPC5	I find it easy to access information for independent use.
	PPC6	I find it convenient to access library collections.
Perceived Access to Information (PAI)	PAI1	Comprehensive print collections are important to me.
	PAI2	Complete runs of journal titles are important to me.
	PAI3	Interdisciplinary library needs are important to me.
	PAI4	Timely document delivery or interlibrary loan is important for me.
	PAI5	Convenient business hour is important for me.
INTENTION		
Intention to Use Library Services (IULS)	IULS	Assuming that any decision to use your current library would be totally up to you, and other libraries were available, how would you rate your potential use of it?

To measure intention to use library services, an item suggested by Francis and others (2004, p.11) was used. They suggested an eleven-point scale using numbers 0 through 10 as response descriptors. As such, the intention was operationalized as “Assuming that any decision to use your current library would be totally up to you, and other libraries were available, how would you rate your potential use of it?” It assumes voluntariness and choice availability to better solicit their cognitive representation. For this item measure, the chosen number is their intention score.

3.2 Pre-test

A pre-test was conducted on the preliminary questionnaire to assess its comprehension. It was tested with a sample of nine subjects. Three of them were library users, four were doctoral students, and two were faculty members. The combination of these diverse pretest subjects is in harmony with Dillman’s (2006) recommendation that the pretest include subjects from three distinct groups: those with similar training as the researcher conducting the survey (the four doctoral students), those with substantive knowledge in survey or subject matters (the two faculty members) and those with similar skills or conditions as those of the population under study (the three library users).

The preliminary questionnaire was sent to each subject via email. Based on feedback, several questions were rephrased for clarity and inconsistencies were rectified. In general, the respondents found the questions and the structure clear, hence, the questionnaire was deemed ready for data collection.

3.3 Data Collection

The propositions described in the previous section were defined at the individual level of analysis. Samples for this study, therefore, were required to be individual library users. A convenient sample of college students from three universities in the United States was recruited. The use of student subjects was considered appropriate because they assessed library services only for purposes with which they were familiar.

The sample was recruited by email through three listserves at Florida State University, Syracuse University and University of North Carolina at Chapel Hill. The web-based questionnaire survey was launched through a survey administration agency,

Survey Monkey (www.surveymonkey.com), from August 30, 2006 until September 19, 2006. To improve the response rate, five respondents were drawn at random and was each to be offered an Amazon.com Gift Certificate valued at US \$20 if they voluntarily provided their email addresses. In compliance with the Syracuse University Institute of Review Board's regulations for conducting research involving human subjects, a cover letter explained subjects' rights when participating in this study. The cover letter informed the subjects about the purposes of the study, the significance and confidentiality of their responses, and the appreciation of the researcher for their participation. One follow-up, used to increase response rate, took place on September 10, 2006.

There are two methodological concerns regarding sampling. One is to find a sample frame that is representative of the target population, and the other is to acquire a sufficiently large number of responses to achieve generalizability. In this study, searching for a sample frame that represents the library users was not easy given the hybrid characteristics of libraries (e.g., digital library versus brick and mortar library). Further, since there is no concrete description of the library user population, representativeness may not be guaranteed. Most studies related to the LibQUAL scale studied general library users without clearly distinguishing between those using digital library versus physical libraries (e.g., Cook & Heath, 2001; Cook & Thompson, 2001; Thompson et al., 2002). Thus, this study adopted the general concept of library users who use physical libraries but who may or may not use digital libraries.

In this study, a total of 208 usable responses were collected. Sample size is critical to assess generalizability in a survey-based study. A power analysis was conducted to decide appropriate minimum sample size. Deciding sample size by power analysis in multiple regression analysis, Cohen (1988) considered an effect size of 0.02 to be a small effect, 0.15 a medium effect, and 0.35 a large effect. A small effect accounts for 2% of the variance in the dependent variable, a medium effect accounts for 15%, and a large effect 35%. The number of subjects required varies with the number of independent variables. This study conducted power analysis by using G*Power (Erdfelder et al., 1996), a power analysis software. It suggested that a total of 129 respondents are required when medium effect size is assigned (0.15), alpha is 0.05, power is 0.95, and the number of independent variables is four. As the sample size ($n=208$) of this study is well over the necessary sample size of the Cohen's (1998) medium effect size, the condition of generalizability was met.

3.4 Validity and Reliability of Data

The validity of a questionnaire is sustained if the responses are measures of what a researcher intends to measure. The reliability of a questionnaire is sustained if responses to the same questions are similar whenever the questions are asked. Statistical techniques were applied to 208 responses to assess whether the questionnaire generated valid and reliable results.

Construct validity was assessed in this study. Construct validity refers to the degree to which inferences can be made from the operationalizations. In other words, it concerns how well a group of items reflects a researcher's idea of a certain construct. Construct validity can be measured by convergent validity and discriminant validity taken together. To assess the convergent and discriminant validity of the constructs, factor analysis is often used (Babbie, 1990; Fowler, 2002; Tabachnick & Fidell, 2007). Factor analysis extracts factors based upon the correlations among items. In doing so, it examines construct validity, which ascertains whether the questionnaire measures the construct it is supposed to be measuring.

Before conducting factor analysis, the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) was first computed to check the suitability of using factor analysis. Regarding a threshold for deciding whether a KMO value is adequate, Kaiser (1974) proposed the following criteria: > 0.9 is marvelous, > 0.8 is meritorious, > 0.7 is middling, > 0.6 is mediocre, > 0.5 is miserable, and < 0.5 is unacceptable. For this study, the KMO was found to 0.841. Thus, it seemed appropriate to apply factor analysis.

Two rounds of a principal component analysis with varimax rotation were performed. At the first round (*see* Appendix I), a total of six factors with eigenvalues greater than 1.0 were identified. These factors explained 73.2% of the total variance. However, a single item (PPC6) was found to load to one factor, which was a problematic result. Thus, one more factor analysis was conducted without the item of PPC6. Unlike the first round, a total of five factors with eigenvalues greater than 1.0 were satisfactorily extracted in the second round (*see* Appendix II). The total variance was slightly reduced to 71.0%; however, all of the loadings were greater than 0.6 (minimum loading = 0.696; maximum loading = 0.892). Regarding the necessary minimum factor loading for its respective items, Hair and others (1992) suggest that items with loadings greater than 0.3 are considered significant; loadings greater than 0.4 are more important; and loadings greater than 0.5 are very significant. For this study, the criteria was to accept items with loadings of 0.5 or greater.

Convergent validity is ascertained if items load highly on their associated factors. The results of the factor analysis indicate that with minimum factor loadings of 0.5 suggested by Hair and others (1992), the conditions of convergent validity were satisfactorily met. As for discriminant validity, the primary criterion is that each item must load higher on its associated factor than on any other construct. Without an exception, as is outlined in Appendix II, the condition for discriminant validity was also met.

The results of factor analysis (Appendix II) show that there was one minor change in the attribution of items to factors. It is the split of some items in one factor into another. Items measuring Perceived Access to Information (PAI) with values PAI1 through PAI5 loaded with two distinct factors. Items with values PAI1 through PAI3 were found to be one factor (factor 4), and items with values PAI4 and PAI5 were the other (factor 5). Dividing this variable into two different factors might be more appropriate since factor 4 was related to the degree of comprehensiveness of information (PAI1 through PAI3) while factor 5 was to the degree of timeliness of information access (PAI4 and PAI5). Thus, two new factor names were assigned to factor 4 and factor 5 respectively as Perceived Comprehensiveness of Information (PCI) and Perceived Timeliness of Information Access (PTIA).

For testing the reliability of the scale, Cronbach's alpha was computed for each factor. Cronbach's alpha is a statistic that is extensively used in survey literature to estimate the reliability of a scale (Pedhazur & Schmelkin, 1991). It returns a measure of how well a set of questions captures a latent variable. Cronbach's alpha implies that the data is more likely to be a latent variable if the value is closer to 1 than 0.

The alpha values range from 0.622 to 0.942 in this study (*see* Table 2). Nunnally (1967, p.226) suggested that a minimum alpha of 0.6 sufficed for early stages of research. Given that this study explored the relationship between attitude towards library services and the intention of adoption, the variables seem to have appropriate reliability for the next stage of multiple regression analysis.

Table 2. Reliability of Variables

Factor #	Variable Name	# of Items	Cronbach's alpha
Factor 1	Perceived Affect of Service (PAS)	9	0.938
Factor 2	Perception of Library as Place (PLP)	5	0.942
Factor 3	Perceived Personal Control (PPC)	6	0.822
Factor 4	Perceived Comprehensiveness of Information (PCI)	3	0.676
Factor 5	Perceived Timeliness of Information Access (PTIA)	2	0.622
Not Applicable	Intention to Use Library Services (IULS)	single item	not applicable

4. Data Analysis and Results

The factor analyses in the previous section identified what valid factors were extracted as well as the determined reliability of these factors. Questions remain regarding whether these factors had any relationship with the intention to use library services (IULS), and which factors have greater importance. Multiple regression analysis was used to discover the major influencing factors by examining the relationships between the factors extracted from the factor analysis and the intention. The extracted factors were the independent variables that explained the changes in the dependent variable—intention to use library services.

There is a trade-off between using raw scores and using factor scores as independent variables in multiple regression analyses. While using raw scores can keep values of variables close to original value, using factor scores is superior in interpretation and generalizability (Dobie et al., 1986). Dobie and others (1986) also provided useful criteria based on their empirical study. They suggested that if the number of items is more than thirty, using factor scores is a better solution than using the raw scores. Following this criteria, this study used raw scores rather than factor scores in measuring independent variables as the total number of items is less than thirty.

While using raw scores loses less variable information, it has a much higher risk of multicollinearity than using factor scores. Multicollinearity is a problem that occurs when independent variables are too highly correlated (Tabachnick & Fidell, 2007). It confounds the influence of independent variables on the dependent variable, leading to unreliable conclusions in multiple regression analyses. Two criteria are commonly used to inspect for evidence of multicollinearity. Tolerance should exceed 0.40 (Allison, 1999, p.50), and Variance Inflation Factor (VIF) is the inverse of tolerance and by this standard should be 2.5 or less. Table 3 shows that all tolerance values exceeded 0.4 and all VIF were less than 2.5. Thus, there was very minimal risk of multicollinearity in this analysis.

Originally, four propositions were formulated for the study (*see* Theoretical Background section). However, after factor analysis, proposition four was divided into two different propositions (P4a and P4b), since the factor (perceived access to information: PAI) of proposition four was divided into two different factors (perceived comprehensiveness of information: PCI and perceived timeliness of information access: PTIA). Thus, the following two propositions replaced proposition four:

Proposition 4a: Perceived comprehensiveness of information is an antecedent of intention to use library services.

Proposition 4b: Perceived timeliness of information access is an antecedent of intention to use library services.

Multiple regression analysis was used to test the propositions. The independent variables (PAS, PLP, PPC, PCI, and PTIA) were regressed on the dependent variable (IULS). Table 3 shows that three propositions (P1, P3, and P4a) were supported. The support for these are expected since past literature on LibQUAL+™ has shown that these factors are critical in deciding library service quality (Cook & Heath, 2001; Cook & Thompson, 2001; Thompson et. al, 2002). Conversely, the lack of support for P2 and P4b contrasts what previous studies assumed. While previous studies assumed that these two factors were important in deciding library service quality, this study indicates that these factors may not cause users to adopt library services. A possible explanation for the lack of support for these propositions in this study is that the easy access to information via the Internet has made potential users less reliant on the services and features of physical libraries, such as interlibrary loan service or convenient business hours. It also has decreased the perception of libraries as meditative or contemplative places.

Table 3. Results of Multiple Regression Analysis

Rank	Factor	Proposition	Beta (β)	p-value	Collinearity Statistics	
					Tolerance	VIF
1	Perceived Personal Control (PPC)	P3	0.369	0.000**	0.880	1.136
2	Perceived Affect of Service (PAS)	P1	0.254	0.000**	0.730	1.371
3	Perceived Comprehensiveness of Information (PCI)	P4a	0.119	0.040*	0.947	1.056
N/A	Perceived Timeliness of Information Access (PTIA)	P4b	0.105	0.078	0.896	1.117
N/A	Perception of Library as Place (PLP)	P2	0.080	0.219	0.743	1.345

Note: ** p<0.01; * p<0.05; R = 0.602; R² = 0.362; Adjusted R² = 0.346; Dependent Variable: IULS; N/A: Not Applicable.

In Table 3, Beta values show which of the factors contributed influence over the dependent variable. The value of R² indicates that this model explains 36.2% of the total variance. Table 3 shows that three factors were significant. Two factors (PPC and PAS) were identified as significant at the level of p<0.01, and one factor (PCI) was significant at the level of p<0.05. While perceived timeliness of information access (PTIA) and perception of library as place (PLP) were identified as insignificant in determining the intention to use library services, perceived personal control (PPC) had the most influence for its largest Beta value (β=0.369). The rank of the factors was based on the absolute value of Beta, which indicates relative importance among the antecedent factors.

Based on the results of multiple regression analysis, a new evaluation framework of library services is proposed in Figure 4. The biggest differences from the original conceptual framework (see Figure 3) are that the perception of library as place was removed, and perceived access to information was replaced by perceived comprehensiveness of information. The relative strengths of factors are also indicated by the thicknesses of arrows and Beta (β) value. Perceived personal control had the

maximum strength, perceived affect of service had the medium, and perceived comprehensiveness of information had the minimum.

Figure 4. Modified Evaluation Framework of Library Services (Note: thickness of arrow represents the effect strength of each factor)

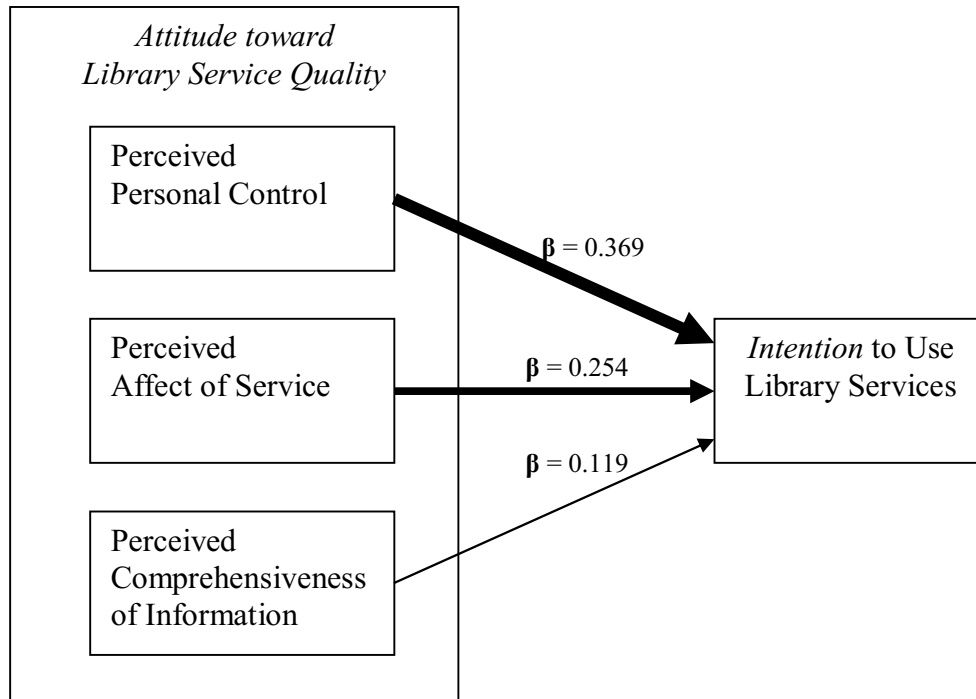


Figure 5. Modified Evaluation Framework of Library Services (Note: thickness of arrow represents the effect strength of each factor)

5. Discussions and Conclusions

While LibQUAL+™ is in the headlines of many articles focusing on library service evaluations, little research has been conducted to study the adoption of library services. It remains unclear whether the factors of LibQUAL+™ have any effect on its adoption. A framework was proposed to extract factors affecting the adoption of library services. The factors were empirically examined via data collection from a web-based questionnaire survey with college students in the United States. The findings lead to the following conclusions and a number of implications for research and practice.

Findings show that the intention to use library services is explained by attitude toward library service quality. The attitudinal factors that are significant are (1) perceived personal control, (2) perceived affect of service, and (3) perceived comprehensiveness of information. The relative importance among the factors is also represented by the numbered sequence. However, perceived timeliness of information access and the perception of library as place do not have a significant effect on the intention.

This study found a positive effect of perceived personal control on the intention to use library services, and this effect was the strongest of those examined. Perceived personal control refers to the extent to which users are able to navigate and control the information with ease and convenience through using modern equipment such as information and communication technologies. The result is consistent with

Thompson and others' (2002) study, which extracted the personal control factor as one of important criteria for measuring library service quality, although their study did not consider the adoption behavior. Considering that most items of this factor are related to library websites, electronic resources, access tools, and modern equipment, library users tend to perceive digital library functions as the most important factor in deciding whether they would adopt the library services or not. Therefore, the findings suggest that the more digital library functions users perceive, the more likely it is that users intend to use the library services.

Another attitudinal factor, perceived affect of service, also had positive effect on the intention to use library services. This effect was the second strongest among the three. Perceived affect of service refers to the extent of users' perceived expectations for the delivery of respectful and caring library service through the library staff members' informed and courteous manners. Given that most of this factor's items are closely related to library staff's service manners, human influences should not be underestimated in providing effective library services to users. The importance of staffs' manners has consistently appeared in studies examining LibQUAL+TM (e.g., Cook & Heath, 2001; Cook & Thompson, 2001; Thompson et al., 2002). Thus, it can be concluded that the more positively users perceive library staff's manners, the more likely it is that users intend to use the library services.

Perceived comprehensiveness of information means the extent to which users perceive complete runs of library collections. This factor was identified as having the least effect strength among the three. Given the fact that a library's large collection is a typical advantage of a research library, this factor represents the degree of perceived capacity of library information. As expected, this factor has a significant effect on the intention to use library services ($p < 0.05$). Prior studies on LibQUAL+TM also identified similar factors. For example, Cook and Heath (2001) qualitatively identified comprehensive collections as a key measurement for library service quality. Similarly, Cook and Thompson (2001) and Thompson and others (2002) included comprehensiveness into the concept of "access to information" (or access to collection). This study went further than previous studies showing that this factor has a relationship with user adoption of library services. Thus, the more comprehensiveness of information that users perceive, the more likely it is that users intend to use the library services.

The results show that the effect of the perception of library as place on the intention to use library services is not significant ($p = 0.219 > 0.05$). This result is in contrast with the assumptions of earlier studies on LibQUAL+TM. While earlier studies found that this factor is an important criterion for evaluating library service quality, no significant causal relationship between this factor and the adoption of library services was drawn. A possible reason may be that, due to easy access to digital information, users no longer use library services only because the library has a meditative and contemplative environment. In other words, while this environmental factor may influence positively on user perception of library service quality, it may not be enough for them to adopt library service.

With regard to perceived timeliness of information access, users do not consider this factor significant when adopting library services ($p = 0.078 > 0.05$). Given that items of this factor were timely delivery of information and convenient business hours, this factor is more related to the operations of physical libraries. Widespread digital library use may hinder users from perceiving benefits in adopting library services. Consequently, users may take the digital access to information for granted

and not assume the timeliness as an antecedent condition that affects their intentions to adopt library services.

As noted in the above discussions, three significant factors (perceived personal control, perceived affect of service, and perceived comprehensiveness of information) imply the effects of technology, the human aspect, and information respectively. Technology is represented by the digital library functions of perceived personal control factor; the human aspect is the library staff's informed and courteous manners of perceived affect of service; and information is the perception of library collection's comprehensiveness of information. Interestingly, these are three important dimensions that organizations are pursuing (Scott, 1992). In this sense, this study provides further evidence regarding the appropriateness of the findings of this study in an organizational setting. Given that a library itself is an organization, library services can be evaluated in the perspectives of organization. Further study may focus on this topic.

One of the most striking implications of the research is that the scales of LibQUAL+™ need improvement despite its popularity in both research and practice. It should consider the user adoption of library services as the significant factors that were found to be different from the factors of LibQUAL+™. Not all factors of LibQUAL+™ facilitate user adoption of library services. Only three factors facilitated the adoption in this study.

This study also extends the research on library service evaluation. In the past, most research on library service evaluation focused on the scales of LibQUAL+™, and other such studies used qualitative or descriptive methods. However, many areas in library service evaluation remained almost untouched, such as user adoptions and their behaviors. Furthermore, reliable and valid scales for these behaviors have not received significant attention in academia. This study provides a new evaluation framework by applying adoption behaviors.

This study applied the theory of planned behavior in the area of library service evaluation. As explained earlier, the relationship between attitude and intention provides a well-established framework for investigating the relationship between the factors of LibQUAL+™ and user adoption of library services. Considering the paucity of theory use in previous information science research (Pettigrew & McKechnie, 2001), this study contributes to developing a new but more rigorous research trend.

The findings of this study also offer advice for library practice. For example, in evaluating and improving library services, libraries should invest more on digital library functions and digital collections rather than on physical library environments. Educating library staff could be highlighted to provide more careful and user-centered services. Applying marketing functions such as customer relationship management would be an alternative option for future implication.

This study has two limitations. One is that this is a cross-sectional study. The main results came from the responses obtained during a relatively short period of time. This approach may not be able to capture the whole picture of user perceptions. The use of a web-based survey may also limit the respondents to Internet users. Thus, the results may not be generalizable to non-Internet users. Another methodological limitation stems from the nature of survey research. Survey technique has limitations involving human recall. It depends on respondents' self-reports. Consequently, respondents tend to rely on their memory to present their beliefs and behaviors.

The other limitation is that the main results explained 36.2% of total variance. The rest may be explained by other types of factors such as policy issues and

interpersonal relationships. It was originally understood that including these factors would strengthen the content of the model; however, the scope of this study was narrowed down to factors of LibQUAL+™ in order to examine the appropriateness of this popular scale. In this sense, this limitation can also be understood as a contribution. This relatively low variance indicates that LibQUAL+™ scale needs further improvement by including more contextual factors.

6. Directions for Future Study

Future study is closely related to the limitations of this study. First, longitudinal evidence is necessary to understand better the influence of the factors. Such research would allow a more specific identification of factors and of their effects across time. Second, this study used a sample that was restricted to those residing in the United States and could speak English. Further research should obtain a more comprehensive sample of scientists in order to enhance the generalization of results. Finally, future studies need to consider the effects of social and contextual factors such as interpersonal relationships and policy issues. Including these factors may provide a broader picture of the phenomenon and thus increase the explanatory variance.

Appendix I. Results of the First Round Factor Analysis

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
PAS7	0.874	0.174	0.005	0.021	0.038	-0.039
PAS9	0.867	0.136	0.126	-0.020	-0.028	-0.003
PAS5	0.850	0.221	0.061	-0.035	0.090	0.048
PAS6	0.820	0.212	0.078	-0.010	0.126	0.034
PAS2	0.818	0.126	0.018	-0.065	0.016	0.056
PAS1	0.777	0.215	0.083	-0.083	-0.060	0.212
PAS3	0.730	0.072	0.141	0.142	0.074	0.037
PAS4	0.721	0.155	0.133	-0.061	-0.041	0.051
PAS8	0.718	0.240	0.029	0.045	0.150	-0.098
PLP3	0.249	0.892	0.076	0.054	0.052	0.044
PLP1	0.192	0.888	0.142	0.021	0.014	0.103
PLP2	0.192	0.869	0.095	0.058	-0.004	0.121
PLP4	0.304	0.849	-0.002	0.010	0.066	-0.015
PLP5	0.285	0.801	0.009	0.039	0.118	-0.041
PPC5	0.104	0.113	0.881	-0.016	0.040	0.062
PPC3	0.073	0.074	0.840	0.132	0.031	0.188
PPC2	0.025	-0.123	0.770	-0.028	0.104	-0.375
PPC4	0.305	0.175	0.730	0.040	-0.146	0.205
PPC1	0.067	0.103	0.646	0.000	0.299	0.398
PAI2	-0.008	-0.028	0.114	0.871	0.095	0.038
PAI3	-0.057	0.138	0.103	0.744	-0.034	-0.301
PAI1	0.004	0.055	-0.129	0.718	0.131	0.313
PAI5	0.090	0.188	-0.077	0.014	0.836	0.131
PAI4	0.100	-0.024	0.285	0.193	0.715	-0.111
PPC6	0.111	0.114	0.326	0.034	0.017	0.714
<i>Eigenvalues</i>	8.281	3.164	2.675	1.894	1.230	1.052
<i>% of Variance</i>	33.123	12.657	10.701	7.577	4.920	4.208
<i>Cumulative %</i>	33.123	45.780	56.481	64.058	68.978	73.186

Extraction Method: Principal Component Analysis
 Rotation Method: Varimax with Kaiser Normalization

Appendix II. Results of the Second Round Factor Analysis

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
PAS7	0.873	0.168	0.002	0.022	0.036
PAS9	0.867	0.132	0.121	-0.020	-0.031
PAS5	0.851	0.221	0.064	-0.034	0.092
PAS6	0.821	0.210	0.075	-0.008	0.127
PAS2	0.818	0.130	0.027	-0.068	0.021
PAS1	0.779	0.232	0.108	-0.089	-0.044
PAS3	0.728	0.074	0.155	0.138	0.075
PAS4	0.720	0.159	0.144	-0.063	-0.038
PAS8	0.718	0.227	0.016	0.050	0.142
PLP1	0.194	0.892	0.144	0.030	0.017
PLP3	0.251	0.891	0.076	0.063	0.053
PLP2	0.194	0.875	0.102	0.065	0.002
PLP4	0.304	0.845	-0.002	0.019	0.066
PLP5	0.286	0.792	-0.002	0.051	0.114
PPC5	0.102	0.115	0.882	-0.014	0.024
PPC3	0.072	0.088	0.861	0.129	0.025
PPC4	0.303	0.193	0.758	0.035	-0.146
PPC2	0.020	-0.158	0.724	-0.017	0.056
PPC1	0.067	0.136	0.696	-0.007	0.313
PAI2	-0.006	-0.034	0.122	0.870	0.092
PAI3	-0.055	0.101	0.057	0.755	-0.063
PAI1	0.008	0.078	-0.081	0.709	0.156
PAI5	0.088	0.196	-0.039	0.015	0.846
PAI4	0.100	-0.044	0.270	0.202	0.696
<i>Eigenvalues</i>	<i>8.192</i>	<i>3.060</i>	<i>2.675</i>	<i>1.887</i>	<i>1.230</i>
<i>% of Variance</i>	<i>34.134</i>	<i>12.748</i>	<i>11.145</i>	<i>7.863</i>	<i>5.125</i>
<i>Cumulative %</i>	<i>34.134</i>	<i>46.882</i>	<i>58.027</i>	<i>65.890</i>	<i>71.015</i>

Extraction Method: Principal Component Analysis
 Rotation Method: Varimax with Kaiser Normalization
 Note: PPC6 were eliminated in this analysis

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