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RUNNING HEAD: Library Service Quality Data Integrity

Does Using Item Sampling Methods in Library Service Quality Assessment Compromise Data Integrity?: A LibQUAL+® Lite Study

Bruce Thompson

Texas A&M University and Baylor College of Medicine

Martha Kyrillidou

Association of Research Libraries

Colleen Cook

Texas A&M University

Bruce Thompson is distinguished professor of educational psychology and CEHD distinguished research fellow, and distinguished professor of library science, Texas A&M University, College Station, TX, and adjunct professor of allied health sciences, Baylor College of Medicine, Houston, TX. He may be contacted via e-mail at: bruce-thompson@tamu.edu.

Martha Kyrillidou is director of statistics and service quality programs at the Association of Research Libraries, Washington, DC. She may be contacted at: martha@arl.org.

Colleen Cook is dean of libraries and holder of the Sterling C. Evans Chair, Texas A&M University, College Station, TX. She may be contacted at: ccook@tamu.edu.

Paper presented at the 2nd Qualitative and Quantitative Methods in Libraries (QQML 2010) International Conference, Chania (Crete), Greece, May 25-28, 2010.

Does Using Item Sampling Methods in Library Service Quality Assessment Compromise Data Integrity?: A LibQUAL+® Lite Study

Abstract

The present study was conducted to investigate the psychometric integrity of scores on the new LibQUAL+® Lite protocol. Specifically, we conducted analyses of LibQUAL+® Lite data to evaluate (a) the reliability and (b) the validity of LibQUAL+® Lite scores. In the present study we collected randomized control trial (RCT) data at 16 diverse institutions from around the world. A total of 13,383 participants provided data.

KEYWORDS; item sampling, library service quality, reliability, validity, factor analysis

As Rowena Cullen (2001) noted, "focusing more energy on meeting... [library] customers' expectations" (p. 663) is critical in the contemporary environment, in part because

> the emergence of the virtual university, supported by the virtual library, calls into question many of our basic assumptions about the role of the academic library, and the security of its future. (pp. 662-663)

In this environment, as Danuta Nitecki (1996) has observed, "A measure of library quality based solely on collections [counts] has become obsolete" (p. 181).

The LibQUAL+® protocol is a "total market survey" intended to help library staff understand user perceptions, and thereby improve library service quality and better meet users' information needs. A total-market survey is one of the 11 ways of listening to users elaborated by Leonard Berry (1995).

To date, LibQUAL+® has been used to collect service quality assessment perceptions from 1,294,674 participants at 1,164 institutions around the world. LibQUAL+® has been implemented so far in 17 language variations: American English, Afrikaans, British English, French (France), Chinese, Danish, Dutch, Finnish, French Canadian, German, Greek, Hebrew, Japanese, Norwegian, Spanish, Swedish, and Welsh.

Thompson (2007) described the origins of the LibQUAL+® protocol. The development of the protocol, and evidence for the integrity of LibQUAL+® scores, have both been quite extensively documented in the refereed journal literature (cf. Cook, Heath & B. Thompson, 2001, 2002; Cook & Thompson, 2001; Heath, Cook, Kyrillidou & Thompson, 2002; Thompson & Cook, 2002; Thompson, Cook & Heath, 2001, 2003; Thompson, Cook & Kyrillidou, 2005; Thompson, Cook & R.L. Thompson, 2002) and elsewhere in two dissertations (Cook, 2002; Kyrillidou, 2009).

LibQUAL+® was developed within a philosophy perhaps best communicated by a set of three quotations. First, in the words of French philosopher and moralist François de La Rochefoucauld (1613-1680), "Il est plus nécessaire d'étudier les hommes que les livres" (p. 51, line 106). Second, in the words of Bruce Thompson (2006), "We only care about the things we measure" (p. 1), so we do not seriously care about service quality unless we listen to library users in various systematic ways. Third, within a service quality orientation, "only customers judge quality; all other judgments are essentially irrelevant" (Zeithaml, Parasuraman & Berry, 1990, p. 16).

Item Sampling

When we collect library service quality assessment perception data from our users, we ought to take into account the overall cost of the information we collect. Two fundamental considerations bear upon this accounting.

First, a major cost in surveying users about their perceptions is the time that users invest in completing the survey. For example, if all 43,000 students at Texas A&M University spent 10 minutes completing a service quality survey, a total of approximately 7,167 person hours were spent producing the

assessment information! Obviously, a common way to mitigate these costs is to not collect data from all library users, but rather do so only for a random sample of the users. Every quadrennial election in the United States, national polling organizations gather data from only 2,000 or 3,000 potential voters to discern with surprising accuracy what the likely presidential election outcome for all 133,000,000 voters may be. Clearly, such person sampling methods have great potential utility.

Second, we can minimize these costs by using fewer items in our assessment protocols, which thereby shortens response times. An important incidental benefit of shorter response times is higher response rates (Cook, Heath & R.L. Thompson, 2000).

Item sampling (also known as split-questionnaire design, and matrix sampling; Popham, 1993) is an assessment technique in which "a) all users answer a few, selected survey questions (i.e., three core items), but (b) the remaining survey questions are answered ONLY by a randomly-selected subsample of the users. Thus, (a) data are collected on all questions, but (b) each user answers fewer questions, thus shortening the required response time" (Thompson, Kyrillidou & Cook, 2009b, p. 8).

Gonzalez and Eltinge (2007) provided an overview of the origins of item sampling, and the fields where it has been applied. For example, item sampling has been applied in the context of the Consumer Expenditure Quarterly Interview Survey (CEQ), an ongoing panel survey of spending within U.S. households. Item sampling has also been used in the 2000 Decennial Census, within Internal Revenue Service (IRS) applications in the 1980s, and in the 1995 Cancer Risk Behavior Survey.

An heuristic example may be useful in making the idea of item sampling (Childs & Jaciw, 2003) fully concrete. Presume that a library service quality assessment instrument had 6 items, with 2 items measuring each of 3 subscales (i.e., Affect of Service [AS], Information Control [IC], and Library as Place [LP]), but that rather than ask all 7 library users to answer all 6 items, each user completed only a subset of items. Note that in real situations we normally would have more than 6 items if we were invoking item sampling, because with only 6 items we might just as well collect data from all 7 users on all 6 items.

In our example, all 7 users are asked to complete 3 of the items, called linking items, one from each of the 3 subscales, because these 3 items are deemed the most important of all the survey items (i.e., LP01, AS02, and IC04). Each of the 7 library users is also asked to complete 2 items randomly selected from among the remaining 3 items (i.e., 6 - 3 linking items). In this manner, each user completes exactly 5 items, but data are collected on every item (here 6).

In the example below, Carol completed only items LP01, AS02 LP03, IC04, and IC06. Shawn completed the same 5 items as Carol. Deborah completed only items LP01, AS02, IC04, AS05, and IC06. Everyone completed linking items LP01, AS02, and IC04.

User	Survey Items						Total Items
	LP01	**AS02**	LP03	**IC04**	AS05	IC06	
Carol	**X**	**X**	X	**X**		X	5
Deborah	**X**	**X**		**X**	X	X	5
Geri	**X**	**X**	X	**X**	X		5
Kathy	**X**	**X**	X	**X**		X	5
Murray	**X**	**X**		**X**	X	X	5
Wendy	**X**	**X**	X	**X**	X		5
Shawn	**X**	**X**	X	**X**		X	5
n	7	7	5	7	4	5	

LibQUAL+® Lite

The LibQUAL+® Lite protocol is a form of the LibQUAL+® protocol on which each participant completes only 8 of the 22 core items. This results in dramatically shorter survey completion times, and also improved survey response rates (see Kyrillidou, 2009; Thompson, Kyrillidou & Cook, 2009a; 2009b).

Three linking items are completed by all Lite participants (i.e., item 13 of the 22 core items, which is an item from the Affect of Service subscale [AS13]; item 10, which is an item from the Information Control subscale [IC10]; and item 3, which is an item from the Library as Place subscale [LP03]). Each Lite participant also completes 5 additional items randomly selected from the remaining 19 LibQUAL+® core nonlinking items (i.e., 22 - 3 = 19). Specifically, each Lite participant also completes 2 items randomly selected from the remaining 8 Affect of Service nonlinking items (i.e., 9 - 1 = 8), 2 other items randomly selected from the remaining 7 Information Control nonlinking items (i.e., 8 - 1 = 7), and 1 item from the remaining 4 Library as Place nonlinking items (i.e., 5 - 1 = 4).

Purpose of the Present Study

The psychometreic integrity of scores from the original LibQUAL+® long-form protocol has been thoroughly investigated (cf. Cook & Thompson, 2001; Thompson & Cook, 2002; Thompson, Cook & Heath, 2001, 2003; Thompson, Cook & R.L. Thompson, 2002). The present study was conducted to investigate the psychometric integrity of scores on the new LibQUAL+® Lite protocol. Specifically, we conducted analyses of LibQUAL+® Lite data to evaluate (a) the reliability and (b) the validity of LibQUAL+® Lite scores.

Participants

In the present study we collected randomized control trial (RCT) data at 16 diverse institutions from around the world. LibQUAL+® was administered in several different languages (e.g., English, Hebrew) across these 16 institutions. A total of 13,383 participants provided data. The study participants included (a) undergraduate students (64.0%), (b) graduate students (26.4%), and (c) faculty (9.8%). The average number of participants from whom data were collected at each of the 16 libraries was 836.4, with the institutional sample sizes ranging from 251 to 2,536.

Each library randomly selected the participants to whom they

sent invitations to participate, and then each user who responded was randomly assigned to receive either the full LibQUAL+® protocol, or the LibQUAL+® Lite protocol. The personnel at each library selected what percentage of participants would receive Lite, and these percentages ranged from 50% to 90%.

Results

Score Reliability

Thompson (2003) explained the concept of score reliability using the methaphor of a bathroom scale, noting that

> many of us begin our day by stepping on a scale to measure our weight. Some days when you step on your bathroom scale you may not be happy with the resulting score. On some of these occasions, you may decide to step off the scale and immediately step back on to obtain another estimate. If the second score is half a pound lighter, you may irrationally feel somewhat happier, or if the second score is slightly higher than the first, you may feel somewhat less happy. But if your second weight measurement yields a score 25 pounds lighter than the initial measurement, rather than feeling happy, you may instead feel puzzled or perplexed. If you then measure your weight a third time, and the resulting score is 40 pounds heavier, you probably will question the integrity of <u>all</u> the scores produced by your scale. It has begun to appear that your scale is exclusively producing randomly fluctuating scores. In essence, your scale measures "nothing." (p. 4)

Scores are (perfectly) unreliable when the scores measure nothing (i.e., fluctuate randomly). Unreliable scores are useful in casinos, or when we want to randomly select survey participants. But perfectly unreliable measurement of library user service quality perceptions would be perfectly useless, because randomly fluctuating scores cannot reasonably be considered to measure the library reality. If we ask library user Martha to rate the Oxford University Bodleian Library at 10am on April 11, 2010 using a 9-point scale, and she rates the library 7, and we ask her to repeat the rating at 10:01am, we reasonably expect her second rating to be 7, or approximately 7, because we cannot conceive that the Bodleian Library has changed appreciably within only one minute.

The APA Task Force on Statistical Inference emphasized that

> It is important to remember that a test is not reliable or unreliable. Reliability is a property of the scores on a test for a particular population of examinees... Thus, authors should provide reliability coefficients of the scores for the data being analyzed even when the focus of their research is not psychometric. Interpreting the size of observed effects requires an assessment of the reliability of the scores. (Wilkinson & APA Task Force on Statistical Inference, 1999, p. 596)

Similarly, the Joint Committee on Standards for Educational Evaluation (1994), which developed the first standards for professional conduct that were ever certified as American standards by the American National Standards Institute (ANSI), emphasized that, "the generalizability of previous favorable reliability results may not be simply assumed. Reliability information should be collected that is directly relevant to the groups and ways in which the information gathering procedures will be used..." (p. 154).

Table 1 presents the Cronbach's (1951) alpha coefficients for both LibQUAL+® Lite and long-form total and subscale scores. These coefficients approach 1.0 as the items have greater internal consistency (see Thompson, 2003). If scores were unreliable, the alpha coefficient would be near-zero. However, although alpha is in a squared metric, alpha can also be negative, or can even be less than -1.0, which would be especially troubling as results.

INSERT TABLE 1 ABOUT HERE

Item analysis can also be employed to investigate the performance of individual items (see Thompson & Levitov, 1985). Table 2 presents item-analysis statistics for the LibQUAL+® Lite data. Alpha-if-deleted statistics are one key indicator of item quality. An item that is performing badly is an item for which the alpha coefficient improves when the item is discarded from the total score. Conversely, the best item is the item for which the alpha coefficient most worsens when the item is discarded.

INSERT TABLE 2 ABOUT HERE

Table 2 also presents the "corrected" item-total correlation coefficients, also called corrected item discrimination coefficients. These are correlations between scores on an individual item, each in turn, with a score computed from the remaining LibQUAL+® core items. More favorable corrected discrimination are positive and larger in magnitude.

Score Validity

If scores measure something (as opposed to nothing), then questions of score validity arise. Score validity raises issues as to whether the scores measure the correct something the scores are intended to measure, and only what the scores are intended to measure.

The present study used factor analysis to investigate the validity of LibQUAL+™ Lite scores. Factor analysis and construct validity have long been associated with each other. For example, historically "construct validity has [even] been spoken of as... 'factorial validity'" (Nunnally, 1978, p. 111). Nunnally (1978) emphasized that "factor analysis is intimately involved with questions of validity" (Nunnally, 1978, pp. 112).

Table 3 presents the varimax-rotated pattern/structure coefficients from a principal components analysis of the LibQUAL+® Lite data (see Thompson, 2004). The expected three-factor structure was retrieved for the LibQUAL+® Lite data.

INSERT TABLE 3 ABOUT HERE

Discussion

The tabled results suggest that LibQUAL+® Lite scores have reasonable psychometric integrity. With respect to score reliability, the alpha coefficients for both Lite and long-form scores are very similar (e.g., 0.955 and 0.956, respectively, for Total scores), as reported in Table 1. Scores on the Library as Place subscale have the lowest alpha coefficients (i.e., 0.867 and 0.861, respetively), but this result is expected given that the Library as Place subscale has only 5 items, as opposed to 9 and 8 items, respectively, for the Affect of Service and the Information Control subscales.

The item analysis statistics reported in Table 2 also are favorable. All 22 alpha-if-deleted statistics are smaller than the alpha (i.e., 0.955) for the LibQUAL+® Lite Total scores, indicating that deletion of any item lowers score reliability. And there is no item which, when deleted, improves score reliability.

Finally, the Table 3 results indicate that the factor structure for the LibQUAL+® Lite data is similar to that repeatedly reported for long-form data (e.g., Thompson, Cook & Heath, 2003). Thus, the same three subscales (i.e., Affect of Service, Information Control, and Library as Place) underlie LibQUAL+® Lite responses.

In summary, the present results suggest that at least from a psychometric score-integrity point of view the LibQUAL+® Lite protocol is a reasonable alternative to the original LibQUAL+® long form. LibQUAL+® Lite minimizes the response burden on individual survey participants, lessens overall the amount of person-time costs expended in creating service quality information, and improves response rates, without sacrificing score integrity.

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Table 1
Cronbach's α for LibQUAL+® Lite and Long Form Scores

Score	Long	Lite
Affect of Service	0.939	0.943
Information Control	0.903	0.897
Library as Place	0.861	0.867
Total	0.956	0.955

Table 2
Item Analysis Statistics for LibQUAL+® **Lite** Data

		Item-Total Statistics		
Name	Item	Corrected Discrimination	R^2	α if Deleted
AS01	Employees who instill confidence in users	0.700	0.635	0.952
IC02	Making electronic resources accessible from my home or office	0.635	0.563	0.953
LP03	Library space that inspires study and learning	0.636	0.673	0.953
AS04	Giving users individual attention	0.765	0.794	0.952
IC05	A library Web site enabling me to locate information on my own	0.657	0.605	0.953
AS06	Employees who are consistently courteous	0.723	0.855	0.952
IC07	The printed library materials I need for my work	0.652	0.655	0.953
LP08	Quiet space for individual activities	0.594	0.693	0.954
AS09	Readiness to respond to users' questions	0.765	0.818	0.952
IC10	The electronic information resources I need	0.642	0.557	0.953
AS11	Employees who have the knowledge to answer user questions	0.709	0.750	0.952
LP12	A comfortable and inviting location	0.636	0.538	0.953
AS13	Employees who deal with users in a caring fashion	0.718	0.685	0.952
IC14	Modern equipment that lets me easily access needed information	0.708	0.642	0.952
AS15	Employees who understand the needs of their users	0.777	0.878	0.952
IC16	Easy-to-use access tools that allow me to find things on my own	0.665	0.727	0.953
LP17	A getaway for study, learning, or research	0.675	0.689	0.953
AS18	Willingness to help users	0.753	0.858	0.952
IC19	Making information easily accessible for independent	0.671	0.676	0.953

	use			
IC20	Print and/or electronic journal collections I require for my work	0.668	0.564	0.953
LP21	Community space for group learning and group study	0.645	0.666	0.953
AS22	Dependability in handling users' service problems	0.722	0.724	0.952

Table 3
Varimax-rotated Pattern/Structure Coefficients for LibQUAL+® **Lite** Data

Name	Item	Factor I	Factor II	Factor III	h^2
AS13	Employees who deal with users in a caring fashion	0.805	0.237	0.200	74.4%
AS18	Willingness to help users	0.801	0.255	0.246	76.7%
AS06	Employees who are consistently courteous	0.796	0.215	0.246	74.1%
AS09	Readiness to respond to users' questions	0.733	0.345	0.250	71.9%
AS11	Employees who have the knowledge to answer user questions	0.725	0.350	0.156	67.3%
AS15	Employees who understand the needs of their users	0.714	0.305	0.338	71.8%
AS04	Giving users individual attention	0.710	0.309	0.324	70.4%
AS01	Employees who instill confidence in users	0.684	0.328	0.212	62.0%
AS22	Dependability in handling users' service problems	0.592	0.452	0.222	60.5%
IC10	The electronic information resources I need	0.234	0.746	0.188	64.6%
IC16	Easy-to-use access tools that allow me to find things on my own	0.264	0.701	0.246	62.1%
IC20	Print and/or electronic journal collections I require for my work	0.281	0.691	0.237	61.2%
IC05	A library Web site enabling me to locate information on my own	0.340	0.682	0.156	60.5%
IC19	Making information easily accessible for independent use	0.358	0.641	0.208	58.2%
IC02	Making electronic resources accessible from my home or office	0.283	0.637	0.237	54.2%
IC14	Modern equipment that lets me easily access needed information	0.259	0.567	0.481	62.0%
IC07	The printed library materials I need for my work	0.269	0.561	0.372	52.6%
LP03	Library space that inspires study and learning	0.174	0.227	0.840	78.7%

LP08	Quiet space for individual activities	0.242	0.163	0.753	65.2%
LP17	A getaway for study, learning, or research	0.273	0.276	0.734	68.9%
LP12	A comfortable and inviting location	0.337	0.222	0.647	58.0%
LP21	Community space for group learning and group study	0.225	0.368	0.637	59.2%

Note. Pattern/structure coefficients greater than |0.4| are presented in italics.

APPENDIX A:
Pearson r Matrices for Lite (Bottom Triangle) and Long (Top Triangle) Protocols

	AS01	IC02	LP03	AS04	IC05	AS06	IC07	LP08	AS09	IC10	AS11	LP12	AS13	IC14	AS15	IC16	LP17	AS18	IC19	IC20	LP21	AS22
AS01		.403	.540	.391	.412	.499	.422	.342	.511	.384	.472	.408	.502	.390	.491	.392	.352	.501	.388	.370	.341	.477
IC02	.437		.342	.528	.345	.388	.419	.309	.434	.554	.437	.334	.391	.462	.409	.491	.325	.386	.475	.485	.252	.403
LP03	.370	.367		.416	.402	.472	.422	.374	.538	.365	.478	.404	.523	.371	.516	.372	.350	.516	.384	.364	.373	.473
AS04	.605	.436	.455		.378	.447	.460	.328	.476	.551	.484	.381	.451	.535	.479	.568	.353	.456	.542	.523	.281	.492
IC05	.492	.523	.350	.466		.391	.446	.584	.419	.350	.411	.511	.401	.392	.381	.370	.539	.389	.366	.345	.465	.393
AS06	.543	.418	.400	.696	.489		.517	.401	.602	.449	.581	.460	.604	.494	.549	.490	.390	.578	.468	.443	.367	.554
IC07	.476	.514	.458	.498	.436	.372		.437	.527	.516	.526	.454	.495	.506	.505	.517	.453	.497	.511	.519	.384	.504
LP08	.411	.344	.652	.469	.341	.367	.402		.472	.376	.427	.526	.412	.414	.386	.389	.599	.401	.369	.362	.505	.420
AS09	.647	.514	.442	.673	.534	.621	.447	.450		.540	.649	.492	.622	.532	.621	.539	.434	.629	.523	.514	.408	.597
IC10	.397	.546	.417	.483	.524	.423	.487	.322	.474		.559	.425	.489	.584	.524	.602	.410	.493	.591	.614	.327	.524
AS11	.615	.444	.357	.571	.490	.668	.500	.368	.740	.456		.534	.638	.593	.639	.573	.482	.636	.582	.537	.407	.634
LP12	.442	.389	.628	.516	.445	.462	.411	.459	.502	.378	.403		.555	.524	.508	.460	.576	.500	.462	.423	.514	.507
AS13	.623	.437	.390	.672	.459	.749	.434	.371	.674	.431	.648	.437		.579	.702	.524	.470	.709	.536	.492	.440	.616
IC14	.426	.518	.503	.534	.516	.487	.557	.468	.510	.581	.503	.508	.461		.606	.646	.500	.567	.617	.570	.422	.588
AS15	.604	.462	.432	.667	.482	.760	.539	.497	.704	.459	.633	.496	.676	.498		.602	.470	.695	.585	.550	.417	.638
IC16	.511	.450	.410	.524	.566	.435	.454	.317	.444	.518	.469	.447	.428	.565	.512		.485	.555	.690	.632	.386	.585
LP17	.463	.462	.670	.466	.398	.518	.470	.605	.459	.399	.455	.567	.419	.554	.430	.465		.511	.504	.473	.566	.489
AS18	.681	.523	.395	.759	.404	.693	.436	.351	.657	.449	.637	.470	.703	.476	.716	.410	.470		.610	.543	.458	.664
IC19	.493	.479	.411	.490	.520	.505	.461	.388	.564	.535	.417	.354	.460	.497	.520	.648	.425	.525		.663	.409	.612
IC20	.452	.519	.425	.522	.538	.419	.547	.428	.486	.606	.514	.376	.451	.474	.518	.558	.432	.447	.499		.374	.548
LP21	.366	.449	.590	.462	.417	.389	.494	.497	.410	.395	.332	.472	.406	.583	.601	.478	.536	.523	.452	.421		.476
AS22	.588	.434	.407	.609	.619	.569	.478	.440	.628	.490	.592	.428	.588	.439	.506	.488	.466	.667	.562	.498	.447	

Note. The 6 underlined values for the Lite protocol were imputed from the Long data, because no Lite protocol respondents receive these 6 combinations of items.