

RUNNING HEAD: Item Sampling Methods

**Does Using Item Sampling Methods in Library Service Quality
Assessment Affect Score Norms?: A LibQUAL+® Lite Study**

Colleen Cook

Texas A&M University

Bruce Thompson

Texas A&M University and Baylor College of Medicine

Martha Kyrillidou

Association of Research Libraries

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.

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.

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

Abstract

Research has previously been conducted to explore the effects of item sampling strategies in the library service quality assessment context (cf. Kyrillidou, 2009; Thompson, Kyrillidou & Cook, 2009a, 2009b). The present study was undertaken to explore item sampling impacts on the percentile rank norms tables for LibQUAL+®. Ideally, scores across the two protocols would be sufficiently similar that a single set of norms tables could be used for both protocols. 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.

Libraries are increasingly stressing the importance of service quality to users. The Association of Libraries (ARL; 2010) recently undertook a content analysis of profiles in which member libraries described themselves as research institutions in the 21st century. One of the largest recurring themes to emerge from the analysis was the need for assessment from the inauguration of assessment programs within libraries to strategic actions based specifically upon user input. Many libraries are keeping their doors open longer hours, are renovating their spaces to accommodate the diverse learning needs of students from "ninja" quiet spaces to group study spaces equipped with the newest and greatest media equipment for producing presentations. Throughout the library environment there are ongoing discussions to reduce the overall number of service points to make information discovery less complex and provide "one stop shopping."

Libraries are also subscribing to millions of dollars of electronic content in the sure knowledge that convenient access to information is an essential service quality objective in research libraries today. The importance of providing access to content is obvious in recurring dissatisfaction with websites and in the insatiable expression of need for additional journal literature. Libraries continue to grow their assessment programs based upon the need to evaluate programs, gauge the need for new programs and to redirect resources within a rapidly changing library landscape--all with the end of improving service quality to users. LibQUAL+®

An important entry in the toolbox for those attempting to listen systematically to library users' perceptions of their needs is the LibQUAL+® protocol. 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 & 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).

LibQUAL+® Lite

When we collect 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, Kyriallidou & Cook, 2009b, p. 8).

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 the 50 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, Allegra completed only items LP01, AS02

LP03, IC04, and IC06. Peggy completed the same 5 items as Allegra. Anne 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	
Allegra	X	X	X	X		X	5
Anne	X	X		X	X	X	5
Barbara	X	X	X	X	X		5
Camie	X	X	X	X		X	5
Catherine	X	X		X	X	X	5
Mary	X	X	X	X	X		5
Peggy	X	X	X	X		X	5
n	7	7	5	7	4	5	

LibQUAL+® Lite is a survey methodology in which (a) all users answer a few, selected survey questions (i.e., 3 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.

On LibQUAL+® Lite, each participant completes only eight of the 22 core survey items. Every participant completes the same single Service Affect, single Information Control, and single Library as Place items, plus two of the remaining eight (i.e., 9 - the 1 core linking item completed by everyone) randomly-selected Service Affect items, two of the remaining seven (i.e., 8 - the 1 core linking item completed by everyone) randomly-selected Information Control, and one of the remaining four (i.e., 5 - the 1 core linking item completed by everyone) randomly-selected Library as Place items.

Three Service Quality Assessment Interpretation Frameworks

One way to conduct library service quality assessments is to collect survey ratings data from users. Presume that ratings were collected on a 1 to 9 rating scale, with 9 being the most favorable rating of perceived service quality, and that a mean was computed across all the survey items for each user. Then the mean of these means might be computed to be 6.3. Is 6.3 a favorable rating, and if so, how favorable?

One way to interpret the 6.3 is to compare the 6.3 against the rating scale midpoint of 5.0. From this perspective, 6.3 seems like a somewhat favorable rating. However, this basis for interpretation is quite limited.

Three interpretation frameworks can be invoked to help interpret library service quality assessment data. Some service quality assessment protocols actually invoke a combination of these three frameworks, so that library personnel can determine whether different interpretation frameworks corroborate each other with respect to conclusions.

First, service quality data can be interpreted longitudinally at a given library, if the library has administered the protocol previously. For example, with a mean rating of 6.3, the library may offer the interpretation, "6.3 is better than last year's mean

rating of 6.0, and it may not be entirely clear what 6.3 or 6.0 mean, but certainly we are doing better."

Second, service quality data can be interpreted within "zones of tolerance," if on each item the participants were asked to rate not only the current level of perceived service quality, but also on each item the desired level of service quality, and what level of service would be acceptable, although only minimally. The difference between the desired rating and the minimally-acceptable rating is the zone of tolerance.

We prefer mean perceived ratings (e.g., 6.3) to be above minimally-acceptable means (e.g., 5.4). This difference is called the adequacy gap (i.e., $6.3 - 5.4 = 0.9$). We also would like the mean perceived ratings ideally to approach or even exceed the mean desired ratings (e.g., 6.5). The difference between the perceived ratings and the desired ratings is called the superiority gap (e.g., $6.3 - 6.5 = -0.2$). In this example the zone of tolerance has a width of 1.1 (i.e., $6.5 - 5.4 = 1.1$).

Third, service quality data can be interpreted by benchmarking against the results achieved by peer institutions, assuming that one or more peer institutions contemporaneously completed the same protocol, and results are openly shared across libraries. This interpretation framework has the appeal that institutions may also be able to identify libraries with extremely favorable results, and libraries can then share best practices with each other.

Score Norms

An elegant form of benchmarking involves the creation of score norms. As Anastasi (1988) observed,

To say that an individual has correctly solved 15 problems on a mathematical reasoning test, or identified 34 words in a vocabulary test, or successfully assembled a mechanical object in 57 seconds conveys little or no information about... standing on any of these functions. [Thus scores] ...are most commonly interpreted by reference to norms which represent the test performance of the standardization sample. (pp. 71-72)

As Crocker and Algina (1986) explained,

...normative scores provide information about an examinee's performance in comparison to the score distribution of some norm sample or reference group... [T]he meaningfulness of these scores depends on (1) the extent to which the test user is interested in comparing the examinee to the normative population and (2) the adequacy of the norming sample in representing that population. (p. 431)

The development and use of score norms in the LibQUAL+® context has been well documented (cf. Cook, Heath & Thompson, 2002; Thompson, Cook & Kyrillidou, 2006). In particular, for several years score norms tables for converting various LibQUAL+® means into percentile ranks have been published on the web. As Cook, Heath and Thompson (2002) explained,

Percentile ranks indicate the percentage of participants (or institutions, in the case of group norms) scoring less than a given raw score. A percentile rank (i.e., a percentage of *people*) is not the same as a percentage score, which is a percentage of *items* (e.g., percentage of items correct), although the meaning and correct use of percentile ranks can be confusing (cf. Thompson, 1993). (p. 15)

For example, a percentile ranks norms table, such as
<http://www.coe.tamu.edu/~bthompson/libq2002.htm>

or

<http://www.coe.tamu.edu/~bthompson/libq2005.htm>

could be used to help interpret an institution's LibQUAL+® total perception score of 7.4. The norms table might reveal that 63% of all 63,285 LibQUAL+® participants rated their library lower than 7.4. Or other norms tables might indicate that 95% of all institutions participating in the LibQUAL+® survey had mean ratings lower than 7.4.

Purpose of the Present Paper

The present study was conducted as an randomized control trial (RCT) experiment in which participants were randomly assigned to receive (a) all 22 items on a library service quality assessment protocol or (b) a subset of 8 items (i.e., 3 linking items, and 5 items randomly selected for each given user). Theoretically, the ratings of a given library at a given institution should closely approximate each other across participants randomly assigned either the full or the item sampling protocol. Any observed differences would be due solely to the presence or absence of the item sampling protocol.

Research has previously been conducted to explore the effects of item sampling strategies in the library service quality assessment context (cf. Kyrillidou, 2009; Thompson, Kyrillidou & Cook, 2009a, 2009b). However, these previous studies focused on only the perceived service quality scores. The present study was undertaken to explore item sampling impacts on the percentile rank norms tables for LibQUAL+®. Ideally, scores across the two protocols would be sufficiently similar that a single set of norms tables could be used for both protocols.

Participants

In the present study we collected 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

Table 1 presents LibQUAL+® Lite and long form percentile equivalent scores for Perception, Adequacy Gap, and Superiority Gap scores for LibQUAL+® Total and subscale (Affect of Service, Information Control, and Library as Place) scores across percentiles 1 through 99.

INSERT TABLE 1 ABOUT HERE

Figure 1 presents a scattergram of percentile equivalent scores for LibQUAL+® Total Perception scores. Figure 2 presents a scattergram of percentile equivalent scores for LibQUAL+® Total Adequacy Gap scores. Figure 3 presents a scattergram of percentile equivalent scores for LibQUAL+® Total Superiority Gap scores.

INSERT FIGURES 1 THROUGH 3 ABOUT HERE

Discussion

The Table 1 results suggest that the percentile rank equivalents for LibQUAL+® scores are similar across the Lite and the long protocols, with the possible exceptions of the extremes of the distributions. In the extremely low percentile ranks, the Lite scores tended to be somewhat lower than the long scores. In the extremely high percentile ranks, the Lite scores tended to be somewhat higher than the long scores. The results presented in Figures 1 and 3 also suggest reasonable stability of the score norms across the two protocols, because the values plotted in the scattergrams tend to form straight lines.

The results in Figures 1 through 3 also have another very important implication, other than that norms tables for both the LibQUAL+® Lite and long forms are reasonably comparable, and that therefore a single set of norms tables might be used in benchmarking. The second implication of the patterns in the figures is that linear equating, using only additive and multiplicative weights, could be used to equate scores across the two LibQUAL+® protocols, if one desired precision in score comparisons across the two protocols. Several score equating formulas are presented by Kyrillidou (2009) and Thompson, Kyrillidou and Cook (2009a, 2009b).

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22	6.00	6.00	-0.55	-0.44	-1.96	-2.00	6.11	6.33	-0.33	-0.33	-1.67	-1.33	6.25	6.00	-0.67	-0.67	-1.88	-2.00	5.67	5.50	-0.80	-1.00	-2.20	-2.50
23	6.00	6.00	-0.50	-0.43	-1.89	-1.89	6.11	6.33	-0.33	-0.33	-1.62	-1.33	6.25	6.00	-0.62	-0.67	-1.88	-2.00	5.80	5.50	-0.67	-1.00	-2.20	-2.50
24	6.00	6.00	-0.44	-0.33	-1.81	-1.78	6.22	6.33	-0.22	0.00	-1.56	-1.33	6.28	6.00	-0.62	-0.67	-1.88	-2.00	5.80	5.50	-0.60	-0.50	-2.00	-2.00
25	6.00	6.00	-0.37	-0.25	-1.74	-1.75	6.22	6.33	-0.22	0.00	-1.56	-1.33	6.38	6.33	-0.50	-0.33	-1.82	-1.67	5.80	5.50	-0.60	-0.50	-2.00	-2.00
26	6.00	6.00	-0.33	-0.22	-1.67	-1.67	6.33	6.50	-0.22	0.00	-1.44	-1.33	6.38	6.33	-0.50	-0.33	-1.75	-1.67	6.00	5.50	-0.60	-0.50	-2.00	-2.00
27	6.04	6.00	-0.27	-0.14	-1.63	-1.57	6.33	6.67	-0.11	0.00	-1.44	-1.33	6.50	6.33	-0.50	-0.33	-1.75	-1.67	6.00	5.50	-0.40	-0.50	-2.00	-2.00
28	6.10	6.00	-0.22	-0.11	-1.56	-1.56	6.40	6.67	-0.11	0.00	-1.33	-1.00	6.50	6.33	-0.38	-0.33	-1.71	-1.67	6.00	5.50	-0.40	-0.50	-1.80	-2.00
29	6.15	6.00	-0.18	-0.11	-1.52	-1.44	6.44	6.67	-0.11	0.00	-1.33	-1.00	6.50	6.33	-0.38	-0.33	-1.62	-1.67	6.00	6.00	-0.40	-0.50	-1.80	-2.00
30	6.22	6.11	-0.15	0.00	-1.48	-1.43	6.44	6.67	0.00	0.00	-1.25	-1.00	6.57	6.33	-0.38	-0.33	-1.62	-1.67	6.20	6.00	-0.40	-0.50	-1.80	-2.00
31	6.30	6.12	-0.11	0.00	-1.41	-1.33	6.56	6.67	0.00	0.00	-1.22	-1.00	6.62	6.33	-0.28	-0.33	-1.57	-1.67	6.20	6.00	-0.20	0.00	-1.60	-2.00
32	6.35	6.22	-0.07	0.00	-1.37	-1.28	6.56	6.67	0.00	0.00	-1.22	-1.00	6.62	6.50	-0.25	0.00	-1.50	-1.50	6.20	6.00	-0.20	0.00	-1.60	-1.50
33	6.41	6.33	-0.04	0.00	-1.32	-1.22	6.67	7.00	0.00	0.00	-1.12	-1.00	6.67	6.67	-0.25	0.00	-1.50	-1.33	6.20	6.00	-0.20	0.00	-1.60	-1.50
34	6.44	6.38	0.00	0.00	-1.26	-1.14	6.67	7.00	0.00	0.00	-1.11	-1.00	6.75	6.67	-0.25	0.00	-1.50	-1.33	6.40	6.00	-0.20	0.00	-1.60	-1.50
35	6.50	6.44	0.00	0.00	-1.22	-1.11	6.67	7.00	0.00	0.00	-1.11	-1.00	6.75	6.67	-0.12	0.00	-1.38	-1.33	6.40	6.00	-0.20	0.00	-1.50	-1.50
36	6.56	6.50	0.00	0.00	-1.18	-1.00	6.78	7.00	0.00	0.00	-1.00	-1.00	6.75	6.67	-0.12	0.00	-1.38	-1.33	6.40	6.00	0.00	0.00	-1.40	-1.50
37	6.62	6.56	0.00	0.00	-1.14	-1.00	6.78	7.00	0.00	0.00	-1.00	-1.00	6.84	6.67	-0.12	0.00	-1.38	-1.33	6.40	6.00	0.00	0.00	-1.40	-1.50
38	6.67	6.62	0.00	0.00	-1.08	-1.00	6.78	7.00	0.00	0.00	-1.00	-0.67	6.88	6.67	-0.12	0.00	-1.28	-1.33	6.50	6.50	0.00	0.00	-1.40	-1.50
39	6.70	6.67	0.00	0.00	-1.04	-1.00	6.88	7.00	0.00	0.00	-1.00	-0.67	6.88	6.67	0.00	0.00	-1.25	-1.33	6.60	6.50	0.00	0.00	-1.25	-1.50
40	6.76	6.75	0.00	0.00	-1.00	-1.00	6.89	7.00	0.00	0.00	-0.89	-0.67	6.88	7.00	0.00	0.00	-1.25	-1.33	6.60	6.50	0.00	0.00	-1.20	-1.00
41	6.81	6.78	0.00	0.00	-1.00	-1.00	6.89	7.00	0.00	0.00	-0.89	-0.67	7.00	7.00	0.00	0.00	-1.25	-1.33	6.60	6.50	0.00	0.00	-1.20	-1.00
42	6.85	6.88	0.00	0.00	-1.00	-1.00	6.89	7.00	0.00	0.00	-0.89	-0.67	7.00	7.00	0.00	0.00	-1.25	-1.33	6.60	6.50	0.00	0.00	-1.20	-1.00
43	6.89	6.89	0.00	0.00	-1.00	-1.00	7.00	7.00	0.00	0.00	-0.89	-0.67	7.00	7.00	0.00	0.00	-1.14	-1.00	6.60	6.50	0.00	0.00	-1.20	-1.00
44	6.92	7.00	0.00	0.00	-1.00	-1.00	7.00	7.33	0.22	0.33	-0.84	-0.67	7.00	7.00	0.00	0.00	-1.12	-1.00	6.75	6.50	0.00	0.00	-1.20	-1.00
45	6.96	7.00	0.00	0.00	-1.00	-1.00	7.00	7.33	0.22	0.33	-0.78	-0.67	7.00	7.00	0.00	0.00	-1.12	-1.00	6.80	6.50	0.00	0.00	-1.20	-1.00
46	7.00	7.00	0.00	0.00	-1.00	-1.00	7.00	7.33	0.22	0.33	-0.78	-0.67	7.12	7.00	0.00	0.00	-1.12	-1.00	6.80	6.50	0.00	0.00	-1.00	-1.00
47	7.00	7.00	0.04	0.11	-1.00	-1.00	7.11	7.33	0.28	0.33	-0.78	-0.50	7.12	7.00	0.00	0.00	-1.12	-1.00	6.80	6.50	-0.20	0.00	-1.00	-1.00
48	7.00	7.00	0.07	0.20	-1.00	-1.00	7.11	7.33	0.33	0.33	-0.75	-0.33	7.12	7.00	0.00	0.00	-1.00	-1.00	6.80	7.00	0.20	0.00	-1.00	-1.00
49	7.00	7.00	0.11	0.22	-1.00	-1.00	7.11	7.33	0.33	0.33	-0.67	-0.33	7.14	7.00	0.12	0.33	-1.00	-1.00	7.00	7.00	0.20	0.50	-1.00	-1.00
50	7.00	7.00	0.15	0.28	-1.00	-0.89	7.22	7.33	0.44	0.33	-0.62	-0.33	7.25	7.00	0.12	0.33	-1.00	-1.00	7.00	7.00	0.20	0.50	-0.80	-1.00
51	7.00	7.00	0.18	0.33	-0.96	-0.88	7.22	7.50	0.44	0.33	-0.56	-0.33	7.25	7.33	0.14	0.33	-0.88	-1.00	7.00	7.00	0.25	0.50	-0.80	-0.50
52	7.00	7.00	0.25	0.38	-0.92	-0.80	7.22	7.67	0.44	0.50	-0.56	-0.33	7.25	7.33	0.25	0.33	-0.88	-0.67	7.00	7.00	0.40	0.50	-0.80	-0.50
53	7.00	7.00	0.29	0.44	-0.89	-0.78	7.33	7.67	0.50	0.67	-0.56	-0.33	7.25	7.33	0.25	0.33	-0.88	-0.67	7.00	7.00	0.40	0.50	-0.80	-0.50
54	7.00	7.00	0.33	0.50	-0.85	-0.75	7.33	7.67	0.56	0.67	-0.50	-0.33	7.38	7.33	0.25	0.33	-0.86	-0.67	7.00	7.00	0.40	0.50	-0.80	-0.50
55	7.00	7.00	0.37	0.56	-0.81	-0.67	7.33	7.67	0.56	0.67	-0.44	-0.33	7.38	7.33	0.25	0.50	-0.75	-0.67	7.00	7.00	0.40	0.50	-0.67	-0.50
56	7.00	7.00	0.41	0.62	-0.78	-0.67	7.43	7.67	0.62	0.67	-0.44	-0.33	7.38	7.33	0.38	0.67	-0.75	-0.67	7.20	7.00	0.50	0.50	-0.60	-0.50
57	7.00	7.00	0.44	0.67	-0.74	-0.57	7.44	7.67	0.67	0.67	-0.44	0.00	7.38	7.33	0.38	0.67	-0.75	-0.67	7.20	7.00	0.60	0.50	-0.60	-0.50
58	7.04	7.00	0.52	0.75	-0.68	-0.56	7.44	7.67	0.67	0.67	-0.38	0.00	7.43	7.33	0.38	0.67	-0.75	-0.67	7.20	7.00	0.60	0.50	-0.60	-0.50
59	7.07	7.00	0.58	0.78	-0.64	-0.44	7.50	7.67	0.71	0.67	-0.33	0.00	7.50	7.33	0.43	0.67	-0.62	-0.67	7.20	7.00	0.60	1.00	-0.60	-0.50

60	7.11	7.11	0.63	0.88	-0.60	-0.44	7.56	7.67	0.78	0.67	-0.33	0.00	7.50	7.33	0.50	0.67	-0.62	-0.67	7.25	7.00	0.60	1.00	-0.60	-0.50
61	7.15	7.12	0.69	0.89	-0.56	-0.38	7.56	8.00	0.78	1.00	-0.33	0.00	7.50	7.50	0.50	0.67	-0.62	-0.50	7.40	7.50	0.75	1.00	-0.40	0.00
62	7.18	7.22	0.74	1.00	-0.52	-0.33	7.60	8.00	0.80	1.00	-0.25	0.00	7.50	7.67	0.50	0.67	-0.60	-0.33	7.40	7.50	0.80	1.00	-0.40	0.00
63	7.22	7.22	0.80	1.00	-0.48	-0.28	7.67	8.00	0.89	1.00	-0.22	0.00	7.62	7.67	0.62	0.67	-0.50	-0.33	7.40	7.50	0.80	1.00	-0.40	0.00
64	7.27	7.28	0.85	1.00	-0.43	-0.22	7.67	8.00	0.89	1.00	-0.22	0.00	7.62	7.67	0.62	1.00	-0.50	-0.33	7.40	7.50	0.80	1.00	-0.40	0.00
65	7.32	7.33	0.92	1.00	-0.38	-0.22	7.67	8.00	0.89	1.00	-0.22	0.00	7.62	7.67	0.62	1.00	-0.50	-0.33	7.40	7.50	0.80	1.00	-0.40	0.00
66	7.37	7.38	0.96	1.00	-0.33	-0.12	7.75	8.00	1.00	1.00	-0.14	0.00	7.62	7.67	0.75	1.00	-0.50	-0.33	7.60	7.50	1.00	1.00	-0.25	0.00
67	7.41	7.44	1.00	1.00	-0.30	-0.11	7.78	8.00	1.00	1.00	-0.11	0.00	7.71	7.67	0.75	1.00	-0.38	-0.33	7.60	7.50	1.00	1.00	-0.20	0.00
68	7.44	7.44	1.00	1.00	-0.26	0.00	7.78	8.00	1.00	1.00	-0.11	0.00	7.75	7.67	0.75	1.00	-0.38	-0.33	7.60	7.50	1.00	1.00	-0.20	0.00
69	7.50	7.56	1.00	1.00	-0.21	0.00	7.78	8.00	1.11	1.33	-0.11	0.00	7.75	7.67	0.86	1.00	-0.38	-0.33	7.60	7.50	1.00	1.00	-0.20	0.00
70	7.54	7.56	1.00	1.00	-0.17	0.00	7.89	8.00	1.11	1.33	-0.11	0.00	7.75	7.67	0.88	1.00	-0.33	-0.33	7.60	7.50	1.00	1.50	-0.20	0.00
71	7.58	7.62	1.00	1.00	-0.12	0.00	7.89	8.00	1.12	1.33	0.00	0.00	7.83	7.67	0.88	1.00	-0.25	0.00	7.75	7.50	1.20	1.50	-0.20	0.00
72	7.61	7.67	1.00	1.00	-0.08	0.00	7.89	8.00	1.22	1.33	0.00	0.00	7.88	8.00	1.00	1.33	-0.25	0.00	7.80	8.00	1.20	1.50	0.00	0.00
73	7.67	7.75	1.00	1.00	-0.04	0.00	8.00	8.25	1.22	1.33	0.00	0.00	7.88	8.00	1.00	1.33	-0.25	0.00	7.80	8.00	1.20	1.50	0.00	0.00
74	7.72	7.78	1.00	1.11	0.00	0.00	8.00	8.33	1.25	1.33	0.00	0.00	7.88	8.00	1.00	1.33	-0.17	0.00	7.80	8.00	1.25	1.50	0.00	0.00
75	7.77	7.78	1.00	1.22	0.00	0.00	8.00	8.33	1.33	1.33	0.00	0.00	7.88	8.00	1.00	1.33	-0.12	0.00	7.80	8.00	1.40	1.50	0.00	0.00
76	7.81	7.89	1.04	1.25	0.00	0.00	8.00	8.33	1.33	1.67	0.00	0.00	8.00	8.00	1.12	1.33	-0.12	0.00	7.80	8.00	1.40	1.50	0.00	0.00
77	7.85	7.89	1.11	1.33	0.00	0.00	8.11	8.33	1.44	1.67	0.00	0.00	8.00	8.00	1.12	1.33	-0.12	0.00	8.00	8.00	1.40	2.00	0.00	0.00
78	7.89	8.00	1.18	1.44	0.00	0.00	8.11	8.33	1.44	1.67	0.00	0.00	8.00	8.00	1.25	1.50	0.00	0.00	8.00	8.00	1.50	2.00	0.00	0.00
79	7.92	8.00	1.26	1.50	0.00	0.00	8.12	8.33	1.50	1.67	0.00	0.00	8.00	8.00	1.25	1.67	0.00	0.00	8.00	8.00	1.60	2.00	0.00	0.00
80	8.00	8.00	1.33	1.56	0.00	0.00	8.22	8.33	1.56	1.67	0.00	0.00	8.12	8.00	1.33	1.67	0.00	0.00	8.00	8.00	1.60	2.00	0.00	0.00
81	8.00	8.00	1.44	1.67	0.00	0.00	8.22	8.50	1.62	2.00	0.00	0.00	8.12	8.00	1.38	1.67	0.00	0.00	8.00	8.00	1.60	2.00	0.00	0.00
82	8.00	8.00	1.52	1.78	0.00	0.00	8.28	8.67	1.67	2.00	0.11	0.33	8.12	8.33	1.38	1.67	0.00	0.00	8.20	8.00	1.80	2.00	0.00	0.50
83	8.00	8.00	1.64	1.89	0.00	0.00	8.33	8.67	1.78	2.00	0.11	0.33	8.14	8.33	1.50	1.67	0.00	0.00	8.20	8.50	1.80	2.00	0.00	0.50
84	8.00	8.00	1.73	2.00	0.00	0.00	8.33	8.67	1.78	2.00	0.11	0.33	8.25	8.33	1.50	2.00	0.00	0.00	8.20	8.50	2.00	2.00	0.20	0.50
85	8.00	8.00	1.81	2.00	0.00	0.00	8.44	8.67	1.89	2.00	0.17	0.33	8.25	8.33	1.50	2.00	0.00	0.00	8.25	8.50	2.00	2.50	0.20	0.50
86	8.00	8.00	1.92	2.00	0.00	0.00	8.44	8.67	2.00	2.00	0.22	0.33	8.28	8.33	1.62	2.00	0.00	0.00	8.40	8.50	2.00	2.50	0.20	0.50
87	8.04	8.11	2.00	2.00	0.00	0.12	8.50	9.00	2.00	2.33	0.22	0.50	8.38	8.33	1.71	2.00	0.12	0.33	8.40	8.50	2.20	2.50	0.20	0.50
88	8.08	8.11	2.00	2.00	0.04	0.22	8.56	9.00	2.11	2.33	0.33	0.67	8.38	8.33	1.75	2.00	0.12	0.33	8.40	8.50	2.20	2.50	0.20	0.50
89	8.15	8.20	2.00	2.00	0.11	0.33	8.62	9.00	2.17	2.33	0.33	0.67	8.50	8.67	1.88	2.00	0.12	0.33	8.40	8.50	2.25	3.00	0.40	1.00
90	8.19	8.25	2.00	2.11	0.15	0.44	8.67	9.00	2.22	2.67	0.44	0.67	8.50	8.67	2.00	2.33	0.25	0.33	8.60	9.00	2.40	3.00	0.40	1.00
91	8.26	8.33	2.00	2.22	0.22	0.56	8.75	9.00	2.33	2.67	0.49	0.67	8.57	8.67	2.12	2.33	0.25	0.67	8.60	9.00	2.60	3.00	0.60	1.00
92	8.35	8.44	2.15	2.40	0.30	0.67	8.78	9.00	2.50	2.67	0.56	1.00	8.62	8.67	2.25	2.50	0.38	0.67	8.80	9.00	2.60	3.00	0.60	1.50
93	8.45	8.56	2.30	2.56	0.41	0.88	8.84	9.00	2.62	3.00	0.67	1.00	8.75	9.00	2.29	2.67	0.38	0.67	8.80	9.00	2.80	3.50	0.80	1.50
94	8.56	8.67	2.51	2.78	0.54	1.00	8.89	9.00	2.78	3.00	0.78	1.00	8.75	9.00	2.50	2.67	0.50	1.00	9.00	9.00	3.00	3.50	1.00	1.50
95	8.67	8.78	2.77	3.00	0.74	1.00	9.00	9.00	3.00	3.33	0.89	1.33	8.88	9.00	2.62	3.00	0.62	1.00	9.00	9.00	3.09	4.00	1.00	2.00
96	8.78	8.89	3.00	3.00	0.96	1.00	9.00	9.00	3.12	3.33	1.00	1.33	9.00	9.00	2.88	3.00	0.75	1.00	9.00	9.00	3.40	4.00	1.20	2.00
97	8.89	9.00	3.00	3.00	1.00	1.12	9.00	9.00	3.36	3.67	1.12	1.67	9.00	9.00	3.12	3.33	0.88	1.33	9.00	9.00	3.60	4.50	1.60	2.50

98	9.00	9.00	3.44	3.56	1.00	1.56	9.00	9.00	9.00	3.78	4.00	1.44	2.00	9.00	9.00	3.50	3.67	1.12	1.67	9.00	9.00	4.00	4.00	5.00	3.00
99	9.00	9.00	4.00	4.00	1.59	2.00	9.00	9.00	9.00	4.30	5.00	1.89	2.67	9.00	9.00	4.00	4.33	1.59	2.33	9.00	9.00	4.60	5.50	2.40	4.00

Note. "Super. Gap" = Superiority Gap.

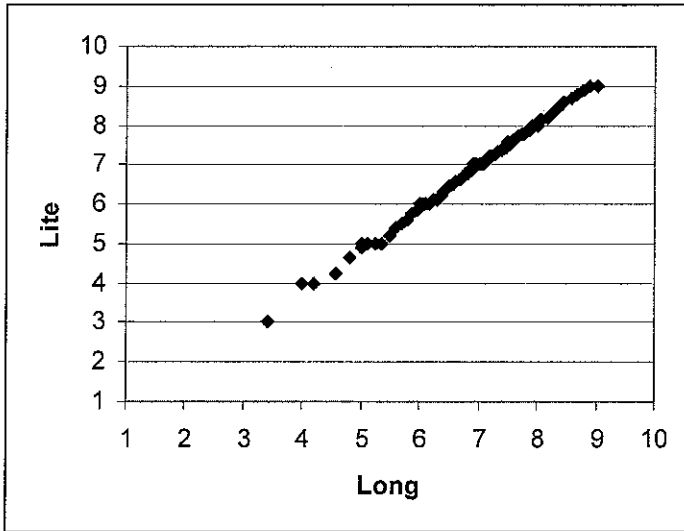


Figure 1.
Scattergram of Percentile Equivalent Scores for **Total Perception LibQUAL+®** Scores

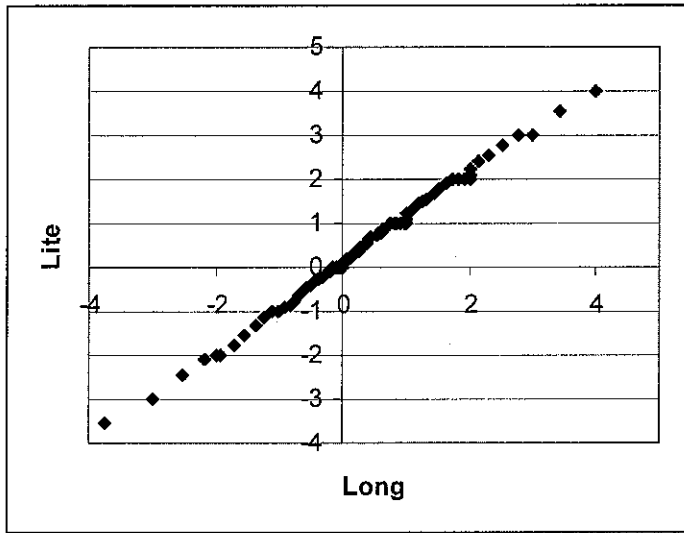


Figure 2.
Scattergram of Percentile Equivalent Scores for **Total Adequacy Gap LibQUAL+®**
Scores

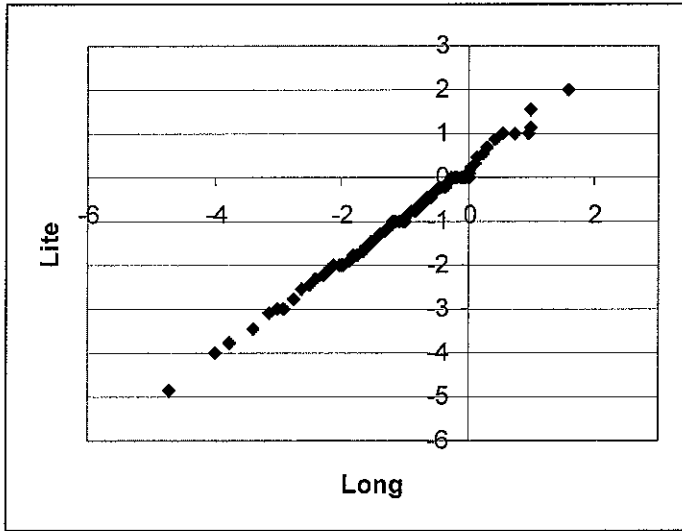


Figure 3.
Scattergram of Percentile Equivalent Scores for **Total Superiority Gap LibQUAL+®**
Scores