


Users' Hierarchical Perspectives on Library Service Quality: A "LibQUAL+" Study

Colleen Cook, Fred Heath, and Bruce Thompson

This study confirms that a single second-order factor is associated with the delivery of high-quality library services in a research university environment. However, a hierarchical factor analysis also demonstrated that research library users simultaneously think about library quality at multiple levels. The LibQUAL+ diagnostic tool, a product of the ARL's New Measures Initiative, shows that although a single factor dominates user thinking about library service quality, all of the items used in the survey suffice this factor. Nevertheless, several first-order factors contribute important unique information to the notion of service quality. As different types of users place varying degrees of importance on the first-order factors, the utility of the hierarchical model is demonstrated.

n the history of many professions, careful research and rigorous design have produced standards of measurement that permit specialist and layman alike to achieve a perspective on performance. In baseball, the most statistically driven of all professional sports, batting average (BA) and earned run average (ERA) provide a benchmarking overview on all batters and pitchers in the history of the game. A .400 batting average is extraordinary; a career ERA below 2.00 will certainly earn the achiever a niche in the Hall of Fame. And although underlying variables contribute to performance measures (bat speed, perhaps, and pitch velocity), those factors are not part of the common

baseball parlance. BA and ERA suffice as measures of excellence in the sport.

Human health also has its overarching higher-order measures. Since Stephen Hale's publication in 1733, blood pressure measurement has been a fundamental indicator of human health. Although methods have improved in the aftermath of Hale's rather invasive methods of measurement, pressure scores expressed as millimeters of mercury have become recognizable standards. A score of 120/70 expresses a desirable human condition the world over. Conversely, a score of 190/100 would be a measurement of considerable concern, although the search for causal factors could span a broad spectrum of possible contributors.¹ As is the case with

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baseball, many underlying lower-order health factors may contribute to an individual's blood pressure reading, but from a health maintenance view, the single higher-order factor often serves as a decision point as to whether more serious intervention may be required.

One plausible model of user perceptions of library service quality posits that users may *simultaneously* think about quality at multiple levels within a hierarchical model.

Just as scientific measurement is used to benchmark observable phenomena such as batting averages and blood pressures, careful statistical procedures are utilized to measure and rank based on passive human activities such as "watching" or as imprecise a precept as "perceiving." For example, Nielsen Media Research, through a process refined over half a century, determines the rankings of television programs in the United States based on the viewing habits of only thirteen thousand people in only five thousands households. This, in a nation in which ninety-nine million households have television sets!² Similarly, in the state of Texas, consumers are asked by the Office of Public Insurance Counsel to rate health maintenance organizations (HMOs) on specific areas of care and physician services as well as to provide an overall ranking. Those perceptions of consumers are analyzed to create a report card in which the state's thirty-four HMOs with the largest market share are rated.³

SERVQUAL Not Enough

And so it is across services and industry sectors. Developing the concept of Gap Theory, Leonard L. Berry, A. Parasuraman, and Valarie A. Zeithaml have offered measures of customer perception of service quality to establish benchmarks across a broad array of public sectors, from health service providers to airlines, to restaurants. Only customer perceptions matter, according to the authors, whose SERVQUAL instrument has become a standard of measurement in the private sector.

Various SERVQUAL studies have shown that, indeed, it is not only possible, but also necessary to benchmark perceptions. The fulfillment of customer expectations is key to the success of every restaurant. A high quality score depends on many things: a solicitous and knowledgeable staff, menus that meet expectations for preparation and presentation, and, importantly, reliability from visit to visit. Over twelve years of study across a wide range of industry sectors, the authors found that five first-order factors contribute to an overall measure of service quality in a nonlibrary environment. These include:⁴

Reliability: Ability to perform the promised service dependably and accurately;

Assurance: Knowledge and courtesy of employees and their ability to convey trust and confidence;

Empathy: The caring, individualized attention the firm provides to its customers;

Responsiveness: Willingness to help customers and provide prompt service; and

Tangibles: Appearance of physical facilities, equipment, personnel, and communications materials.

However, various studies have clearly demonstrated that (1) the five SERVQUAL dimensions are *not* recoverable in the library context, and (2) additional dimensions of quality *not* measured by SERVQUAL are necessary.^{5,6}

Library Context

What has all this to do with libraries? Libraries have long recognized that their metrics were out of phase with the rising demands for accountability in higher education. Among the member libraries of the ARL, for example, measurement has not yet progressed appreciably beyond basic input metrics. Despite the cautions of the ARL to the contrary, the *ARL Index*, based solely on expenditure metrics, have come to be widely accepted as a measure of library quality.⁷ With hopes of improving the situation, researchers and practitioners alike have begun to explore a number of assessment alternatives.

And so within the library service community there has been "increasing pressure on libraries to assess the degree to which their services demonstrate criteria of 'quality' ... [and] not to equate 'quality' merely with collection size."⁸ This movement beyond sole reliance on collection counts as indices of quality seems eminently reasonable. As Danuta A. Nitecki recently observed, "Flying across the Atlantic, are you more likely to judge the quality of the airline you use by the number of planes it operates or by the reliability of its schedules of departures and arrivals and the attention its staff gives you?"⁹ Library users appear to invoke similar criteria when they evaluate the services that libraries provide.

Responding to this movement within the field, the ARL has sponsored a number of New Measures initiatives. In October 2000, ARL organized a two-day conference bringing library directors and staff together with internationally recognized experts on measuring perceptions of service quality. One of the New Measures initiatives is the LibQUAL+ study being conducted by ARL and the Texas A&M University libraries.¹⁰ Continuing phases of the LibQUAL+ study are being supported in part by the Fund for the Improvement of Post-Secondary Education (FIPSE).

However, a fundamental question that must be addressed in these initiatives involves how user perceptions of library service quality should be modeled. Of course, as Clyde Hendrick and Susan Hendrick noted, in the behavioral sci-

ences "theory building and construct measurement are joint bootstrap operations."¹¹ That is, we progress in an iterative manner by tentatively formulating a theory, developing a measure of that theory, evaluating the measure, revising the theory, and then proceeding cyclically back through this bootstrap process.

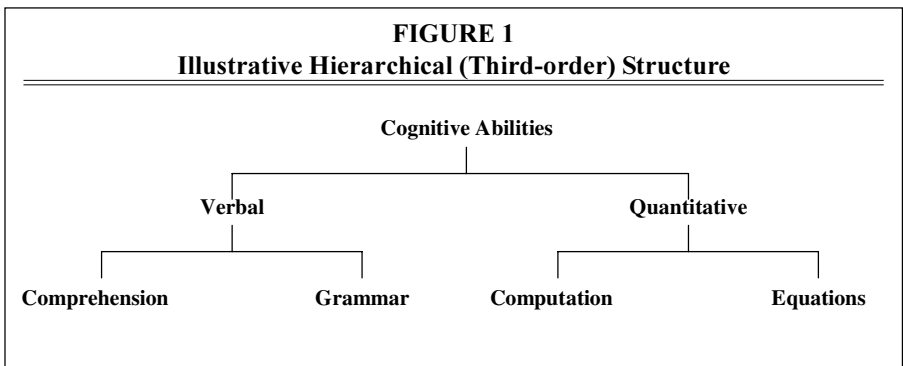
Hierarchical Models

One plausible model of user perceptions of library service quality posits that users may *simultaneously* think about quality at multiple levels within a hierarchical model. An illustrative model—in this example a model of cognitive abilities—is presented in figure 1. This actually is an approximation of the model commonly used to measure intelligence. However, similar hierarchical models also can be used in understanding attitudes or perceptions.

Hierarchical models are useful because perspective taking at different levels allows us to see different dynamics. Bruce Thompson offered the following analogy:

The first-order analysis is a close-up view that focuses on the details of the valleys and the peaks in mountains. The second-order analysis is like looking at the mountains at a greater distance, and yields a potentially different perspective on the mountains as constituents of a range.¹²

At the first-order lower level, we may see trees and streams but not recognize the mountain range. At the second-order



level, we lose sight of details but gain the global perspective of the range.

Purpose of the Study

The purpose of the present study was to investigate what hierarchical structure underlay library service perceptions of 3,987 participants. These data were provided from users at eleven ARL institutions participating in the LibQUAL+ study.

Method

Participants

The 3,987 participants in this phase of the LibQUAL+ study represented the range of library user groups at the eleven ARL member institutions. Included were undergraduate students ($n_U = 998$), graduate students ($n_G = 1,281$), faculty ($n_F = 1,022$), and staff and ancillary professional personnel (e.g., research scientists not in tenure accruing positions, $n_O = 686$).

Half the participants were males and half females. The ages of the 3,987 participants were: (a) < 22 years, 17.8 percent; (b) 22–30 years, 29.7 percent; (c) 31–45 years, 25.3 percent, and (d) > 45 years, 27.2 percent. The disciplines of the participants were: (a) science, 17.1 percent; (b) social science, 16.6 percent; (c) libraries, 12.0 percent; (d) humanities, 11.3 percent; (e) engineering, 10.9 percent; (f) health sciences, 9.4 percent; (g) business, 8.1 percent; (h) education, 6.5 percent; (i) fine arts, 3.8 percent; (j) law, 1.7 percent; (k) architecture, 1.5 percent; and (l) veterinary medicine, 1.0 percent. Thus, the sample was both large and diverse.

Instrumentation

An instrument used with some frequency to measure perceptions of service quality is the 22-item protocol called SERVQUAL. The SERVQUAL protocol ostensibly measures perceptions of service in terms of tangibles, reliability, responsiveness, assurance, and empathy.¹³ Within this model, "only customers judge quality; all other judgments are essentially irrelevant."¹⁴

Based on the authors' qualitative research, the twenty-two generic SERVQUAL

items do not appear to capture all the relevant aspects of users' perceptions of library service quality.¹⁵ Therefore, the authors also administered an additional nineteen items that emerged out of qualitative interviews at nine institutions. These forty-one items were administered on the Web using browser software.¹⁶ The 3,987 participants rated their perceptions of library services using 1-to-9 Likert scales.

Results

All five principal components with eigenvalues greater than 1.0 were extracted and rotated to the promax criterion. Promax rotation results in correlated factors. In the authors' study, the correlations of the five factors ranged from .183 to .641. As Richard L. Gorsuch has emphasized:

Rotating obliquely in factor analysis implies that the factors do overlap and that there are, therefore, broader areas of generalizability than just a primary factor. Implicit in all oblique rotations are higher-order factors. It is recommended that these [always] be extracted and examined so that the investigator may gain the fullest possible understanding of the data.¹⁷

The authors then factor-analyzed the first-order factor correlation matrix. One second-order factor had an eigenvalue greater than 1.0 ($\bar{\epsilon} = 2.78$). Finally, to complete the analysis, the authors invoked a useful interpretation aid proposed by John Schmid and John M. Leiman and also explained by Gorsuch.^{18, 19} This solution "orthogonalizes" the two levels of analysis to each other by removing from the first-order factors any information that also is present at the second-order level. This solution also allows interpretation of both levels of analysis in terms of the observed variables.

This solution is presented in table 1. Figure 2 is a graphic representation of the results. The sizes of the objects in figure 2 reflect the amount of information residing in both levels of the analysis after the

TABLE 1
Factor Pattern Coefficients from Schmid–Leiman Solution

Residual First-order Factors			A	I	II	III	IV	V
Item	Item Core	Topic						
19	Responsive	Willingness to help users	.696	.499	-.050	-.065	.026	.083
24	Empathy	Deal with users in caring fashion	.724	.476	.056	-.013	.059	.070
18	Responsive	Readiness to respond to user	.708	.460	-.049	-.041	.065	.044
34	Assurance	Employees who are courteous	.685	.453	.033	.003	-.010	-.073
20	Assurance	Employees have knowledge	.708	.447	-.020	-.003	.005	.079
9	Assurance	Employees instill confidence	.673	.422	-.014	-.050	-.003	.240
11	Empathy	Employees understand needs	.734	.387	-.021	-.004	.032	.251
41	Empathy	Giving users individual attention	.704	.355	.033	.117	-.042	.028
15	CollAccess	Instruction in use, when needed	.646	.332	-.007	-.011	.033	.231
33	Reliable	Handle users' service problems	.734	.293	-.017	.150	.087	-.079
13	Empathy	Users' best interests at heart	.738	.274	.044	.000	.102	.256
28	Reliable	Performing services right	.756	.246	.011	.101	.188	-.096
26	Responsive	Prompt service to users	.778	.239	-.013	.139	.150	.021
38	Tangibles	Employees have neat appearance	.580	.231	.158	.110	-.049	-.072
39	LibAsPlace	A meditative place	.588	-.004	.601	.033	-.051	-.059
30	LibAsPlace	A haven for quiet and solitude	.604	-.023	.596	.017	.007	-.078
40	LibAsPlace	Space that facilitates quiet	.617	-.006	.583	.048	-.012	-.113
12	LibAsPlace	A contemplative environment	.645	.010	.533	-.042	.005	.223
4	LibAsPlace	A place for reflection	.571	-.031	.474	-.092	.075	.276
14	LibAsPlace	Comfortable and inviting location	.665	.037	.444	-.047	.033	.311
29	LibAsPlace	Space group/individual study	.601	-.033	.423	.112	-.004	.081
22	LibAsPlace	Center intellectual interaction	.581	.023	.382	.134	-.122	.234
21	LibAsPlace	A secure and safe place	.577	.097	.230	-.018	.182	-.110
23	Tangibles	Visual appeal materials	.689	.103	.185	.132	.039	.171
37	CollAccess	Complete runs of journal titles	.609	-.062	-.012	.490	-.035	.121
27	CollAccess	Comprehensive print collection	.646	-.052	.029	.429	-.005	.163
36	CollAccess	Interdisciplinary needs addressed	.635	.001	.006	.406	.014	.038
32	CollAccess	Library materials in the stacks	.620	.022	.044	.254	.119	.004
35	Tangibles	Modern equipment	.638	.037	.072	.248	.042	.173
31	Assurance	Assuring accuracy/confidentiality	.620	.173	.053	.176	.060	-.086
2	Reliable	Providing services as promised	.692	.041	-.031	-.015	.468	.038
5	Reliable	Service at promised time	.707	.036	.012	-.025	.458	.050
3	Responsive	Keep users informed	.605	.061	-.013	-.061	.388	.131
1	CollAccess	Convenient access collections	.640	-.046	-.005	.080	.337	.250
17	CollAccess	Timely document delivery	.609	.048	-.058	.167	.235	.046
16	Reliable	Maintain error-free records	.639	.113	.036	.096	.223	-.060
10	CollAccess	Resources added to collection	.589	.019	-.106	.295	.037	.403
8	Empathy	Convenient business hours	.546	.022	.017	.127	.088	.378
6	Tangibles	Visually appealing facilities	.606	-.014	.370	-.058	.092	.371
25	CollAccess	Full text delivered electronically	.524	.074	-.005	.287	-.126	.370
7	CollAccess	Access to archives	.621	-.016	.047	.100	.195	.354
Trace/Information			17.34	2.08	2.38	1.14	1.04	1.51

Note. The first column represents the second-order factor. The next 5 columns represent the first-order solution, based on variance orthogonal to the second order (Richard L. Gorsuch, *Factor Analysis, 2nd ed.* [Hillsdale, N.J.: Erlbaum, 1983], 248–54).

Schmid–Leiman solution was invoked. What is noteworthy here is that both levels of analysis contain unique information on user perceptions.

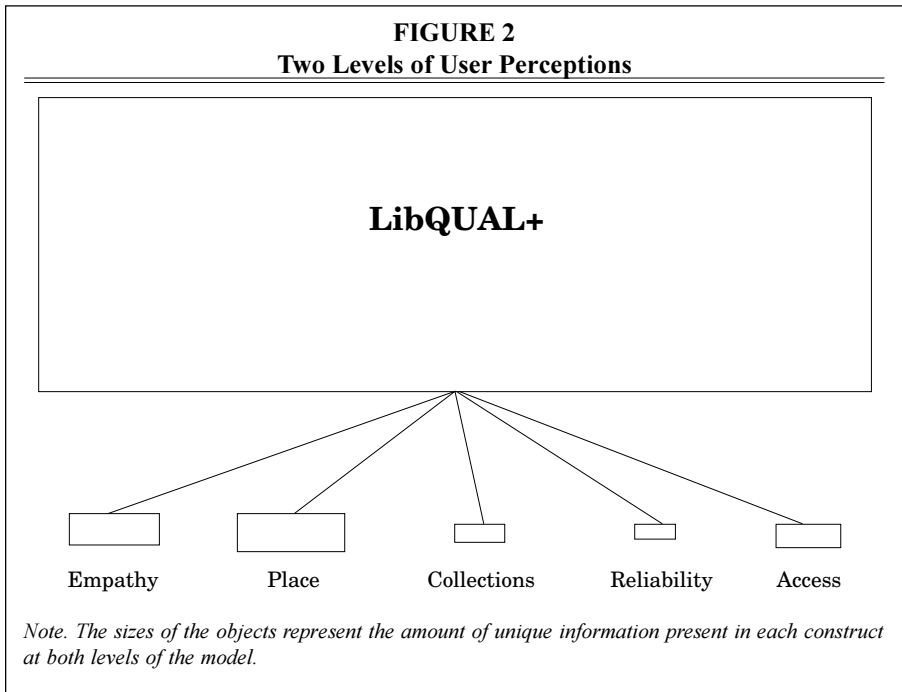
Discussion

The SERVQUAL measure has proved useful in measuring library users’ perceptions of service quality.²⁰ However, the five dimensions presumed by the SERVQUAL developers have typically not been recovered in these applications.²¹ And the authors’ qualitative research has indicated that additional items must be added to the measure to represent some important dimensions of users’ perceptions of library service quality.²²

The results presented in table 1 and figure 2 do indicate that a single dimension does dominate user thinking about library service quality. As indicated by the coefficients for the second-order factor presented in table 1, basically all forty-one items that the authors used saturate this factor. The result is also consistent with related findings.²³

However, it is noteworthy that considerable information on users’ perceptions is *not* present in this single, overarching second-order perspective. This was true even though the Schmid–Leiman solution vests in the higher-order factor any information existing at both levels. Thus, the result is compelling. The constructs still operating at the first-order level, even in the presence of the general second-order service construct, involve the Library as a Place, Empathy with User Needs, Access, Collections, and Reliability.

The study results suggest that users perceive library service at a global level but also *simultaneously* invoke a more nuanced view involving these specific elements. The results mean that ongoing efforts to evaluate library service quality would do well to invoke both levels of characterizing service. As the field moves beyond collection counts in measuring service quality, it will be critical that the final measures be ecologically grounded in ways that honor the users’ frames of mind when they think about library services.



Notes

1. Nassim H. Naqui and M. Donald Blaufox, *Blood Pressure Measurement: An Illustrated History* (New York: Parthenon, 1998).
2. Nielsen Media Research, "What TV Ratings Really Mean—And Other Frequently Asked Questions," 2000. Available online at [http://www.nielsen.com](#). (31 July 2000).
3. Tricia L. Silva, "Most HMO Members Rate Plans High, Survey Shows," *San Antonio Business Journal*, 3 Jan. 2000. Available online at <http://www.bizjournals.com/sanantonio/stories/2000/01/03/story1.html>. (31 July 2000).
4. A. Parasuraman, Valarie A. Zeithaml, and Leonard L. Berry, "A Conceptual Model of Service Quality and Its Implications for Future Research," *Journal of Marketing* 49 (fall 1985): 41–50.
5. Colleen Cook and Bruce Thompson, "Higher-order Factor Analytic Perspectives on Users' Perceptions of Library Service Quality," *Library Information Service Research* (in press); Danuta A. Nitecki, "An Assessment of the Applicability of SERVQUAL Dimensions: A Customer-based Criteria for Evaluating Quality of Services in an Academic Library" (Ph.D. diss., University of Maryland, 1995), abstract in *Dissertation Abstracts International* 56: 2918A.
6. Syed S. Andaleeb and Patience L. Simmonds, "Explaining User Satisfaction with Academic Libraries," *College & Research Libraries* 59 (Mar. 1998): 156–67; Colleen Cook and Fred Heath, "Users' Perceptions of Library Service Quality: A 'LibQUAL+' Qualitative Interview Study" (paper presented at the Association of Research Libraries Measuring Service Quality Symposium on the New Culture of Assessment: Measuring Service Quality, Washington, D.C., Oct. 20, 2000).
7. Association of Research Libraries. *ARL Membership Criteria Index, 1998–99* (2000). Memorandum to Directors of ARL Libraries from Martha Kyrillidou, senior program officer for statistics and measurement, and Julia Blixrud, director of information services, ARL, Mar. 8, 2000.
8. Peter Herson and Charles R. McClure, *Evaluation and Library Decision-Making* (New Jersey: Ablex, 1990), xv.
9. Nitecki, "Assessment of Service Quality in Academic Libraries: Focus on the Applicability of the SERVQUAL," in *Proceedings of the Second Northumbria International Conference on Performance Measurement in Libraries and Information Services* (Newcastle upon Tyne, England: Univ. of Northumbria at Newcastle, 1998), 181.
10. Cook and Heath, "The Association of Research Libraries LibQUAL+ Project: An Update," *ARL Newsletter: A Bimonthly Report on Research Library Issues and Actions from ARL, CNI and SPARC* (July 2000); Colleen Cook, Fred Heath, Bruce Thompson, and Russell L. Thompson, "The Search for New Measures: The ARL 'LibQUAL+'—A Preliminary Report," *Portal: Libraries and the Academy* (under review).
11. Clyde Hendrick and Susan Hendrick, "A Theory and Method of Love," *Journal of Personality and Social Psychology* 50 (Feb. 1986): 393.
12. Bruce Thompson, "SECONDOR: A Program That Computes a Second-order Principal Components Analysis and Various Interpretation Aids," *Educational and Psychological Measurement* 50 (1990): 579.
13. Parasuraman, Berry, and Zeithaml, "Refinement and Reassessment of the SERVQUAL Scale," *Journal of Retailing* 67 (winter 1991): 420–50; ———, "A Conceptual Model"; ———, "Alternative Scales for Measuring Service Quality: A Comparative Assessment Based on Psychometric and Diagnostic Criteria," *Journal of Retailing* 49 (fall 1994): 201–30.
14. ———, *Delivering Quality Service: Balancing Customer Perceptions and Expectations* (New York: Free Pr., 1990), 16.
15. Cook and Heath, "Users' Perceptions."
16. Cook, Heath, Thompson, and Thompson, "Score Reliabilities in Web- or Internet-based Surveys: Unnumbered Graphic Rating Scales Versus Likert Scales" (paper presented at the Association of Research Libraries Measuring Service Quality Symposium on the New Culture of Assessment: Measuring Service Quality, Washington, D.C., Oct. 20, 2000).
17. Richard L. Gorsuch, *Factor Analysis*, 2nd ed. (Hillsdale, N.J.: Erlbaum, 1983), 255.
18. John Schmid and John M. Leiman, "The Development of Hierarchical Factor Solutions," *Psychometrika* 22 (Mar. 1960): 53–61.
19. Gorsuch, *Factor Analysis*, 248–54.
20. Colleen Cook and Bruce Thompson, "Reliability and Validity of SERVQUAL Scores Used to Evaluate Perceptions of Library Service Quality," *Journal of Academic Librarianship* (July 2000): 248–52.
21. ———, "Higher-order Factor; Nitecki, "An Assessment of the Applicability of SERVQUAL Dimensions."
22. Cook and Heath, "Users' Perceptions."
23. Bruce Thompson, Colleen Cook, and Fred Heath, "How Many Dimensions Does It Take to Measure Users' Perceptions of Libraries?: A 'LibQUAL+' Study," *Portal: Libraries and the Academy* (under review).