Library Quality and Impact: Is There a Relationship between New Measures and Traditional Measures?

by Sharon A. Weiner

Traditional measures of quality are no longer adequate to reflect library excellence and impact. Analysis of an Association for Research Libraries data set showed that there was a relationship between the ARL Index and services; between the number of undergraduate students and services; and between instructional presentations and operating expenditures.

Sharon A. Weiner is Director, Peabody Library, Vanderbilt University, 230 Appleton Place, #325 Peabody College, Nashville, TN 37203, USA <s.weiner@vanderbilt.edu>.

INTRODUCTION

As colleges and universities experience increased economic constraints, there is also a trend toward increased accountability. Correspondingly, the libraries in these institutions need to demonstrate accountability through relevant and meaningful measures of organizational impact. The indicators that served as benchmarks in the past, such as number of volumes and number of journal subscriptions, are no longer sufficient because of the more expansive role that the contemporary library has assumed. Rather than completely discard the old measures, this study will determine what relationship the traditional measures have to newer measures of library service and impact.

LITERATURE REVIEW

Economic Pressures

Institutions of higher education have experienced serious fiscal pressures in recent years. One example is the California State University system which reduced its budget by $300 million in 2002.[1] Like other departments in research universities, academic libraries have had to reduce costs. There has been a concurrent escalation in the costs of library resources. During the period from 1986 to 2003, operating expenditures increased by 84 percent among members of the Association of Research Libraries. But expenditures for library materials increased by 206 percent. The percentage of staff decreased by 21 percent, but salary costs increased by 116 percent.[2] The average academic library budget was about $3.1 million in both 2002 and 2003 while at the same time library missions were broadening.[3]

Historically, the academic library has been considered to be the heart of the university.[4] As such, allocation of university resources to the library was assumed. Evidence that this assumption can no longer be made is the decline in the percentage of university budget allocations to members of the Association of Research Libraries. The mean share of the allocation of university expenditures to an ARL library declined from 3.91 percent in 1982 to 3.32 percent in 1992.[5] Many university administrators now expect departments such as the libraries to justify costs and to be accountable for outcomes.[6,7]

The concept of evidence-based practice originated in the medical disciplines and is becoming established in librarian-

ship.[8] Clearly, an administrator who uses the best evidence to guide decision making will have more credibility with policy makers and others who control budget allocations than an administrator who does not. A recent study showed that library administrators do use data for planning, priority setting, policy development, staff allocation, and collection building.[9] Therefore, the data that are collected should measure functions and processes that are relevant to contemporary higher education administrators. The data should include measures of the impact of the library on the higher education institution.[10] Qualitative as well as quantitative data are needed to provide a holistic view.[11] Once identified and institutionalized, cross-institution comparisons will be possible.

Measurement Indicators

Traditional measures of academic library quality included such factors as number of volumes owned, number of journal subscriptions, number of staff, and size of budget. These measures were adequate when the primary function of libraries was to acquire books and journals. New measures of library quality and accountability are needed to better reflect the quality and impact of the academic research library in its institutional setting.[12,13] Pritchard summarized attempts to measure academic library quality and effectiveness.[14] Her conclusion is that "the future vitality of libraries in academia will be dependent on whether they can dynamically and continually prove their value to the overall educational endeavor…at a level that transcends specific formats of information, locations of collections and locations of users, and that clearly links the investment in campuswide information resources to the effectiveness of particular disciplinary programs."[15] Nicholson included a history of library evaluation with his proposed conceptual framework for library services evaluation.[16] He posits that measurement using data should lead to information that is produced from evaluation.[17]

To accomplish this, academic libraries need to determine what assessment data will accomplish this purpose and then incorporate these data into their decision making.[18] Measures that have been suggested in the literature are quality of services,[19,20] customer satisfaction,[21] patron perception of library service quality,[22] market penetration,[23] assessment of impact,[24] and outcomes assessment.[25–28] The Business and Finance Division of the Special Libraries Association uses criteria similar to those of the Malcolm Baldrige National Quality Awards for its "Centers of Excellence Awards." Those criteria include the following: incorporates the delivery of ever-improving value to customers; improves overall organizational performance; and shares information about successful quality strategies.[29] The most recent edition of standards for college libraries compiled by the Association of College and Research Libraries included input, output, and outcome measures that could be related to the institutional mission statement. Points of comparison with peer institutions might include the ratio of resource expenditures to combined student and faculty FTE; the ratio of library staff to combined student and faculty FTE; and the ratio of reference questions to combined student and faculty FTE.[30]

The Standards specify that "the library should provide information and instruction to users through a variety of reference and bibliographic services."[31] The extent to which library instruction is integrated in a higher education curriculum is an indicator of its success.[32] In 2002, the Middle States Association of Colleges and Schools Commission on Higher Education declared that information literacy is vital to undergraduate education and that librarians and faculty should collaborate on teaching the requisite skills.[33] Indicators of library instruction activity or assessment of information literacy competency should be included in the assessment of the quality of academic libraries. Since these services are considered standard in today's library, their assessment should be included in the assessment of the quality of academic libraries.

The purpose of this study is to investigate the relationship between traditional measures of library quality and measures that reflect library service characteristics. By using existing data from a reliable and relatively consistent data set, this paper will explore how closely the measures of services parallel the traditional measures.

RESEARCH QUESTION

This study will examine the research question, "Is there a relationship between library services and its budget, number of employees, or primary clientele?" It will explore the relationship among service indicators, funding, staffing, and faculty and students. The library services considered in this study were number of reference transactions, number of instructional presentations, and number of attendees at group presentations. This research question is based on the hypothesis that newer measures of library service will be highly related to the characteristics that have traditionally defined institutional status and size.

METHODS

There are 124 members of the prestigious Association of Research Libraries (ARL). ARL collects and compiles data from these institutions annually and makes it available on their Web site. For this study, Canadian universities were removed from the data set. Only institutions in the United States were examined which increased the homogeneity of the study population. There were ninety-nine U.S. institutions. The data set used was "ARL Statistics 2002/2003."[34] There were no missing cases in the set because ARL requires that members submit annual statistics. The data are collected annually through a survey.[35] Each record in the data files contains a case that represents one year of data for one institution. There were fifty-four variables for each of the 2002/2003 records.[36] All variables were numeric and continuous. The dependent variables in these analyses were the three variables that related to library services:

- total number of reference transactions (REFTRAN);
- total number of instructional presentations by library staff to groups (INSTRUC); and
- total number of people who attended the instructional presentations by library staff to groups (ATTEND).

The independent variables were those that represented significant expenditures or the primary clientele of the academic library:

- total professional/support staff (STF);
- total library expenditures (EXP);

- total full-time graduate/professional student enrollment (GRAD);
- total full-time faculty whose major regular assignment is instruction (FAC); and
- total full-time undergraduate/unclassified student enrollment (UNDGRD). The data set did not include a variable for undergraduate students, so this variable was created by subtracting the full-time graduate/professional student enrollment from the full-time student enrollment. Thus, the figure includes "unclassified" students.

All of the variables considered are part of university records and the accuracy of reporting was assumed to be acceptable.

The Association of Research Libraries calculates its Membership Index[37] annually using a formula that weights the number of volumes, serial subscriptions, number of staff, and total expenditures. It is important to note that the index does not include "services" variables in its formula. The statistical method used to calculate this index is principle component analysis. The data are multiplied by the weights and then summed. This results in an index score for each member institution that aggregates the five measures of size and resources.[38] The values in the index range from −2.5 to 2.5. The minimum score required for potential new members is −1.65; −2.25 is the minimum required score continuing membership. Institutional ranking is based on the index score.

To begin this study, it was important to consider whether library services had a relationship to the ARL Index, since the index itself did not incorporate any library services measures.

Correlation coefficients were computed for the dependent variables and the ARL Index. All correlations were statistically significant (see Table 1), which indicated that there was a relationship between the variables that relate to services and the ARL Index. When a multiple regression analysis was performed on the ninety-nine cases, 19 percent of the variation in the ARL Index could be attributed to the variables reference transactions, number of instructional presentations by library staff to groups, and number of people who attended the presentations. This was a statistically significant relationship. This indicated that the services variables are a predictor of the ARL Index score and therefore the ARL ranking.

To determine whether there were any outlier institutions that might be skewing the results, scatterplot charts and box plot graphs were analyzed using the services variables. Scatterplot charts of these analyses showed that four outlier institutions were skewing the results. Box plot graphs confirmed this and

Table 1
Correlation Coefficients for Dependent Variables and ARL Index

	ARL Index	Reference Transactions	Presentation	Attendees
ARL Index	1	0.36**	0.42**	0.36**
Reference transactions	0.36**	1	0.42**	0.55**
Presentations	0.42**	0.42**	1	0.66**
Attendees	0.36**	0.55**	0.66**	1

**$P \leq 0.01$.

Table 2
Values and Mean for Outlier Institutions on "Index" and "Services" Variables

Outlier Institution	Variable	Value[a]	Mean[b]	SD
Harvard University	Index	2.545	−0.78	0.93
University of California at Berkeley	Group presentations	5004	930	689
University of Kentucky	Attendees at presentations	63,553	14,326	10,154
University of Utah	Reference transactions	396,307	116,394	75,964

[a] Actual value in the data set.
[b] Mean of the ninety-nine cases.

identified the institutions. Table 2 shows the variable for which each of four institutions was an outlier. The mean score for the ARL Index was −0.78 and the standard deviation was 0.93. Therefore, 99 percent of the institutions had a score that was 2.01 or less, while Harvard's score was 2.545. The mean number of group presentations was 930 and the standard deviation was 689. Therefore, 99 percent of the institutions reported the number of group presentations was 2997 or less while the University of California at Berkeley reported 5004 presentations. The mean number of attendees at group presentations was 14,326 and the standard deviation was 10,154. Therefore, 99 percent of the institutions reported that the number of attendees at presentations was 44,788 or less while the University of Kentucky reported 63,553 attendees. The mean number of reference transactions was 116,394 and the standard deviation was 75,964. Therefore, 99 percent of the institutions reported that the number of reference transactions was 344,286 or less while the University of Utah reported 396,307.

Due to these results, the institutions, Harvard University, University of California at Berkeley, University of Kentucky, and University of Utah, were eliminated from the data set to better approximate homogeneity. By eliminating the outlier institutions, the variation in the ARL Index that could be attributed to the service variables (reference transactions, number of instructional presentations by library staff to groups, and number of people who attended the presentations) increased from 19 percent to 31 percent. This was a statistically significant relationship.

Using the resulting data set of ninety-five cases, multiple regression was performed using, respectively, each of the three dependent services variables. Standardized regression coefficients are reported in the results. Correlations of the individual pairs were analyzed.

RESULTS

Table 3 shows the mean and standard deviation for the dependent and independent variables in the ninety-five U.S. institutions. The values are frequencies except for "total expenditures" which is in dollars. As seen, the average number of reference transactions exceeded 100,000. Group presentations averaged almost 900 for the year and there were approximately 14,000 attendees at presentations. The

Table 3
Descriptive Statistics

	Mean	SD
Dependent variables		
Reference transactions	108,151	70,613
Group presentations	880	541
Attendees at presentations	13,656	8636
Independent variables		
No. of staff	232	103
Total expenditures	21,542,783	9,183,438
No. of faculty	1482	711
No. of graduate	4818	2520
No. of undergrad	16,959	9300

average amount expended for library functions exceeded $21 million.

Table 4 shows the regression coefficients for the three multiple regressions considered. Using reference transactions (REFTRAN) as the measure of library services, 31 percent of the variation in REFTRAN could be explained by these independent variables: total number of staff, (STF), total operating expenditures (EXP), number of faculty (FAC), number of graduate students (GRAD), and number of undergraduate/unassigned students (UNDGRD). This was a statistically significant relationship. For every increase of 0.32 UNDGRD, there was an increase of one reference transaction. This was a statistically significant association.

Forty percent of the variation in the number of instructional presentations could be attributed to the independent variables (STF, EXP, FAC, GRAD, UNDGRD). This was a statistically significant regression. Two of the variables, EXP and UNDGRD, had statistically significant regression coefficients in this equation. There was a statistically significant relationship between the number of instructional presentations and EXP. For every increase of 0.9 in EXP, there was an increase of one instructional presentation. For every increase of 0.5 UNDGRD, there was an increase of one instructional presentation.

Fifty-four percent of the variation in the number of attendees at group presentations could be explained by the independent variables (STF, EXP, FAC, GRAD, UNDGRD). This was a statistically significant relationship. UNDGRD had a signifi-

cant regression coefficient in this equation. For every increase of 0.57 UNDGRD, there was an increase of one participant in group presentations.

Correlations between all of the dependent and independent variables were statistically significant (Table 5). The strongest correlations were between FAC, GRAD, UNDGRD, and the number of attendees at presentations.

DISCUSSION AND IMPLICATIONS

The purpose of this study was to determine whether there was a relationship between library services and factors related to expenditures, types of clientele, and staffing. Three aspects of library services were examined: number of reference transactions, number of instructional presentations to groups, and number of attendees at group presentations. The number of reference transactions is a quantitative indicator of a library's market penetration, or connection with its clientele. Library instruction sessions are service indicators that are recognized by higher education accrediting agencies as fulfilling requirements such as those specified by the Middle States Commission. The Association for College and Research Libraries specifies that ratios of resource expenditures to student and faculty FTE; of library staff to student and faculty FTE; and of reference questions to student and faculty can be points of comparison with other institutions.[39]

This study showed that there is a relationship between the ARL Index, which is the traditional measure of library quality based on collection size, staffing, and expenditures, and library services ($R^2 = 0.31$). Thirty-one percent of the variation in the number of reference transactions, 40 percent of the variation in the number of instructional presentations, and 54 percent of the variation in the number of attendees at instructional presentations, respectively, could be explained by the total number of staff, total operating expenditures, number of faculty, number of graduate students, and number of undergraduate/unassigned students. In the REFTRAN regression, one variable, UNDGRD, had a significant coefficient. That coefficient suggested that there was a predicted increase of one reference transaction for every 0.32 UNDGRD. In the instructional presentations regression, two variables had significant regression coefficients. These were EXP and UNDGRD. There was a predicted increase of one instructional presentation for every increase of 0.9 in EXP and for every increase of 0.5 UNDGRD. In the regression describing participation in group presentations, UNDGRD had a significant regression coefficient. There was

Table 4
Standardized Regression Coefficient (Beta)

Independent Variable	Reference Transactions	Group Presentations	Attendees at Presentations
No. of Staff	0.33	−0.40	0.20
Total expenditures	−0.14	0.93	0.17
No. of faculty	−0.03	−0.05	−0.07
No. of graduate	0.25	−0.23	0.04
No. of Undergrad	0.32	0.50	0.57
R^2	0.35	0.40	0.54

Table 5
Correlation Coefficients for Dependent and Independent Variables

	Reference Transactions	Group Presentations	Attendees at Presentations
No. of staff	0.46	0.47	0.55
Total expenditures	0.40	0.48	0.48
No. of faculty	0.46	0.36	0.53
No. of graduate	0.46	0.27	0.43
No. of undergrad	0.47	0.46	0.60

a predicted increase of one participant in group presentations for every increase of 0.57 UNDGRD.

There has been much discussion in the literature and at conferences about alternatives to the ARL Index as a determinant of the quality and impact of libraries. Since this study showed a relationship between the traditional measure of ARL library quality, the ARL Index, and library services, the ARL Index may continue to be a reasonable predictor of certain aspects of library quality. Certainly, it is reasonable to assume that this measure could be one in a multimethod approach to assessment because of the complexity and interrelatedness of the academic research library.[40] At least 31 percent of the variation in library services could be explained by the independent variables. This implies that library staffing, budget, and the number of students and faculty at an institution could affect the level or volume of certain services that a library provides. Noteworthy in this study was that the variable, "number of undergraduate/ unassigned students," had a significant relationship to all of the services variables. This may be due to a current emphasis in academic research libraries on services to undergraduates. However, this raises the question of whether there is equity in services to graduate students and faculty, or whether service to those groups is an area that needs attention. Also notable is that the only area for which total operating expenditures were significantly related was the number of instructional presentations. An area for further exploration would be the impact of library budget on the number of library staff assigned to provide library instruction presentations.

ISSUES, CONCERNS, LIMITATIONS, SPECIFIC QUESTIONS

There were several limitations of this project. The data set included only three indicators of library service (reference transactions, instructional presentations, and attendees at group presentations), although service measures are recognized today as a better measure of library quality and impact than collection size.[41] The index that is used to assign library rankings does not include any service measures. The index considered volumes owned, volumes added, number of serial subscriptions, number of staff, and total expenditures. The population included large academic research libraries and so results can only be generalized to other large academic research libraries.

NOTES AND REFERENCES

1. "California State University Expected to Turn Away up to 15,000 Students Next Year," *Black Issues in Higher Education* 20 (22) (2003).
2. *Expenditure Trends in ARL Libraries: 1986–2003*, Association of Research Libraries. Online. 2004 Available: http://www.arl.org/ stats/arlstat/graphs/2003/graph4_03.xls (accessed May 30, 2004).
3. "The Changing Roles of Content Deployment Functions: Academic Information Professionals," *Information Briefing* 6 (20) (2003): 5–6.
4. Charles Eliot, Forty-Ninth Annual Report of the President of Harvard College. 1873–1874, Cambridge, MA: John Wilson and Son, 1875. Online. Available: http://pds.harvard.edu:8080/ pds/servlet/PageDeliveryService?id=158085&type=intermediate.
5. Kendon Stubbs, "Trends in University Funding for Research Libraries," *ARL: A Bimonthly Newsletter of Research Library Issues and Actions* 172 (1994).
6. Clara M. Lovett, Robert T. Mundhenk, Nancy Shulock, Charles B. Reed, Edward B. Rust, Thomas D. Layzell, Joseph C. Burke, & Carol Christ, "How Can Colleges Prove They're Doing Their Jobs?" *Chronicle of Higher Education* 51 (2) (2004): B6.
7. Martha Kyrillidou, "An Overview of Performance Measures in Higher Education and Libraries," *ARL: A Bimonthly Newsletter of Research Library Issues and Actions* 197 (1998).
8. Julie Hooke, "Evidence-Based Practice and Its Relevance to Library and Information Services," *LASIE* (1999): 23–34.
9. Susan J. Beck, "Data-Informed Decision Making," *ARL Bimonthly Report* 230/231 (2003): 1–2.
10. Ian M. Johnson, Dorothy A. Williams, Caroline Wavell, & Graeme Baxter, "Impact Evaluation, Professional Practice, and Policy Making," *New Library World* 105 (1196/1197) (2004): 44.
11. Liz McDowell, Linda Banwell, & Gwen Marples, "First Catch Your Student: Issues in Qualitative Evaluation," *Performance Measurement and Metrics* 3 (1) (2002): 20.
12. Martha Kyrillidou, "In Search of New Measures," *ARL: A Bimonthly Newsletter of Research Library Issues and Actions* 197 (1998): 6.
13. Kathryn J. Deiss, *Organizational Capacity White Paper*, Association of Research Libraries. Online. 1999 Available: http:// www.arl.org/stats/program/capacity.pdf (July 6, 2004).
14. Sarah M. Pritchard, "Determining Quality in Academic Libraries," *Library Trends* 44 (Winter, 1996): 572–594.
15. Ibid., p. 589.
16. Scott Nicholson, "A Conceptual Framework for the Holistic Measurement and Cumulative Evaluation of Library Services," *Journal of Documentation* 60 (2) (2004): 164–182.
17. Ibid., p. 175.
18. Amos Lakos, & Shelley Phipps, "Creating a Culture of Assessment: A Catalyst for Organizational Change," *portal: Libraries and the Academy* 4 (3) (2004): 346–347.
19. Danuta A. Nitecki, "Changing the Concept and Measure of Service Quality in Academic Libraries," *Journal of Academic Librarianship* 22 (May, 1996): 181–190.
20. Peter Hernon, "Quality: New Directions in the Research," *Journal of Academic Librarianship* 28 (4) (2002): 224–231.
21. Ibid., pp. 224–231.
22. Bruce Thompson, Colleen Cook, & Fred Heath, "How Many Dimensions Does It Take to Measure Users' Perceptions of Libraries? A Libqual + Study," *portal: Libraries and the Academy* 1 (2) (2001): 129–138.
23. Paul Kobulnicky, & Carla Stoffle, *Market Penetration in Research Libraries* [white paper], Association of Research Libraries. Online. July 30, 2003 Available: http://arl.org/stats/program/ Market.pdf (January 16, 2005).
24. Ronald F. Dow, "Using Assessment Criteria to Determine Library Quality," *Journal of Academic Librarianship* 24 (4) (1998): 278.
25. Ethelene Whitmire, "Academic Library Performance Measures and Undergraduates' Library Use and Educational Outcomes," *Library & Information Science Research* 24 (2) (2002): 107–128.
26. Hernon, op. cit.
27. John Carlo Bertot, & Charles R. McClure, "Outcomes Assessment in the Networked Environment: Research Questions, Issues, Considerations, and Moving Forward," *Library Trends* 51 (4) (2003): 590–689.
28. Bruce T. Fraser, Charles R. McClure, & Emily H. Leahy, "Toward a Framework for Assessing Library and Institutional Outcomes," *portal: Libraries and the Academy* 2 (4) (2002): 505–528.
29. Stephen T. Kochoff, "The Malcolm Baldrige National Quality Awards: A Model for the Centers of Excellence Awards," *Business and Finance Division Bulletin* (118) (2001): 33–38.
30. *Standards for College Libraries*, edited by (Association of College and Research Libraries, 2000) pp. 3–4 (17 pp.).
31. Ibid., p. 8.

32. Edward K. Owusu-Ansah, "Information Literacy and Higher Education: Placing the Academic Library in the Center of a Comprehensive Solution," *Journal of Academic Librarianship* 30 (1) (2004): 12.

33. *Characteristics of Excellence in Higher Education: Vol. 32. Eligibility Requirements and Standards for Accreditation*, edited by (Philadelphia, PA: Middle States Commission on Higher Education, 2002) p. 38 (71 pp.).

34. *ARL Statistics 2002/2003*. Online. 2004 Available: http://www.arl.org/stats/arlstat (June 10, 2004).

35. *ARL Statistics 2001/02*, edited by (Washington, DC: Association of Research Libraries, 2003) pp. 76–85.

36. *ARL Statistics, 1989–2003: A Guide to the Machine-Readable Data*, Association of Research Libraries. Online. April 19, 2004 Available: http://www.arl.org/stats/arlstat/ddoc.html (May 30, 2004).

37. "The ARL Membership Criteria Index," *ARL: A Bimonthly Newsletter of Research Library Issues and Actions* 197 (1998).

38. *ARL Membership Criteria Formulas*, Association of Research Libraries. Online. May 26, 2004 Available: http://www.arl.org/stats/index/indxform.html (December 27, 2004).

39. Op. cit., "The ARL Membership Criteria Index," p. 8.

40. Op., cit., "Standards for College Libraries," p. 601.

41. Op., cit., "Bertot and McClure," p. 4.