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.

**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. 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. 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. Qualitative
as well as quantitative data are needed to provide a holistic
view. 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. Pritchard summarized attempts to
measure academic library quality and effectiveness. 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
devotee...at a level that transcends specific formats of
information, locations of collections and locations of users,
and that clearly links the investment in campuswide informa-
tion resources to the effectiveness of particular disciplinary
programs.” Nicholson included a history of library evalua-
tion with his proposed conceptual framework for library
services evaluation. He posits that measurement using data
should lead to information that is produced from evaluation.

To accomplish this, academic libraries need to determine
what assessment data will accomplish this purpose and then
incorporate these data into their decision making. Measures
that have been suggested in the literature are quality of
services, patron perception of library service quality, market
penetration, assessment of impact, and outcomes assessment.
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. 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.

The Standards specify that “the library should provide
information and instruction to users through a variety of
reference and bibliographic services.” The extent to which
library instruction is integrated in a higher education curric-
ulum is an indicator of its success. In 2002, the Middle States
Association of Colleges and Schools Commission on Higher
Education declared that information literacy is vital to under-
graduate education and that librarians and faculty should
coordinate on teaching the requisite skills. 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 relation-
ship 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.” There were no
missing cases in the set because ARL requires that members
submit annual statistics. The data are collected annually
through a survey. 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. 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 service 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 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 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 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 1

<table>
<thead>
<tr>
<th>Variable</th>
<th>Reference Transactions</th>
<th>Presentation</th>
<th>Attendees</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARL Index</td>
<td>1</td>
<td>0.36**</td>
<td>0.42**</td>
</tr>
<tr>
<td>Reference transactions</td>
<td>0.36**</td>
<td>1</td>
<td>0.42**</td>
</tr>
<tr>
<td>Presentations</td>
<td>0.42**</td>
<td>0.42**</td>
<td>1</td>
</tr>
<tr>
<td>Attendees</td>
<td>0.36**</td>
<td>0.55**</td>
<td>0.66**</td>
</tr>
</tbody>
</table>

\(^*\)p < 0.01.

### Table 2

<table>
<thead>
<tr>
<th>Outlier Institution</th>
<th>Variable</th>
<th>Value(^a)</th>
<th>Mean(^b)</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvard University</td>
<td>Index</td>
<td>2.545</td>
<td>−0.78</td>
<td>0.93</td>
</tr>
<tr>
<td>University of California at Berkeley</td>
<td>Group presentations</td>
<td>5004</td>
<td>930</td>
<td>689</td>
</tr>
<tr>
<td>University of Kentucky</td>
<td>Attendees at presentations</td>
<td>63,553</td>
<td>14,326</td>
<td>10,154</td>
</tr>
<tr>
<td>University of Utah</td>
<td>Reference transactions</td>
<td>396,307</td>
<td>116,394</td>
<td>75,964</td>
</tr>
</tbody>
</table>

\(^a\) Actual value in the data set.

\(^b\) Mean of the ninety-nine cases.
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 significant 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.

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

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**Table 3**

**Descriptive Statistics**

<table>
<thead>
<tr>
<th>Dependent variables</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference transactions</td>
<td>108,151</td>
<td>70,613</td>
</tr>
<tr>
<td>Group presentations</td>
<td>880</td>
<td>541</td>
</tr>
<tr>
<td>Attendees at presentations</td>
<td>13,656</td>
<td>8636</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of staff</td>
<td>232</td>
<td>103</td>
</tr>
<tr>
<td>Total expenditures</td>
<td>21,542,783</td>
<td>9,183,438</td>
</tr>
<tr>
<td>No. of faculty</td>
<td>1482</td>
<td>711</td>
</tr>
<tr>
<td>No. of graduate</td>
<td>4818</td>
<td>2520</td>
</tr>
<tr>
<td>No. of undergrad</td>
<td>16,959</td>
<td>9300</td>
</tr>
</tbody>
</table>

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**Table 4**

**Standardized Regression Coefficient (Beta)**

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Reference Transactions</th>
<th>Group Presentations</th>
<th>Attendees at Presentations</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Staff</td>
<td>0.33</td>
<td>−0.40</td>
<td>0.20</td>
</tr>
<tr>
<td>Total expenditures</td>
<td>−0.14</td>
<td>0.93</td>
<td>0.17</td>
</tr>
<tr>
<td>No. of faculty</td>
<td>−0.03</td>
<td>−0.05</td>
<td>−0.07</td>
</tr>
<tr>
<td>No. of graduate</td>
<td>0.25</td>
<td>−0.23</td>
<td>0.04</td>
</tr>
<tr>
<td>No. of Undergrad</td>
<td>0.32</td>
<td>0.50</td>
<td>0.57</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.35</td>
<td>0.40</td>
<td>0.54</td>
</tr>
</tbody>
</table>

**Table 5**

**Correlation Coefficients for Dependent and Independent Variables**

<table>
<thead>
<tr>
<th></th>
<th>Reference Transactions</th>
<th>Group Presentations</th>
<th>Attendees at Presentations</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of staff</td>
<td>0.46</td>
<td>0.47</td>
<td>0.55</td>
</tr>
<tr>
<td>Total expenditures</td>
<td>0.40</td>
<td>0.48</td>
<td>0.48</td>
</tr>
<tr>
<td>No. of faculty</td>
<td>0.46</td>
<td>0.36</td>
<td>0.53</td>
</tr>
<tr>
<td>No. of graduate</td>
<td>0.46</td>
<td>0.27</td>
<td>0.43</td>
</tr>
<tr>
<td>No. of undergrad</td>
<td>0.47</td>
<td>0.46</td>
<td>0.60</td>
</tr>
</tbody>
</table>

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*September 2005* 435
a predicted increase of one participant in group presentations for every increase of 0.57 UNDGDRD.

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.41 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).
15. Ibid., p. 589.
17. Ibid., p. 175.
31. Ibid., p. 8.


