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EFFECTIVENESS OF LIBRARY OPERATIONS: A MANAGEMENT INFORMATION SYSTEMS APPROACH AND APPLICATION

by Neal Kermit Kaske

Major Professor: Dr. Raymond P. Lutz

This research developed a methodology for assessing the effectiveness of a university library. The level of effectiveness was reported to the management of the library via a segment of the management information system.

The effectiveness of a university library was assessed from three different points of view. The first area assessed by the management information system was patron attitudes. Data were collected regarding patrons' attitudes toward the quantity and quality of library materials supplied to them. Data were also collected which reflect patron attitudes relative to the quantity and quality of assistance that they received from the library's staff and facilities. The second area assessed by this management information system was the status of the collections. Data in this area relates the percentages of missing volumes both within the library (misshelved) and outside the library (stolen). The percentages for the volumes which were shelved correctly, checked out, and in need of being reshelved were also reported by this management information system. The third area assessed by this management information system was that of the utilization made of the collections. An actual and a potential utilization was worked out and reported by this system.

Each of these three assessment tools were applied to a university library. The results of these applications related that the methodologies developed were functional, time-related, and economical to use.

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CHAPTER I

NEED FOR THE STUDY

The central question of "How well is the library
doing?" must be answered by the management of a library in
order to plan (Webster, 1971) and control the library's op-
erations. The use of traditional intuitive approaches to
answer this question has been difficult to utilize and to
justify in the presence of the new technologies and new
techniques (Bookstein and Swanson, 1972). The search for
indicators of library effectiveness still goes on, for as
yet, the profession does not have an acceptable, usable set
of measures (Griffen and Hall, 1972). Therefore, there is a
need for research to construct performance measures, to test
their feasibility, and to determine their advantages, dis-
advantages, and general usefulness (Hamburg, Ramist, and
Bommer, 1972).

Within the area of higher education much is being

done to apply the concept of management information systems[1]
(Johnson and Katzenmeyer, 1969). The need for the use of
this managerial technique has been shown (Brien, 1970), and
a number of methods for using this technique have been set
forth (National Center for Higher Education Management Sys-
tems at WICHE, 1969). This concept has also been reviewed
for the library profession (Weiss, 1970).

There have been numerous efforts made during the last
few years to have the total educational system of society
become more accountable (Richburg, 1971; Thomas and McKinney,
1972; Young, 1971). This call for accountability can be
clearly seen by the ever increasing number of articles and
reports indexed under the subject headings of "accountability
in education" and "educational accountability" within the
major indexes to the literature of education (Education
Index, Current Index to Journals in Education, ERIC: Re-
search in Education).

This call for accountability has also been heard
within the library subset of the educational system
(Harrigan, 1971). In answer to this call, a search for

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[1]The term "management information system" will be de-
fined for the purposes of this proposal as it appears in a
standard dictionary of the subject area (Computer Dictionary
and Handbook). This definition was also chosen for its
general non-computer based nature. A management information
system is "a communications process in which data are re-
corded and processed for operational purposes. The problems
are isolated for higher-level decision making, and informa-
tion is fed back to top management to reflect the progress
or lack of progress made in achieving major objectives."
(Sipple, 1966).

meaningful library statistics has been made (American Library Association, 1966; National Conference on Library Statistics, 1967; Hamburg, et al., 1969; Hamburg, Ramist, and Bommer, 1972). The problems of university libraries have been underscored in an attempt to establish areas where research about libraries is needed (Booz, Allen, and Hamilton, Inc., 1970; Haas, 1968; Lyman, 1972; Bolton, 1972).

This underscoring has called for both meaningful statistics on the effectiveness of university libraries and for the design of a management information system for university libraries (Booz, Allen, and Hamilton, Inc., 1970; Griffen and Hall, 1972). A federal law relating to libraries has been added to the statutes. This law calls for periodic evaluation of the effectiveness of programs and projects supported by an act of Congress (U.S. Congress, House, 1970). The use of a research and development department by university libraries has been recommended (Haro, 1972). The establishment of courses within library schools to cover the subjects of statistics and quantitative management techniques has been recommended (Bookstein, 1972; Heinritz, 1970; Wynar, 1970) so the library profession may be provided with trained librarians who can design systems that will provide this needed statistical and managerial data. These recommendations and ideas have been followed in a new doctoral program for library managers (Miller and Lutz, 1971).

The job descriptions of new positions within the

profession also underscore the move toward finding more meaningful statistics for libraries. For example, the Planning Officer for the library at the University of California at Los Angeles has as one of his major responsibilities the "development of integrated management information system designed to improve operational effectiveness and to provide a more valid basis for decisions on resource allocations" (U.C.L.A., 1972). At the University of Nebraska at Lincoln, the Systems Analyst and Automation Librarian is charged with the "collection of management data and statistical interpretation of them" (University of Nebraska, 1973).

This concern for effective library operations has been exhibited not only by the modifications in the training of professional librarians and in current job descriptions but has also been demonstrated through numerous standards for libraries. There are librarians who believe that these existing standards are meaningful measures of effectiveness. They are in error because the standards set down by the American Library Association (American Library Association, 1966, 1969, 1970) relate only various minimum inputs that a library should have in order to give service to patrons. These standards do not state how to judge the service of a library but just what is believed to be the minimum tools necessary to conduct service (Hamburg, Ramist, and Bommer, 1972). Thus, measures of effectiveness are still needed.

Meaningful measures of effectiveness are not only

necessary for university libraries but also for public serv-
ice operations of all kinds; the development of these ef-
fectiveness measures has been particularly difficult because
the profit motive has not been paramount or even present.
Measures of effectiveness are essential for public service
operations in these days of expanding demands for better
service and increasing pressures on budgets (Morse, 1972).

With the problem of determining "how well the library
is doing" still undecided, it seemed advantageous to examine
the necessary elements of effectiveness measures before re-
viewing the research that has been done on library effective-
ness measures and management information systems for li-
braries. Three key properties which measures of effective-
ness should possess seemed appropriate; these properties were

1. measures related specifically to the objectives
   of the project or program;

2. measures scaleable in appropriate units with
   stable dimensions;

3. measures related to time (Lutz, 1972).

It can be seen in the literature sighted thus far that there
is a need for a workable system of effectiveness measures to
be developed for libraries.

In light of the recent cancellation of research funds
by the federal government, it is most important that research
of the nature provided here be conducted. Without answers to
the question "How well is the library doing?" the ability of

libraries to compete for funds would be diminished even more. With the need for library effectiveness measures and the properties of these effectiveness measures in mind, the objective of this research will be stated in the next chapter.

CHAPTER II

OBJECTIVE

The objective of this study was to develop a method-
ology for relating the effectiveness[1] of a university li-
brary to the management of the library on a time-related
basis and to apply this methodology to a university library.
The levels of effectiveness indicated by the methodology are
intended to be reported to the management of the library via
a management information system (MIS). The economic factors
relating to the use of the management information system were
considered as an integral part of the system design.

The effectiveness of a university library was as-
sessed from three different points of view, attitudes of
patrons, status of collections, and utilization of collec-
tions; and the data produced have been presented in the form
of a management information system. To obtain these effec-
tiveness measurements data regarding patron's attitudes
toward the quantity and quality of library materials

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[1]The term effectiveness is used to mean the degree
of or the level of the accomplishment of a library's goals
or objectives. Effectiveness is measured in relation to the
objectives or goals of the library.

supplied by the library as well as their attitudes regarding the quantity and quality of the assistance that they receive from the library's staff and facilities were provided by the MIS. The status of the collections was assessed at given intervals in order to provide data on the percentages of missing volumes both within the library (misshelved) and outside the library (stolen). Percentages for the volumes that were shelved correctly, checked out, and in need of being reshelved were also determined and those data were reported by the management information system. Finally, data on the utilization made of the collections were also recorded and transmitted. This utilization was related to both potential user populations and to actual user populations.

The following three assumptions were made in formulating the measures of effectiveness:

1. A university's library is to work toward the goal of meeting the information needs of its faculty and students for both coursework and research. The attitudes of these patrons about the ability of the library to meet their information requirement will be an indicator of how well the library is meeting this goal.

2. A university's library is to maintain its collections so that there are a minimum of volumes missing within the library (misshelved) and outside the library (stolen). This maintenance

maximizes the possible exposure of patrons to in-

formation sources and preserves the collections.

3. The utilization made of a university library's

   collection can be measured to a degree from the

   number of materials withdrawn by the patrons for

   home use.

To meet the objective of this research no one special type of computerized library or accounting system would be required. The data collection and analysis processes would be expedited if some of the library's operations were computerized and if sophisticated accounting systems were in use, but these systems would not be necessary to make use of this library management information system. The advantages of this management system design were 1) it would be independent of any one type of computer or accounting system, and 2) it would not require technical personnel to perform the data collection. Thus, this line of development would be more generally applicable because additional personnel and computer systems would not be required in order to use the library management information system.

The tools used in the development of these effectiveness measures were those of experimental design, systems analysis, economic evaluation, statistical analysis, and library systems management. By using these tools the effectiveness measures were derived from tangible (measurable) outputs of library services, underlying purposes of a

university library, and related research. The system was designed so that it can be used by all librarians who take the time to follow the system carefully; and it does not require a high level of mathematics to implement and use.

The management of the library should be able to evaluate the library's effectiveness by using this management information system. The collection and presentation of data by this system should aid in the planning of future library programs and in the monitoring of current ongoing library system toward desired goals and objectives.

The proposed system does not reveal how to change the library's system but will point toward problems by monitoring the library system. To make managerial judgments on what actions need to be taken regarding the realignment of the library system was beyond the scope of this research. To provide data for comparing one library to another was also beyond the scope of this research, but it is noted that comparisons could be made between libraries of universities if the managements of these different libraries were agreeable to the comparison.

To summarize the objective of this research, the following division of the objective into major goals and minor goals is presented.

Major goals:

1. Develop a methodology to relate the effectiveness of a university library from three points of

view (a. attitudes of patrons, b. status of
collections, and c. utilization of collections).

2. Apply the methodology to a university library.

3. Report the findings relating the effectiveness
   of library operations to the management of the
   library via a management information system.

Minor goals:

1. Design the method of reporting the levels of
   effectiveness so they are time-related and
   record the changes in the factors assessed.

2. Note the economic factors relating to the use of
   the management information system.

With the objective of the research stated and the need for
the study defined, the related research of this field will
be examined in the next chapter.

CHAPTER III

RELATED RESEARCH

There have been a number of proposed effectiveness
measures for libraries and their component systems presented
in the literature. In view of the current state of the
literature this section will review proposed library effec-
tiveness measures which have been recorded in the literature
and will also review two ongoing research projects (Hamburg
et al., 1969; DeProspo Jr., 1973) which are developing a na-
tional model for a system of library statistics and effec-
tiveness measures for public libraries.

Effectiveness Measures

One of the best known persons in the field of library
effectiveness is Philip Morse. His main work (Morse, 1968)
relates measures of effectiveness for a number of different
aspects of library operations with examples of their use.
His model for library use or patterns of use[1] designed for
the M.I.T. Science Library was found to be represented by a

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[1]Patterns of use is used by Morse to mean tasks per-
formed such as book withdrawn or consulted, periodical with-
drawn or consulted, catalogue consulted, etc.

geometric probability distribution. The four groups of users
studied (biologists, chemists, mathematicians, and
physicists) were found not to be homogeneous in their pat-
terns of library use, but each group's pattern could be re-
lated by a geometric probability distribution. From this
study it was learned that on the average "biologists and
mathematicians used the catalogue more; they also preferred
to withdraw more books, than did the chemists or physicists"
(33, Morse, 1968). In the area of arrival times of patrons
at the library and the length of stay of patrons, Morse
found that these times fit a poisson distribution for both
faculty and students. The length of time a book is used
(i.e., checked out of the library) was found by Morse to fit
the pattern of the Markov Process. From this type of in-
formation on the pattern of book use Morse was able to pre-
dict in a general manner the future use of books which aided
in the purchases and retirements of books. It was made very
clear by Morse that the results of his studies should not be
generalized to other libraries and user groups but that the
studies should be replicated (Morse, 1968). Morse does not
relate an overall measure for effectiveness for a library
nor does he relate a general measure.

In addition to the book Morse has provided the liter-
ature with an article (Morse, 1972) which presents a number
of proposed effectiveness measures. The proposed measures
cover such topics as the point at which to purchase a

duplicate copy, the effects of retiring inactive books, the prediction of circulation, and the noting of book use. These measures are generally the same as those presented in his book, but they are reduced for better understanding in this article's presentation. However, the article does not note if these proposed models have been tested or what their cost would be if used. A general or overall measure of effectiveness of a library is not related either. It is recorded in the conclusion of this article that

> we must learn by experience which measures are most useful in monitoring library effectiveness, so we can ensure that the computers, when they arrive, will be designed to tell us what we need to know (33, Morse, 1972).

From these remarks it was clear that there is a need to establish and use a system of effectiveness measures such as this research is suggesting. The remarks also illustrate the attitude that more models of effectiveness need to be developed and tested. This attitude is shared by other researchers (Booz, Allen, and Hamilton, Inc., 1970; Griffen and Hall, 1972; Hamburg, Ramist, and Bommer, 1972).

One of the most interesting proposed set of effectiveness measures, yet untested, has been set forth by Philip Rzasa and Norman Baker. These measures were related in a paper (Rzasa and Baker, 1971) entitled "Measures of Effectiveness For A University Library." There was a primary (e_1) and a secondary (e_2) measure of effectiveness offered by this paper. The primary measure was symbolized by the following model: $e_1 = \frac{m}{N} (1 + \frac{n}{N})$

Where:

e_1 represents primary measure of effectiveness

m represents the number of materials reshelved

N represents the total number of possible users

n represents the total number of users.

The secondary measure of effectiveness was symbolized by the following model:

$$e_2 = \frac{r_2}{N} \left(1 - \frac{r_1}{N}\right)$$

Where:

e_2 represents secondary measure of effectiveness

r_1 represents the total number of non-material information items sought

r_2 represents the total number of acceptable non-material information items supplied

N represents the total number of possible users.

These two measures each relate a number which can be compared to derived numbers of other libraries and to previous periods of time for the same library in order to relate which time or which library is more effective. Both e_1 and e_2 are to be done for a given time period. All data used in these models for the different factors therefore must come from the same time period or the measures would be meaningless. The purpose of this paper was "to develop an adequate measure of effectiveness for university libraries to evaluate ongoing programs or in determining the impact of proposed programs"

(13, Rzasa and Baker, 1971). Unfortunately the Rzasa and Baker measures were not tested. These measures, even if tested, would not relate the attitudes of the users. It should be kept in mind that all library operations are ultimately directed toward the user's satisfaction (Smith and Schofield, 1971), and therefore the user's level of satisfaction should be assessed.

Another interesting measure of library performance was put forth by Hamburg, Ramist, and Bommer in the form of a journal article (Hamburg, Ramist, and Bommer, 1972). This article not only relates an annual effectiveness measure for a library but also discusses the problem of defining the library's objectives and the problem of decision making within libraries. From the study of library objectives, it was concluded that the most realistic measure for determining if a library were meeting its true underlying objective of providing individuals with information was to note the ratio of exposures of individuals to documents of recorded human experience (Hamburg, Ramist, and Bommer, 1972). The factor of cost was included in the ratio as was the value inputed to society from the use of library materials. These performance measures were set to note the annual effectiveness of a library. The models used were symbolized in the following manner to represent a ratio of benefits to costs on a per capita basis and to note the difference between benefits and costs:

$$(VE - C)/N \qquad \text{and} \qquad [V(E/N)] - C/N$$

Where:

V represents the monetary value to society from each exposure hour

E represents the number of exposure hours for that fiscal year

C represents the total costs for a fiscal year including current expenditures designed to produce current exposure and allocated past expenditures

N represents the total number of potential users.

These ratios relate cost benefits on a per capita basis per fiscal year which can be compared to other libraries; but to provide the data for the ratios, a fair level of accounting would be required as well as the setting of a monetary value on the library's value to society. These ratios do not account for user satisfaction or for an evaluation of the status of the library's collection. The ratios were used to relate the effectiveness of Philadelphia's Free Library by way of an example.

Ongoing Research

In another work (Hamburg, et al., 1969) Hamburg is proposing to develop a national model for a system of library statistics. The system would be used to compare libraries to each other. A two volume interim report has been printed on this project; but the interim report has not been cited,

for it has yet to be published.[1] In addition to the interim
report on this project a final report has been written, but
copies have not as yet been distributed. However, a supple-
ment (Bommer, 1972) to the final report has been released.
This report, which was also a dissertation, develops a man-
agement system to aid university librarians in making de-
cisions regarding the allocation and control of scarce re-
sources. The use of cost benefit analysis, probability
theory, and a planning-programing-budgeting system were em-
ployed to develop models to assist librarians in making de-
cisions regarding multiple copy selection, new title selec-
tion, and reserve service. A model for forecasting demand
was also given. Though the work of Dr. Hamburg and
Dr. Bommer were in the same general area as this disserta-
tion, the works are different. Their research was directed
toward the development of statistical models to aid in
multiple copy selection, new title selection, and reserve
service rather than the development of a management informa-
tion system for a university library's management.

The other ongoing research project is under the di-
rection of Dr. E. DeProspo, Graduate School of Library Serv-
ice, Rutgers University. There are no printed materials,
unpublished or published, on this project, which has as its
purpose the development of effectiveness measures for public

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[1]Dr. Hamburg requested this report not be cited
during a telephone conversation with the author in December,
1972.

libraries. From a public presentation of this ongoing re-
search project (DeProspo, 1973) it was learned that the re-
search defines effectiveness as some function of availabil-
ity of library materials, professional library personnel,
and library facilities (physical). The type of data being
collected and used was for comparing one public library to
another public library and not for internal management of
the libraries (DeProspo, 1973).

Costing Measures to Show Effectiveness

Two members of the Library Management Research Unit,
University Library, Cambridge, England, recently published
an article (Smith and Schofield, 1971) on a tested process
to relate the administrative effectiveness within a univer-
sity library. To them effectiveness was being efficient,
that is, finding the "saddle point" which resulted in mini-
mizing the time and cost of operations while maximizing the
production of materials. The measures they used were those
of time and costs of different library operations. Their
work related methods to find the times and costs of different
units of library outputs. The articles also related ways to
find the work rates of different departments, the time re-
quired to clear outstanding work within a given department,
and the degree of inter-departmental staff exchanges. This
process presented by Smith and Schofield could provide an
insight into the times and costs of library operations, but

it did not deal with the ultimate purpose of library operations which they noted to be the user's satisfaction.

Within the area of costing, there have been two additional works which should be noted. The first is the work done with cost-benefit analysis and programming-planning-budgeting systems which was done by Raffel and Shishko. Their book (Raffel and Shishko, 1969) shows that both cost-benefit analysis and programming planning and budgeting systems can be used by university libraries. From their study of the M.I.T.'s libraries, they found a number of very interesting facts, such as the M.I.T. libraries spend fifty percent more for seating of patrons than for the storing of books and that it takes three-fourths of the annual resources to provide a general and research collection and the other one-fourth to provide required reading and course-related study facilities (Raffel and Shishko, 1969).

The other costing work to note was done by Lutz. In his article (Lutz, 1971) on methods for costing information services, he presented a clear methodology and example for establishing prices for information services.

Special Library Effectiveness

Within the area of special libraries, there are two works which deal with the effectiveness of this type of library. In one of the works (Wessel, 1968), a number of possible criteria for evaluating a technical library are presented. This article was somewhat similar to, but more

rigorous than, a work which suggests possible criteria to judge the operations of large libraries done by Meier (Meier, 1961).

The other work (Miller, 1972) on special libraries provided a methodology to obtain user-generated information on particular aspects of special library operations. The information from this system was to be used by the management of the library in decisions regarding resource allocation.

As one may note a very limited amount of research has been undertaken to aid the management of libraries. This aid to library management has been mainly in the form of theoretical models which were designed to provide data on select library problems. There have been also a few overall effectiveness measures proposed for libraries, but most of these measures have yet to be tested. Those that have been tested require high levels of library computerization and sophisticated accounting systems. In addition these measures only assess the library from one point of view. The research in this dissertation developed and tested effectiveness measures for university libraries. The effectiveness of library operations were assessed from three different points of view on a time-related basis, and data were presented in the form of a management information system.

CHAPTER IV

METHODOLOGY

The objective of this study was to develop a methodology for relating the effectiveness of a university library to the management of the library on a time-related basis and to apply this methodology to a university library. The levels of effectiveness indicated by this methodology were designed to be reported to the management of the library via a management information system. In order to design a system to meet the objective of this research and for the purpose of clarity the objective has been divided into three major and two minor goals. The major goals were to:

1. develop a methodology for the relating of the effectiveness of a university library from three points of view a. status of collections, b. attitudes of patrons, and c. utilization of collections;

2. apply the methodology to a university library;

3. report the findings relating the effectiveness of library operations to the management of the library via a management information system;

and the minor goals were:

    1. the designing of a method of reporting the
       levels of effectiveness so they will be time-
       related and will record the changes in the fac-
       tors assessed;

    2. the noting of the economic factors relating to
       the use of the management information system.

With the objective stated in the form of the above
major and minor goals and with the assumptions of this pro-
posed research (pages 8 and 9) in mind it was reasoned that
to be able to note the effectiveness of its system, a li-
brary would need to know the following about the status and
utilization of its collections and the attitudes of its
patrons. One, what are the attitudes of the faculty and
students regarding the quality and quantity of library ma-
terials and services provided to them by the library for
their studies and research information needs? Two, does the
library have collections which are used and to what degree
are these collections used? Three, is the library able to
maintain these collections so patrons may find the materials
the library notes that it owns, or to what degree are the
volumes in the collections misshelved or stolen?

To answer these questions, three models and instru-
ments were developed. One, a patron attitude assessment
tool was developed to reflect the patrons' attitudes about
the quality and quantity of the library's information

materials and services supplied. Two, to relate the level of collection utilization, a methodology was developed which assessed the collection utilization and related it to potential supply and demand on the collection. Three, a model of collection status was offered with a methodology for the collection of data to reflect the factors in the model.

This methodology was to provide a library management information system which would analyze the library from three different points of view. These three points of view are shown in Figure 1 (page 25).

The management information provided by this system would relate a number of different factors which should aid the library in planning and controlling its programs. In the general application of this system the university library organization would obtain data matrixes regarding a given collection or collections, library or libraries similar to the one shown in Figure 2 (page 26). It should also be possible, with sufficient data, to note (a) which factor or factors in the general model were most significant where the general model of library effectiveness is some function of patron's attitudes toward the library's collections and services, (b) how the collection or collections are used, and (c) what is the status of the collection or collections. With this overall model in mind, this dissertation now turns to relating the different methods of obtaining the data points required by the model and assessment tools.
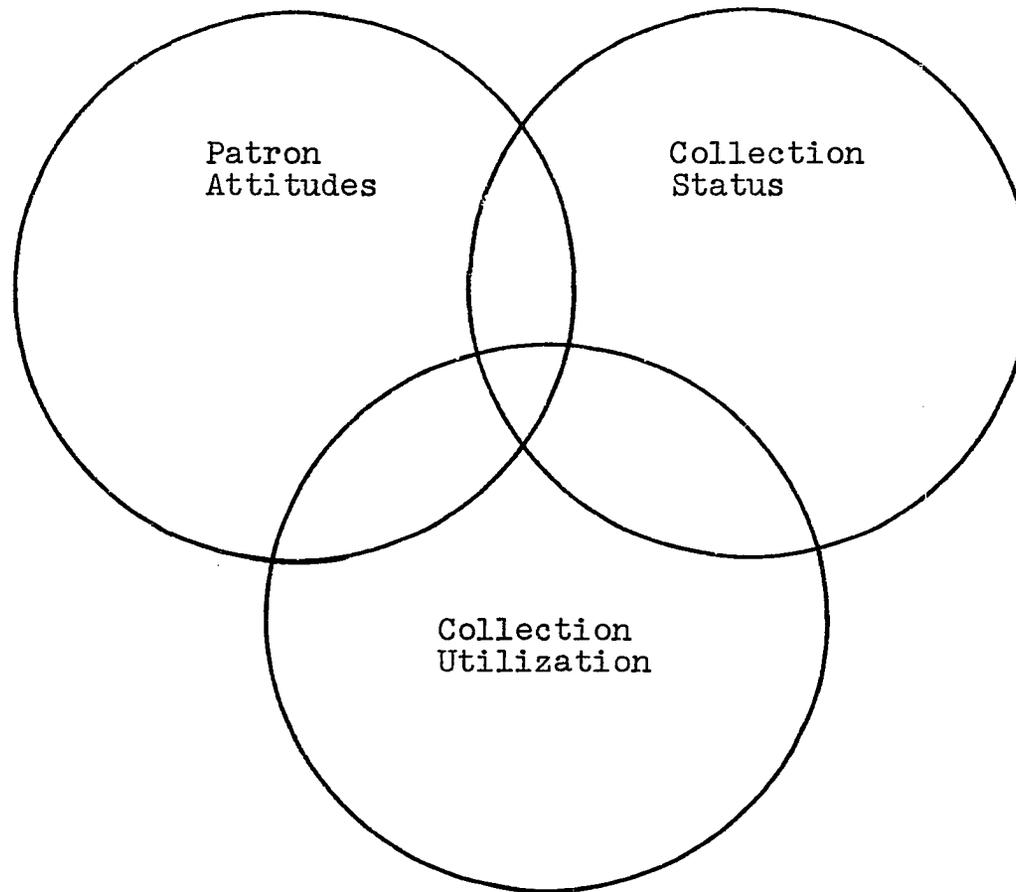
Fig. 1.--Three views of the university library

Collection or collections

Patron attitudes towards:			
Materials for study			
research			
Services			
1.			
2.			
3.			
n.			
Status of Collections			
Correctly shelved factor			
Stolen factor			
Misshelved factor			
Circulation factor			
Reshelving factor			
Utilization of Collections			
Potential			
Actual			

Fig. 2.--Management information matrix

Collection Status Model

The first point of view which evaluates the library's effectiveness is that of collection status. A library's total collection is recorded by the shelf-list. If one wants to know the current status of a given volume in the collection one uses the desired volume's call number to determine the volume's status. The volume could be on the shelf in its correct position, or it could be misshelved, stolen, checked out, waiting to be reshelved, or it could be in use by a patron or just lying about in the library. This is, of course, making the assumption that the book has not been miss-labeled, which is a fair assumption, for the labeling of a book is normally checked a number of times in the processing of volumes. For example, if the labeling were checked three times during processing and each time it was inspected for errors the probability that a person did not note a miss-labeling is 3%, then the chances of having a miss-labeled book is .000027 or 27 out of each one million volumes labeled (.03 x .03 x .03 = .000027).

Therefore, if one could assume that the total number of volumes in the collection, TC, would be a function of those volumes identified by their relative location at a particular instant of time:

$$TC = f(B, M, C, I, S, R)$$

Where:

B = the number of volumes on the shelves in their correct locations

M = the number of volumes misshelved

C = the number of volumes checked out to patrons, repair, interlibrary loan, etc.

I = the number of volumes in use or just lying about within the library but not checked out

S = the number of volumes stolen

R = the number of volumes needing to be reshelved, located on book trucks or shelves used to hold books that need to be reshelved.

Since the total collection would be a sum of each of the above items, the sum would be a linear expression:

$$TC = B + M + C + I + S + R$$

This collection status model can be reduced by assessing the collection when it is not in use (when the library is closed). If this were done, then the materials that were being used by patrons and the materials that were lying about, but yet not checked out, would go into one of the other factors in the model. Given that the collection assessment was done when the library was closed and all materials lying about were picked up and placed in proper locations then the value of I would be zero and the model would be as follows:

$$TC = B + M + C + S + R$$

With the objective of finding what part of the collection is within these different factors of the model at any given time, one could inventory the total collection.

But this is not practical, for it not only would cost a great deal of money for large collections, but it would also take a great deal of time and during this time the factors would change. It is possible and economical to conduct a sample inventory in order to find percentages for these factors in the model.

To reflect percentages for all of the factors in the collection status model a two part experiment was required. The first part of the experiment would be to determine the percentage of volumes missing from the library based upon a random sample drawn from the shelf-list. The size of the sample would be based upon the level of confidence required by the library's management. With a sample size set, a search would be made for the volumes drawn in the sample. From this search it would be learned if the volumes are on the shelves in their correct positions (B), or if they are checked out (C), or if they are awaiting reshelving (R). The volumes which could not be located would then either be mis-shelved (M) or stolen (S), assuming they are not miss-labeled. Thus, for the reduced model one would have percentages for the factors of B, C, R, and M + S. From this one would know the percentage of the collection that was on the shelf in correct order, checked out, and waiting to be reshelved. One would not know the percentage of volumes stolen or misshelved but only the percentage of books either stolen or misshelved.

The second part of the experiment would determine

these last two percentages. The methodology to find these
percentages will make use of the following model:

$$m = S + M$$

Where:

> m = missing, a volume not on the shelf in its cor-
> rect position (B), not checked out (C), and not
> waiting to be reshelved (R)
>
> S = stolen
>
> M = misshelved

The objective of this part of the experiment was to find the
percentage of misshelved volumes. This was done by reading
the shelves upon which the volumes were located or should
have been located when doing the first search for the volume
(part B) and noting the number of misshelved volumes.
Volume numbers and copy numbers, if out of sequence, would
be omitted from being classed as misshelved. By making use
of the ten volumes per foot rule and by counting the number
of volumes misshelved a percentage of misshelved volumes (M)
can be learned. Taking the percentage of volumes that could
not be located in the first part of the experiment and the
percentage of misshelved volumes from the second part of the
experiment and placing them in the model:

$$m = S + M$$

the percentage of stolen volumes can be found by subtracting
M from both sides of the model in the following manner:

$$m = M + S$$
$$\underline{-M \quad -M}$$
$$S = m - M$$

Now all of the elements of the model have percentages associated with them.

If one desired to relate these percentage to patrons in the form of ratios the model could be divided by the number of patrons. Thus the model would be as noted below where P represents the number of patrons.

$$\frac{TC}{P} = \frac{B}{P} + \frac{M}{P} + \frac{C}{P} + \frac{S}{P} + \frac{R}{P}$$

From this model then the ratio of number of total volumes to the number of patrons can be noted, as well as the ratio of volumes per patron. This ratio of the number of volumes per number of patrons can be noted for each factor in the model as can the ratio of volumes per patron.

If the collection sampled were defined in such a way as to include a single subject area, much could be learned about that collection and its use. For example, if one sampled only volumes classed in education and defined the patron population as those who are currently enrolled in or teaching courses in the field of education as defined by a current class schedule, one then has the number of volumes classed in education and the number of patron term-course-hours being taken and/or taught in the field of education. By defining the collection and patrons in this way one can then sample the collection in the manner noted above by using

the model: TC = B + M + C + S + R. From this one can determine the number of volumes per patron term-course-hour and the ratio of volumes per patron term-course-hour for each of the factors in the model.

The real advantages of using this collection status model in this manner would be in projecting collection utilization and in the comparing of one collection to another. With this predictive ability the library staff would be able better to manage the collections. The comparison of branch libraries could be made also. These comparisons would be possible with the ratios in the model for the size of collections and patron populations would in effect be normalized.

Patron Attitude Assessment Tool

The second point of view which is to be assessed regarding the effectiveness of the library was that of patrons' attitudes. The patrons' attitudes towards the library's quality and quantity of information materials and services needs to be noted in order to accomplish this. The instrument used to make this assessment was a questionnaire. This questionnaire had the following objectives: one, to assess the patrons' attitudes relative to the quality of the library information materials and services, and two, to assess the patrons' attitudes relative to the quantity of library information materials and services. The questionnaire in Figure 3 (pages 34 and 35), was designed to obtain the information to meet these two goals with respect to faculty

members. The questionnaire in Figure 4 (pages 36 and 37),
was designed to obtain the information needed from the student
population. A third questionnaire is shown in Figure 5 (pages
38 and 39). This questionnaire was used within the library
in order to assess the attitudes of actual patrons (not po-
tential patrons). These three questionnaires were designed
not to lead the group being sampled. Careful reading of each
questionnaire should reveal this factor. Each of these ques-
tionnaires were designed to be used by the University of
Oklahoma's library system.

Collection Utilization Assessment Tool

The third point of view which was to be assessed re-
garding the effectiveness of the library was that of collec-
tion utilization. This library management information system
assessed the potential (holdings) and actual utilization
(circulation) made of the library's collection. In order to
make this assessment of the circulation and holdings one must
convert the classification schedule or schedules used by the
library to the one used by the University's Registrar's Of-
fice. This conversion was done so the population of users
was defined in terms of patron term-course-hours per subject
classification. Once the conversion was completed, the fol-
lowing were compared for a given group of subject areas by
way of a statistical analysis: user populations, collection
holdings, circulated holdings, misshelving factors, stolen
factors, patron attitude factors.

Dear Faculty Member:

Please help evaluate the materials and services provided by the Library which you have utilized this term (Spring, 1973). Check your answers to the following questions. Please return the questionnaire via campus mail by using the enclosed envelope.

In answering the following questions please check (a) for excellent; (b) for good; (c) for fair; (d) for poor.

RATINGS

	Excellent (a)	Good (b)	Fair (c)	Poor (d)	Not Used (e)

1. The _quality_ of materials provided by the library for my
   a. teaching is
   b. research is

1a.					
1b.					

2. The _quantity_ of materials provided by the library for my
   a. teaching is
   b. research is

2a.					
2b.					

3. The service provided by the Information Desk is

3.					

4. The Photo Duplication service provided by the
   a. copy machines on the different floors are
   b. Duplication Office in the basement is

4a.					
4b.					

5. The study areas are

5.					

6. The service from the Reserve Book Collection is

6.					

7. Help from a subject area (floor)
   a. librarian is
   b. student assistant is

7a.					
7b.					

Fig. 3.--Faculty attitude assessment form

RATINGS

	Excel- lent	Good	Fair	Poor	Not Used
	(a)	(b)	(c)	(d)	(e)

8. The Interlibrary Loan
Office service is

8.

9. The Acquisitions
(book order) Office
service is

9.

10. YOUR COMMENTS: Please note them on the back of this page.

THANKS FOR YOUR ANSWERS AND YOUR TIME!

Fig. 3.--Continued

Dear Student:

Please help evaluate the materials and services provided by the Library which you have utilized this term (Spring, 1973). Check your answers to the following questions. Please return your completed questionnaire by using the enclosed envelope. Give the envelope to an instructor or secretary on campus and ask them to please place the envelope in campus mail.

In answering the following questions please check (a) for excellent; (b) for good; (c) for fair; (d) for poor.

RATINGS

	Excel-lent	Good	Fair	Poor	Not Used
	(a)	(b)	(c)	(d)	(e)

1. The quality of materials provided by the library for my
   a. coursework is — 1a.
   b. research (if graduate student) is — 1b.

2. The quantity of materials provided by the library for my
   a. coursework is — 2a.
   b. research (if graduate student) is — 2b.

3. The service provided by the Information Desk is — 3.

4. The Photo Duplication service provided by the
   a. copy machines on the different floors are — 4a.
   b. Duplication Office in the basement is — 4b.

5. The study areas are — 5.

6. The service from the Reserve Book Collection is — 6.

Fig. 4.--Student attitude assessment form

37

RATINGS

	Excellent (a)	Good (b)	Fair (c)	Poor (d)	Not Used (e)
7a.					
7b.					

7. Help from a subject area (floor)
   a. librarian is
   b. student assistant is

8. Graduate students only--The Interlibrary Loan Office service is

8.

9. YOUR COMMENTS: Please note them on the back of this page.

THANKS FOR YOUR ANSWERS AND YOUR TIME!

Fig. 4.--Continued

Dear Library Patron:

Please help evaluate the materials and services provided by
the Library which you have utilized this term (Spring, 1973).
Check your answers to the following questions. Please place
your completed questionnaire in the box near the exit checker
as you leave the building.

1. I am (a) an undergraduate
    student; (b) a graduate
    student; (c) a faculty
    member; (d) other, please
    note. _____   1.   (a)__(b)__(c)__(d)__

In answering the following
questions please check   RATINGS
(a) for excellent; (b) for
good; (c) for fair; (d) for   Excel-   Not
poor.   lent   Good Fair Poor Used

	(a)	(b)	(c)	(d)	(e)

2. The quality of ma-
    terials provided by
    the library for my

a. course or classroom work is					
2a.					
2b.					

    b. research is

3. The <u>quantity</u> of ma-
    terials provided by
    the library for my

a. course or classroom work is					
3a.					
3b.					

    b. research is

4. The service provided
    by the Information
    Desk is

4.					

5. The Photo Duplication
    service provided by
    the
    a. copy machines on
       the different
       floors are

5a.					
5b.					

    b. Duplication Office
       in the basement is

6. The study areas are

6.					

Fig. 5.--User attitude assessment form

RATINGS

	Excellent (a)	Good (b)	Fair (c)	Poor (d)	Not Used (e)

7. The service from the Reserve Book Collection is

7.

8. Help from a subject area (floor)
   a. librarian is
   b. student assistant is

8a.

8b.

9. The Interlibrary Loan Office service is

9.

10. The Acquisitions (book order) Office service is

10.

11. YOUR COMMENTS: Please note them on the back of this page.

THANKS FOR YOUR ANSWERS AND YOUR TIME!

Fig. 5.--Continued

To convert the library's classification schedule or
schedules to the University's Registrar's system required
the following steps, given that the university library had
materials classed in both the Library of Congress's and
Dewey's schedules. First, convert the Library of Con-
gress's to Dewey on a double letter Library of Congress to
the tens division of Dewey basis. Second, convert the Dewey
schedule to the Registrar's schedule. The first conversion
was made by using the unpublished data generated by a study
(Reynolds, et al., 1971) which, as a by product, correlated
59,115 MARC tape records which had both Library of Congress
and Dewey classifications given for the same items. From
these data a conversion matrix was made that enabled Library
of Congress double letter classifications to be expressed in
the different tens classes of the Dewey classification sched-
ule. The conversions were not done on a one-to-one but on a
percentage basis. The second conversion was done by fitting
the Dewey classification schedule to the Registrar's classi-
fication schedule. The Registrar's classification schedule
at the University of Oklahoma is related in Table 1 (page 41).
The schedule does show some overlap but most of the overlap
was due to courses being offered on both graduate and under-
graduate levels. The overlapping thus did not create prob-
lems but only added additional information.

TABLE 1

REGISTRAR'S CLASSIFICATION SCHEDULE

Arts and Sciences
  Anthropology
  Botany & Microbiology
  Chemistry
  Classics
  English
  Geography
  Geology & Geophysics
  Health, Physical Education & Recreation
  History
  History of Science
  History (Incl. History of Science)
  Home Economics
  Journalism
  Library Science
  Mathematics
  Modern Languages
  Philosophy
  Physics, Engineering Physics & Astronomy
  Political Science
  Psychology
  Regional & City Planning
  Social Work
  Sociology
  Zoology

Architecture

Fine Arts
  Art
  Drama
  Music
  Applied Music

Law

Liberal Studies

Business Administration
  Accounting
  Business Communications & Business Law
  Economics
  Finance
  Management
  Marketing

Education

Engineering
  Aerospace, Mechanical & Nuclear Engineering
  Architecture
  Chemical Engineering & Material Science
  Civil Engineering & Environmental Science
  Electrical Engineering
  Engineering
  Industrial Engineering
  Meteorology
  Petroleum & Geological Engineering

Pharmacy

Provost Direct
  Aerospace Studies
  Architecture
  Aviation
  Human Relations
  Information & Computer Science
  Journalism
  Library Science
  Military Science
  Naval Science
  Speech Communication

Schedule for the Assessment of Patron's Attitudes, Collection Status, and Collection Utilization

The library management information system relates information about the status of collections, attitudes of patrons, and utilization of collections over time. An annual schedule for the assessments is offered in Table 2. The reasons for picking the times for the different assessments were as follows: attitude assessments during the latter part of each main term will give a picture of the patron's attitude at a time in the term when they will have had a chance to have used the library; collection status and utilization assessments are to be made at the start of each term so that base line data is provided and in the last part of the term so that a near peak level can be noted.

TABLE 2

ANNUAL SCHEDULE FOR THE DATA COLLECTION

Week of Term	Term	
	Fall	Spring
First	C, U	C, U
Thirteenth	C, U, Fa, Sa,	C, U, Fa, Sa,

Key: Fa = faculty attitude assessment
Sa = student attitude assessment
Ua = user attitude assessment
C = collection status
U = collection utilization

The schedule in Table 2 assumed a fifteen week fall and spring term. A similar schedule could be designed for a university on the quarter term system also.

Thus far the methods to be used in determining the effectiveness of a university library have been related along with a format for the reporting of the information and a time schedule for obtaining the data. Therefore, the methodology for meeting the three major goals of this research have been stated. The methodology used to meet the two minor goals will be related in the following section as will the data analysis processes.

Analysis of Data

The management information system provides for the data to be presented in numerical and graphic form. The numerical data were tested to note significant changes over time by using the Chi-square statistical test. The data were in the form of multinomial distributions which were reduced to binomal distributions for the setting of sample sizes and the running of statistical tests. The Chi-square statistical test was performed in the following manner for the different questions on the questionnaires and for the different factors of the collection status model in order to note any significant changes over time or between user groups. The Chi-square statistical formula is:

$$\chi^2 = \sum_{i=j}^{r} \sum_{j=1}^{k} \frac{(f_{ij} - e_{ij})^2}{e_{ij}}$$

Where:

      f is the observed number

      e is the calculated expected number

      r is the number of data rows

      k is the number of data columns

The reason for performing this test was to find out if there had been a significant change in one or more of the elements or attitudes. For example, one might want to know if a new reshelving method has made a significant difference in the level (percentage) of misshelved volumes. This statistical test is able to answer this question. Another example would be if one wanted to know if the attitude of patrons regarding the quantity of a collection had changed after a major collection building project. This statistical test would be able to note the change in the attitude of patrons if, in fact, there was a significant change.

The first minor goal was to design a method of reporting the levels of effectiveness so they are time-related and record the changes in the factors assessed; to meet this goal a graphical format was utilized. This graphical format made it possible to note over time the percentage of different attitudes held by patrons and to note the percentages of the different factors in the collection status model over time as well as the potential and actual utilization made of the collection. Examples of these graphs are related in Figure 6 (page 46), Figure 7 (page 47), and

Figure 8 (page 48). An example of a graph depicting the col-
lection status model is shown in Figure 6 (page 46). The
purpose of this graph is to provide the library management
with a visual display of the values for the different factors
of the collection status model. This method of display
should aid the management of the library in seeing trends in
the different factors of the collection status model over
time. It should depict the dynamic nature of the collec-
tion's status over time too. When the graph is used with the
numerical data on the status of the collection it should re-
inforce the numerical data for the library management and
aid the library management in relating the status of the col-
lection to librarians on the staff and to the university ad-
ministration as well.

The purpose of the graph in Figure 7 (page 47) is to
furnish the management of the library with a visual display
of the different attitude levels of patrons toward the dif-
ferent services and materials provided by the library. This
method of display should assist the library administration
in the identification of significant shifts of patron atti-
tudes toward the library over some time frame, when the
graphs are used in conjunction with related numerical data on
the attitudes of patrons. The differences between patron
groups can also be assessed if desired. Graphs of this type
could be made for each service provided by the library and
related to each patron group if desired.
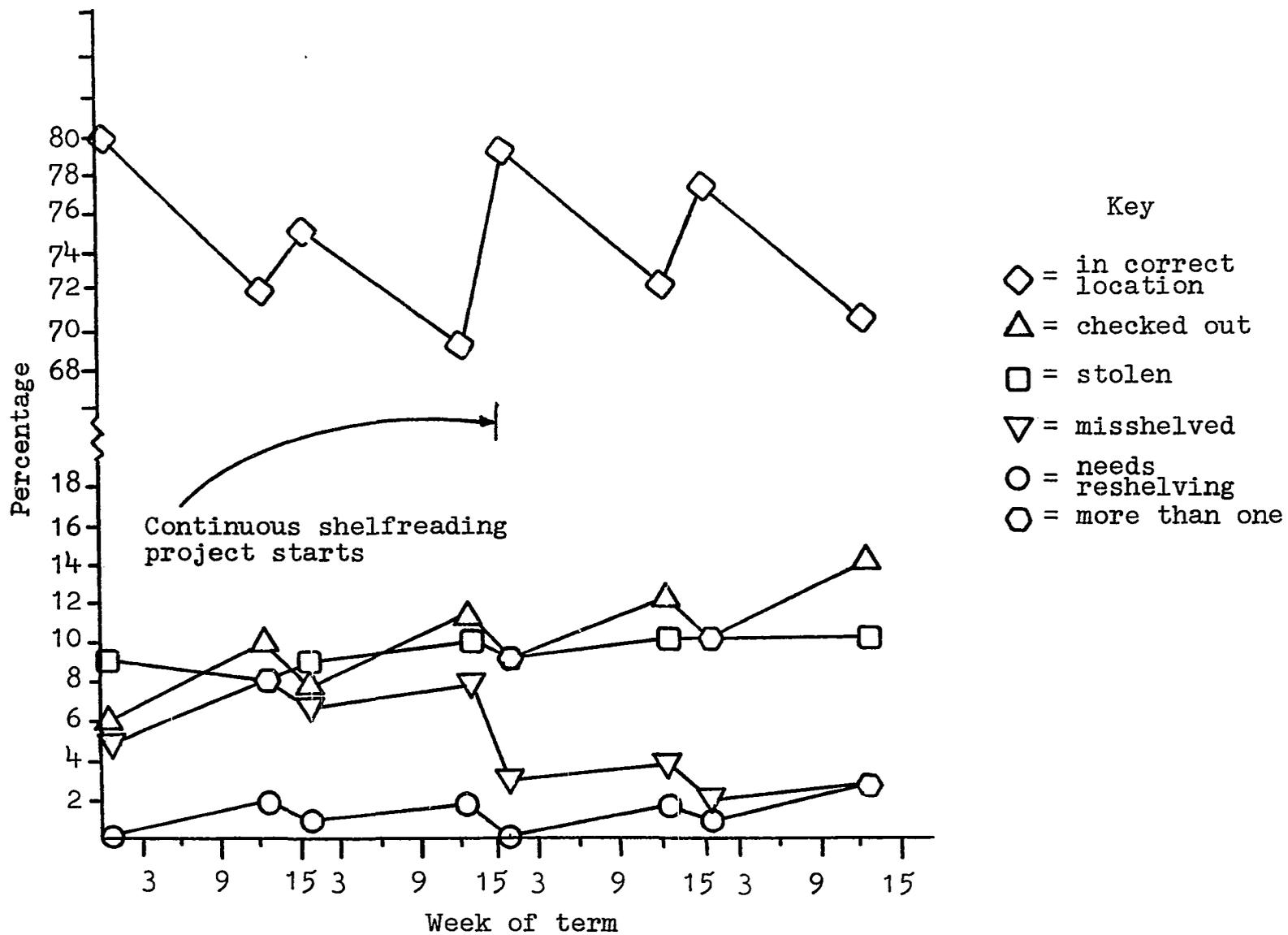
Fig. 6.--Collection status model graph
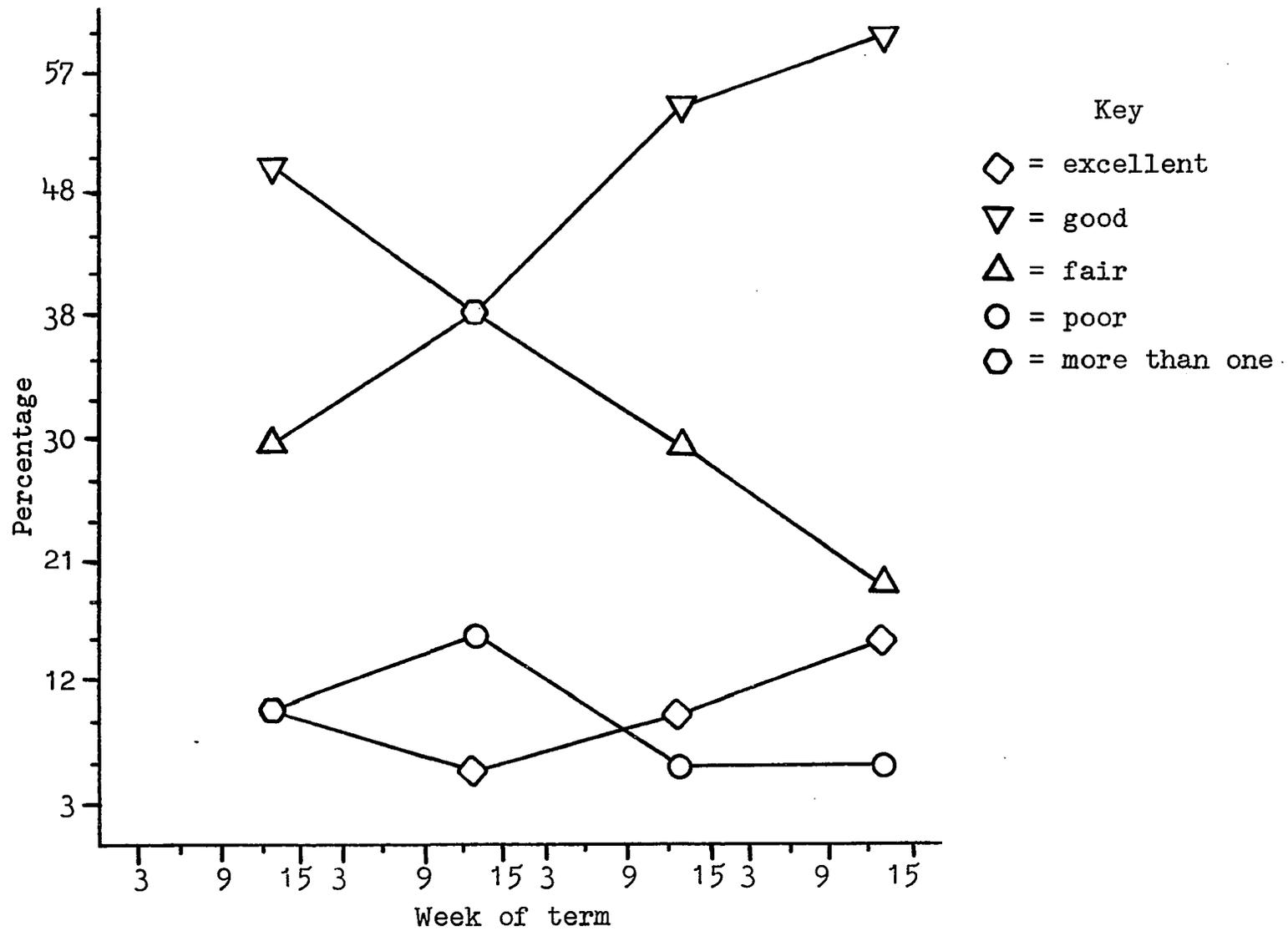
Fig. 7.--Patron attitude graph

Left
ordinate

Right
ordinate

needs
reshelving

graduate
total
course
hours

misshelved

under-
graduate
total
course
hours

stolen

checked out

total
patron
course
hours

in correct
location

Percentages

82
80
78
76
74
72
70
68
66
16
14
12
10
8
6
4
2

Patron course hours

250,000

200,000

150,000

100,000

50,000

3   9   15   3   9   15   3   9   15   3   9   15

Term of week
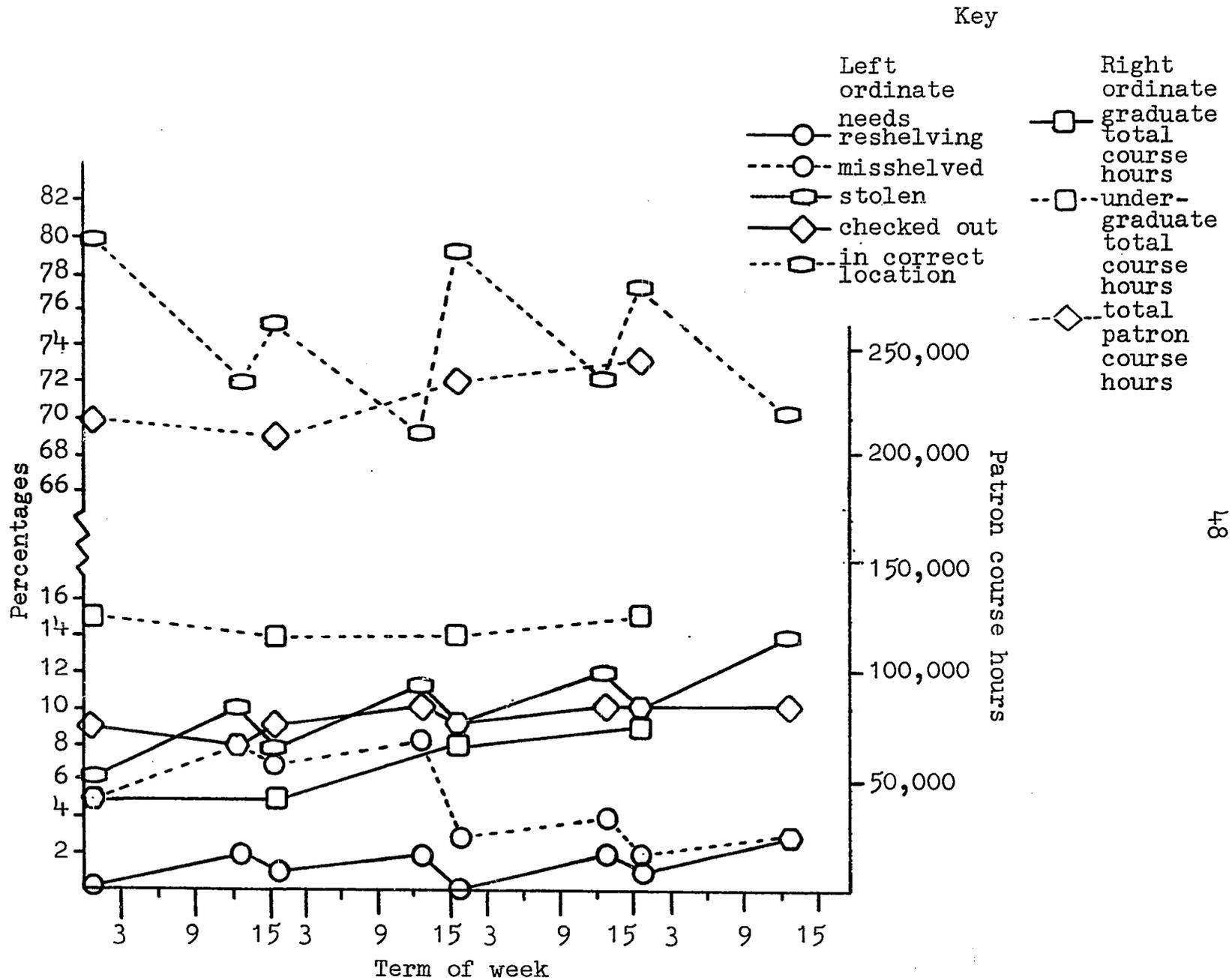
Fig. 8.--Collection utilization graph

48

The graph in Figure 8 (page 48) has as its purpose
the depicting of the utilization made of the collection over
a given time period related to the number of course hours in
which students are enrolled for that same time span. A
graph of this type could be prepared for each major subject
area, for all subject areas together, or for combinations of
subject areas. This type of graph when used with related
numerical data should permit the library management to note
the effect of the number of course hours being taught to the
utilization made of the collection. Graphs of this type
should also assist the library's management in identifying
to the faculty and university administration the utilization
made of the collection or collections. This should then
assist in collection building and balancing as well as over-
all academic planning. The utilization of these graphs need
not be limited to university settings only.

To meet the second minor goal which was noting the
economic factors relating to the use of the management in-
formation system, actual costs incurred in making the various
analysis were recorded and reported where performed by this
research.

With the methodology for meeting the objective of
this research now stated, a brief discussion of the method
to be used in determining sample sizes is offered.

Sample Size

The confidence one can place in the data derived from

this management information system is related to the size of
the sample and the degree of accuracy. The distribution
studied is binomial or multinomial in all cases. The method
of determining sample size therefore makes use of the follow-
ing formula:

$$N \geq \frac{K^2}{4 \epsilon^2}$$

Where:

N is the size of needed sample

K is the value of the student-t distribution at a
set level

α is the probability that the observed sample is in
fact representative of the total population
sampled

ϵ is the interval around the factor being tested
given the level

As example: One wanted to be 95% confident that the sample
taken represents the population studied by ± 2%, therefore:

$$N \geq \frac{K^2}{4 \epsilon^2}$$

$$N \geq \frac{(1.96)^2}{4(.02)^2}$$

$$N \geq 12,500$$

This method is derived from the Bernoulli's "weak law of
large numbers." For the derivation of the formula note
Parzen, 1960, pages 228-232.

The formula can be written in the following manner:

$$N = [\ (P)\ (1-P)]\ \frac{K^2}{\epsilon^2}$$

where P is the highest possible probability of the occurrence of the factor being tested. Therefore, the formula with the four in the denominator will test the worst case, 50% or where P is 1/2 and 1/2 x 1/2 = 1/4. If one knows or is confident that not more than 20% of all of the volumes in the collection are missing, then the sample size needed to test this hypothesis would be calculated in the following way if one wanted to be ± 5% from the true level of the factor (missing volumes):

let: K = 95%

ϵ = 5%

P = 20%

$$N \geq \frac{K^2}{\epsilon^2}\ [\ (P)\ (1-P)\ ]$$

$$N \geq \frac{(1.96)^2}{(.05)^2}\ [\ (.2)\ (.8)\ ]$$

$$N \geq 246$$

From this last example it can be seen that the sample sizes needed to find the data for the collection status model and for the patron attitudes is workable and should be within economical ranges for any university library.

Limitations

The library management information system discussed in this research is designed only to relate statistical data on the attitudes of patrons, status of collections, and the utilization made of those collections. The information gleaned from the system would be used in concert with other management information about the library and its setting. It should be pointed out that library managers would be ill advised for a number of reasons to make decisions on library problems using only data from this information system. First of all, there is no data on the personnel in the library system produced by this information system. Second, there is no fiscal data about the library. Third, there is no reading of the informal information systems of the library and the library's parent organization. Without data from all of these different information systems a library manager would be unequipped to make an intelligent decision on many library problems. In short, the information provided by the methods related in this research will add to that which should already be in use by a manager; thereby he will have more complete data to place in his decision model.

CHAPTER V

APPLICATION OF METHODOLOGY

The first major goal of this research was to develop
a methodology for relating the effectiveness of a university
library from three points of view (a. status of collections,
b. attitudes of patrons, and c. utilization of collections).
Now that the methodology has been developed in the preceding
chapter, the second major goal, the application of the meth-
ology to a university library, and the third major goal of
reporting the findings relating the effectiveness of library
operations to the management of the library via a management
information system need to be met. To accomplish these goals
data derived from the application of the collection status
model will be tabulated and then data on the two assessment
tools (patron attitudes and collection utilization) will be
presented. The meeting of the two minor goals (designing the
reporting system so that it is time-related and the noting of
economic factors) will also be demonstrated in this chapter.

Collection Status Model: Application,
Results, and Reporting System

The source of data used to demonstrate the collection

status model was the Bizzell Memorial Library at the University of Oklahoma, Norman, Oklahoma. The collection studied was the monographs classified in the Library of Congress system. This segment of the library's collection was chosen for it received heavy use, and it was known that all volumes classed in this sector were added to the collection sometime during the past six years subsequent to the time the library switched to the Library of Congress system.

The size of the sample was determined by using the formula noted in the previous chapter for calculating sample size. The management of the library made the judgment that they wanted to be 95% confident in the findings with a $\pm$ 3% confidence interval. With the assumption that the collection to be studied would not have more than 16% of its books missing, a sample size of 574 (or more) was calculated.[1] A random sample of 603 volumes was drawn from the shelf list. The sampling area did not encompass all of the Library of Congress classed monographs noted in the shelf list. The volumes that were predominately located in branch libraries were omitted in order to restrict the study to the main library.

By using the experimental methodology noted in the proceeding chapter, the following percentages (Table 3, page 55) for the functions in the collection status model were determined.

---

[1]This percentage was derived subjectively through discussions with the library management.

TABLE 3

COLLECTION STATUS REPORT

Status of Volumes	Percentage of Volumes for each Iteration		
	1(12-3-72)	2(1-14-73)	3(4-15-73)
On the shelves in their correct location	68.7	75.5	70.3
Checked out	11.1	6.3	10.8
Needing to be reshelved	.5	.4	.3
Stolen	11.1	10.9	13.2
Misshelved	8.6	6.9	5.4
Total	100.0%	100.0%	100.0%
Week of term	14th	0	13th

The same experiment was repeated two additional times. The
percentage results and dates of the studies are also noted in
Table 3. The graphical presentation of the data is noted in
Figure 9 (page 56). In order to determine if the shifts in
the data were significant a Chi-squared statistical test was
performed. The null hypothesis, i.e. there is no significant
difference between the three studies that relate the status
of the collection, was tested. The Chi-squared statistic
used was the one produced by using the frequency data of the
factors in the formula noted below.

$$x^2 = \sum_{i=1}^{r} \sum_{j=1}^{k} \frac{(f_{ij} - e_{ij})^2}{e_{ij}}$$
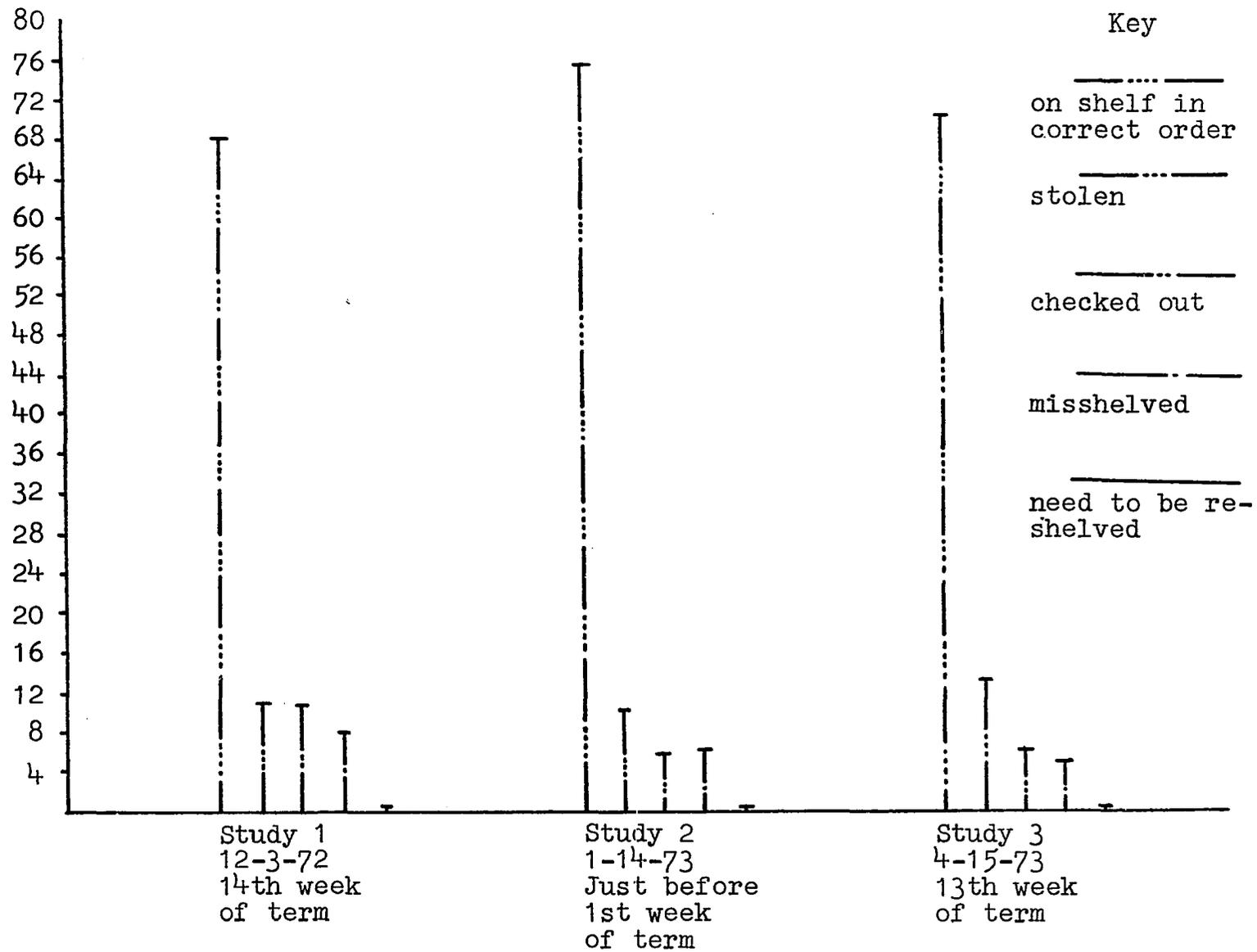
Fig. 9.--Collection status graph

Where:

       f is the observed number

       e is the calculated expected number

       r is the number of data rows

       k is the number of data columns

This Chi-squared statistic can accommodate the unequal sample sizes which were present. It was found that the null hypothesis, i.e. that there is no significant difference between the three studies of collection status, must be rejected (at the .05). The same test statistic was also calculated for all the logical sets of two of the three studies using the same null hypothesis. It was found that the null hypothesis must be rejected in each of the following cases.

            First study to second study,

            first study to third study, and

            second study to third study.

From the tabular and graphical displays of the findings, one can see a significant shift in the status of the collection. For example, the study done at the start of the term (1-14-73) noted a higher percentage of books on the shelves in their correct locations than did the studies done during the last part of the terms. The percentage of books checked out was higher for the studies conducted at the later part of the term then was found by the study done at the start of the term. The lowering of the misshelving factor can be explained because the library management set up a

project to read the shelves and place the volumes in their correct order. This decision was made based upon the first study (12-3-72) which was done to relate the status of the collection.

Thus far in this section and in the preceding chapter the collection status model has been developed, applied, and reported on a time-related basis for a major collection in a university library. In order to meet all of the major and minor goals of this research, the minor goal of relating the economic factors needs to be fulfilled. The direct costs of the statistical collection status model were those recorded in Table 4.

TABLE 4

DIRECT COSTS OF USING THE COLLECTION STATUS MODEL

Librarian (researcher)

1.	setting up sample	6 hrs	
2.	running the study	5	
3.	evaluating results and writing a report	4	
		15 hrs at $6.00	90.00

Student assistants

1.	setting up sample (two for six hours each)	12 hrs	
2.	collecting the data (eighteen for four hours each)	76	
		86 hrs at $2.00	172.00
Printing of forms			4.00
	Total Direct Costs		$266.00

Additional Uses of the Collection
Status Model

With the major and minor goals of this research met for the collection status model, it is advantageous to relate other uses of this model before noting the application and results of the patron and utilization assessment tools. One clear use of part of the collection status model is to evaluate ongoing reshelving and shelf reading projects. In order to do this, one uses just the portion of the procedure that relates to misshelving. This could be done for a group of collections or for a segment of one collection. For example, if it is believed that one area of a collection or one physical section in the library has a misshelving problem when related to another collection or section, an experiment can be conducted to note if there is a statistically significant difference.

The total model could be used to relate the effectiveness of a security system. This could be done by first noting the level of stealing in the collection before adding the system. Then the level of stealing in the part of the collection could be added to the library after the new security system had been put into use. It would be important to do this study over a period of two years or more given the cyclical pattern of book use. It can be seen from this brief discussion that this part of the library management information system can be used by itself as well as in concert with the other sectors of the system.

Summary

The collection status model is one-third of the library management information system developed and applied by this research. When in use by a university library, it is to consist of time-related reports on the status of the total collection relative to the percentages of volumes a) on the shelves in their correct location, b) checked out, c) needing to be reshelved, d) stolen, and e) misshelved. These time-related reports may also note the status of major divisions of the collection if this information were desired by the management of the library. The report will be formated as shown in Table 3 (page 55). In addition to this report a graphic display of each collection or division of a collection will also be presented. This graphing will be done in the format shown in Figure 9 (page 56).

With the data on the status of the collection noted by this library management information system, the administration of a university library could have a clearer picture of the location dynamics of its collections. The management of the library could also monitor the effects of actions taken by the library to change the location status of its collection or collections.

Patron Attitude Assessment Tool: Application, Results, and Reporting System

The setting used to demonstrate the patron attitude assessment tool was the Bizzell Memorial Library at the

University of Oklahoma, Norman, Oklahoma. A questionnaire, Figure 5 (pages 38-39), was used in this assessment. The questionnaires used were printed on one page by using smaller typeface. The questionnaire was given to every patron in the library during three randomly selected thirty minute periods (one morning, one afternoon, and one evening) during the thirteenth week of the Spring term. The thirteenth week was chosen because historically it is the busiest week of the term using home loans as the indicator of use.

A total of 890 questionnaires were given to patrons in the library during these three times; 666 useable questionnaires were returned. The return rate was 74.83%.[1] From these useable questionnaires the following percentages could be determined. The percentage of the questionnaires coming from each of the three times were

26.0% for the morning,

26.4% for the afternoon, and

47.6% for the evening.

When the above data were statistically tested, it was learned that the null hypothesis could not be rejected. The null hypothesis was that the distribution found was the same as the expected distribution. The expected distribution was 25% morning, 25% afternoon, and 50% for evening. The statistical test used was a Chi-square (at the .05 level).

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[1] According to Kerlinger, page 397, this percentage of return is uncommonly high for this type of questionnaire. Returns of less than 40 to 50 percent are common.

The percentage for each patron group in the sample was noted to be

68.3% undergraduate students,

28.2% graduate students,

1.4% faculty, and

2.1% other.

When these groups were compared statistically to the make up of the university community as related by the Provost Office, it was learned that the null hypothesis (the distribution are the same) must be rejected (at the .05 level). The following data relates library users to the university community population make up.

Library Users		University Population[1]
68.3%	Undergraduate students	73.95%
28.2%	Graduate students	21.07%
1.4%	Faculty	4.19%
2.1%	other/ special	.79%

Turning now to the heart of the questionnaire (questions two through ten), the following percentages of patrons marked responses in one of the five ratings. These percentages are noted in Table 5 (page 63). From these data it is important to note that 19.4% of the patrons did not avail themselves of the assistance offered by the subject area

[1]These percentages were developed from head count data provided by the Provost Office. The Law school's faculty and students have been omitted for their library was not part of this study.

TABLE 5

GENERAL PATRON ATTITUDE

	Percentage Responding				
	Excel-lent	Good	Fair	Poor	Not Used
Quality of materials provided by the library for my course or classroom work is (N=650)	19.5	48.3	17.4	5.4	9.4
Quality of materials provided by the library for my research is (N=609)	15.4	37.1	24.6	10.8	12.1
Quantity of materials provided by the library for my course or classroom work is (N=640)	15.8	39.2	22.3	13.2	9.5
Quantity of materials provided by the library for my research is (N=604)	11.4	28.9	27.2	20.7	11.8
Service provided by the Information Desk is (N=654)	25.8	37.8	16.8	5.8	13.8
Photo Duplication service provided by the copy machines on the different floors are (N=642)	20.1	33.6	17.9	13.1	15.3
Photo Duplication service provided by the Duplication office in the basement is (N=607)	15.8	25.9	8.7	3.0	46.6
Study areas are (N=648)	15.6	49.1	26.1	8.2	1.0
Service from the Reserve Book Collection is (N=630)	15.6	32.2	11.6	4.9	35.7
Help from a subject area (floor) librarian is (N=644)	23.5	34.3	14.4	8.4	19.4
Help from a subject area (floor) student assistant is (N=626)	20.6	32.2	17.9	10.1	19.2
Interlibrary Loan Office service is (N=608)	6.6	12.8	5.6	2.1	72.9
Acquisitions Office service is (N=604)	2.8	11.6	6.5	3.3	75.8

librarians. It is also important to note that 19.2% of the patrons did not request help from the subject area student assistants. This library management information system was not designed to provide reasons as to why 19% of the library's patrons did not avail themselves of the personal assistance available to them, but it does relate that 19% of the patrons were not using this service. This fact was not known by the library management. If actions were taken to change this situation, the results of the action would be noted by the next patron attitude assessment.

The degree that the library was used as a study area was very high (99%). Therefore, it is correct to assume that the main library was a study area. If it was a goal of the library to provide acceptable study areas for its patrons, then it is correct to assume that this service was being used. The next step was to see what the level of user satisfaction was relative to this service.

The rating of the library relative to providing the quantity of materials needed for research was much lower than the quantity of materials needed for course or classroom work. This evaluation of the patrons provides or raises a group of questions about the library's research collection. Some of these questions might be, is the research collection too small, too hard to use, or are the patrons not informed as to how best to use the collection? This type of question can not be answered by this library management information

system for the system is not designed to do so, but the system is designed to point out problem areas and it appears to have done so in this case.

The service provided by the Information Desk is rated high as compared to other services. The reason or reasons why the service was rated high by the patrons is not part of the systems design but the management of the library can and should note what is being done by this department so that this well rated service can be replicated by other departments. With an information system which will point up both the strong and weak areas, management should then be able to adjust the weak areas by replicating the methods used in the highly rated areas.

In the cases of ratings for the Reserve Book Collection and the Duplication Office there were a large number of patrons who noted they did not use these services. It may be logical for these library services to ask themselves the reason for this lack of use. Is it a matter of little need or the locations of the services? The system is not designed to tell the management the answers to these questions, but the system does tell us there is little use. It should be pointed out again that this assessment tool can be used by itself in most types of libraries. This particular questionnaire was designed only for the main library at the University of Oklahoma. All one needs to do to use this assessment tool in another library is to reword some of the

questions on the questionnaire. All other segments of the
assessment methodology would remain the same.

By examining the reactions of the patrons who used
the materials and services provided by the library and who
rated these materials and services, a great deal can be
learned about the patrons' attitudes toward the library. The
percentage ratings of these attitudes are noted in Table 6
(page 67). When these data were ranked from the highest
rating to the lowest, the attitudes of the patrons were re-
corded in relation to each function provided by the library.
The method of ranking was that of adding the percentages for
excellent and good together and then assigning the highest
rank (one) to the largest percentage. The ranks noted in
Table 7 (page 68) were done by this method.

This form of assessing and reporting patrons' atti-
tudes may not only reveal the relative placement of the dif-
ferent materials and services provided by the library as
viewed by its patrons, but it may also note the changes in
these attitudes over time as subsequent patron attitude as-
sessments are completed. These changes may be in percentage
or in relative rank, but in either case the changes can be
noted when the assessing is repeated. The method of noting
these changes is shown later in this chapter. The method is
one that relates if there has been a statistically signifi-
cant change.

When looking at the responses to the questionnaires

TABLE 6

GENERAL PATRON ATTITUDE: NON USER OMITTED

	Percentage Responding			
	Excellent	Good	Fair	Poor
Quality of materials provided by the library for my course or classroom work is (N=589)	21.6	53.3	19.2	5.9
Quality of materials provided by the library for my research is (N=536)	17.5	42.2	28.0	12.3
Quantity of materials provided by the library for my course or classroom work is (N=579)	17.4	43.4	24.7	14.5
Quantity of materials provided by the library for my research is (N=533)	12.9	32.8	30.8	23.5
Service provided by the Information Desk is (N=564)	30.0	43.8	19.5	6.7
Photo Duplication service provided by the copy machines on the different floors are (N=544)	23.7	39.7	21.1	15.5
Photo Duplication service provided by the Duplication office in the basement is (N=324)	29.6	48.5	16.4	5.6
Study areas are (N=641)	15.8	49.6	26.4	8.2
Service from the Reserve Book Collection is (N=405)	24.5	50.1	18.0	7.7
Help from a subject area (floor) librarian is (N=519)	29.1	42.6	17.9	10.4
Help from a subject area (floor) student assistant is (N=506)	25.5	39.9	22.1	12.5
Interlibrary Loan Office service is (N=165)	24.2	47.3	20.6	7.9
Acquisitions Office service is (N=146)	11.6	47.9	26.7	13.8

TABLE 7

RANKING OF PATRON ATTITUDES: NON USER OMITTED

	Rank
Quality of materials provided by the library for my course or classroom work is	2
Quality of materials provided by the library for my research is	11
Quantity of materials provided by the library for my course or classroom work is	10
Quantity of materials provided by the library for my research is	13
Service provided by the Information Desk is	4
Photo Duplication service provided by the copy machines on the different floors are	9
Photo Duplication service provided by the Duplication office in the basement is	1
Study areas are	7 & 8
Service from the Reserve Book Collection is	3
Help from a subject area (floor) librarian is	5
Help from a subject area (floor) student assistant is	7 & 8
Interlibrary Loan Office service is	6
Acquisitions Office service is	12

by user groups, additional information is learned. Only two user groups were of sufficient size to compare; thus only the undergraduate and graduate students' attitudes were contrasted. In Table 8 (page 70) the overall ratings of undergraduates are noted and in Table 9 (page 71) the ratings of those undergraduates who noted they used the materials and services provided by the library are noted. The same information regarding graduate students is recorded in Tables 10 (page 72) and 11 (page 73).

By comparing the data from the tabulations of the undergraduates and graduate students, the information noted in Table 12 (pages 74-75) is revealed. This information includes both the relative rank of each service (including type of material provided by the library for both graduate and undergraduate students) and the percentage (the sum of excellent and good) representing each rank. An examination of the data for the undergraduate and graduate students revealed a significant difference between the two. In order to determine if there was a significant difference between these two groups, a null hypothesis was stated and statistically tested. The null hypothesis was that there is no significant difference between the attitudes of the graduate and undergraduate students (H_o: $P_1 = P_2$). To test this hypothesis the following Z statistic was used.

TABLE 8

GENERAL UNDERGRADUATE STUDENT ATTITUDE

	Percentage Responding				
	Excellent	Good	Fair	Poor	Not Used
Quality of materials provided by the library for my course or classroom work is (N=449)	18.5	51.9	14.0	4.5	11.5
Quality of materials provided by the library for my research is (N=412)	14.6	38.6	21.8	8.3	16.7
Quantity of materials provided by the library for my course or classroom work is (N=443)	14.7	43.3	20.5	10.2	11.3
Quantity of materials provided by the library for my research is (N=407)	10.8	32.4	24.6	16.0	16.2
Service provided by the Information Desk is (N=449)	26.7	40.1	14.7	4.7	13.8
Photo Duplication service provided by the copy machines on the different floors are (N=441)	21.5	34.7	15.2	9.8	18.8
Photo Duplication service provided by the Duplication office in the basement is (N=417)	13.7	24.5	7.0	1.7	53.2
Study areas are (N=180)	17.5	48.9	25.8	7.0	0.9
Service from the Reserve Book Collection is (N=428)	15.2	30.1	11.0	4.7	39.0
Help from a subject area (floor) librarian is (N=440)	20.2	36.4	12.5	7.0	23.9
Help from a subject area (floor) student assistant is (N=427)	17.8	32.3	18	8.7	23.2
Interlibrary Loan Office service is (N=413)	3.1	9.7	3.7	.7	82.6
Acquisitions Office service is (N=411)	2.4	10.5	5.8	2.2	79.1

TABLE 9

GENERAL UNDERGRADUATE STUDENT ATTITUDE: NON USER OMITTED

	Percentage Responding			
	Excellent	Good	Fair	Poor
Quality of materials provided by the library for my course or classroom work is (N=399)	20.8	58.4	15.8	5.0
Quality of materials provided by the library for my research is (N=343)	17.5	46.4	26.2	9.9
Quantity of materials provided by the library for my course or classroom work is (N=393)	16.5	48.9	23.2	11.4
Quantity of materials provided by the library for my research is (N=341)	12.9	38.7	29.3	19.1
Service provided by the Information Desk is (N=387)	31.0	46.5	17.1	5.4
Photo Duplication service provided by the copy machines on the different floors are (N=358)	26.5	42.7	18.7	12.0
Photo Duplication service provided by the Duplication office in the basement is (N=195)	29.2	52.3	14.9	3.6
Study areas are (N=442)	17.7	49.3	26.0	7.0
Service from the Reserve Book Collection is (N=261)	24.9	49.4	18.0	7.7
Help from a subject area (floor) librarian is (N=335)	26.6	47.8	16.4	9.3
Help from a subject area (floor) student assistant is (N=328)	23.2	42.1	23.5	11.3
Interlibrary Loan Office service is (N=72)	18.1	55.6	22.2	4.2
Acquisitions Office service is (N=146)	11.6	47.9	26.7	13.8

TABLE 10

GENERAL GRADUATE STUDENT ATTITUDE

	Percentage Responding				
	Excel-lent	Good	Fair	Poor	Not Used
Quality of materials provided by the library for my course or classroom work is (N=182)	22.5	40.1	25.3	7.7	4.4
Quality of materials provided by the library for my research is (N=174)	16.1	33.9	30.5	17.2	2.3
Quantity of materials provided by the library for my course or classroom work is (N=179)	19.0	30.2	26.3	20.1	4.5
Quantity of materials provided by the library for my research is (N=174)	10.9	21.3	34.5	30.5	2.9
Service provided by the Information Desk is (N=183)	23.0	33.9	21.9	7.7	13.7
Photo Duplication service provided by the copy machines on the different floors are (N=180)	14.4	33.9	23.9	21.1	6.7
Photo Duplication service provided by the Duplication office in the basement is (N=169)	19.5	29.6	13.6	5.3	32.0
Study areas are (N=180)	8.9	51.1	27.8	11.1	1.1
Service from the Reserve Book Collection is (N=179)	16.8	39.1	14.0	4.5	25.7
Help from a subject area (floor) librarian is (N=183)	29.0	32.2	18.0	11.5	9.3
Help from a subject area (floor) student assistant is (N=177)	25.4	32.8	18.6	13.0	10.2
Interlibrary Loan Office service is (N=174)	13.2	19.5	9.2	4.6	53.4
Acquisitions Office service is (N=171)	3.5	14.6	7.6	4.7	69.6

TABLE 11

GENERAL GRADUATE STUDENT ATTITUDE: NON USER OMITTED

	Percentage Responding			
	Excellent	Good	Fair	Poor
Quality of materials provided by the library for my course or classroom work is (N=174)	23.6	42.0	26.4	8.1
Quality of materials provided by the library for my research is (N=170)	16.5	34.7	31.2	17.7
Quantity of materials provided by the library for my course or classroom work is (N=171)	19.9	31.6	27.5	21.1
Quantity of materials provided by the library for my research is (N=169)	11.3	21.3	35.5	31.4
Service provided by the Information Desk is (N=158)	26.6	39.2	25.3	8.9
Photo Duplication service provided by the copy machines on the different floors are (N=168)	15.5	36.3	25.6	22.6
Photo Duplication service provided by the Duplication office in the basement is (N=115)	28.7	43.5	20.0	7.8
Study areas are (N=178)	9.0	51.7	28.1	11.2
Service from the Reserve Book Collection is (N=133)	22.6	52.6	18.8	6.0
Help from a subject area (floor) librarian is (N=166)	31.9	35.6	19.9	12.7
Help from a subject area (floor) student assistant is (N=159)	28.3	36.5	20.8	14.5
Interlibrary Loan Office service is (N=81)	28.4	42.0	19.8	9.8
Acquisitions Office service is (N=52)	11.5	48.1	25.0	15.4

TABLE 12

ATTITUDES OF GRADUATE AND UNDERGRADUATE STUDENTS COMPARED

	Percentage Responding (Excellent added to Good)		Rank	
	Under-graduate	Grad-uate	Under-graduate	Grad-uate
Quality of materials provided by the library for my course or classroom work is	79.2	65.6	2	5
Quality of materials provided by the library for my research is	63.9	51.2	10	10
Quantity of materials provided by the library for my course or classroom work is	65.4	51.5	8	9
Quantity of materials provided by the library for my research is	51.6	33.2	11	11
Service provided by the Information Desk is	77.5	65.8	3	4
Photo Duplication service provided by the copy machines on the different floors are	69.2	51.8	6	8
Photo Duplication service provided by the Duplication office in the basement is	81.5	72.2	1	2
Study areas are	67.0	60.7	7	7
Service from the Reserve Book Collection is	74.3	75.2	5	1
Help from a subject area (floor) librarian is	74.4	67.5	4	3
Help from a subject area (floor) student assistant is	65.3	64.8	9	6

TABLE 12--Continued

	Percentage Responding (Excellent added to Good)		Rank	
	Under-graduate	Grad-uate	Under-graduate	Grad-uate
Interlibrary Loan Office service is	73.7	70.4	*	**
Acquisitions Office service is	61.6	59.6	*	**

**Not ranked so the two patron group could be compared on the same base.

*Not ranked for the service is not to be used by this patron group.

$$Z = \cfrac{\dfrac{X_1}{n_1} - \dfrac{X_2}{n_2}}{\sqrt{P^* (1 - P^*) \left(\dfrac{1}{n_1} + \dfrac{1}{n_2}\right)}}$$

with $\quad P^* = \dfrac{X_1}{n_1} + \dfrac{X_2}{n_2}$

where: $\quad X_1 \quad$ is the frequency for undergraduate students who noted a rating of excellent or good

$\qquad\quad X_2 \quad$ is the frequency for graduate students who noted a rating of excellent or good

$\qquad\quad n_1 \quad$ is the total number of undergraduate students who rated the library in this area

$\qquad\quad n_2 \quad$ is the total number of graduate students who rated the library in this area.

The results of this test are shown in Table 13 (pages 77-78).

If the data on the difference between the attitudes of the graduate and undergraduate students are interpreted based on the assumption that graduate students are more informed users of libraries and thus better judges of library services and materials, the rates for the library would be lowered because the graduate students rated the library lower on all but one topic (the reserve book collection).

Thus far in this section and in the preceding chapter the patron attitude assessment tool has been developed, applied, and reported on a time-related basis for a given university library. In order to meet all of the major and minor goals of this research, the minor goal of relating the economic factors needs to be fulfilled. The direct costs

TABLE 13

ATTITUDE OF GRADUATE AND UNDERGRADUATE STUDENTS
TESTED FOR SIGNIFICANT DIFFERENCES

	Z Calcu-lated	Significant Difference at 95% Level
Quality of materials provided by the library for my course or classroom work is	3.33	Yes
Quality of materials provided by the library for my research is	2.7	Yes
Quantity of materials provided by the library for my course or classroom work is	3.02	Yes
Quantity of materials provided by the library for my research is	3.89	Yes
Service provided by the Information Desk is	2.819	Yes
Photo Duplication service provided by the copy machines on the different floors are	3.867	Yes
Photo Duplication service provided by the Duplication office in the basement is	1.909	Yes
Study areas are	1.432	No[a]
Service from the Reserve Book Collection is	.189	No

TABLE 13--<u>Continued</u>

	Z Calcu-lated	Significant Difference at 95% Level
Help from a subject area (floor) librarian is	1.53	No[b]
Help from a subject area (floor) student assistant is	.112	No
Interlibrary Loan Office service is	.	*
Acquisitions Office service is		*

*Data too limited to test.

[a]Yes at the 92% level.

[b]Yes at the 93.5 level.

associated with using the patron attitude assessment were those recorded in Table 14.

TABLE 14

DIRECT COSTS OF USING THE PATRON
ATTITUDE ASSESSMENT TOOL

Personnel

1. Pass out the questionnaires
   a. student assistant 1.5 hrs at $2.00 $ 3.50
   b. librarian (researcher) .5 hrs at $6.00   3.00

2. Code results
   a. student assistant 8 hrs at $2.00   16.00

3. Tally results
   a. student assistant 40 hrs at $2.00   80.00
      or
   b. computer tally of results at $10.00
      or less   (10.00)

4. Analysis of data and report writing
   a. librarian (researcher) 20 hrs at $6.00   120.00

Printing

1. Questionnaires
   Estimated at $4.00 per 1000   4.00

Total Direct Costs Estimated total without
      computer tally $226.50
Total Direct Costs Estimated total with
      computer tally $156.50

Summary

The purpose of the patron attitude assessment tool is to report patron attitudes toward the materials and services provided by a library. The reporting is done so that the materials and services provided by a library are ranked according to patron ratings of these materials and services.

The ratings are reported to the management of the library in the form of percentages as well as rank. The attitudes of the different user groups are noted, reported, and tested to determine if there are significant differences between these different user groups. The change of attitudes within any one user group over time is also noted and reported.

The data collected to demonstrate the methodology expressed by this research is reported in Table 15 (page 81) which notes the rank and corresponding percentages for patrons' ratings of the materials and services provided by the library. In Table 16 (pages 82-83) the attitudes of different patron groups are reported as are the results of the tests which note if the attitudes of the different user groups are significantly different. When the management information system is used over time, a report would also be made that would record if significant changes in attitudes occurred within the different patron groups.

It is assumed that the management of the library will have set a goal regarding the level of patron attitudes. For example, if the goal is that 75% of the patrons (by user groups) will rate each of the services provided by the library as being excellent or good, then the report shown in Table 17 (pages 84-85) would be provided to the management of the library based upon the data collected by this researcher. To determine if the hypothetical goal was met the following hypothesis was tested, $H_o: P = P_o$

TABLE 15

RANKING OF PATRON ATTITUDE: NON USER OMITTED

	Percentage Responding (Excellent added to Good)	Rank
Quality of materials provided by the library for my course or classroom work is	74.9	2
Quality of materials provided by the library for my research is	59.7	11
Quantity of materials provided by the library for my course or classroom work is	60.8	10
Quantity of materials provided by the library for my research is	45.7	13
Service provided by the Information Desk is	73.8	4
Photo Duplication service provided by the copy machines on the different floors are	63.4	9
Photo Duplication service provided by the Duplication office in the basement is	78.1	1
Study areas are	65.4	7 & 8
Service from the Reserve Book Collection is	74.6	3
Help from a subject area (floor) librarian is	71.7	5
Help from a subject area (floor) student assistant is	65.4	7 & 8
Interlibrary Loan Office service is	71.5	6
Acquisitions Office service is	59.5	12

TABLE 16

ATTITUDES OF PATRON GROUPS COMPARED AND
TESTED FOR SIGNIFICANT DIFFERENCES

	Percentage Responding (Excellent added to Good)		Rank		Difference Significant at 95% level
	Under-graduate	Graduate	Under-graduate	Graduate	
Quality of materials provided by the library for my course or classroom work is	79.2	65.6	2	5	Yes
Quality of materials provided by the library for my research is	63.9	51.2	10	10	Yes
Quantity of materials provided by the library for my course or classroom work is	65.4	51.5	8	9	Yes
Quantity of materials provided by the library for my research is	51.4	33.2	11	11	Yes
Service provided by the Information Desk is	77.5	65.8	3	4	Yes
Photo Duplication service provided by the copy machines on the different floors are	69.2	51.8	6	8	Yes
Photo Duplication service provided by the Duplication office in the basement is	81.5	72.2	1	2	Yes

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TABLE 16--Continued

| | Percentage Responding (Excellent added to Good) | | Rank | | Difference Significant at 95% level |
	Undergrad-uate	Grad-uate	Undergrad-uate	Grad-uate	
Study areas are	67.0	60.7	7	7	No/ Yes at 92
Service from the Reserve Book Collection is	74.3	75.2	5	1	No
Help from a subject area (floor) librarian is	74.4	67.5	4	3	No/ Yes at 93.5
Help from a subject area (floor) student assistant is	65.3	64.8	9	6	No
Interlibrary Loan Office service is	73.7	70.4	*	**	
Acquisitions Office service is	61.6	59.6	*	**	

**Not ranked so the two patron groups could be compared.

*Not ranked for the service is not to be used by this patron group.

TABLE 17

GOAL ATTAINMENT CHART FOR PATRON ATTITUDES

	25%	50%	Goal 75%	Goal Met 100%
Quality of materials provided by the library for my course or classroom work is			-------------------------------79.2*	Yes
	-.-.-.-.-.-.-.- 65.6 ·			No
Quality of materials provided by the library for my research is		----------------63.9		No
	-.-.-.-.-.-51.2			No
Quantity of materials provided by the library for my course or classroom work is		--------------65.4		No
	-.-.-.-.-.- 51.5			No
Quantity of materials provided by the library for my research is	-------------- 51.4			No
	-.-.- 33.2			No
Service provided by the Information Desk is			---------------------77.5	Yes
	-.-.-.-.-.-.-.- 65.8			No
Photo Duplication service provided by the copy machines on the different floors are			------------------69.2	No
	-.-.-.-.-.- 51.8			No
Photo Duplication service provided by the Duplication office in the basement is			---------------------------81.5	Yes
	-.-.-.-.-.-.-.-.-.-72.2			Yes
Study areas are		---------------67.0		No
	-.-.-.-.-.- 60.7			No
Service from the Reserve Book Collection is			-------------------74.3	Yes
	-.-.-.-.-.-.-.-.-.-.-75.2			Yes

TABLE 17--Continued

	25%	50%	Goal 75%	Goal Met 100%
Help from a subject area (floor) librarian is			----------------------74.4	Yes
			-.-.-.-.-.-.-.- 67.5	No
Help from a subject area (floor) student assistant is			----------------65.3	No
			-.-.-.-.-.-.-.-64.8	No
Interlibrary Loan Office service is			-.-.-.-.-.-.-.-.--70.4	Yes

*Excellent and good are summed in all cases.

Key: ------------- Undergraduate.

      -.-.-.-.-.-.- Graduate.

Where

P   is the percentage for the sum of excellent and
     good related by the completed questionnaires

P_O is the percentage for the sum of excellent and
        good based upon the goal (this is .75 in the
        case used)

The alternative hypothesis tested was $P < P_O$. The test sta-
tistic used was

$$Z = \frac{X - nP_O}{\sqrt{nP_O (1 - P_O)}}$$

Where

n   is the number of questionnaires that were noted
     good or excellent for a given question

X   is the total number of responses to the given
     question being tested

P   is the same as noted above

P_O is the same as noted above

From the data given in Table 17 (pages 84-85) it is
seen that the library would meet its hypothetical goal in
eight out of twenty-three cases. These reports would be
made on a time-related basis, and the assessment would be
made as often as desired. With these reports on the atti-
tudes of patrons toward the materials and services provided
by the library, the management of the library will be able
to note how close it was coming to meeting its goals. The
effect of different programs on the attainment of goals set
by the library management will also be noted by using the
patron attitude assessment tool over time.

Collection Utilization Assessment Tool:
Application, Results, and
Reporting System

The setting used to demonstrate the collection utilization tool was the Bizzell Memorial Library and the nine branch libraries at the University of Oklahoma, Norman, Oklahoma. The purpose of this portion of the library management information system was to determine the relationship between the potential and actual utilization made of the collection. In order to note the relationship between actual and potential utilization made of the collection or segments of the collection, it is necessary to define the collection as to size and to record the use made of the collection or segments of the collection. The size of the collection was determined by measuring the shelf list. Because statistical samples indicated it was correct, the standard rule of one hundred cards per inch was used. An experiment was conducted to determine the relationship between cards in the shelf list and the number of volumes represented by these cards. The relationship noted was 1.989 volumes per card in the list. Once the number of cards in the shelf list for each major classification groups was known, these numbers were then converted to the Registrar's classification system. This conversion was done as related in the previous chapter. Once this process was completed, a list of the number of volumes held by the library in the Registrar's classification system was produced. The three systems of

classification (Library of Congress, Dewey, and Registrar)
are not totally compatible; therefore, a few extra classifi-
cations were also produced. The end product of this process
is a listing by the Registrar's classification system of the
number of volumes held in each teaching area at the univer-
sity and a percentage which notes that portion of the col-
lection held in each area. Data in Table 19 (pages 92-94)
relates the number of volumes held in each of the teaching
areas at the University of Oklahoma. The percentage of the
total collection in each of these subject areas is also
noted in Table 19. Thus, the potential volumes to be used
in each classification was known and reported.

The next step was to note the potential user popula-
tion for each of these classifications. This was done by
noting the number of credit hours being taught in each of the
Registrar's classifications. Data relating the number of
credit hours were obtained from the Registrar's "Credit Hour
Analysis." With these data a complete picture of the poten-
tial utilization of the collection was known. This is to
say, the size of each subject classification was known rela-
tive to the number of volumes held, and the number of credit
hours being taught in each subject classification was known
too. Table 19 (pages 92-94) gives the number of credit hours
being taught for each teaching area and the percentage of the
total credit hours devoted to each of these subject areas.

A record of the actual utilization made of the

TABLE 18

COLLECTION UTILIZATION REPORT

Subject Area	Potential (Volumes held per credit hour) (Spring '73)	Actual[a] (Volumes circulated per credit hour)
1. Aerospace Studies	11.1	.64
2. Anthropology	3.7	.33
3. Architecture	2.4	.23
4. Art	3.8	.29
5. Aviation	2.6	.15
6. Botany & Microbiology	3.1	.19
7. Business Administration	3.9	.23
8. Chemistry	1.5	.07
9. Classics	1.9	.08
10. Drama	7.9	.36
11. Education	2.6	.19
12. Engineering	3.1	.16
13. English	10.1	.48
14. Geography	19.4	.50
15. Geology & Geophysics	5.3	.22
16. Health, Physical Education & Recreation	3.2	.24
17. History	10.6	.40
18. Home Economics	1.5	.09
19. Human Relations	1.5	.21
20. Information Science	5.8	.39

TABLE 18--Continued

Subject Area	Potential (Volumes held per credit hour) (Spring '73)	Actual (Volumes circulated per credit hour)
21. Journalism	.9	.04
22. Library Science	5.7	.35
23. Mathematics	1.2	.10
24. Meteorology	5.4	.24
25. Military Science	3.2	.19
26. Modern Languages	2.2	.08
27. Music	3.5	.24
28. Naval Science	3.5	.21
29. Pharmacy	3.5	.29
30. Philosophy	8.6	.50
31. Physics, Engineering Physics, & Astronomy	4.0	.27
32. Political Science	4.2	.24
33. Psychology	0.8	.13
34. Regional & City Planning	2.5	.29
35. Social Work	3.8	.32
36. Sociology	2.4	.31
37. Speech Communication	0.3	.02
38. Zoology	2.7	.20

TABLE 18--Continued

Subject Area	Potential (Volumes held per credit hour) (Spring '73)	Actual (Volumes circulated per credit hour)
39. Special Generalities		
40. Special Bibliographies & Catalogs		
41. Special Class[b]		
42. Statistics[c]		
43. General Science[d]		
44. Agriculture[e]		
45. Special History[f]		
Average	4.3	.23

4% of the total circulation fall in this area

[a]Data in this column is only the sum of the three samples.

[b]This group includes the 030's, 040's, 050's, 060's, and 080's of the Dewey Classification.

[c]This is the 310 of Dewey. Statistics was used by all so it was not divided.

[d]This is the 500's of Dewey. The general science was not divided.

[e]Not part of the educational program.

[f]The biography group.

TABLE 19

COLLECTION/CREDIT HOUR GROWTH REPORT

Subject Area	Number of Volumes in Collection	Number of Credit Hours This Term	Percentage of Collection	Percentage of Credit Hours
1. Aerospace Studies	2532	228	.28	.108
2. Anthropology	13426	3648	1.48	1.734
3. Architecture	7114	2935	.78	1.395
4. Art	23537	6114	2.60	2.906
5. Aviation	1254	485	.14	.231
6. Botany & Micro-biology	15019	4905	1.66	2.332
7. Business Administration	102003	26339	11.25	12.520
8. Chemistry	11964	8247	1.32	3.920
9. Classics	4853	2518	.54	1.197
10. Drama	16476	2085	1.82	.991
11. Education	46649	18191	5.15	8.647
12. Engineering	27330	8777	3.01	4.172
13. English	137039	13539	15.12	6.436
14. Geography	58609	3021	6.46	1.436
15. Geology & Geo-physics	17446	3283	1.92	1.561
16. Health, Physical Education & Recreation	11697	3659	1.29	1.739
17. History	98341	9279	10.85	4.411
18. Home Economics	7397	5318	.82	2.413

TABLE 19--Continued

Subject Area	Number of Volumes in Collection	Number of Credit Hours This Term	Percentage of Collection	Percentage of Credit Hours
19. Human Relations	2025	1318	.22	.627
20. Information Science	3954	686	.44	.326
21. Journalism	3436	3843	.38	1.827
22. Library Science	7987	1411	.88	.671
23. Mathematics	13012	10994	1.44	5.226
24. Meteorology	3491	641	.39	.305
25. Military Science	1278	405	.14	.193
26. Modern Languages	20944	9601	2.31	4.564
27. Music	16766	4858	1.85	2.309
28. Naval Science	1278	369	.14	.175
29. Pharmacy	9621	2774	1.06	1.319
30. Philosophy	54035	6251	5.96	3.019
31. Physics, Engineering Physics, & Astronomy	17488	4396	1.93	2.090
32. Political Science	36126	8580	3.98	4.078
33. Psychology	6585	8219	.73	3.907
34. Regional & City Planning	2282	923	.25	.439
35. Social Work	9402	2490	1.04	1.184
36. Sociology	17547	7195	1.94	3.420
37. Speech Communication	1399	4861	.15	2.311

TABLE 19--<u>Continued</u>

Subject Area	Number of Volumes in Collection	Number of Credit Hours This Term	Percentage of Collection	Percentage of Credit Hours
38. Zoology	22532	8229	2.49	3.912
39. Special Generalities	697		.08	
40. Special Bibliographies & Catalogs	6805		.75	
41. Special Class	4548	5.8% of the Collection	.50	
42. Statistics	2987		.33	
43. General Science	6368		.70	
44. Agriculture	9368		1.03	
45. Special History	21933		2.42	
Total	906578	210373		

collection was obtained by noting the number of home circulations made per each subject area. The process of recording all home circulations for ten libraries was determined to be unnecessary for this research. Instead, three samples of home circulations were taken from each of the ten libraries with each sample consisting of the total number of volumes in circulation at a given time; over due books were excluded from these samples. The data was taken by Library of Congress and Dewey classifications and converted to the Registrar's classification. The samples were taken four weeks apart during the spring term. The spacing of four weeks was done to minimize overlap.

The three sets of data relating the number of books circulated were compared by using a Chi-square statistical test. It was found that the three sets of data were not from the same distribution. The different combinations of pairs of the data did not relate that they were from the same distribution either. Since the three sets of data covered the total population studied, it was concluded that the demand placed on the different subject segments of the collection was not uniform over the semester. In light of this finding a total circulation count was desirable so that a complete distribution of the total utilization made of the collection could be noted. In order to demonstrate the methodology of this research the sum of the three circulation samples was used. Since the three samples were four

weeks apart and the library's loan policy was four weeks, the samples are believed not to exhibit a great deal of overlap. At the same time this data does not reflect the total utilization made of the collection, and therefore indepth analysis of the findings is unwarranted.

To report via this library management information system the actual and potential utilization made of the collection by subject areas, the format of Table 18 (pages 89-91), would be used. This report would be made just after the end of each term. The potential column would need to be up-dated at the start of each term. Once base line data was developed, this up dating could be done with ease by noting the classification of the volumes added to the collection from some point in time.

When the management of the library examines this data a number of very important quantitative facts about the collection can be noted. For example, there are about four times as many volumes in the area of English as there are in the area of education. There are two and one-half times as many volumes in business administration as there are in home economics. Many more of these ratios could be noted, but this is not the purpose of this research. The point is to determine if the collection is balanced in relation to the educational goals and purposes of the library and university. The methodology presented here will aid in noting whether the collection is or is not balanced. The methodology will

also assist in assessing the actions taken in collection
building so that the library's management can determine the
effects of actions taken to bring the collection into a de-
sired balanced state. This methodology will also aid in
noting the levels of utilization made of the collection over
time so that the actions taken to increase utilization can
be judged as to their effectiveness.

In addition to recording the utilization of a col-
lection by using these data, a reporting system on the
growth of the collection and the changes occurring in the
credit hours being taught is also possible. The data would
be reported in the format shown in Table 19 (pages 92-94).
This data could also be reported graphically and thereby
provide management with a critical tool. The assessing of
the attainment of quantitative collection building goals is
greatly enhanced by using this reporting system. This re-
porting system should assist the management of the library
when working with the faculty and university administration
because changes in the size and use made of the collection
can be shown clearly and quantitatively by the system. It
should be noted again that this module of this library man-
agement information system can be used by other types of
libraries. College, junior college, and secondary school
libraries could use these utilization assessment tools with-
out having to alter the methodology presented in this re-
search.

Another method of reporting the utilization made of
a collection is by relating the percentage of turnover of a
collection. This would be done by dividing the size of the
collection by the total number of books circulated. These
data would be reported in the format noted in Table 20
(pages 99-101). This collection turnover rate could also be
presented in graphic form on a subject by subject basis over
time. It would be reasonable to assume that if the number
of credit hours stayed the same over time and the collection
still grew, then the percentage of collection turnover would
go down. If the utilization of a given subject area levels
off and then goes down, it would be a sign that the subject
collection could be weeded and/or parts of it moved to a
remote storage area. This would assume that the patron's
attitudes and the status of the collection relative to stolen
volumes and misshelved volumes were at acceptable levels.
The levels of acceptability would need to be set by the man-
agement of the library.

The results of using these methods of reporting,
relative to the utilization made of collections at the Uni-
versity of Oklahoma, are related in Tables 18 (pages 89-91),
19 (pages 92-94), and 20 (pages 99-101). Further discussion
and interpretation of this information will not be undertaken
because it is beyond the purpose of the current research.
The current research has been involved in the development of
a methodology to provide measures of effectiveness and not

TABLE 20

COLLECTION TURNOVER RATES

Subject Area	Percentage of Collection Circulated*
1. Aerospace Studies.	5.81
2. Anthropology	8.95
3. Architecture	9.67
4. Art.	7.41
5. Aviation	5.66
6. Botany & Microbiology.	6.26
7. Business Administration.	5.89
8. Chemistry.	5.09
9. Classics	4.16
10. Drama.	4.55
11. Education.	7.40
12. Engineering.	5.27
13. English.	4.73
14. Geography.	2.56
15. Geology & Geophysics	4.06
16. Health, Physical Education, & Recreation	7.63
17. History.	3.76
18. Home Economics	5.99
19. Human Relations.	13.83
20. Information Science.	6.75
21. Journalism	4.34
22. Library Science.	6.12

TABLE 20--Continued

Subject Area	Percentage of Collection Circulated
23. Mathematics.	8.85
24. Meteorology.	4.47
25. Military Science	6.27
26. Modern Languages	3.55
27. Music.	6.91
28. Naval Science.	6.03
29. Pharmacy	8.41
30. Philosophy	5.79
31. Physics, Engineering Physics, & Astronomy.	6.80
32. Political Science.	5.79
33. Psychology	16.84
34. Regional & City Planning	11.74
35. Social Work.	8.40
36. Sociology.	12.59
37. Speech Communication	5.58
38. Zoology.	7.44
39. Special Generalities	12.63
40. Special Bibliographies & Catalogs.	9.99
41. Special Class.	2.99
42. Statistics	9.07
43. General Science.	5.31
44. Agriculture.	6.00

TABLE 20--<u>Continued</u>

Subject Area	Percentage of Collection Circulated
45. Special History.	1.00
Average.	5.65

*Data in this column is only the percentage based on the sum of the three samples.

in the detailed interpretation of the findings. Some interpretation of the findings has been presented to clarify the methodology where necessary.

Thus far in this section and in the preceding chapter the collection utilization assessment tool has been developed, applied, and reported on a time-related basis for a given university library setting. To meet all of the major and minor goals of this research, the minor goal of relating the economic factors needs to be fulfilled. The economic factors noted in using the collection utilization tool were those associated with recording the number of home circulations made as well as incurred while obtaining credit hour data from the Registrar's Office. There was also the cost of writing up the reports. The cost of recording the circulations made was a function of the number of circulations made. No dollar value is given, but an estimate of one-tenth of a cent per circulation is noted. The time required to write the reports was not great. The cost of obtaining data on credit hours was minor too.

Summary

This segment f the library management information system was designed to report the utilization made of the collection (and its major subject areas) and to relate this utilization to the number of credit hours taken in the different subject areas. The reporting is to be done using the formats noted in Tables 18 (pages 89-91), 19 (pages 92-94),

and 20 (pages 99-101). These reports would be expanded and graphed as additional data were collected so that the reports would portray time-related information on the utilization made of the collections. With these data and the data on the status of the collection and the attitudes of patrons, much new information could be produced for the management of a university library on a time-related basis within realizable economic limits.

CHAPTER VI

SUMMARY AND AREAS FOR FUTURE RESEARCH

The objective of this study was to develop a methodology for relating the effectiveness of a university library to the management of the library on a time-related basis and to apply this methodology to a university library. Effectiveness was used to mean the degree or level of accomplishment of a library's goals or objectives. The level of effectiveness was reported to the management of the library via a management information system.

The effectiveness of a university library was assessed from three different points of view, patron attitudes, collection status, and collection utilization. An assessment instrument was developed and applied to a university library system for each of these three areas. The results of these applications indicated that the methodologies developed were functional, time-related, and economical to use. To summarize this research and to place the management information system developed here into the context of the total library management information system Table 21 (page 105) is provided.

TABLE 21

SUMMARY OF MANAGEMENT INFORMATION SYSTEM
DEVELOPED AND APPLIED

	Library Effectiveness Assessment Tools		
	Patron Attitudes	Collection Status	Collection Utilization
Data collection tools developed and tested	Faculty, student, and user questionnaires	Mathematical model of collection and sample inventory methodology	Conversion matrixes for the Library of Congress and Dewey classifications
Data collected to demonstrate methodologies	666 usable questionnaires	Three sample inventories of the Library of Congress classed monograph collection	Three samples of the total circulation by subject classifications
Statistical tests on data performed and explained?	Yes	Yes	Yes
Results and Inferences	Only eight out of twenty-three hypothetical library goals were met; thus, the general patron attitude was acceptable only for 35% of the segments researched.	A missing factor of 18% ± 3% was found. A $5,000.00 shelf reading project was undertaken based upon data produced by the research.	New information relating the degree of balance between subject collections was noted. New information revealing the utilization made of the different subject collections was reported.

The most logical area for future research would be a study of the interactions of the many factors assessed by this library management information system over a period of two or more years. This research would need to make use of the same university library, patron population, and collections. If this were done, all the data collected from each of the three assessment tools would be compatible. The format of reporting could be a two way matrix of management information with collection or collections on one side and the data on patron attitudes, status of collections, and utilization of collections on the other side. An additional advantage to using this library management information system over a period of years would be that of being able to note the effects of different library programs in quantitive terms.

Another major area for future research would be in the adding of a cost factor to the factors assessed by this library management information system. The outcome of research of this type would be data on the costs of collections relative to utilization, patron attitude, and upkeep. The addition of a factor for the utilization made of materials used in, but not checked out of the library, on a subject by subject basis would enhance the collection utilization assessment tool.

The application of this type of library management information system to public and school libraries is also an area for future research.

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APPENDIX A

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