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Shawnee Mission's On-Line Cataloging System: The First Two Years

The last detailed article about the Shawnee Mission (Kansas) Public Schools' library system was written during the summer of 1970 and published in March 1971.[1] This paper reports major events from April 1970 through March 1972. It quantitatively describes the on-line system, discusses management issues, and reports on plans for future development.

Given the general dearth of continuous quantitative and qualitative reporting about library computer applications, it is hoped that this second article will be followed by later performance analyses. Periodic reporting is particularly critical in library areas with relatively little automation, such as school and medium-sized libraries.

To put this paper in its correct perspective, it is necessary to know that no major changes have been made during the past two years in either the hardware or software support systems for library on-line cataloging. The current configuration includes: IBM 360/40; DOS 256 K; eight 2314 disks; one 2702 line control; 2741 terminals for student use via APL (A Programming Language); 2740 terminals for library on-line cataloging; and three core partitions for APL, library FASTER (Filing and Source Data Entry Techniques for Easier Retrieval), and batch operations during first shift.

TWO MAJOR EVENTS SINCE SYSTEM START-UP

The on-line cataloging system began in April 1970 when four elementary collections were entered via terminal: two collections were entered retrospectively from shelflists, and two represented newly built schools. The four schools contributed about 10,000 titles to the new on-line system.

Converting 45,000 Batch Records

During the summer of 1970, work began to merge the 10,000 new elementary title records with 45,000 batch records for secondary schools. The batch records had been created during the previous two years while the first automated library system operated. Three major tasks developed: (1) intelligently converting upper-case records to upper- and lower-case records; (2) finding the duplicates among the 45,000 batch records, and (3) enlarging almost all fields. To the authors' knowledge, these tasks have been attempted only at Shawnee Mission; the problems and ultimate success can perhaps aid those with similar tasks.

Several factors affected the approach taken: (1) aside from the massive bibliographic difficulties of merging the two files, new materials were stacking up; (2) two previously separate central processing groups had joined into the new on-line Library Technical Processing (LTP) group and the LTP staff was anxious to take ownership of the on-line system; and (3) the authors were involved in other projects simultaneously.

The following steps were taken to merge the elementary and secondary records:

1. All 45,000 batch records were transformed into upper- and lower-case format and compared with the elementary upper- and lower-case records. Unfortunately, no duplicates were found for several reasons: lack of collection overlap, unstandard data on batch records, and different field sizes.
2. Therefore, computer programs were written to convert the batch records to upper- and lower-case and to enlarge field sizes. Examples of this computer editing included: (1) expanding author, title, series, collation, and subject heading field size; (2) converting all letters to lower-case except those in selected fields which followed punctuation; and (3) deriving a three-letter "Cutter" from the first three letters of the author's last name to replace the regular Cutter.

   No computer duplicate test was made since librarians feared that nonstandard data from the batch system would prove misleading. Nonstandard data had resulted from using variable abbreviations and " . . . " to indicated omitted information on too-small batch fields.
3. Title lists for all 55,000 records were printed; all bibliographic data was in the new, converted format. Catalogers then edited the lists for duplicates and for inaccurate data.

4. Terminal operators keyed in the revised data. Records were either updated and the correct number of copies added or they were deactivated.

The above steps took from July 1970 through February 1971 to complete. Out of 45,000 records, almost 30,000 were transferred to the FASTER files. The rest were dropped as redundant or erroneous.

A large backlog of new materials accumulated while the file merger continued. However, the then-director of Libraries and Administrative Services, realized that the merged data base was necessary if the cost benefits of a high duplicate rate were to be realized later. The file merger utilized one supervisor, three catalogers, and seven terminal operators during seven months. Three terminals were used in August, six in December, and eight were in operation during February 1971.

After working elbow deep in the merged file for seven months, both catalogers and operators had confidence in its contents. Catalogers had long recognized several imperfections in the batch system's data, such as unstandard data and cryptic information. The file merging process required that they examine each bibliographic and copy record carefully. Long-postponed standardization of subject headings, publisher names, and author names (personal and corporate) were some by-products of their scrutiny.

The LTP staff's new confidence in the cataloging data spread to confidence in the system. The combination of reliable data and ease in manipulating it via terminal resulted in LTP unit taking ownership of the new system. Change in ownership from designers to operators is a requirement for any viable automated system.

In April 1971, the new director of library services realized that Library Technical Processing, just emerging from its tedious file merger, needed relief. Therefore, book processing arrangements for fiscal year 1971-72 were made with a jobber for all but one elementary school, which elected to stay with LTP.

With almost all elementary book items diverted to the jobber, LTP proceeded during the summer of 1971 to demolish its backlog of approximately 32,000 items by utilizing eight terminals twelve hours per day with double shifts from mid-June through mid-August. Monthly production statistics show 13,250 new items processed in June; 14,342 in July; and 12,482 in August. At this production rate the backlog was removed and incoming new materials were processed.

Fig. I shows cumulative file size since December 1971. Preoccupation with the file merger is revealed by the small increment in new titles processed between December 31, 1970 and the end of the first quarter of 1971.

Since September 1971, LTP has been able to process all incoming secondary materials with no backlogs. This system capacity allowed for the return of all elementary processing to LTP as of July 1972. In the meantime, however, LTP has processed shelflists of older holdings on a time-available basis, resulting in a steadily growing rate of retrospective conversion.

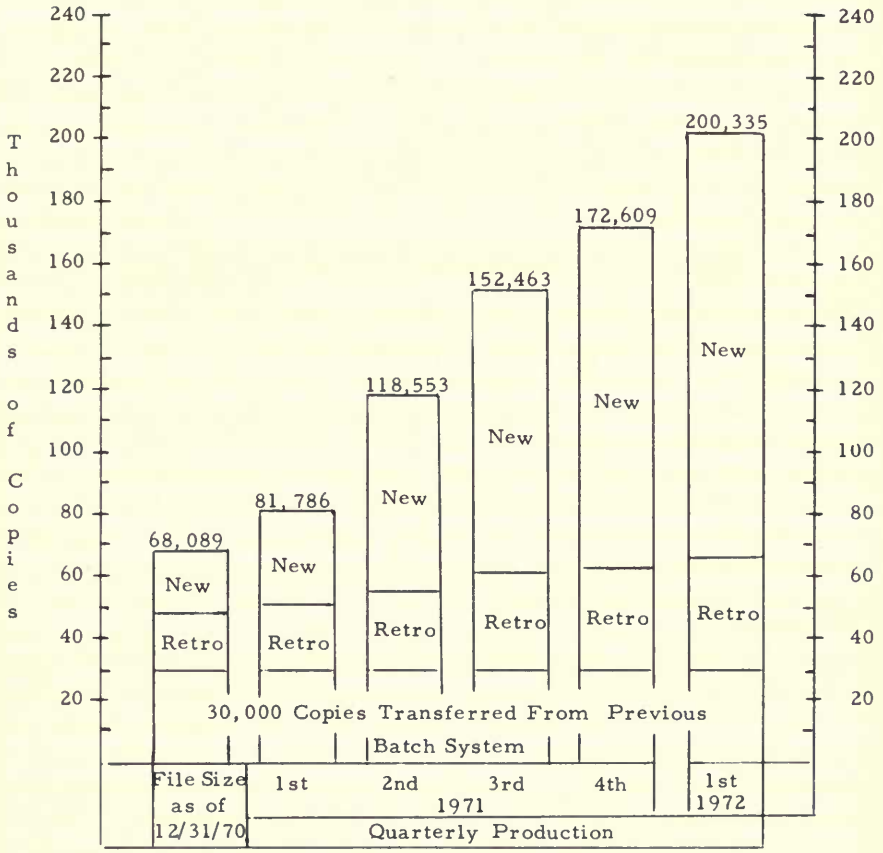

Fig. 1. Total Number of New, Retrospective and Transferred Items in Master Cataloging File

Retrospective Conversion

Several ways of converting shelflists have been tried during the past two years. The major variables have been: (1) the degree to which the shelflist is compared with actual holdings before a duplicate search is attempted via terminals; (2) location of terminals in LTP or the school libraries; (3) which staff–LTP or building–examines computer-sorted and printed card catalogs and applies new labels; and (4) whether card catalogs and labels are sorted and printed at the end of conversion, or printed on demand during retrospective conversion.

To date, one secondary and two elementary schools have been completely converted from shelflists. Two secondary schools are now in progress on a time-available basis. This leisurely approach explains the relatively small

increment in retrospective items in fig. 1. All incoming items have higher processing priority than any retrospective items.

Experience with five schools has shown that a careful comparison of the shelflist with actual holdings is very useful before attempting a duplicate search via terminal. If this step is not taken, inaccurate copy information, missing shelflist cards and poor shelflist data appear. These problems are especially likely in a school system which had for years relied upon cataloging by busy librarians and volunteers; some of the latter not highly trained or supervised.

Printing cards and labels is flexible. Librarians can choose massively sorted and printed card catalogs, and massively printed label sets in shelflist sequence. Or, they can request item-by-item cards and labels as conversion proceeds. The intent of library management is to provide as responsive an output schedule as possible.

However, decisions must be made well in advance of the deadline for output. Sort and print time for a large card catalog is considerable; the large number of Shawnee Mission computer applications[2] requires that the Division of Library Services puts its bid in early to the computer center for large chunks of computer time.

Several manpower options for relabeling and for checking entire card catalogs have been used. One secondary school requested cards to be printed in small clusters by Dewey number; that school's librarians did all filing and replacing of old card files. Two elementary school libraries let LTP staff examine and refile the massively printed card catalogs, and relabel the collection. One junior high school used parent and student volunteers to relabel the collection. In one instance, the terminal was located in a secondary school. The operator worked with the librarians in performing a duplicate search, adding copies for those duplicates, and keying in entire records for new items.

At the end of March 1972, a total of 36,718 retrospective items had been added to the master copy file; 18,629 were in the file by January 1, 1971. Included are entire collections as well as individual items sent in by librarians; in earlier years some audiovisual items were not cataloged by overloaded librarians. The on-line system has the capacity to process these older items on a time-available basis, and several librarians have taken advantage of this service. One example is the 1,500 film strips submitted to LTP in February 1972 by an elementary library; that work was still in process as of March 1972.

LTP staff consider retrospective conversion a good way to keep the terminals busy. However, operators tend to become bored by several hours of keying from shelflist cards because transaction response time, averaging six seconds between hitting the bid key and starting to type the response, is too long. Normally, an operator inputing books and audiovisual items scans them

while waiting for the computer to respond. Since there is nothing of interest to scan on shelflist cards, operators may get bored.

Retrospective conversion is an excellent filler for a high capacity on-line cataloging system, but it may cause impatience and frustration in operators when undertaken in lengthy stints.

QUANTITATIVE DESCRIPTION

Total File Characteristics

A total of 200,335 copies and 78,113 titles are held in the Shawnee Mission on-line library files. Table 1 presents data for each type of physical format currently processed by LTP.[3] Books represent 76 percent of all copy records, compared to 74 percent of all title records. Of the 200,335 copy records, 47,280 are for audiovisual items. There are 20,138 unique audiovisual titles among the 78,113 title records.

The overall duplicate ratio is 2.58 to each new title. This desirable ratio is important for cost reasons: highly paid catalogers are not needed to handle duplicates, fewer terminal transactions are needed to enter each duplicate, and duplicates move through LTP more quickly.

System Efficiency

"Efficiency" connotes speed, accuracy, and economy. That definition applies to the Shawnee Mission on-line cataloging system.

COSTS

When cost data were compiled in the summer of 1970,[4] the authors did not anticipate the heavy use that would later be made of listings, statistical reports, bibliographies, entire card catalogs and label sets, and other printed products. Therefore, two sets of cost data were computed for this paper. Table 2 shows unit cost estimates for card/label output only, which is comparable with the figures of 1969-70. It also gives unit cost estimates which include the present high rate of auxiliary printing.

Costs in table 2 are based on: 1) tasks performed at LTP from item arrival to mailing out to the destination library, 2) library and data processing staff, 3) computer time, and 4) supplies.

A junior high school which requested an entirely new public catalog, shelflist, and set of labels exemplifies the importance of auxiliary printing. Its collection had been added to the batch system; later, the librarian desired uniform printed products from the upper- and lower-case system. An example of another product for which auxiliary printing is needed is the union catalog for all 16mm films, organized by title and subject headings, which will be placed in buildings for teacher and librarian use.

Physical Format	*Copies*	*Titles*
Art prints	1751	958
Books	153055	57500
Charts	94	79
Cassette recordings	938	549
Disc recordings	5438	2743
Flash cards	53	19
Filmstrips	20401	7609
Games	156	115
Globes	9	8
Kits	224	140
Super 8 loop films	4520	1990
Sound loops	20	8
Models	66	65
16mm films	901	793
Maps	66	62
Realia	10	9
Sound filmstrips	5638	2061
Slides	925	425
Study prints	1791	475
Sound slides	69	28
Tape recordings	1533	1095
Transparencies	2430	1199
Viewmaster reels	245	181
Collections	2	2
Total	200,335	78,113

Table 1. Total Copies and Titles for Each Physical Format (As of March 10, 1972)

	Card & Label Sets Only	*Card & Label Sets and All Other Printed Products*
Any Item	$2.25	$2.53
Duplicate	1.91	2.15
New to system	4.36	4.91

Table 2. Estimated Unit Costs for Fiscal Year 1971–72

A large data base encourages a large amount of auxiliary printing. Therefore, cost data should reflect both original data entry and basic cards/label output, and later use in many printed products.

AVAILABILITY

Availability is a very important measure of system performance. Specifically, availability means the ratio of downtime to total hours scheduled for operation. Data kept from July 1 through December 31, 1971, reveal a highly dependable on-line cataloging system.

During that period the system was scheduled for 8,280 terminal hours. In reality, it was down for 880 hours. Of that downtime, 672 hours were for weekly preventative maintenance on the System 360. The remaining 208 hours of downtime were due to other causes, including quarterly system dedication to grade reporting.

Thus, the system was down 10.6 percent of its scheduled time. Downtime for other than preventative maintenance accounted for 2.5 percent of the 8,280 hours during those six months. This high rate of system availability is especially significant because another teleprocessing system, APL, runs concurrently with the library FASTER system. In the third core partition, batch jobs are also processed.

DATA QUALITY

One area lacking dependable statistics is the correction rate for on-line data. Since no count is made of, or can be derived for, corrections, estimates must be used. The usual caveats accompany the following statements from LTP personnel.

LTP staff estimates that 1/10 full time equivalent terminal operator corrects erroneous data found on cards, labels, or any other output. Generally errors are spotted by the clerks who match cards/labels with each item. Suspected errors are turned over to the terminal supervisor, who consults with catalogers when necessary. Currently, only one terminal operator actually keys corrections. However, one operator spent about 75 percent of her time on corrections when a second shift of operators was added during July and August 1971.

RESPONSE TIME

Another area lacking reliable statistics is transaction response time. Since it was impossible to construct average transaction time from the computer center, the authors timed individual operators with a stop watch. Specifically, the interval between hitting the bid key and receiving a reply was timed. At the time this small, statistically unreliable study was made, all six terminals were operating along with the other teleprocessing system and batch jobs. The

		Week Completed				
Week Tagged	*Number of Items*	*1*	*2*	*3*	*4*	*Total*
1	1,326	0	0	39	576	615
2	1,000		0	40	169	209
3	543			0	11	11
Total	2,869	0	0	79	756	835

Table 3. Number of Items Completely Processed During Throughput Study

average for seventy-nine transactions was six seconds, ranging from three to sixteen seconds.

THROUGHPUT TIME

Another measure of system efficiency is the time taken for new acquisitions to be processed. In order to study that throughput time, new acquisitions were monitored during a four-week period, March 13 through April 7, 1972.

The method used included: (1) inserting different colored tags into audiovisual and book materials, (2) stamping the date the item was compared with its purchase order (usually not more than one day later than actual delivery), (3) noting on each tag whether the item was a duplicate, and (4) pulling the dated tag out when the item was fully processed and being boxed for the building librarian. The number of completed tags was compared against the total number inserted. Tags were inserted during the first three weeks of the study; they were gathered when completed during weeks three and four. No tags were ready during weeks one or two, as seen below.

Table 3 shows the number of items that were completed during each of the study's four weeks. Of the 2,869 new acquisitions, 1,216 were audiovisual items and 1,653 were books; 188 of the 1,216 audiovisual items were completely processed during the study. Of those 188 audiovisual items processed, 182 were duplicates of titles already in the system. Thirty-eight percent of the 1,653 books were completed during the study. Of the 636 completed book items, 71 were new to the system; 565 were duplicates.

Fig. 2 shows the frequency distribution of elapsed working days between tagging and boxing for delivery to the building librarian. An average of one day preceded tagging; tags were inserted when the item was compared with its purchase order.

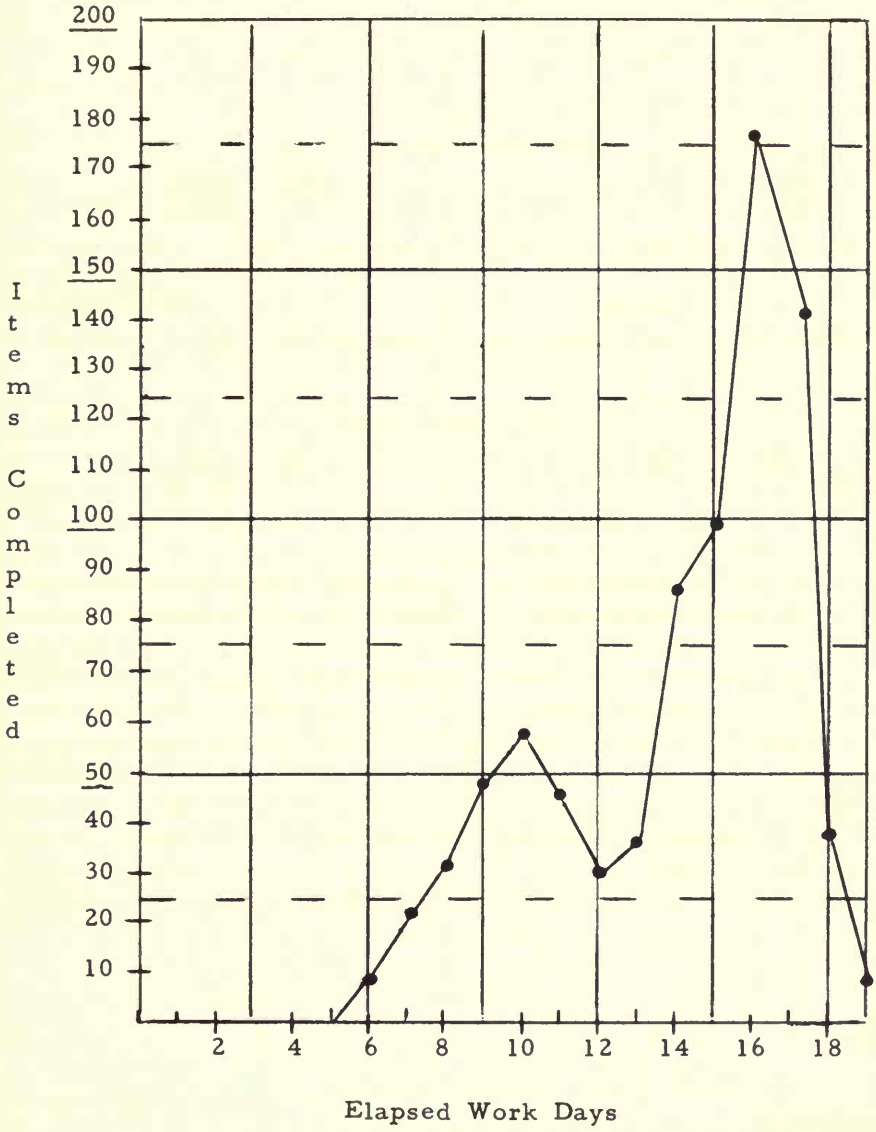

Fig. 2. Work Days Needed to Process 835 Book and Audiovisual Items During a 19-day Study

A full-capacity staff in Library Technical Processing for data entry, cataloging, and physical preparation is six terminal operators, three catalogers, and six preparation clerks. During the first 2.5 weeks of the study, only one preparation clerk was on duty; the others were helping with priority tasks in the schools. During the last 1.5 weeks of the study an average of three preparation clerks were at LTP. The variable number of these clerks helps explain why no sample items were completed during the first two weeks–items already in the processing pipeline had to be completed by available LTP staff.

During week three, boxing for building librarians was performed twice, on Tuesday and Friday. Thus, tags could be retrieved only on those two days. Boxing occurred each day during the fourth week of the study.

The fluctuations in manpower symbolize the responsive method of library management used at Shawnee Mission. Instead of assigning staff to permanent positions, clerks and professionals perform tasks as needed–whether at LTP or in school libraries.

File Usage

Title and copy file usage measures their data's relevancy to library needs. Of the scheduled printed products, approximately 83,700 card and label sets were printed during fiscal year 1971-72 for new items. Terminal transaction statistics are printed weekly, LTP production tallies for each building monthly, and statistics on active title records monthly.

School librarians and the library management also request specific listings on demand. One union catalog for 901 16mm films has been printed; it consists of a 57-page title index and a 54-page subject index.

During the five months beginning November 1, 1971, twenty inventories of school holdings were run; sort and print time for the programs involved took 29 hours and 17 minutes. During the same period eight union subject heading bibliographies were compiled by the computer. Total run time for those eight bibliographies was 9 hours and 42 minutes.

There are two on-line file query transactions: (1) by title number, and (2) by author last name and title. Table 4 shows the rate for each type of file query, and the proportion of the two query transactions to total transactions.

In general, the author/title query is used to find duplicates among new acquisitions. The title number query is used to enter additional copies and to complete bibliographic data for new-to-the-system titles.

Daily Operations

As of March 1972, six operators work weekdays from 8:00 A.M. to 4:30 P.M. Coffee breaks and lunch periods are taken, of course; there is no operator

	Fourth Quarter 1971		First Quarter 1972	
Terminal Transactions	*Number*	*% of Total Transactions*	*Number*	*% of Total Transactions*
Title Number Query	24,876	22	18,813	16
Author/Title Query	15,815	14	22,685	18
All Library Transactions	114,186		120,908	

Table 4. Rate of Terminal Transactions upon the Title and Copy Files

backup for those relief periods. Absentee backup is provided by the terminal supervisor, who also checks newly printed cards and labels, and identifies corrections for operators. No overtime or weekend hours are currently scheduled.

Monthly production from this work force averages 8,400 new and retrospective items. On the average, each operator processes 1,400 items per month, or 350 per week. Absences and downtime affect production; another variable is the arrival rate of new items. The current batch order system prints orders bimonthly, resulting in a fairly steady flow of new acquisitions to LTP.

Twenty-one LTP staff receive, catalog, enter, and process new and retrospective items. They also handle all jobs connected with the 16mm film library. Two staff are certified teachers, the rest are clerks. LTP processes items for the sixty-five Shawnee Mission schools as well as for fifteen other locations, including professional collections and several parochial schools.

MANAGEMENT IMPLICATIONS

The Shawnee Mission Public School District has undergone some significant management changes since June 1969. Affecting problemsolving and budgetmaking are many variables including: (1) unifying thirteen small districts in July 1969; (2) providing management expertise for the resulting K-12 system with sixty-five schools and 44,000 students; (3) adopting middle-management decisionmaking systems; and (4) living with a Kansas State property tax lid that allows no more than 5 percent annual increase in operating funds.

Changes in the environment and composition of the new unified district required different approaches to problemsolving. The on-line cataloging system was carefully watched by top management, who followed up that positive experience with team-operated system design in other areas, notably accounting and budgetmaking.

Development

The following section presents the authors' views on several levels of management development in the Shawnee Mission School District.

MANAGEMENT OF THE ON-LINE PILOT PROJECT

The authors believe that the management of pilot project implementation was generally satisfactory although inexperience led to one major miscalculation about the amount of time needed and the method chosen for editing the batch records to expanded, upper- and lower-case format. Recognizing the importance of file merger, our direct control of the pilot project should have continued until it was completed. Instead, there was no strong control of the file merger, especially in its initial stages. That lack of task management probably lengthened the time taken for the file merger.

LIBRARY MANAGEMENT

That we were soon reassigned to other, nonlibrary projects meant that the LTP staff quickly claimed ownership of the on-line system. Any new system's viability depends, of course, on the users' psychological identification with that system. The seven months spent merging the file helped LTP staff to identify with and own the on-line system.

The same cannot be said for school librarians during that period, however, since relatively few new materials trickled through the backlog into their buildings. The decision to send elementary orders to a commercial jobber for processing was, therefore, a wise one. Both groups of librarians—LTP and the school librarians—found library management responsive to their different needs.

Unit costs decreased from the batch system to the on-line system. While unit costs for any automated system are probably higher than manual processing, the additional use of the data through file query and auxiliary printing is significant. Indeed, the two major future projects for the library system draw heavily upon the growing data base: (1) on-line control for the booking and circulation of the 16mm film collection, and (2) special bibliographies for use by subject areas such as seventh grade unified studies.

Perhaps most important for the building librarian, improvements in the cataloging and order systems during the past two years have resulted in decreased throughput time for new orders. Two years ago it was not unusual for 12-18 months to elapse between submitting a request and receiving the item. Currently, that time is estimated to be about three months. The on-line system has cut the processing time of new acquisitions; additional savings of time will be possible with a revised order system, scheduled to begin operation in 1973.

DATA PROCESSING MANAGEMENT

The on-line library system has achieved that highly desirable division of labor between any data processing installation and its users: users have full responsibility for data quality and format while data processing guarantees data and file safety. This relationship is especially appreciated at Shawnee Mission, where programmers previously worked daily with library data in the previous batch system.

The success of two teleprocessing systems–student-oriented APL and library FASTER–has encouraged other district offices to request teleprocessing. Significantly, educators now requesting this service realize that it must be accompanied by more core, better central processing unit-disk turnaround time, and more disk storage. These traditional computer mysteries are becoming the property of educators, whose growing sophistication helps the computer center explain and expand its current applications.

One implication of more teleprocessing applications may be a role change for programmers. The bulk of system programming is usually done prior to starting a teleprocessing system. After the system is up, programming efforts tend to shift to general software maintenance rather than application maintenance.

TOP MANAGEMENT

Top management continued its experiment with team assignments when the authors were asked to participate with data processing and business office staff in setting up a cost-centered accounting system. The subsequent success of the accounting system was due in large part to the business office staff assuming ownership and file control.

As a result the business manager can say with confidence that he knows the latest status of all district expenditures. By pursuing proven methods of team problemsolving, top management gained a middle level staff expertise that continues to be utilized. The resulting staff skills are usable in many parts of the school district.

The on-line cataloging system's interest in providing production and operations statistics has been carried much further during the past fiscal year. The business office now prepares a semiannual budget report showing all expenditures cost centered to specific locations and programs.[5] Information about costs, production, and operation for any part of the school district is consistent with the movement to inform and utilize middle management. Without information, middle managers cannot participate fully in problem detection and problem-solving.

Shawnee Mission's cost-centered accounting system aided in contracting with two national companies to provide audit and computer hardware services. These companies can compare Shawnee Mission's development

with national trends and local staff can benefit from their state-of-the-art knowledge about educational management.

Finally, the successes of both the library system and the accounting system have provided national publicity for this school district. A summary article written by the superintendent of schools was published in 1971.[2] The coordinator of public information has provided the local media with stories and interviews. Needless to say, top management of school districts–like that in any sector of the economy–likes favorable publicity on innovative programs. The fact that no grant funds of any type have been used in these projects has enhanced top management's ownership.

Throughout this section on management implications is discussion of the changes that Shawnee Mission School District has undergone since unification in July 1969. Since then, ownership of the management process has spread to middle level administrators. Why? They have been encouraged to detect and solve problems; more important, top management has continued to utilize their new skills. By participating in decisionmaking committees, such as the budget review committee which creates a district-wide draft budget, school principals and directors are becoming the critical management cadre upon which future improvements depend. It is intended that such decentralization will result in even more vital and relevant services being rendered to the community by Shawnee Mission Public Schools.

REFERENCES

1. Miller, Ellen and Hodges, B. J. "Shawnee Mission's On-Line Cataloging System, " *Journal of Library Automation*, 4:13-26, March 1971.

2. Ball, Arzell L. "A Superintendent's View of a Computer System," *School Management*, 15:12-14, Dec. 1971.

3. Tomcak, Jackie. "Shawnee Mission's Cataloging and Processing of Non-Book Materials," *Mountain Plains Library Association Quarterly*, 16:5, Spring 1972.

4. Miller and Hodges, *op. cit.*, p. 22.

5. Ferguson, Walter E. "Attendance Center Report by Major Accounts for the Period July 1, 1971, Through December 31, 1971." Unpublished volume prepared for Shawnee Mission (Kansas) School District, 1972.

Additional Reference

"Budget Making Procedures (for) Fiscal Year 1972-1973." Unpublished paper prepared by the Shawnee Mission Public Schools, 1972.