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ABSTRACT

This document contains three papers presented at the 1995 Arizona Library Association conference. Papers include: (1) "ERLs and URLs: ASU Libraries Database Delivery Through Web Technology" (Dennis Brunning & Philip Konomos), which illustrates how and why the libraries at Arizona State University developed a world wide web server and a home page to expedite navigating and searching the library's electronic databases; (2) "A Process Improvement Approach to Interlibrary Loan" (Linda Dols and others), which explains how data workflow analysis, cost-benefit analysis, benchmarking, and statistics gathering aided an improvement team in doing needs assessment on interlibrary loan services at the University of Arizona; and (3) "Using Total Quality Management Tools to Improve Library Processes" (Barbara Allen & Deborah Smith), which chronicles the implementation of a process improvement team charged with improving physical access to library collections and with adapting total quality management techniques to work processes. (BEW)

AzLA Arizona Libraries: Books to Bytes

1995 Annual Conference • Nov. 17-18 • Phoenix Civic Plaza

Contributed Papers

presented at the

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College and University Libraries Division

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ERLS AND URLS: ASU LIBRARIES DATABASE DELIVERY THROUGH WEB TECHNOLOGY

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The World Wide Web (WWW) has significantly altered and expanded Internet access and use in academic libraries. In 1995, the number of URL (Uniform Resource Locators) and Web Servers hosted by academic libraries has increased exponentially; all indicators point to a continued growth and use through the year 2000.

Introducing World Wide Web computing to an academic library used to dumb terminal access to traditional online catalogs is not an easy or unidimensional task. This paper describes the designing, testing, implementing, and the managing of a library world wide server and clients to not only access a variety of library databases but to provide an integrated and "smart" method of searching these databases. The paper will illustrate how and why ASU Libraries developed a Windows NT workstation, a Web Home Page, and a Web browser to navigate and search the library's electronic databases. Particular attention will be given to the reasons ASU Libraries has embraced Web technology and has selected SilverPlatter's Electronic Reference Library (ERL) technology as its flagship database delivery system.

This paper presents the use of several key technological advances to deliver library database services. Client/Server computer (ERL, Windows NT Advanced Server and client), HTTP/HTML computing (Web page, server, home, browser). The paper not only reports how a program was devised but examines why a library should take the initiative to challenge a practice, in this case, dumb terminal access to online systems.

The Online Revolution

Every couple of years libraries and the librarianship have gone through significant technological change. Only recently, it seems, reference librarians were extremely proud and eager to put forward online search services. We dialed off to far away computers to use complicated search commands and strategies to produce bibliographies of articles and books.

At about the same time, a little slower but no less inexorable, card catalogs began to disappear, replaced by computers. Hidden from us was a miraculous box, larger than a fridgedaire, whose control panels blinked lights, whose drives spun and hummed, and whose activity remained supervised by a priest of sorts, the System Analyst. And what did this person control? Bibliographic energy of a very basic but important sort; access to our Marc records, what the library owned in the way of books and serials.

Dumb Terminals to Workstations

What we saw were bibliographic pixels on TV screens framed in a plastic box--the dumb terminal. In the olden days, however, this terminal wasn't dumb; no, far from it. At its keyboard one could keystroke commands, words, touch screens, press colored keys--a variety of ways of putting in information to get back information. Wasn't it great? Perhaps confusing at times, inelegant by some standard we had yet to give voice to, yet extremely powerful. Type in a subject heading and an author's name and within seconds we had a bib records and a call number and some idea where it was and if we could have it!

But it wasn't enough was it? Technology advanced. Public access catalogs became more sophisticated. We attached them to phone lines and we got remote access. We used principles of MARC database design and construction and created local databases--community information files, the electronic kwic and kwoc.

CD-ROM Technology

On or about the same time that PACs began to evolve, CD-ROM technology appeared. Suddenly, print indexing and abstracting services, the guidance counselors to the world of serial literature, became CD-ROM databases. Companies like UMI and SilverPlatter began to transform print indexes and abstracts into CDs and even online databases into CDs. Powerful search interfaces--made possible by the personal computer--hunted information residing on this new silver real estate and libraries and librarians experienced a profound revolution in the way things were done.

PCs began to proliferate in reference rooms. Users flocked to the stand alone workstations. Librarians would point to the PsycLit workstation or ABI workstation--go for it. Users did, in significant numbers, and use of the printed tools diminished. The reference room became a computer domain.

Unfortunately, and most of us found this out early, the famous " stand alone" workstation featuring a database or two or three did not meet demand. User cues

soon became symptomatic of the incredible success of computerized access to indices and abstracts. But a major limitation to the stand alone workstation also became apparent. One machine, one user.

Networking CD-ROM

Again, advances in technology stepped in and provided direction for libraries. Borrowing a concept from business, the notion of sharing resources, printers, files, databases became a reality through computer networks. Libraries began installing "CD-ROM file servers", hanging them off local area networks, mapping CDs to network loadable modules. Seemingly overnight, libraries now could connect dozens of workstations together. Multiple databases, multiple access points, could it not get better?

Of course, it could be--better. Local area networks brought economy of scale but at a significantly high cost of hardware, software upgrades, and human management. Moreover, coverage was limited to small areas, software never was optimized for local area networks, and most significantly, local area networks lacked integration. In most libraries that attempted local area networks, the network was that set of terminals over there, the online catalog were these other terminals. More often than not these two areas were managed separately, the online catalog the domain of "systems", CD network management a mishmash of public and technical services administrative units.

Internetworking through ERL Technology

Enter internetworking. Four developments in computing made internetworking possible. One, an established and evolving institutional and global network of UNIX or UNIX like computers linked via TCP/IP networking communication. Two, reduction in cost of high speed and high-capacity personal computers to serve as both workstations and servers. Three, general acceptance of Microsoft Windows' graphical user interface as a standard user interface and operating system, and four, the development of client-server software design and network logic.

Internetworking can best be described and explained with an actua example. At Arizona State University (ASU), we became a beta test site in August, 1993, for SilverPlatter's Electronic Reference Library or ERL. ERL was at that time a UNIX-based client server network designed to distribute access to SilverPlatter databases over a campus ethernet network using TCP/IP communications protocol and a client server architecture.

One of the earliest entrants into CD-ROM library market, SilverPlatter was also an early player in the networking of CD-ROM. MultiPlatter, SilverPlatter's first network product, debuted in 1988/89. MultiPlatter used existing networking software, Novell Netware 3.21, and CBIS, one of several vendors who wrote MS-DOS CD-ROM file server software and provided CD-ROM towers. With MultiPlatter, a library could attach a number of workstations to a Novell network and access CD-ROM drives located somewhere on the network. In this setup, the searching and processing took place on the workstation while the information was spinning on

another computer. The user saw the regular SilverPlatter user interface, the now familiar DOS-SPIRS menu, and addressed this interface no differently than if the data were on CDs in a box attached to the workstation.

Although there were some significant advantages to MultiPlatter--resource sharing, greater access, centralized management--there were some significant disadvantages for the user and for the vendor. One proprietary hardware was expensive. Two, Novell management required a Novell manager, someone with the skill and expertise to manage a local area network. Three, Novell is a DOS extender and takes networkability that is built into DOS and transforms the DOS computer into a machine that can exchange information about itself over a network. However the DOS machine's capacity to network itself is limited. For all the ballyhoo in the computer press about the network being the computer, in MultiPlatter and similar networks, the action was all concentrated at the workstation with the DOS-based software. The data resided on a server that was attached by cable or wire to the workstation which asked, process, and displayed data to the user. The greater the distance the computer is from the data, the greater the load put on the workstation--these and other factors created network and cpu bottlenecks that slowed down performance. Moreover, networking did not add to the value of the retrieval software. It starts as DOS and ends as DOS.

For the library, MultiPlatter was expensive to manage, limited in use, and no better than the DOS program that it supported. For SilverPlatter, users did not really get enhanced networked access they desired which did not increase sales of networked databases. Both users and vendor knew another solution was called for.

SilverPlatter's solution was to quit the hardware market altogether and concentrate on developing networking software. SilverPlatter focused on four attributes of networking in libraries. One, libraries wanted to provide access to databases from terminals within and outside the library. Two, more and more academic libraries were joining the networking community by linking up to campus ethernet/TCP/IP networks. Three, libraries wanted to take advantage of the increased power of pc-based workstations to provide users with access to not only library databases but to services outside the library and the campus community and to take advantage of downloading, post search processing, etc. Workstations per unit costs were also declining 'gnificantly, positioning libraries for the first time to begin replacing dumb terminals as the standard terminal. Four, libraries wanted to increase access to resources while at the same time keeping costs down.

With these assumptions SilverPlatter reworked the widely known and accepted SilverPlatter Information Retrieval Software (SPIRS) to work as a DOS client to a UNIX Server over TCP/IP. What this means is that SilverPlatter software designers looked at the requirements of users, ethernet networks, and CD-ROM databases working in the network environment and engineered a software relationship between these key elements to work effectively and efficiently. For example, unlike MultiPlatter which assigned the bulk of processing to the workstation, ERL shares processing between client and server. The DOS-SPIRS client, for example,

takes care of taking the user through the steps of selecting and searching databases and displaying, printing, or downloading citations. The server, in contrast, handles searching for the data on the CD, and holding the data temporarily for transfer to the workstation. Linking the two, the TCP/IP communications protocol, transports data and data about data, over the network. Since TCP/IP is a virtual network and connects widely distributed and dissimilar machines--sort of like an omnipresent aunt on a party line, always listening, always ready to converse--server and client can communicate and perform, communicate and perform, in a seamless, efficient, and effective manner.

The important achievement of the first client DOS ERL client was to demonstrate that a client server network could work well in an environment characterized by a huge number of low-end DOS machines.

DOS Spirs works on machines that have enough memory to load DOS and other drivers in some higher memory--386 machines for example. But it is slow and the requirement of running DOS TCP/IP drivers--the software that translates client to server and server to client to network language--is somewhat complicated and daunting even to experienced network programmers.

More limiting is DOS-SPIRS look, feel, and functionality. It translates PC-SPIRS into a software that connects over a network. Now this network is far more functional, faster, and adaptable to campus computing than the earlier MultiPlatter network. However, it does not represent any significant advance in functionality or connectivity.

WinSpirs

WinSpirs, SilverPlatter's windows software, represents a fundamental shift in direction. WinSpirs translates DOS-SPIRS into a graphical user interface which maps SPIRS many function keys, command menus, and monofunctional screens to pulldown menus, icons, and hot buttons. Most important, all SPIRS key screens--search, search history, and search results are available to the user on one screen.

Additionally, indexes and thesauri, once clumsily accessed by commands and viewed screen by screen in the DOS version are in WinSpirs creatively handled to allow mapping to the search window, exploding and explanation of terms, and instant viewing of documents linked to the descriptor.

As important as the user interface is to the value of WinSpirs as information retrieval software, even more important from a systems point of view is WinSpirs easy and powerful connectivity. Windows was designed with built-in network support for several protocols and is easily adapted, through drivers, to other protocols. ERL uses TCP/IP to connect client and server. Through TCP/IP, a WinSpirs workstation need only point to a server to establish a connection. This server (as well as workstation) need not be near each other; in fact, they could be anywhere in the world.

Moreover, WinSpirs does not have the memory restrictions imposed upon the DOS client. The latter must condense retrieval program (300+KB), DOS kernal (128 KB), and network drivers (128 KB) within the 640 KB of random access memory allowed by any version of DOS. WinSpirs, running under Windows, takes advantage of Window's memory management, to offer the ideal client for the network environment. TCP/IP creates virtual sessions over a virtual network; client and server keep track of each other by means of their respective IP (internet protocol) addresses.

WinSpirs, accessing SilverPlatter databases over the campus ethernet network, provides an ideal client server solution to ASU Libraries networking requirements. As a retrieval interface it combines powerful search features with easy to learn and use functions. As client software it takes advantage of a powerful workstation and equally flexible and powerful network to allow access to workstations located within and outside the library. It also positions us to take advantage of developments in network computing, most notably, Windows NT Advanced Server , Windows NT Workstation, and the World Wide Web.

From Dumb Terminals to NT Workstations

At the beginning of 1995, ASU libraries accessed its CARL on-line system through 200 dumb terminals while PC workstations provided connections to two Novell networks and a client/server CD-ROM network. There was no way to provide remote workstation management, nor to interconnect these systems. In addition, the Libraries classrooms and laboratories were not connected to any network, and were frequently being re-configured to change the software used for specific presentations. Also present was the problem of viruses and security breaches. The scanning for virus had became a daily routine, with most machines becoming infected when users downloaded. Also, on more than one occasion an enterprising user would find a path to the c:drive, load word processing software and work on a term paper in the quiet of the library. Without a integrated system the result of this was the staff could not "see" workstations from a remote location, and had to frequently re-install software at the workstation.

The Library Instruction, Systems and Technologies (LIST) department of ASU Libraries spent considerable time and energy identifying the need for improving the network. They were also concerned with the best way to meet the needs of the users and staff asking for Internet access and a Graphical User Interface. In addition a World Wide Web interface was being to developed as a gateway to the library's electronic databases. To address not only current the needs of the library , but also future ones, a new LAN was decided upon. Microsoft's Windows New Technology (Windows NT) Advanced Server network was chosen.

Windows NT offers a client/server network and provided excellent support for databases and applications. The system would serve both as a LAN, and also as a "supervisor" for the Novell and client/server LANs managed by the libraries. It would connect to all of the library's classrooms and laboratories workstations, and would be equipped with a suite of network management tools that would provide

remote management of all workstations and existing library networks. In connecting all of the library's classroom and laboratories to the network it would also serve as a file/print server for administrative purposes; provide network management tools to ensure the smooth operation the network; and allow staff to remotely manage all workstations.

To accommodate the new system a new server was needed, all laboratory and classroom workstations would need to be upgraded to run Windows NT, and finally eighty-two Dell Pentiums would need to be purchased. The new workstations would begin to replace the current dumb terminals, and not be an addition to them. Funding was secured from the Provost's office and a project plan was designed.

The project was began in June 1995, with a target date for installation of August 18, 1995. The project was divided into six action points: many of the action point were occurring simultaneously

Coordinating Departments

The first action point involved department coordination not only within the library, but also Informational Technology (IT). From IT there was assistance in network configuration, installation of Ethernet, and loading the NT workstations. Within the library the issue of demonstrating the new system to Library personnel and training. Also discussions were began with Copy Service in the library to offer centralize printing in the two main library branches and stand alone printers in the music and architecture libraries.

Memory Upgrades

Second, with the introduction of windows NT, existing machines running our Novell and SilverPlatter networks need to be upgraded from eight megabytes to sixteen megabytes. This process was completed by the middle of July.

Connecting to Ethernet

Because most of the workstations would be the new Pentiums the decision was made between LIST and Library public service departments, in which the computers would reside, to place them within visual contact of personnel in these areas. The third action point was the identification of where workstations would be place. Since all workstations would need ethernet connections, there was a need to map where each would be placed and place an order to install. In addition to ethernet connections the new workstations needed to be given Internet Protocol (IP) address and be put into a Domain Name Server (DNS). This was a joint project between the LIST department and University's Datacommunication Department.

Installing NT Software

In the planning stages a Dell 590 Server was selected as the primary server for the NT system. Action point four dealt with the installation and testing of the Server software. In addition to setting up and installing the NT Server software, the server needed to be configured to only execute the client software, have the ability to download to d:drive, to FTP files, ability to send e-mail, but not read, logoff, not

allow user to change program manager, icons or groups; cannot change password. Also part of action point four was the adding of all workstation names to the domain and create accounts for every machine.

After all the workstations had been converted to NT, the Novell network was moved to the NT Server. This required down time of a few days.

Installing the Applications

Task five was quickly completed by loading the software NT Back Office 3.5 on the server. While the server allows management of the workstations, software still needs to be loaded on each workstation. First the drives must be partitioned, c:drive for the software and d:drive to allow for downloading. Each computer was assigned a name, in this case actually a number, accounts needed to loaded, and all machines needed to tested.

Placing the Workstations in Public Services Areas

The last stage was actual placement of the workstations in the four branches of the Libraries, and final configuring.

The World Wide Web and a Library Home Page

The Windows NT Workstation integrates previously separate but equal library systems. At one point of use, the library patron can easily move from one system to another, accessing a wide variety of electronic databases. In fact, under Windows NT, and with a little skill and ingenuity, the user can create database connections and relations that were previously unavailable. For example, while searching PsycLit with WinSpirs, one of our ERL databases, the user can also open a window to the online catalog. The user can then move back and forth between sessions, finding articles while at the same time checking our holdings.

Not all users, however, are so skillful or challenged. Many simply want a simple way of finding materials. For these users, developments in the World Wide Web are very exciting. LIST is creating, with input and assistance from public service departments and Information Technology, a library home page which simplifies the Windows NT interface while at the same time preserves much of the power of the underlying retrieval systems.

Libraries have always dreamt of a universal database of information that would be accessible to people from any remote site. Widespread use and acceptance of the Internet, a world-wide network of computers was the first step in achieving this goal. However, in the early 1990's, the software used to access and navigate the internet and to use its resources was very difficult to use. One of the earliest improvements, Gopher, was an internet software tool that allowed the user to search and retrieve files from computers throughout the Internet. Gopher skillfully brought together software concepts that not only made navigating the myriad directories of computers on the internet easier but also reduced network traffic by using a client/server architecture.

At the same time as Gopher became an internet standard, the World Wide Web (WWW) began to emerge. Developed by CERN, a Swiss physics consortium, the World Wide Web reconceptualized and reconfigured computing on the internet as a matrix or web of interdependent servers. Using Hypertext Mark-up Language (HTML), the WWW brought an integrated multimedia approach to internet computing. Text, images, sound are intermingled; information is found and displayed as a series of pages whose contents serve not only as content but as departure points for more information.. Using powerful browsers like NCSA's Mosaic or NetCom's NetScape as front ends to WWW servers, users can connect, navigate, search, and retrieve information in one user-friendly interface.

Web sites now flood the Internet providing access to information that cover all subjects and disciplines. ASU Libraries is taking advantage of these resources by designing a home page that will be a WWW starting point to access not only ASU Library computers but also similar services throughout the campus and the world. These launch points represent both very simple and very complex operations. Some links simply establish telnet sessions to other computers--the connection to our online system is an example. When users click on the CARL link they will be taken to the CARL system. A more elaborate connection typifies the link to Current Contents and the Arizona Economic Data Center. Both of these databases are BRS databases, indexed and searched using BRS OnSite software. BRS OnSite is command driven and not very user-friendly. To simplify access but to retain BRS retrieval power, LIST has written a common gateway interface (CGI) which translates the BRS system into a HTML browsable documents.

ASU Libraries also uses web clients developed by Encyclopedia Britannica to access an HTML version of its encyclopedia. We also are planning to implement SilverPlatter's WebSpirs browser to access ERL databases. Additional projects include incorporating Z39.50 into a common gateway interface in order to provide web browsing of other online systems that support HTML and Z39.50.

Concluding Unbibliographic Postscript

World Wide Web computing and client-server CD-ROM networks are only possible when the accessing machine, the terminal, is smart. The move from dumb terminals to smart terminals positions ASU Libraries to take advantage of developments in computer networking that have gone beyond the promise of changing the way the library does business to its reality. The library workstation connected to the campus ethernet and from the campus ethernet to the internet represents a powerful tool for the user and for the librarian. The user not only expands bibliographic horizons but has the means to make use of the resources. The librarian has the means to manage this powerful tool as well as to extend the limits of what we do--making the unbibliographic, bibliographic.

A PROCESS IMPROVEMENT APPROACH TO INTERLIBRARY LOAN

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Continuous improvement of processes and services is a priority at the University of Arizona. Interlibrary Loan is undergoing an in-depth, data driven study which will result in new and better processes, greater customer satisfaction, and increased customer education about the ILL/document delivery process. The Library's Interlibrary Loan Process Improvement Team (ILL PI) utilized a variety of tools to develop a needs assessment approach that forms the knowledge base on which brainstorming and selecting solutions, and pre-piloting and implementing recommendations can take place. Tools such as data workflow analysis, cost-benefit analysis, benchmarking, identifying potential technologies and competitor intelligence, statistics gathering, focus groups, and a customer satisfaction survey have been used. Communication with other library teams and our University customers has been crucial to determining customers' needs, reality testing, fostering "buy-in," implementing and evaluating improvements, and "handing off" the continuous process improvement process. This paper imparts some findings and outcomes to illustrate the team's methods and activities.

Introduction

Process improvement reflects a paradigm shift from library-focused services to customer-focused services. A similar shift is occurring throughout the public sector. In an article entitled, "Quality process analysis: A technique for management in the Public Sector," authors Navaratnam and Harris forecast that by the year 2000 cus-

tomer satisfaction will have become increasingly important to the public sector. The demand to demonstrate libraries' value to society will be incessant and arise from a critical need to justify our funding at every level. Our purposes, activities, and customer needs will be continuously challenged because of this paradigm shift.

Process improvement involves increasing productivity and customer satisfaction while reducing or stabilizing costs and empowering staff. (Navaratnam, 24) It is a step towards becoming a competitive player in the game of funding and support. Of our many processes in the University of Arizona (UA) Library, Interlibrary Loan was an excellent candidate for process improvement.

In 1993-94, the UA Library canceled 1,725 journal titles (worth $686,000). These cuts, coupled with the continual increase in the production and price of printed information and the proliferation of on-line indexes that lead the user to more and more citations, has put increasing demands on the interlibrary loan unit. In fact, UA interlibrary loan requests for serials has been increasing approximately 20% a year. This increase is occurring at a time when budgets and staff are decreasing, and the focus is shifting from ownership to access of information. In response to this shift, the Library has transformed its Materials Acquisition Budget into an Information Access Budget to allow for the purchase of consumables such as ILL costs and on-line searching.[3]

The Interlibrary Loan Process Improvement (ILL PI) Team was one of three process improvement teams formed to improve a particular activity that the Library's strategic planning groups had deemed as a high priority based on their potential impact on customer service. Funded by a Council on Library Resources grant, all three process improvement teams received support from consultants on the broad planning and evaluating level (through the Association of Research Libraries Office of Management Services in Washington DC) and on the application level by Laurie Ingram, a local expert consultant on TQM processes and techniques. The University's Office of Human Resources was consulted to frame appropriate TeamStart activities and Shelley Phipps, the Library's Assistant Dean for Team Facilitation, acted as mentor and facilitator throughout our work.

In December 1994, five individuals from professional staff and librarian pools were appointed to the Interlibrary Loan Process Improvement Team. These individuals brought expertise from the Information Access Team, Interlibrary Loan Work Team, Business Operations Accounting Team, and the perspective of a public service librarian shared between the Undergraduate Services and Social Sciences Teams. Charged "to increase customer satisfaction by improving access to materials not owned by the library and by improving customer education about the interlibrary loan/document delivery process," the Process Improvement Team's parameters included "borrowing for UA customers and lending to primary non-UA customers." The group was assured that there would be no Library staff layoffs although it was posited early on that reallocation of staff to other teams might be strategic in our goal to reduce or contain costs.

Budget

The Interlibrary Loan Process Improvement Team was allotted $8,300.00 to cover costs associated with the project. With 94% of the budget spent by November 18, 1995, the ILL PI Team estimates that 43% of its overall monies will have been spent to employ a student to attend key team meetings, transcribe minutes, design and input data collected into statistical spreadsheets, produce graphs and tables, make arrangements for focus groups, and perform a wide variety of miscellaneous tasks to support the team. Only 4% of the Team's funds were spent on benchmarking activities, as it was possible to combine these trips with professional travel funded from other accounts.

In this way, the team was able to take advantage of unique conference opportunities that were presented during the timeframe in which we worked. One ILL PI member attended "From Documents to Data: Anticipating the Next Wave," an ACRL Pre-conference sponsored by the UnCover Company in March of 1995. Another member was able to attend both the National Online/IOLS meetings in New York in early May, and the 4th International Interlending and Document Delivery Conference in Calgary in June, 1995.

Information gained from attendance at these conferences was shared among the team and helped educate us about new technologies and competitive intelligence. Other portions of our money were spent conducting focus groups, collecting workflow data, administering a customer satisfaction survey, and for an open house to share our draft recommendations and elicit feedback from the library and campus community. (See Appendix A for a detailed breakdown of budget expenditures).

One-time monies were also allocated by Dean's Cabinet to hire two half-time employees for the Interlibrary Loan unit to "fill-in behind" for the two members of the ILL Work Team who were expending 10-20 hours each per week for the greater part of the project.

Data Gathering Approaches

There are several key steps involved in process improvement. The first involves collecting data including customer feedback, workflow cycle time, cost per request, and information about other institutions, suppliers, and new technologies.

Our process improvement project involved collecting the following data:

a. focus groups
b. customer satisfaction survey
c. workflow data
d. cost analysis
e. benchmarking/new technologies/competitive intelligence

Focus Groups

Changes to the ILL process must be informed by the needs of our customers. One of our challenges was to bridge the gap between what we thought our customers need from us and what the customers themselves perceive they need and want

in an ILL service. To prepare to do this, the needs assessment subteam consulted with the head of the Marketing Department in the School of Business, Susan Heckler. We also consulted with two other teams in the Library who were in the process of conducting a needs assessment study for their customers.

As a result of this input we decided to conduct focus groups with three of our major customer groups - undergraduate students, graduate students and faculty, as well as ILL student employees. Our objectives were to:

1) give us some insight into what our customers needed,
2) encourage us to think more openly about ILL services, and
3) gather fresh, new ideas from our customers on possible solutions.

Information we gathered from the focus groups on speed, electronic ordering, status updates, reliability in meeting deadlines, and the lack of efficiency of office processes, played a role in creating solutions to improve our process. (Appendix B)

Customer Satisfaction Survey

As well as giving us more direct customer feedback, "user surveys are especially valuable when conducted periodically to measure reactions to changes in service delivery patterns and to continue monitoring user satisfaction." (Perrault, 98) A customer satisfaction survey also elicited information directly from our customers. These surveys were sent out with ILL materials. Of 82 completed surveys the majority were from faculty, graduates, and staff.

We asked customers to rate Interlibrary Loan in three categories:

- Quality (of material received)
- Experience (their overall experience with ILL)
- Speed (how fast they received their materials)

For each category there were five possible ratings:

- Above and beyond
- Better than average
- Adequate
- Could have been better
- Not even close

We also asked for demographic information, whether loan, photocopy, rush or non-rush materials were requested, and if this was the first time they had ever used ILL.

What we found was that overall, our customers give us an almost 30% rating at above and beyond expectations. 34% responded in the better than average category. The remaining 36% fell in the adequate and below adequate ranges. We are concerned that we are not satisfying a full third of current ILL users.

The major problem seems to be in the area of speed, where we are not satisfying 42% of our customers. The next biggest problem was with the quality of material received, which did not satisfy 37% of our customers. Approximately one-third of our users were not satisfied with their overall experience with ILL.

Workflow Data and Analysis

The workflow in Interlibrary Loan was divided into seven separate processes. In the Borrowing Section:

1. Non-Rush Photocopy requests
2. Rush Photocopy requests
3. Non-Rush Loan requests
4. Rush Loan requests
5. UnCover requests

In the Lending Section:

6. Loan requests from Arizona State University (ASU), Northern Arizona University (NAU), and Arizona Health Sciences Center (AHSC)
7. Photocopy requests from ASU, NAU, and AHSC

For each of these processes, a data collection sheet was developed listing the steps for the process in the order the workflow was currently done. Because of time limitations, some of the processes were divided into two to three sub-processes to insure we would be collecting data on the entire process. For example, in the non-rush loan process, three data collection sheets were developed: search and order, receive, and return. Because of time constraints, a book was not tracked through the entire loan process from start to finish. Instead, different books were tracked for each of these three sub-processes.

The minimum number of requests to produce an effective control chart of that process is twenty-five. In order to ensure that we reached this number, at least fifty requests were tracked through each of the seven processes. The start and end time for each workflow step in a given process was recorded along with the initials of the employee completing that step.

The start and end times from the data collection sheets were input into an Excel chart which provided turnaround times for each process as well as processing time for each task. From this data, control charts were produced. Control charts are a way of detecting and monitoring the variation in a process. Charting the data in this format allows you to visually see each request with total turnaround time within set limits. Upper and lower control limits, which indicate how much variation is typical for the process, are calculated according to statistical formulas from the data collected. "Points that fall outside the limits or into particular patterns indicate the presence of a special cause of variation, a cause that deserves investigation." (Schottes, Ch. 2, 33) It was important to determine the *common* causes (reasons for

fluctuation within set limits) as well as the *special* causes (reasons for fluctuation outside the set limits.) The goal is to constantly monitor the process, and to reduce variation over time. (A sample control chart is depicted in Appendix C.)

In conjunction with producing control charts, we also produced Pareto charts for each of the seven processes. A Pareto chart helps "to focus efforts on the problems that offer the greatest potential for improvement by showing their relative frequency or size in a descending bar graph." (Brassard, 95) Our Pareto charts graph the wait or lag time between two workflow steps in a process. Our aim was to address 80% of the lag times in each of the seven processes. (A sample Pareto chart is depicted in Appendix D.)

The Interlibrary Loan Process Improvement Team as a group analyzed and interpreted the control charts to determine the causes for the variation in each of the seven processes. The *common* causes identified in the data analysis were the lag times between tasks in each process. These lag times were consistently attributed to the batching done within a process. Contrary to our previous assumptions, the amount of time to complete a task (the *value added time*) was not a significant problem. Therefore, the main focus of our problem solving and solution finding was eliminating the lag times in the workflow of each of the seven processes. (A sample of the lags and causes of the lags of one of the processes are depicted in Appendix E.)

Cost Analysis

In order to conceptualize the cost-benefit of various possible solutions, it was necessary to determine the cost of our current operations. A total direct cost of $9.73 per request was determined. (See Appendix F for a detailed cost analysis). Perhaps most startling was the information learned from the central University's Financial Services Office. They estimate that it costs the University of Arizona anywhere from $75 to $150 to cut a check to pay a single invoice. The Interlibrary Loan check cutting process cost the University as much as $256,000 per year. The ILL PI Team is still working to determine a cost per item for lending requests (requests filled from within the University of Arizona's collections).

Statistics

The ILL Work Team's broad historical ILL statistics and the most recent year's detailed statistics for both borrowing and lending were studied in order to familiarize us with the receiving and processing levels that have characterized the unit's overall activities. This information also pinpointed trends that helped inform our problem solving and solution finding. For example, photocopy borrowing activity grew by 25% and 20% over the last two years respectively.

Our lending statistics show that we have had difficulty keeping up with the increasing lending activity. It is likely that we have reached our maximum capacity at current staffing and other resource levels. We recognize, however, that we must maintain quality service for the cooperative agreements to which we are committed, even as lending and borrowing demands on our library continue to increase. (Borrowing and lending statistics are depicted in Appendix G.)

Other historical data was also examined. It was helpful to compare the University of Arizona's 1991 statistics with the national research library averages reported in the ARL/RLG Interlibrary Loan Cost Study. (Roche, 4, 35, 38-39) This drew our attention to areas in which our costs were substantially different from those of other large research institutions. For example, our borrowing level was slightly above the national average and our lending level slightly lower. (Appendix H)

Benchmarking, New Technologies, and Competitive Intelligence

The ILL PI Team attempted to identify ILL offices and non-library businesses that had cycle times similar to that in our ILL workflow; however, no institutions with comparable information were found. We did visit institutions whom we identified as having "best practices" including Texas Women's University (the "paperless ILL office") and the University of Michigan, where we learned about expanded hours and how to manage students when supervisors are not present.

New technologies from PI Team members' conference travel, literature, direct communication with vendors, and the ILL-L listserv were explored. Information about AVISO, the North American Interlibrary Loan and Document Delivery Project, OCLC's FirstSearch, Innovative Interfaces Inc.'s ILL Module, OCLC's Interlibrary Fee Management System and other products were also shared among members to

build a knowledge base from which to brainstorm creative technical solutions. Competitive intelligence was used to explore methods by which services could be delivered.

Problem Solving and Solution Finding

After reviewing the information we have outlined thus far, the ILL PI Team used brainstorming techniques to identify the best solutions for improving the ILL process. We brainstormed each of the major lags for the seven processes by using the nominal group technique. This technique enabled us to create a high volume of potential solutions free of criticism and judgment from other team members. After each brainstorming session we narrowed the ideas down to a critical few which dovetailed with the information we had collected about our processes. We brought these recommendations forward first to the Information Access Team for feedback. After incorporating this input, we conducted an open house with Library staff and the university community for even more feedback. Questions which came out of these forums were answered in detail and disseminated via electronic mail.

The solutions which emerged from this entire process included five major components: outsourcing photocopies to EBSCOdoc, using the Innovative Interfaces Inc.'s ILL module, creating a Circulation Outpost, single item processing, scheduling, and training. See Appendix I for an outline of our recommendations.) It is important to stress that we do not recommend that these solutions be transferred to other institutions. It is necessary to undergo process improvement in order to gather data and produce solutions to address a specific environment.

Conclusion

This project is still a work in progress. We are now in the early stages of preparing to test our recommendations in a controlled and measurable environment. Following this stage we will educate staff and customers and then implement changes. Shortly thereafter we will review and evaluate the results of the improvements, duplicating many of our initial data collection efforts for comparison purposes.

Process improvement must become a constant, never ending part of the ILL Work Team's mission. Therefore, mastering and perpetuating these skills must become an inherent part of this team's work. Handing off ownership of our data and methods is key to further refining the process in response to our customers' changing needs.

The authors would like to thank:

Virginia Valenzuela and Snowden Wyatt, our fellow team members on the Interlibrary Loan Process Improvement Team, for gathering and analyzing a large portion of the information contained in this report. Paula Moxham also contributed as a full team member until her resignation to accept a new position in July 1995. Shelley Phipps, Laurie Ingram, and Jan Murphy have all facilitated, instructed and otherwise assisted the group in moving forward towards its goal. Glen Redford and Stephean Applegate have been fabulous student assistants. Mina Parish, the University of Arizona's ILL WorkTeam Leader, compiled the data in the Statistics section of this report and, along with Stephen Bosch, Gloria Alvillar, Kay Dodder, and Mimi Hernandez, formed the original Management Review Team that created our charge and gave us direction. Three graduate students (Sury Balasubramanian, Anshoo Gaur & Daniel A. Soosai) from the Systems and Industrial Engineering Department collected and analyzed the lending photocopy process as a class project. We'd also like to thank the ILL WorkTeam, the Library staff, and the University of Arizona campus community for providing valuable input, feedback, and support of our endeavors.

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Appendix A

Interlibrary Loan Process Improvement Team Budget Report

Expenditures	Amount
Workflow Data Collection:	
Date/Time Stampers	466.09
Students:	
Supplies	10.67
Wages	3,539.07*
	3,549.74
Focus Groups:	
Cassette Tapes	5.97
Index Cards	8.84
Batteries	33.42
Lunches	494.73
	542.96
Benchmarking:	
Speaker Phone	22.69
Travel	350.03
	372.72
Conference Travel:	
IOLS/National Online	656.60
ACRL (Pre-conf on Doc Del)	1,068.78
4th Int'l Interlending Conf	1,445.33
	3,170.71
Customer Satisfaction Surveys:	
Postage and Supplies	53.32
Sharing/Feedback Open House:	
Printing & Costume	144.46**
TOTAL:	**$ 8,300.00**

* $501.15 had not been expended by November 18, 1995. We anticipate using this money for student wages to support our data collection and analysis during pretesting, and for administering our customer satisfaction survey to measure customers' changed satisfaction level once improved processes are in place.

**Food was provided for this event from library-wide celebration funds.

Appendix B

A Snapshot of Focus Group Findings

- Undergraduates want materials immediately. Many undergraduates, in fact, do not bother with interlibrary loan because of their immediate deadlines. They will make do with what is available in-house. Undergraduates said things like, "if it's not there, I'll find something else." Someone else said, "I go by what's in the stacks, what's physically there."

- Undergraduates want to order documents directly on the computer. Their impression is that electronic ordering is "more efficient" and "faster" than paper ordering. One undergraduate said, "If you file it electronically yourself, it's like doing your own tax file -- it's done." They want the document immediately right on the computer.

- Faculty and Graduates, in contrast, indicated several times in several different ways that as long as ILL is reliable in meeting its deadlines, they can plan their requests within that time-frame.

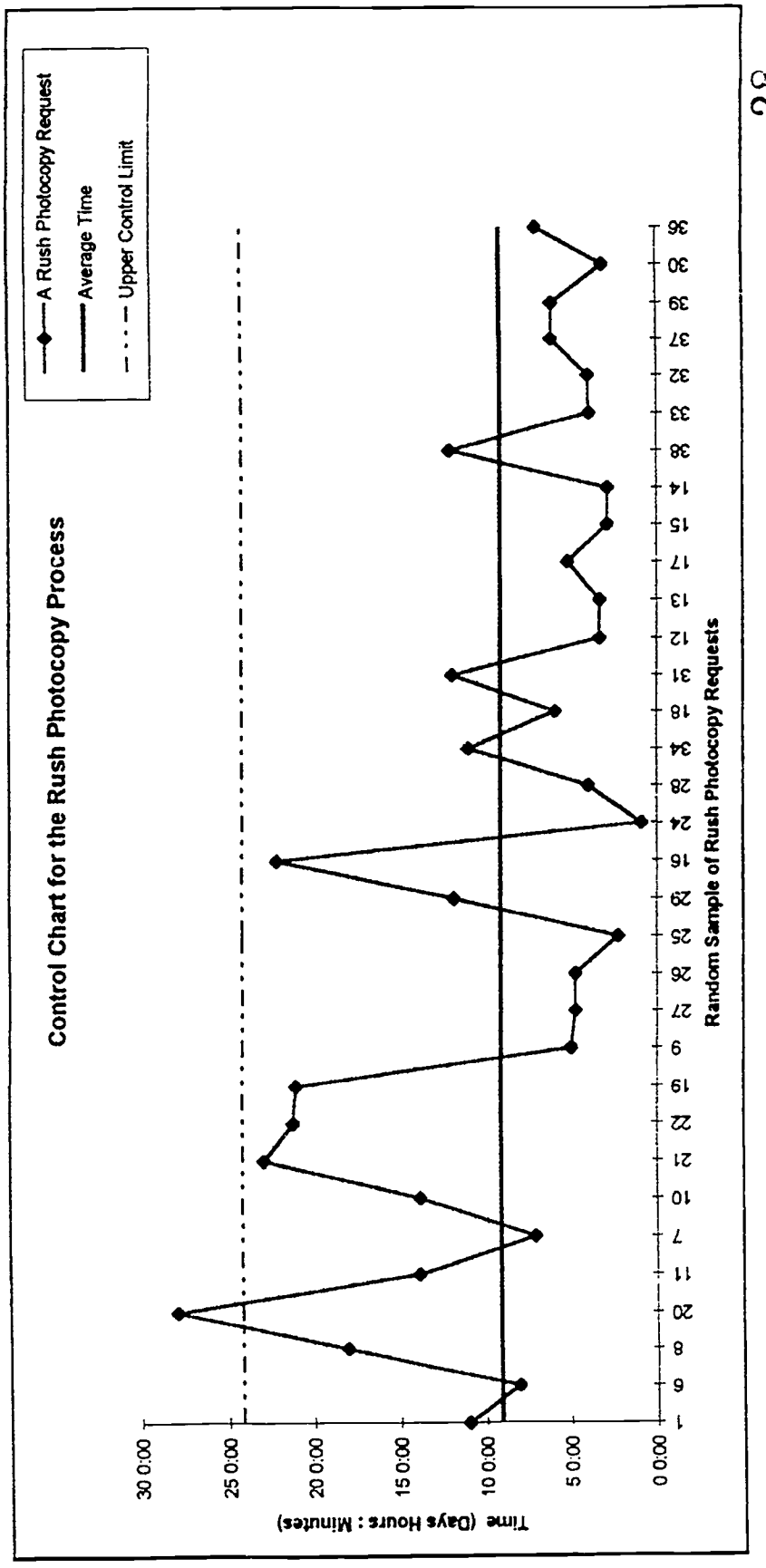
- Customers want to know what's happening with their requests -- especially after a month or so. Has the request been received? Has it been processed? Ordered? Is there a delay? Has ILL given up looking for their request and not informed them yet?

- Customers also agreed that the pick-up procedure at the circulation desk is irritating and inefficient.

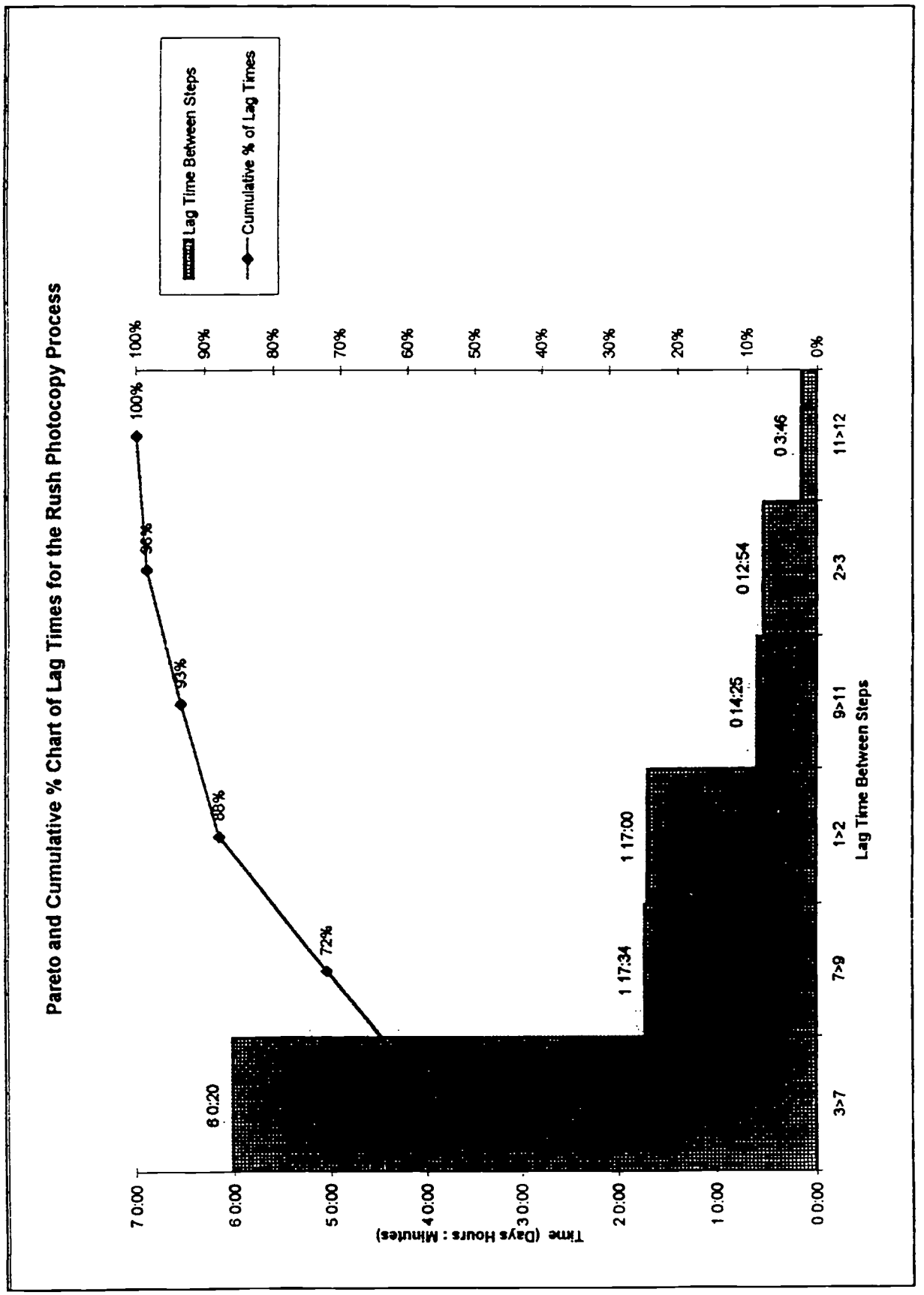
- Undergraduates said that one of the best ways for the Library to inform them that ILL exists is on the OPAC system itself. Students also thought that their professors should tell them about ILL in class and on the syllabus.

- ILL student workers pointed out problems in work space and inefficiencies in processing. Student workers showed concern that processes had not changed in response to the increased number of requests, or in response to the move to new office space.

Appendix C



Appendix D



Appendix E

Borrowing - Rush Photocopy Process

Lags in the process:

- ***From*** searching and ordering the request via OCLC *to* matching the request with the photocopies once received.
Average time delayed = 6 days 0 hours 20 minutes

- ***From*** matching the request with the photocopy order when received *to* checking the quality of the photocopy order.
Average time delayed = 1 day 17 hours 34 minutes

- ***From*** receiving the request from reference desk or information desk *to* sorting the request in ILL.
Average time delayed = 1 day 17 hours 0 minutes

Causes for these lags:

- Some of the photocopies are sent by US Mail and not faxed to our office.

- Requests wait in a basket after the photocopies arrive and are matched with the request as well as before the quality of the copy is checked.

- Rush requests are not handled differently at the request receiving site (Reference desks or Information desk.) Requests are only treated as "rush" once requests are received in the ILL office.

Total Cycle times for a Rush Photocopy Request:

Average cycle time:	9 days 1 hour 25 minutes
Best time / canceled request	0 days 21 hours 23 minutes
Best time / filled request	2 days 19 hours 24 minutes
Worst time	27 days 22 hours 22 minutes

Appendix F

Cost Analysis

Borrowing Requests Processed (Filled and Unfilled)

Description	Cost per Request
Charges from lending library	$ 2.69
CRL Membership	$ 1.95
On-line searching charges	$ 1.82
Staff/student wages	$ 1.76
Postage costs	$ 1.04
ILL Forms	$ .20
Other supplies	$ .17
Courier express costs (UA, ASU & NAU)	$ .10
TOTAL costs per request:	**$ 9.73**

Additional Costs:

It is estimated that it costs the U of A anywhere from $75 to $150 to cut a check to pay an invoice. The Interlibrary Loan Office paid 1,713 invoices in 1994/95. **The estimated cost to cut checks for Interlibrary Loan charges in 1994/95 is $128,000 - $256,000.**

Appendix G

Broad Historical Statistics
University of Arizona Interlibrary Loan

Borrowing Requests

	FY93	FY94	(% change)	FY95	(% change)
Received:	13,011	14,061	(+ 8%)	16,372	(+16%)
Filled:	9,992	11,615	(+16%)	13,090	(+13%)
Borrowing Requests Filled					
Loans:	4,834	5,164	(+ 7%)	5,357	(+ 4%)
Copies:	5,158	6,451	(+25%)	7,733	(+20%)

Lending Requests

	FY93	FY94	(% change)	FY95	(% change)
Received:	40,366	40,803	(+ 1%)	41,924	(+ 3%)
Filled:	18,061	16,685	(- 8%)	15,656	(- 6%)
Lending Requests Filled					
Loans:	9,291	8,255	(-11%)	7,488	(- 9%)
Copies:	8,770	8,430	(- 4%)	8,168	(- 3%)

Appendix H

ARL/RLG ILL Cost Study Comparison, FY91*

	UA	ARL Mean
Transactions:		
Borrows	8,381	8,046
Loans	20,063	25,487
Costs: (per request)		
Borrows	$16.82	$18.62
Loans	$ 7.14	$10.93
Staff Costs:		
Total	$220,447	$285,037
Materials Delivery:		
Total	$ 24,285	$23,263
Photocopying:		
Total	$ 3,779	$ 8,529

*Data has been very broadly excerpted from this report, and the original source should be consulted for more comprehensive, detailed explanations and representations of data. Also, because this is illustrative only, this excerpt does not include all of the categories presented in the ARL/RLG ILL Cost Study.

Appendix I

Pre-Pilot Recommendations

The solutions include five major components: outsourcing photocopies to EBSCOdoc, using the Innovative Interfaces Inc.'s ILL module, creating a Circulation Outpost, single item processing, scheduling, and training.

- Photocopy requests will be outsourced directly to EBSCOdoc, a document delivery company. Customers will submit their photocopy requests electronically via the OPAC main menu and receive their materials without Library mediation.

- The III ILL module allows customers to submit their book loan requests electronically via the OPAC main menu. The ILL module links with OCLC and RLIN for searching and ordering, as well as with the III Circulation system for book receiving and customer notification.

- Single Item Processing is an alternative to batching. Multiple processes are completed immediately for a single item when searching, ordering, sending, receiving, and returning an item.

- The Circulation Outpost will be an area in the Circulation section of the Main Library for sending and receiving books. For example, working in Circulation will allow us to do single item processing without a delay in having the items available to the customer for pick-up.

- Processing tasks will be scheduled hourly. This type of schedule facilitates single item processing and the ability to process all work within a given day.

- Easy to use standardized training procedures and check lists will be developed for staff and students.

* The Stratactic Team on Electronic Document Delivery independently studied and evaluated numerous potential document suppliers, and in consultation with ILL PI, determined that EBSCO's EBSCOHost/EBSCOdoc services would serve most strategically to supply access to both the full-text of articles, and as a commercial document delivery source.

USING TOTAL QUALITY MANAGEMENT TOOLS TO IMPROVE LIBRARY PROCESSES

BARBARA ALLEN
Library Specialist
Library Support Team
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DEBORAH SMITH
Library Specialist
Bibliographic Access Team
Science-Engineering Library
University of Arizona

The University of Arizona is nationally recognized for its commitment to quality customer service. As part of its 1994/95 annual Strategic Plan, projects were identified that would help us to meet the needs of our customers more effectively. This paper addresses the implementation of a process improvement team, charged with improving physical access to the library's collections, and its adaptation of total quality tools to design and improve processes. It discusses the preparation of workflow diagrams and control charts that help to identify and visually depict problems in work processes. Control charts depicting data collected during various phases of our project demonstrate how our new processes have reduced shelving cycle times.

OVERVIEW

The University of Arizona Library, as part of its strategic plan for 1994-1995, identified the need to improve physical access to its collections. Data collected, anecdotal information, customer complaints, information from staff and user focus groups, clearly articulated the need for improvement in this area. To accomplish this, a Process Improvement Project was charged "To develop and integrate library wide process improvements in collection maintenance activities to improve accessibility."

The first process involved the selection and training of the process improvement team members. The criteria for selection included the following: Knowledge of library physical access activities; good data gathering and data analysis skills; depth of understanding of collection maintenance activities; commitment to

customer service; knowledge of Sabio; the library's online system; library-wide thinking (ability to see "big" picture); task-oriented; ability to apply survey/assessment knowledge to the problem at issue to process improvement team; internal library customer, whose key work activities require use of the collections (e.g. Interlibrary Loan).

The seven members selected then attended an all day Team Start training session. The purpose of the Team Start session was twofold: 1.) team members were given the opportunity to ask questions and seek clarification of the charge given to the team; and 2.) began basic team building. An initial team building exercise was naming our group. "PITcrew", which stands for Process Improvement Teamcrew, became our name for the duration of the project. Following this initial training session, we received from Laurie Ingram, Total Quality Management consultant, and Shelley Phipps, Team Facilitator for the University of Arizona Library, extensive training in quality improvement tools and techniques.

TECHNIQUE

The Plan, Do, Check, Act (PDCA) cycle developed by Walter Shewhart and modified by Dr. Deming provided the framework for our process improvement project. A description of each step, and how it relates to our project is outlined below.

PLAN

The "Plan" phase, involving the analysis of the current situation, and the subsequent planning of the improvement, is the most critical and time consuming phase of the process. As an example, we began this phase in October 1994 and finished planning the improvement in early August 1995. Major steps include: collecting data; analyzing data; brainstorming possible solutions; selecting an improvement, and, finally planning the improvement.

DO

The "Do" phase is where the improvement is actually implemented. This phase may involve a pre-pilot as well as a pilot. For us at the University of Arizona we were able to pre-pilot our improved process at the Science-Engineering Library in early August. This allowed us time to fine tune the process before beginning a semester long pilot during the Fall 1995 semester.

CHECK

The "Check" phase involves the analysis of what happened during the process to determine if the improvement needs to be modified. This phase is currently in process and we are redoing our data collection for shelving and pickups so that we will be able to compare cycle times, and identify any problem areas.

ACT

The "Act" phase involves making the improvement permanent. The Shelving Process Improvement Team will have completed its charge in December 1995. At that time the continuous data collection for shelving and pickups will be the responsibility of the Materials Access Team.

TOOLS

While there are tools to help collect, analyze and present data, there are also tools to help understand the tools. The first "tool" that we were introduced to at our Team Start session was an extremely handy pocket guide called Memory Jogger II by Michael Brassard and Diane Ritter. We used this guide throughout our Process Improvement Project to aid us in deciding which tool to use. Another "tool" that we found useful in preparing this paper was Quality Improvement Tools & Techniques by Peter Mears.

The tools, and what they revealed about our process, will be discussed in detail below. A description of the basic tools and their uses are in Appendix A.

FOCUS GROUPS

Focus groups were one of the first tools that PITcrew used. We wanted faculty, staff and students to identify for us the problems they encountered in using our library. Though recruitment was difficult, and PITcrew was disappointed with the turnout, we were able to verify that our customers had low expectations that their feedback would result in substantive changes.

We did hold a unique and very successful focus group with our student shelvers in which we had them "fishbone" our shelving problem. The problem posed to them was "What prevents our customers from finding materials in the library?" This problem became the fish head. Their responses were organized along the "ribs" of the fishbone, and articulated specific problems. This activity provided our core workers with a creative way to discuss their work and the problems they encounter.

One of the most valuable lessons that PITcrew learned was that students are not only shelving books, but also answering questions for customers lost or confused in the stacks. We would later use information gathered from this session as justification to create a position called Shelving Coordinator. Shelving Coordinators now work in our stacks, organizing and assessing work situations and answering customer questions.

This same problem was posed to PIT crew. Our brainstormed responses were organized into four broad categories: methods; manpower; machinery; and materials. After examination of our responses, decision was made to examine the following areas, and to collect and analyze data as appropriate: workflow diagrams

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for shelving and pickups; examination of data on searches placed by our customers; and feedback from our public service points.

FLOWCHARTS

Flowcharts diagram the steps that occur in a process. PITcrew used flowcharts to help us see what steps we did, and the order in which we did them. The flow charts were especially useful in our examination of the shelving and pickup processes in the Main and Science-Engineering Libraries. The simple act of recording each step in sequential order helped us visually identify steps that were repeated and may be unnecessary. We chose to display our flow chart data using an Excel spreadsheet. We combined our flow charts with a time-motion study, in which we timed how long each step in the process took to be performed.

The flowchart increased its usefulness to us as we timed the active steps, (active steps are value added activities), in the process; and measured wait times, (wait times are non value added activities). We quickly identified that wait times were much longer than active times. If we could reduce the wait times, and eliminate unnecessary/redundant steps, it was logical to assume that we could improve the process. When it came time to propose solutions we analyzed our workflow data. To achieve our goal, we eliminated from our Main Library shelving process five redundant steps and one step that could take up to 45 hours to complete. Our shelving cycle time was reduced by redesigning a work flow which included only the essential value added steps. (See Appendix B & C.)

CONTROL CHARTS

Through our readings of Deming, and through the teachings of our total quality management consultant, Laurie Ingram, PITcrew learned that work process which display a lot of variation are processes that don't work. Control charts, like work flow diagrams, are a visual tool; they help identify the amount of variation inherent in a process. PITcrew used control charts to identify variation in its shelving and pickup cycle times. We "marked" books with flags in order to measure the time it took to complete each step in the shelving process. We measured from the time the book was placed in the return book bin, or left somewhere in the library, to the time it took to be correctly shelved. We did our initial data collection for shelving cycle times three times throughout the Spring 1995 semester: a slow period, (the first two weeks of the semester); an average period, (around mid-semester), and the peak time for library use and book return (the last three weeks of the semester). We are currently in the process of repeating the data collection using the same corresponding times as in the Spring 1995 semester.

During our initial data collection we found plenty of variation in our process. The range of shelving cycle time at the Main Library during our peak time, Spring 1995, was 28 to 350 hours. This variation was due to two things: tampering, and scheduling. Some floors were infrequently shelved because we made the decision

they weren't as important. Our erratic shelving schedule put us in a crisis mode, and that's when we began to tamper by shifting shelving teams from one floor to another.

Once the shelving cycle times were visually depicted on a control chart, we determined that much of the variation could be eliminated by implementing a shelving schedule based on need. If books are returned to the library throughout the day, then they should be shelved during the same period. As much as we wanted to give our shelvers a choice in their work schedule, we also insisted that they work when our library customers needed them.

Control charts also have statistical advantages. Once again we chose to use Excel to construct our control charts. Using them we were able to calculate the upper control limit, as well as the average time it takes a book to be shelved. The upper control limit is especially useful, as it identifies for our customers the upper limit of the time they will have to wait for a book to get shelved. For example, at the beginning of the Spring 1995 semester, the average cycle time at our Main library was 18 hours; while the upper control limit was 43 hours. With the implementation of a regular shelving schedule and a revised shelving workflow, the average shelving cycle time at our Main Library was reduced to 2.5 hours, and the upper control limit to 8 hours during the slow time at the beginning of the Fall 1995 semester. (See Appendix C)

PARETO CHARTS

Pareto charts use a bar graph with cumulative percentages to determine the vital few problems that need to be corrected. In interpreting Pareto charts the 80-20 rule applies: 80% of the problems caused by 20% of the sources. Pareto charts also identified for PITcrew those areas that we did not need to deal with. Pareto charts were used to analyze our searches data, our study carrel data, and data collected at our public services desks. (See Appendix D)

Pareto charts helped us to narrow our decision making. We concentrated our efforts on the processes that would most impact our customers. Our missing book data revealed a need to address issues relating to the integrity of the Sabio database. The data that we have gathered will be summarized and handed off at the conclusion of our project Our study carrel data showed that our customers' perception of materials being hoarded in study carrels by faculty and graduate students was correct, however, the numbers of items not checked out was not significant enough to warrant a change in the process. Our data did indicate a need for positive public relations in this area. Finally, the data from our public services desks confirmed that our database is confusing to our customers. To determine our customers' problems in finding materials in the stacks we gathered data by direct observation. We "shadowed" our customers by following in their footsteps. Once we had identified what their problem was we were able to assist them in locating the needed materials. It was through this process that we learned that we have a customer education problem. Customers often times did not understand how to

interpret our Dewey Decimal and LC call numbers. The physical layout of the stacks also caused problems for our customers. Better, improved signage may help to correct this situation.

BENCHMARKING

The final data collection "tool" we used was benchmarking. We sought assistance from the Association of Research Libraries to conduct a survey of the 108 member institutions and determine what they did to achieve good shelving turnaround time. The survey, in addition to follow up phone interviews, and a site visit to Northwestern University, were extremely helpful. As a result of this process we were able to establish a tracking system that enabled us to determine, at a glance, how many carts of returned books were waiting on any given floor to be shelved. A parallel tracking system allows us to determine the last time a given floor/section of the library had been picked up. This helps us to identify where and when we need to schedule shelvers.

RESULTS

The results listed below reflect an examination of our processes during the first weeks of the Spring and Fall semesters of 1995.

* At the Main Library we reduced our average cycle time for reshelving books from 18 hours to 2.5 hours.
* At the Science-Engineering Library we reduced our average cycle time for reshelving from 81 hours to 1.5 hours.
* At the Main Library we reduced our upper control limit from 50 hours to 8 hours.
* At the Science-Engineering Library we reduced our upper control limit from 43 hours to 5 hours.
* By eliminating redundant steps in the shelving process, we were able to realize savings of $26,246, or approximately 13% of the student wages budget for collection maintenance activities.
* Two functional workteams were combined to create one team that shared work tasks and goals. This helped facilitate better communication and increased commitment to collection maintenance activities.

WHAT WE LEARNED

* The goal, purpose, and expected outcome of a Process Improvement Project should be clearly defined.
* It is often times impossible to solve ALL the problems identified during the course of the project.
* Continual improvement needs to be built into every process.
* Process Improvement is neither easy to understand nor easy to accept when it impacts your work.
* Data collection is time consuming, but it simplifies decision making by helping to identify the problems.

* Process improvement is complex, and requires commitment of time and energies to master the tools and techniques necessary to complete the project. Negotiation may have to occur to provide adequate time to devote to the project.
* All processes are unique. Organizations must know their own processes before they can improve them.
* Cross functional teams are a unique way to combine individual expertise and talents. They provide an opportunity to broaden our thinking and adapt a wider perspective on organizational issues.
* Change is difficult.
* Concrete data to show the change is necessary, and a willingness to do the tasks with the affected team promotes "buy in" of the changes.
* It is extremely useful to have a consultant who is an expert in the tools and techniques of Total Quality Management.

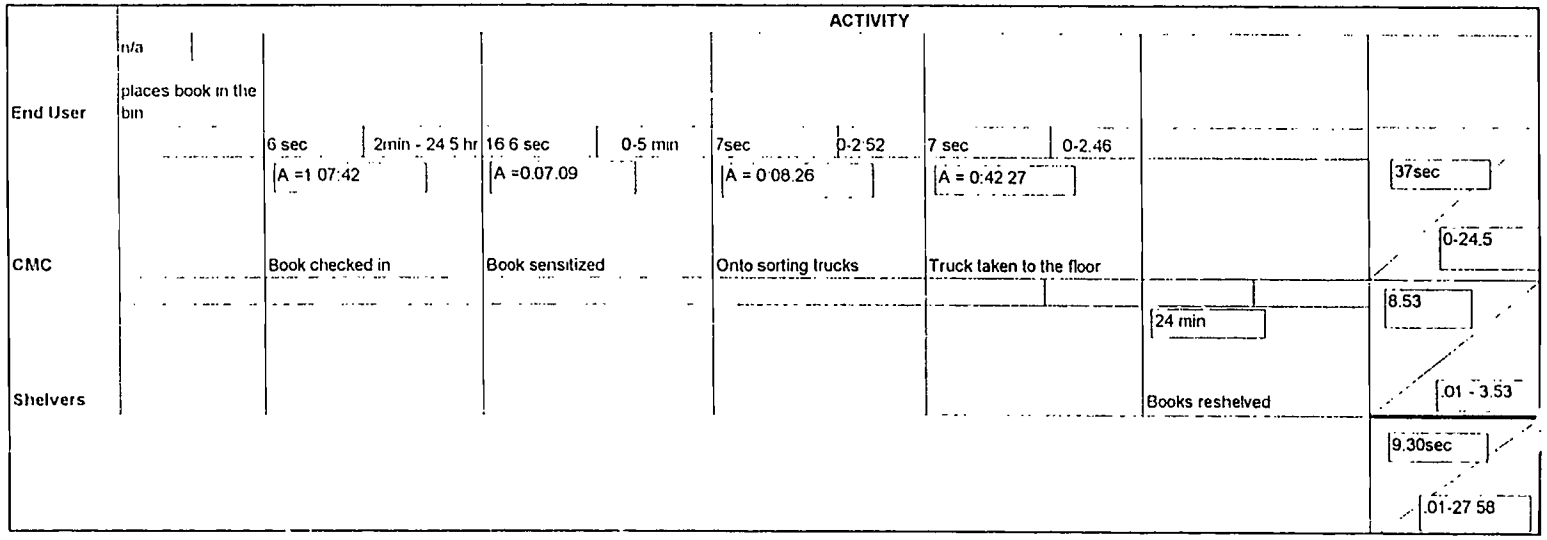
REFERENCES

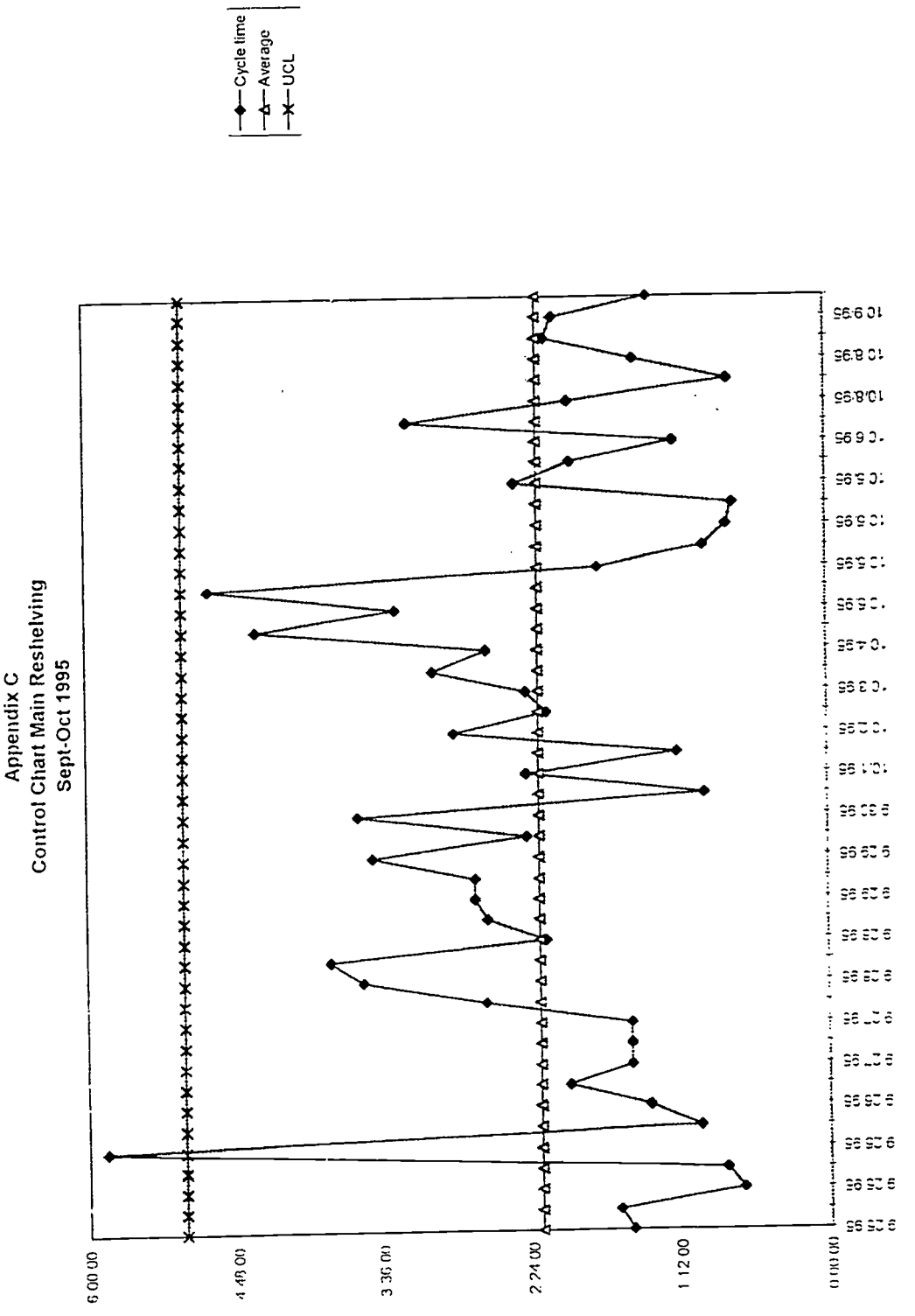
Brassard, Michael and Diane Ritter. The Memory Jogger II. Methuen, MA: Goal/QPC, 1994.

Mears, Peter. Quality Improvement Tools & Techniques. New York: McGraw-Hill, 1995.

Appendix A		
Basic Quality Improvement Tools		
Tool	Description	Uses
Fishbone diagram	Fish's head (main activity) on right. Ribs contain major process steps. Shows cause and effect relationship. (Mears, 16)	* Helps identify root cause * Helps generate ideas * Is an orderly arrangement of theories (Mears, p.52)
Pareto chart	A bar chart with percent arranged so bars touch. Bars are in descending order from the left. Frequencies are on the left and cumulative percent is on the right. (Mears, p.15)	* Separates the vital few from the trivial many Problems/symptoms/causes * 80-20 rule: 80% of the problems come from 20% of the causes * Provides order to the activity
Control charts	A line graph with an average line and lines for upper and lower control limits.	* Monitors an ongoing process and detects changes in output * Is a visual display of process * Helps organize process into manageable size * Promotes greater understanding and control of the process * Shows if process is in statistical control * Shows trends over time
Bar chart	A graph that compares different quantities by means of rectangles (bars) whose length is proportional to the number represented.	* Provides a quick visual reference * Provides order to the activity
Flowchart	A visual map of a process. Traditional flowchart symbols may be used to indicate the steps in the process.	* Serves as a training aid to understand the complete process * Shows unexpected complexity, problem areas, redundancy, and where simplification and standardization may be possible (Memory Jogger II, p.56)

Appendix B
Workflow: Reshelving Science/Engineering Libray
9/25 - 10/9




Appendix C
Control Chart Main Reshelving
Sept-Oct 1995
Cycle time
Average
UCL
6.00.00
4.48.00
3.36.00
2.24.00
1.12.00
0.00.00

Appendix D

Sabio difficult	Not found	Found not on shelf	Building difficul tto interpret	Found on shelf by staff	Misshelved
14	9	6	6	5	2
33%	54%	68%	82%	94%	99%