A STRUCTURAL ANALYSIS OF INTER—LIBRARY NETWORKS: A REGIONAL ILL NETWROK IN THE WESTERN NEW YORK 3Rs REGION

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ABSTRACT

This study is a structural analysis of a multi-type and multi-level library network within the framework of a regional interlibrary loan (ILL) system. The study monitored to information network structure for resource sharing of academic and research library materials transmitted through the ILL. The local flow of academic and research information was measured by a survey of the filled ILL transactions by individual libraries in the Western 3Rs region. The major findings were as follows: 1) the regional ILL network showed less than half of participation of the total subject libraries, 2) existing structure surveyed was identified as a composite centralized network with three communication groups, 3) depending on the types of materials transacted, the structure were changed, 4) statewide and multi-state library cooperatives had direct interactions with some of the local libraries, 5) individual libraries participated in the ILL network more for periodicals than book materials, 6) academic libraries throughout the total six structure analyzed showed the highest percentage of participation.

I.   INTRODUCTION

Interlibrary loan (ILL) is a library function concerned with managing the use of library's collection and facilities (to some extent) by other libraries. Under the ILL policies and rules, the member libraries interact to each other to share the library resources through the system.

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So many changes have occured so fast in the recent decades from the time that automated support for the interlibrary network was available. Not only have we seen a rapid increase in the number of various cooperation organization such as consortia, bibliographic utilities, and library cooperation organization such as consortia, bibliographic utilities, and library cooperatives, we have also seen a major shift in the ILL network composition from a single-type to a multi-type and from one geographic level to multi-level. The formal interaction among ILL member libraries form multi-type library network which can not be independently operated by an ILL member library.

As long as the ILL network is a library application that cannot be performed by a single library, the problem of working relationships arises. University and college libraries are involved in a variety of the ILL facilities, including single and multi-type library cooperatives and at the various

FIGURE 1

REPRESENTATION OF MULTI-TYPE AND MULTI-LEVEL *

INTERLIBRARY LOAN SYSTEM
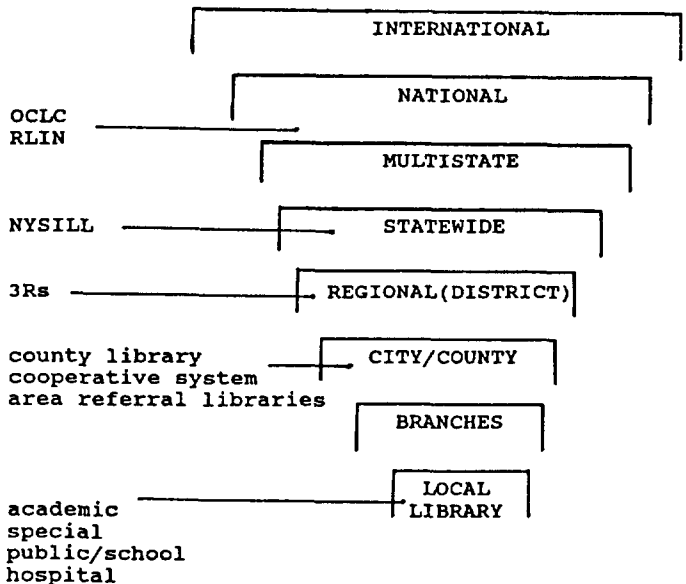
* Source: James E. Rush Associates, inc., Library, Computer and Information Science Consultants. Library Systems Evaluation Guide, Volume 6: Interlibrary Loan. 1985.

levels. The systematic research and academic information flow at a local level cannot be completed unless a concern for systematized network interaction among the local individual libraries precedes it. (see: figure 1)

The library profession has discussed the improvements in the inter-library network for years, however, the consistent monitoring of network interactions among local participating libraries from a macroscopic view of library network, including individual libraries, library systems, as well as network organizations, has not been allowed for. Moreover, academic librarians over the years have experienced in resource sharing activities and have engaged in the formation of an interlibrary network, still no significant steps have been taken to recognize the academic participant libraries' network interactions in the context of the overall structure of multi-type ILL network.

II.   RESEARCH PURPOSE

Specific research questions, based on the problem of study, are focused on the type and number of individual libraries which actually participating in the ILL network, the structure of the network, the network relationship among the participant libraries, the relationship of individual libraries and multi-type and level cooperatives, and the major network role of academic libraries.
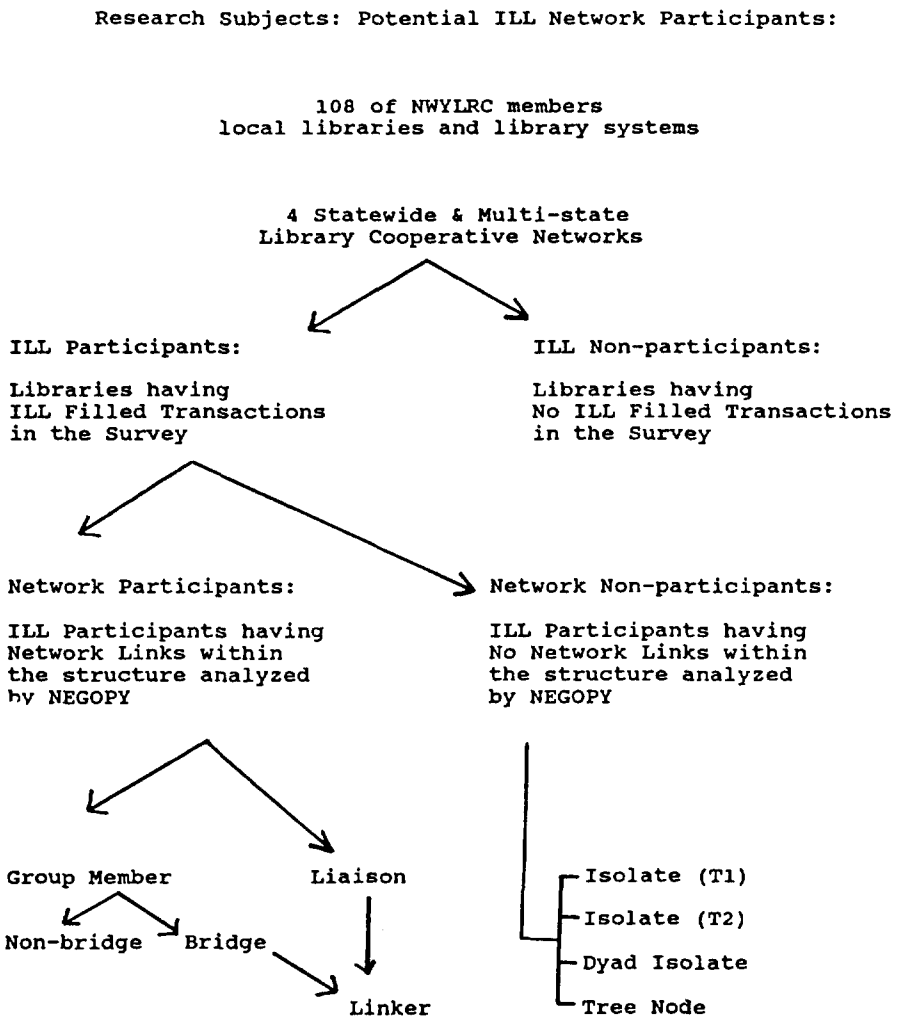
The purpose of the study are:

1. to provide a macroscopic view of a regional 3Rs ILL network by determining the existing network structure and the present participation in the libraries in the research region,

2. to examine the information flow by ILL interactions among the local participant libraries and library systems,

3. to examine the actual participation and the network roles of academic libraries with other types of libraries,

4. to find out whether there are implications of change in the improvement of the regional ILL network structure and the local participa-tion of individual libraries from the results of network analysis.

III. METHODOLOGY

Population: The subjects for the present study consisted of the members of the Western New York Library Resources Council (WNYLRC). The WNYLRC as a regional library cooperative center which mobilizes the principal library resources in six of the western New York counties. The total of 108 member libraries of the WNYLRC represents many different

FIGURE 2

FRAMEWORK OF NETWORK ROLES

Research Subjects: Potential ILL Network Participants:

108 of NWYLRC members
local libraries and library systems

4 Statewide & Multi-state
Library Cooperative Networks

ILL Participants:

Libraries having
ILL Filled Transactions
in the Survey

ILL Non-participants:

Libraries having
No ILL Filled Transactions
in the Survey

Network Participants:

ILL Participants having
Network Links within
the structure analyzed
by NEGOPY

Network Non-participants:

ILL Participants having
No Network Links within
the structure analyzed
by NEGOPY

Group Member   Liaison

Non-bridge   Bridge

Linker

Isolate (T1)

Isolate (T2)

Dyad Isolate

Tree Node

types of local libraries which participate in the local ILL through the WNYRLC. The network components are a set of independent libraries and library systems of different types and these are the components being studied. The local number libraries of the WNYRLC also have ILL contacts with the statewide library cooperatives or bibliographic centers such as OCLC, RLIN, and so on. Therefore, the network under use study is an intertype and multi-level library network within the framework of a regional ILL system. (see:figure 2)

Scope: This study investigated the network structure by collecting and analyzing the successfully filled ILL transactions of the individual libraries in the region. The information flow by ILL interactions for the purpose of this research, were limited to the transactions of 1) library materials or copies of library resources not found in a local collection; 2) which were sucessfully filled by the referral libraries, exculding the unfilled requests. Then, the communication flow of the ILL network measured only the successfully transacted loan interactions among individual libraries.

Measurement instrument: The network data for this research was obtained by a questionnaire mailed to each member of the WNYRLC. The self-reported survey was employed to gather the ILL transaction data of the individual libraries in the region. The most common method for information network analysis, the roster technique, was used. The questionnaire was expected the following responses: the member of filled requests which were sent to each of the member libraries and library systems during the three month research period (March to May of 1987)

The format also was designed to examine the transaction flow according to material type. Three categories of materals were given by following the general scheme of ALA Interlibrary Loan Request Form.

Procedure: A pre-study in the form of consultation with local sources was conducted to get an overview of the local ILL interaction data in the WNYLRC. The transaction data of the WNYLRC revealed that a considerable number of libraries of the population had direct ILL contacts with each other without consulting the WNYLRC. Based on the pre-study, a pre-survey was conducted with twelve individual libraries which represented

approximately eleven percent of the population randomly selected from the total. The results of pre-survey showed the possible percentage of libraries that kept the local ILL transaction which were needed to respond to the questionnaire; the return time for the completed questionnaire; and some critical comments about the questionnaire.

Data gathering: 8 From the total of 108 local libraries, 100 responses were received, resulting in a return rate of ninty-two percent. Of the questionnaire returned, sixteen had missing data which showed zero transaction in the network data due either to the absence of the data in the library or to no transactions having taken place during the given research period. This resulted in a return rate of seventy-seven percent for usable responses.

Data analysis: The network analysis computer program which was used in this study has been used often in communication research. According to the sequential steps in NEGOPY, the analysis of the network data began with the specification of the number of lines of data that were processed by computer.

The research procedures by network analysis are; the cliques within the total system are identified and the effects of the clique on the whole system are determined; second, certain specialized network roles such as liaison, bridges, and isolates are identified; third, various communication structural indices for individual units, dyads, cliques, or for entire systems are measured. In addition to defining the node's network positions, network analysis provides indicators which describe a social system's overall struc-ture. The general indicators analyzed in this study are connectedness, integrativeness and centrality. (see:figure 3)

FIGURE 3

NETWORK SOCIOGRAM
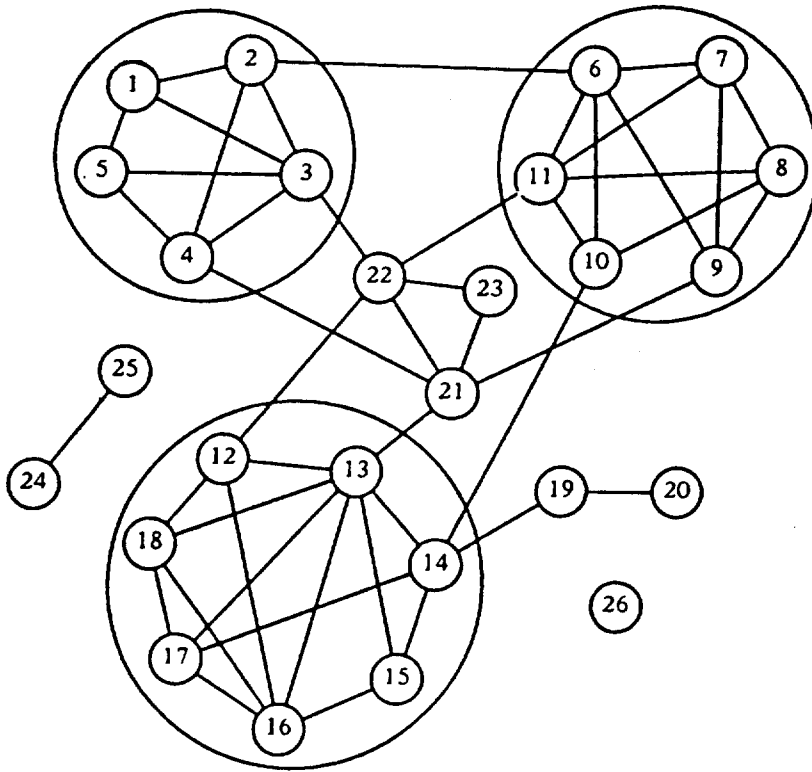
GROUP MEMBERS: #1 THROUGH #18

LIAISONS.   (DIRECT)   — #21 & #22
                      (INDIRECT) — #23

ISOLATES: (TYPE1)   — #26
                      (TYPE2)   — #20
                      (DYAD)   — #24 & #25
                      (TREE NODE) — #19

IV. MAJOR FINDINGS

ILL transactions: Among 108 member libraries of the WNYLRC, eighty-four (77%) had ILL transactions and the total number of transactions which the members had during the three months was 9167. Academic libraries had the largest proportion of the total transactions (32.3%) and most libraries had more periodical transactions. On the other hand, the libraries which had contacts with the council during the period seventy-

seven (71.2%) and the total number was 4144. the largest proportion of the total transaction was done by academic and special libraries. While most type of libraries had indirect contacts (75%) with the council, hospital libraries had the least contacts (44%) with the council.

Network structure: Forty-seven local libraries or library systems in the region participated the ILL network. It indicated more than half of the total remained as non-network participants in the structure. The ILL network structure had a composite centralized structure which included three different types of communication groups connected many bridges and liaisons. The structure had one academic library which played the inter-locking liaison role in the structure. On the other hand, the structure based on the indirect ILL transaction through the council showed a group communication structure that the council placed at the center. There were more isolates and fewer group members than the survey structure. The local ILL members' network relationships represented by the general network structure and the characteristics (connectedness, integrativeness, centrality) were varied according to the material transacted. (see: table 1,2 & 3)

TABLE 1

DISTRIBUTION OF NETWORK ROLES
OF THE ILL NETWORK
(N = 112)

Network Role	Total # of Libraries	Percentage of the Total
Isolate (T1) *	37	33.3
Isolate (T2) *	22	19.6
Dyad Member	4	3.5
Tree Node	2	1.7
Liasion	4	3.5
Group Member	43	38.3
Total	112	99.9 (rounding error)

* Isolate T1 refers to the isolate which had no links at all and Isolate T2 is what had only one link to others in the network.

TABLE 2

STATISTICS OF STRUCTURE VARIALBES

OF THE SURVEY STRUCTURE

	Centrality		Integrativeness		Connectedness	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Group 1 (hospital)	.782	.585	.534	.267	.848	.199
Group 2 (special)	.557	.822	.466	.361	.978	.189
Group 3 (mixed)	.653	.683	.249	.219	.391	.118

Common scripts indicate significant differences p<.05.

TABLE 3

NETWORK ROLES BY LIBRARY TYPE

	Group Member	Isolate	Dyad	Tree Node	Liaison
Academic	12	6	1	0	3
Special	16	23	0	1	1
Public/School	4	7	0	1	0
Hospital	8	22	3	0	0
Library Cooperatives	3	2	0	0	0
Total	43	59	4	2	4

Network role of academic libraries: From the results of both survey and council network structures it is found that more than half of the academic libraries of the total academic population were network partici- pants. Moreover, most of the academic participants were played the linker role (bridge and liaison) rather than simple within-group members. Academic network participants in the structure had the most intertype interactions with other type libraries and library systems. Among the multi-networks, academic libraries in the region had the most interactions with OCLC. (see: table 4)

TABLE 4

ACADEMIC LINKER LIBRARIES IN EACH STRUCTURE

BY NETWORK ROLE

	Group Member						Linker		
	Non-Bridge			Bridge			Liaison		
	N*	Acad.	%	N	Acad.	%	N	Acad.	%
Sur	16	5	31.2	27	7	25.9	4	3	75.0
LC	31	7	22.5	0	5	0	0	0	0
Book Council	5	1	20.0	28	13	46.4	13	4	30.7
Book	19	9	47.3	12	5	41.6	0	0	0
Per Council	21	3	14.2	27	7	25.9	4	3	75.0
Per	49	17	34.6	0	0	0	0	0	0

* N refers to total number of libraries in each network structure
   according to each category of network role.

V.   DISCUSSION AND CONCLUSIONS

Regarding the findings which were described in the previous section, the following points focused on the meaning of the results.

Network structure: The actual information exchange structure of a local ILL network being examined was not entirely a hierarchical structure. The structure analyzed was not the designed structure of the regional council, but an unplanned existing structure of a library network within a regional ILL system. This discrepancy between the existing and the designed structure, thus, indicated the different interactive relationship of local libraries which actually resulted in the "unplanned" structure. The important point here, then, is that the actual ILL interactions among the network participants, on an individual base should be monitored and supervised by library network managers. An ongoing monitoring of the interlibrary network structure by this analysis method is provide a specific network relationship to suggest to individual potential participants of the ILL. (see: figure 4, & 5)
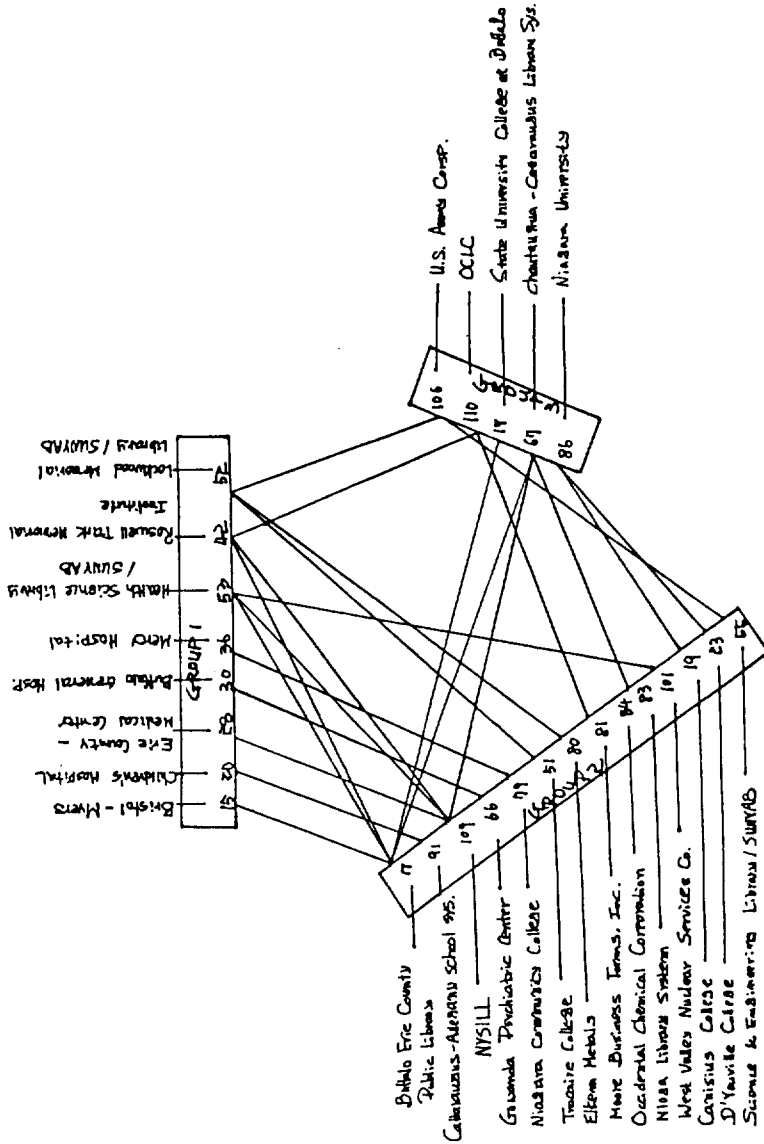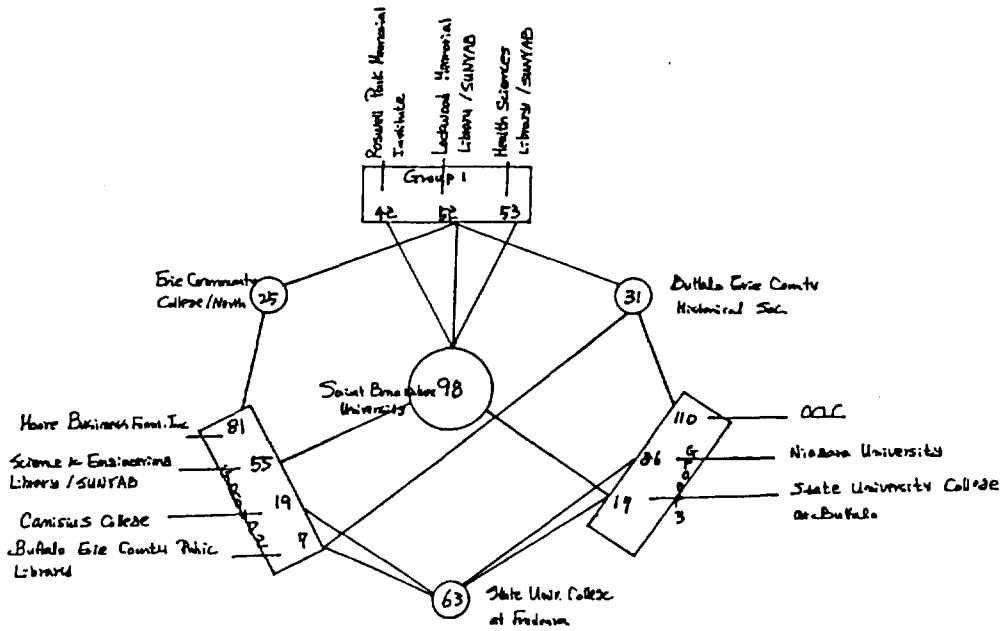
FIGURE 4

BRIDGE LINKS AMONG GROUPS

FIGURE 5

LIAISON LINKS AMONG GROUPS

Network participation: This network had less than half of the potential ILL network participants and this participation was almost same result in the council transactions structure. Considering the fact that the existing regional ILL network had many isolated libraries, the role of council should be intensified as a "local liaison". From the viewpoint of the library council in the western New York it is necessary to investigate the WNYLRC member libraries which were identified as isolates in the council network. One of the most urgent intervention efforts, for improving the use of existing the council channels, should be to find out the factors affecting the lack of participation of individual libraries and attempt to alleviate their prohibitive influence, and ultimately seek to integrate the isolated members into the system.

Relationship to statewide library cooperatives: Library cooperative

systems above the local libraries or library systems, i.e., statewide and multi-state systems, had network relationships with the regional ILL network participants. Nevertheless, their relationships had been limited some of local libraries. In particular, none of those library cooperatives were working as liaisons in the structure. Library cooperatives and their role in the interlibrary network, thus, must be reexamined by local ILL members. As the local libraries have an increasing number of direct ILL with libraries, the network interactions with state-wide and multi-state library systems need to be more widely dispersed from the local level.

Network structure by type of materials: We found that the whole network structure and the network roles of individual libraries differ depending on the types of material transacted. In relation to this, we can also observe the consistent interactive relationships among some of the participants regardless the materal types. Yet most of the relationships changed depending on the different types of materals transacted. Therefore, the understanding of network structure in considering of the materals and the ability to diagnose the differences of the information flow are absolutely necessary in monitoring the structure of the ILL network. (see: figure 6-1 & 6-2) (see: 7-1 & 7-2)

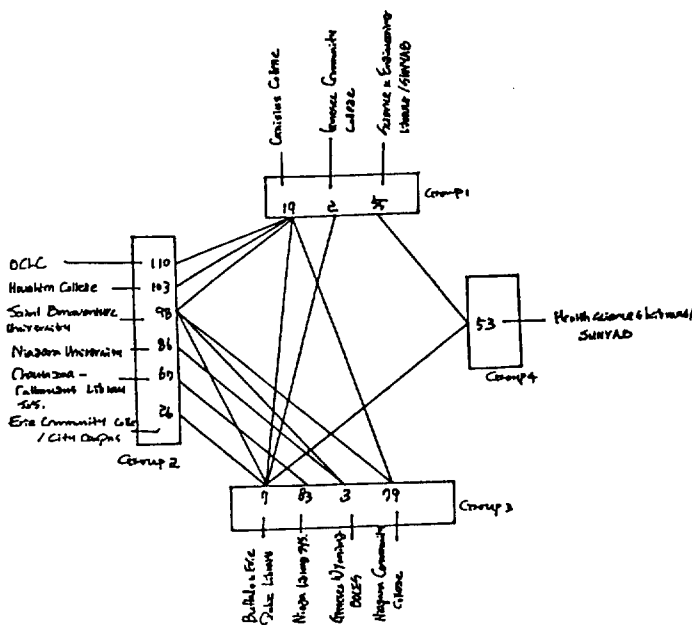FIGURE 6 — 1

BRIDGE LINKS IN THE BOOK STRUCTURE

FIGURE 6－2

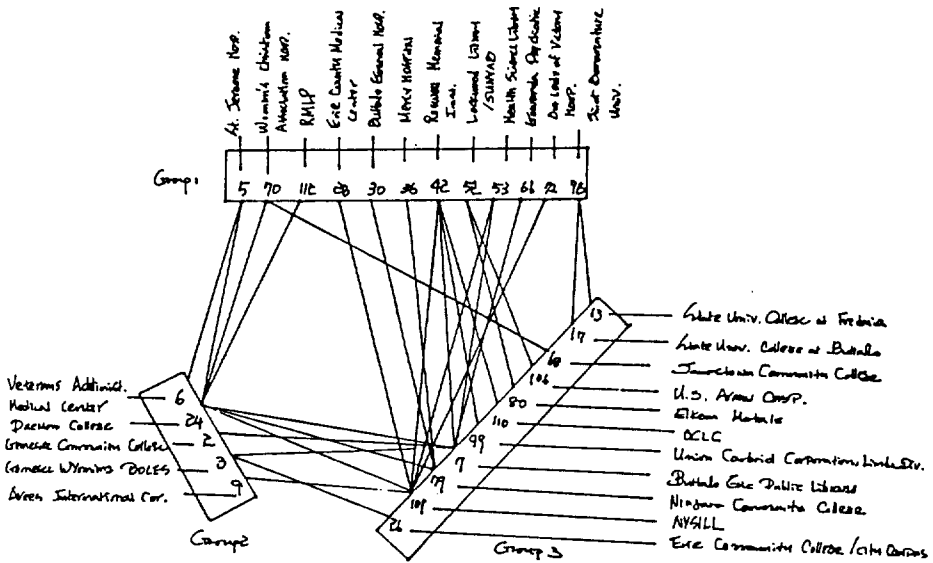BRIDGE LINKS IN THE PERIODICAL STRUCTURE
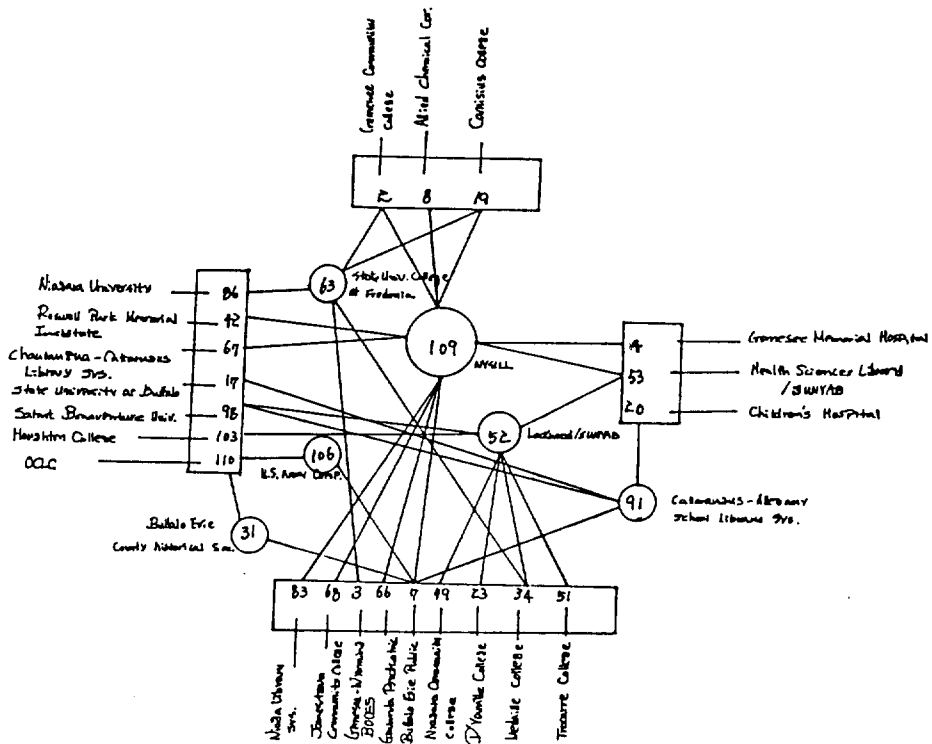

FIGURE 7－1
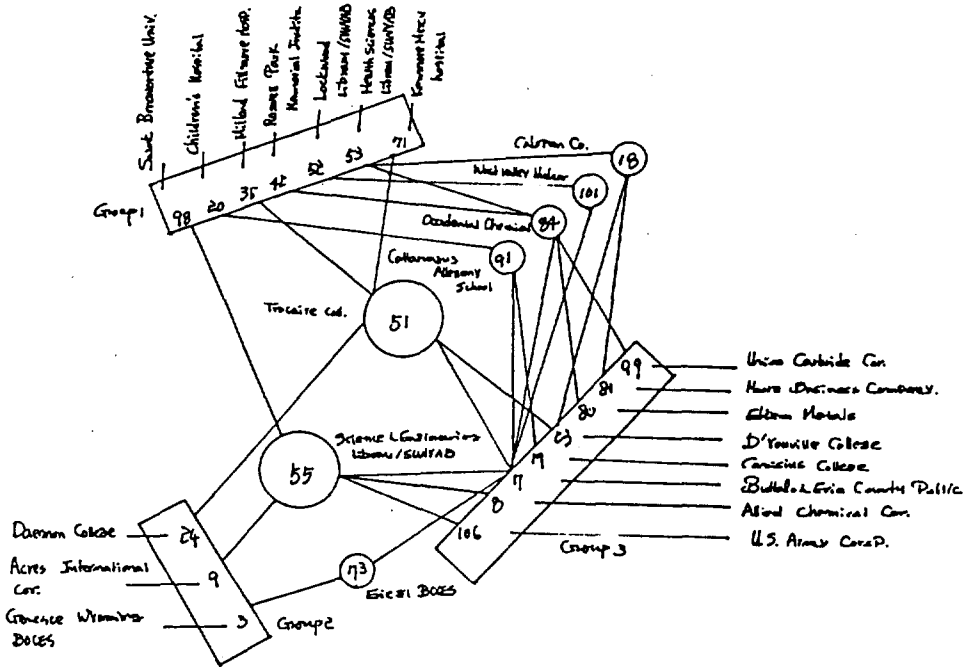
LIAISON LINKS IN THE BOOK STRUCTURE

FIGURE 7-2

LIAISON LINKS IN THE PERIODICAL STRUCTURE

Academic libraries in the network: To be fully efficient and effective in academic and research information network, academic libraries should not be remained as isolate in the structure. Academic libraries which were identified as in the category of network isolate in the structure examined were mostly private rollege libraries. These libraries, at the very least, need to recognize their network positions and should be aware of the importance of interlibrary communication for efficient information provision through local network participation. The network participation by academic libracries in this study, showed the highest one of all library types. Also we learned that academic individual libraries participated more in the regional ILL for periodical loans than book. These libraries having group member relationships with hospital group libraries were mostly university libraries while those having the relationship with special group libraries were college libraries. From the individual matrix of academic libraries, the type of libraries that had the most interaction was academic libraries and had second largest intertype interactions was with special libraries.

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〔표5〕 敎科課程의 比較

[PR(Pre-requisite) : RQ(Required) : RC(Recommended) : EL(Elective)]				
Representative Courses	Theory Oriented	Computer Oriented	Systems Oriented	Library Oriented
Formal Disciplines				
Calculus	PR	PR	PR	−
Programming	PR	PR	RQ	RC
Symbolic Logic	RQ	RQ	EL	−
Recursive Functions	RQ	RQ	EL	−
Linguistics	RQ	RC	RC	−
Applied Disciplines				
Statistics	EL	EL	RQ	−
Operations Research	EL	EL	RQ	EL
Psychology	RC	EL	−	−
Information Theory	RQ	RQ	EL	−
Systems Analysis	−	EL	RQ	RC
Methods of Social Research	−	−	RC	−
Computer Oriented Courses				
Computer Hardware	EL	RQ	RC	EL
Compiler Construction	EL	RQ	−	−
Data Base Management	EL	RQ	RQ	RC
Information Retrieval System	RQ	RQ	RQ	RQ
Management Information System	−	EL	RC	−
Management Oriented Courses				
Managerial Accounting	−	−	RQ	EL
Organization Theory	EL	−	RC	−
Information Center Mgt.	−	−	RQ	RQ
Service Oriented Courses				
Sources of Information	−	−	RC	RQ
Catal., Class., Index., Abst.,	RC	RC	RC	RQ
Documentation	−	−	RC	RQ

※ 本表는 第5卷 2號(通卷9號)에 收錄된 論文中 142페이지에 누락된(표5) 比較表를 追加 揭載한 것임.