DOCUMENT RESUME

ED 039 905 LI 001 959

AUTHOR	Olsen, Wallace C.
TITLE	Digital Storage of an Academic Library Book Collection - Nontechnological Information to Aid Consideration.
INSTITUTION	Interuniversity Communications Council (EDUCOM), Princeton, N. J.
PUB DATE	Apr 69
NOTE	362p.
AVAILABLE FROM	Interuniversity Communications Council (EDUCOM), P.O. Box 364, Princeton N. J. 08540 ($4.00 to members; $8.00 to non-members)
EDRS PRICE	EDRS Price MF-$1.50 HC Not Available from EDRS.
DESCRIPTORS	*Automation, Books, *College Libraries, Computer Storage Devices, Digital Computers, Information Needs, Information Utilization, *Library Collections, *University Libraries
IDENTIFIERS	*Library Automation

ABSTRACT

Digital storage of textual portions of a library collection was reconsidered in the context of current technology and economics at a conference at the University of Pittsburgh in the Fall of 1967. The inevitable value and feasibility of textual digital storage was generally accepted. Basic data advantageous in placing in perspective the academic library collection and the potential of the digital concept are given. Academic librarians will find little new information here, however, the analysis of the graphics in a book collection may be the first quantification of past observations. The purpose of the document is to give industrial and other nonacademic technologists data against which they can match technology. The approach has been to provide technologists with quantified data, relevant insights and directly related socio-political understanding for decisions on localization of design and experimentation. The largely quantitative information provides profiles of institutions and critical problems that need to be considered. Since this is intended to provide background and statistical evidence for technologists, the digital and related technological questions are not discussed. (NH)

DIGITAL STORAGE OF AN ACADEMIC LIBRARY BOOK COLLECTION —NONTECHNOLOGICAL INFORMATION TO AID CONSIDERATION

April 1969

Wallace C. Olsen

100 CHARLES RIVER PLAZA BOSTON, MASS. 02114 617-227-1805

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

The communications-network and digital-storage concepts as applied to a university or college library collection were revived for discussion at an EDUCOM meeting in 1967 at the University of Pittsburgh [reported in *EDUCOM* 2, No. 6, 1-5 (Dec. 1967)]. The often discussed digital storage of textual portions of a library collection was reconsidered in the context of current technology and economics. There was general acceptance of the inevitable value and feasibility of textual digital storage. The conferees agreed that further discussion would be advantageous only with more detailed data which might clarify areas worthy of possible experimentation or further investigation.

This document contains basic data advantageous in placing in perspective the academic library collection and the potential of the digital concept. Librarians of academic institutions will find little new information although the analysis of the graphics in a book collection (in Chapter VI and Appendix C) may represent the first quantification of past observations.

This document was prepared for industrial and other nonacademic technologists who need data against which they can match technology. The report is statistically oriented but does provide rules of thumb and summaries when they tend to sharpen the focus or broaden understanding. As a result, such factors as

the political and administrative structures, whether in the university or the library, are not discussed since they do not raise a nontechnological question or problem, although they may be very influential in any successes or failures. The approach has been to provide the technologist with quantified data, relevant insights, and directly related socio-political understanding for decisions on localization of design and experimentation.

The largely quantitive information provides profiles of institutions and critical problems that need to be considered. The document should not be viewed as an historical summary of specific aspects of an academic library. Such a document was beyond the scope of the needs of this project and EDUCOM's resources. Likewise, because the document is intended to provide background and statistical evidence for the technologist, the digital and related technological questions are not discussed.

Many closely related or possibly influential factors about academic libraries or institutions might have been included. Time and money did not allow. Major portions of the document are bare-bones summaries of the most pertinent data.

The next logical phase of this project is to settle corporately on experiments or design considerations and realistically test digital-storage subcomponents in the academic environment. This document is intended to aid in the determination of realistic tests or machine designs.

ACKNOWLEDGMENTS

This document and the renewed interest in the possibility of digital storage of books in the colleges or university community were a direct outgrowth of a conference at the University of Pittsburgh in the Fall of 1967. To the organizers and discussants of that meeting, acknowledgment for the genesis must be made. Focus on the most pertinent elements for the industrial technologist was aided by communication with several commercial representatives and information-science technologists directly and through their expressions in the literature.

The patience of EDUCOM officers was always evident during the long time it took to bring the discussions, literature expressions, and the investigative studies together in this document. Most particularly, acknowledgment is made of the interest and encouragement of Joseph Becker, director of EDUCOM's Bethesda office. The professional staff of the Bethesda office also helped to clarify issues and localize on the most important questions.

Ross Kimmel served as a research monitor on the graphics study and assisted in its tabulation and computation. His counsel and thorough examination of the details were a valuable contribution. Mrs. Barbara Samakow, Mrs. Nancy Simson, and Mrs. Marie Mears labored long and well over their typewriters to prepare copy.

The Radio Corporation of America and the American Educational Publishers Institute granted funds to survey graphic representation in individual volumes of a book collection. The active support of Mr. Thomas Paterson of RCA and Mr. Clifford P. Greck of AEPI are acknowledged. The study was performed at the George Washington University Library, which graciously agreed to the use of its central collections; the director of the library and his staff were helpful and generous of their time. The Biological Sciences Communication Project of George Washington University performed the study.

CHAPTER I

THE ACADEMIC INSTITUTION

The educational ferment of 1968 was most dramatically evident on higher-educational campuses with unrest, petitions, and burgeoning numbers of students. The changes that have come about and those that have not, but are devoutly wished for by many students and faculty, have been the topics of discussion in the popular press. Within the past half-dozen years, the focus of public attention has been on the academic community to such a degree that both problems and general trends are probably better understood by the layman than at any time in the past.

This document approaches the subject and discussion of the academic institution without delving into the social, political, organizational, societal, and geographic factors that direct and influence individual institutions. We assume that the reader having come through the academic community, albeit some time ago, has along with his current knowledge enough understanding of academia in which to set the concept of digital storage of a library collection. Therefore, we will not touch on such pressing matters as the intellectual problems of academia, nor its limits on enrollments or admission policies, nor the standard political structures and relationships of state institutions to the state government. These and similar features probably

will have no bearing on the overall consideration of the question central to this document. For a quick sketch of the academic community, the reader is referred to the first 29 pages of the 10th edition of *American Universities and Colleges*.[2] A more detailed analysis with emphasis on problems and suggested redirection can be found in a recent and well-publicized book by Jacques Barzun.[3]

The purpose of this Chapter is to offer the statistical details that provide an in-depth relationship to those features or basic factors that may serve to determine practicability of digital storage, and a guide to the parameters of any possible testing or design. We are concerned with a large population spending great quantities of money. There are currently 2300 higher-educational institutions with seven million students enrolled. The instructional staff in higher education numbers half a million, turning out an equal number of people with bachelor's degrees each year. Add to that the 250,000 who yearly get advanced degrees, and the magnitude of the higher-education establishment comes somewhat into blurred focus. The details supporting these summary figures will be examined.

Before looking at these figures, a few, less obvious influences should be mentioned. The Federal government's monetary and political leverage in the academic world grew extraordinarily during 1960-1968. Although the amounts of money

are represented in the statistical tables, the pervasive influence is far greater than the dollars might signify. Research monies are also represented as a part of total expenditures for the composite education communities. Again, this influence on the structure and tone of the educational institution goes far beyond its spending. The urban university's importance has grown; it is beginning to play a greater role in its community's non-academic activities. Universities and colleges are banding together in consortia on regional, subject-discipline, and political bases to perform jointly a variety of functions that they did not in many cases do separately. The consortium trend and its growing importance are manifest in a 175-page U.S. Office of Education statistical directory.[8] All of these factors add background and understanding to academia today. Their direct influences as well as many others may not be directly evident in the statistical profile in this Chapter.

STATISTICAL PROFILES

The U.S. Office of Education maintains an organization to gather, standardize, analyze, and publish statistical data for many aspects of educational activity. The depth of analysis is increasing yearly, and the number of approaches to the data can give a comprehensive statistical picture. This information suffers to some degree from lack of standard definition or application.

In nearly all cases, the data are supplied by the individual institutions and are subject to the usual problems of complete and validated reporting. The information is remarkably thorough and reliable. The reproduced Tables have come from U.S. Office of Education documents that were available in December 1968; later and newer data were not available. Care must be exercised in comparing data from different documents since time, organization, or categories of structuring may not be comparable. In some cases, this is not critical since the main concern is to provide a range of understanding, and the yearly changes are not great.

The following major components of academia are covered in the Tables.

1. Type of Institutions:	Public, private Coeducational or not Religious affiliations or control
2. Subject Offerings:	Level of offerings Degrees granted Academic programs
3. Students:	Two-year students All undergraduates Graduates
4. Faculties:	Ranks Subject disciplines and degrees Salaries
5. Staffs:	Administrative Service Research
6. Income and Expenditures:	Sources Instructional Support

TYPES OF INSTITUTIONS

Public institutions are defined in Tables in this Chapter as being controlled by local, state, or Federal governments. A rather surprising fact is that nearly twice as many higher-educational institutions are private than public. The student population is quite another matter, as we will see shortly. Far more than half of all universities and two-year institutions (primarily junior colleges) are publicly controlled, but the private four-year institutions (including universities) are three times as common as the comparable public institutions.

It will be evident to the reader in examining these Tables that there are discrepancies of numbers between various Tables and documents. These have not been adjusted, since they are minor and assumedly the result of inadequate data at time of publication. Later changes in the past have been slight. Universities are so designated if they give considerable stress to graduate education, confer advanced as well as bachelor's degrees in several liberal-arts fields, and have a minimum of two professional schools not exclusively technological (Ref. 6, p. 4).

Trends to coeducational institutions have been evident in all categories of types of institutions. In most cases, this is done by admitting women for the first time, such as in professional schools or to male campuses. New institutions now

TABLE I-1. Number of institutions of higher education, by level and control of institution: United States and outlying areas, fall 1965 - 1967.

Level and control of institution	1965[a]	1966[a]	Increase 1965 to 1966[a]	1967[b]	Increase 1966 to 1967[b]
TOTAL, PUBLIC AND PRIVATE					
All institutions	2,238	2,337	99	2,382	45
4-year institutions	1,556	1,582	26	1,593	11
Universities	155	157	2	157	0
All other 4-year	1,401	1,425	24	1,436	11
2-year institutions	682	755	73	789	34
PUBLIC					
All institutions	825	884	59		
4-year institutions	403	405	2		
Universities	90	92	2		
All other 4-year	313	313	—		
2-year institutions	422	479	57		
PRIVATE					
All institutions	1,413	1,453	40		
4-year institutions	1,153	1,177	24		
Universities	65	65	—		
All other 4-year	1,088	1,112	24		
2-year institutions	260	276	16		

[a]From Ref. No. 9, p. 82, Table 105. (SOURCE: U.S. Department of Health, Education, and Welfare, Office of Education, "Opening Fall Enrollment in Higher Education, 1966.")

[b]1967 data from Ref. No. 6, p. 4, and Ref. No. 2, p. 6.

TABLE I-2. Number of institutions of higher education, by institutional control, sex of student body, and highest level of offering: aggregate United States, 1966-67. (From Ref. 7, Table 4, p. 13.)

Highest level of offering and sex of student body	Total	Public		Private			
		State	District or city	Independent of religious group	Religious group		
					Protestant	Roman Catholic	Other
Total	**2,252**	[1] 445	361	[2] 536	489	391	[3] 30
I—2 to 4 years beyond 12th grade:							
Coeducational	568	[4] 60	345	[5] 77	74	9	3
Men	38	2	1	[6] 11	1	23	----
Women	79	----	----	[6] 29	7	43	----
II—Bachelor's and/or first professional degree:							
Coeducational	563	79	3	[7] 178	259	35	9
Men	111	[8] 11	----	13	12	70	5
Women	154	2	----	24	19	109	----
III—Master's and/or second professional degree:							
Coeducational	379	176	7	[6] 89	82	21	4
Men	58	[9] 1	----	12	11	34	----
Women	46	4	----	15	----	27	----
IV—Doctor of philosophy or equivalent degree:							
Coeducational	210	[4] 105	5	[6] 60	21	12	7
Men	21	1	----	11	1	7	1
Women	4	1	----	3	----	----	----
V—Other:							
Coeducational	17	[9] 2	----	[10] 14	1	----	----
Men	4	[9] 1	----	----	1	1	1
Women	----	----	----	----	----	----	----

[1] Includes 11 under Federal control.
[2] Includes 32 proprietary.
[3] Includes 2 Greek Orthodox, 11 Interdenominational, 7 Jewish, 4 Latter Day Saints, 1 Reorganized Latter Day Saints, 2 Russian Orthodox, 1 Unitarian.
[4] Includes 1 under Federal control.
[5] Includes 21 proprietary.
[6] Includes 1 proprietary.
[7] Includes 5 proprietary.
[8] Includes 5 under Federal control.
[9] Under Federal control.
[10] Includes 2 proprietary.

are rarely begun other than coeducational. There is a direct relationship in nearly all cases (New Jersey perhaps being the only major exception) between the state population and the institutions of higher learning. Those states with large populations lead in the number of institutions. This Table illustrates that point; no state with less than 50 insitutions in Table I-3 is listed:

New York	has 193	institutions of which	135 are private.
California	186		89
Pennsylvania	134		117
Illinois	119		93
Massachusetts	107		81
Texas	100		
Ohio	81		67
Michigan	77		
Missouri	65		
Wisconsin	62		
Georgia	52		
Iowa	50		

The control of those private institutions is specified in Table I-4; note that the data are for 1965, not 1966-1967 as in Table I-3.

On Table I-3, the highest level of offering categories are divided according to the following

I 2 to 4 years beyond 12th grade

II Bachelor's and/or first professional degree

III Master's and/or second professional degree

IV Doctor of philosophy or equivalent degree

V Other

TABLE I-3. Number of institutions of higher education by state, highest level of offering, and control. (From Ref. 7, Table 2, p. 11.)

State or outlying part	Total	Total		Highest level of offering									
				I		II		III		IV		V	
		Public	Private	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private
Total	**2,252**	**806**	**1,446**	**406**	**277**	**95**	**733**	**188**	**295**	**112**	**123**	**3**	**18**
Alabama	31	11	20	1	5	1	11	7	3	2	------	------	1
Alaska	3	1	2	------	1	------	1	------	------	1	------	------	------
Arizona	11	9	2	6	------	------	1	1	1	2	------	------	------
Arkansas	20	9	11	1	1	4	8	3	2	1	------	------	------
California	186	97	89	74	4	6	39	15	34	2	11	------	1
Colorado	22	14	8	5	------	3	4	2	2	4	2	------	------
Connecticut	44	12	32	6	9	1	13	4	7	1	3	------	------
Delaware	4	2	2	------	2	1	------	------	------	1	------	------	------
District of Columbia	25	3	22	------	4	1	7	------	5	------	5	2	1
Florida	46	24	22	19	6	------	9	3	5	2	1	------	1
Georgia	52	22	30	9	8	6	16	3	5	4	1	------	------
Hawaii	4	1	3	------	1	------	2	------	------	1	------	------	------
Idaho	10	5	5	3	3	------	1	1	1	1	------	------	------
Illinois	119	26	93	18	16	------	39	4	28	4	8	------	2
Indiana	42	5	37	1	1	------	22	1	10	3	2	------	2
Iowa	50	17	33	14	4	------	27	1	2	2	------	------	------
Kansas	48	23	25	16	4	------	19	4	2	3	------	------	------
Kentucky	39	8	31	1	9	1	15	4	6	2	1	------	------
Louisiana	22	10	12	------	2	2	5	7	3	1	2	------	------
Maine	22	7	15	------	3	4	11	2	1	1	------	------	------
Maryland	47	20	27	12	6	3	12	4	5	1	4	------	------
Massachusetts	107	26	81	12	22	4	24	8	21	2	13	------	1
Michigan	77	29	48	18	8	3	28	5	10	3	1	------	1
Minnesota	48	18	30	12	3	------	20	5	7	1	------	------	------
Mississippi	42	25	17	17	8	3	8	2	1	3	------	------	------
Missouri	65	17	48	9	[illegible]	4	28	3	6	1	3	------	------
Montana	11	8	3	2	------	1	3	3	------	2	------	------	------
Nebraska	22	10	12	4	1	1	10	4	1	1	------	------	------
Nevada	1	1	------	------	------	------	------	------	------	1	------	------	------
New Hampshire	19	5	14	2	1	------	11	2	1	1	1	------	------
New Jersey	42	10	32	1	8	------	15	6	4	3	4	------	1
New Mexico	10	7	3	1	------	------	3	3	------	3	------	------	------
New York	193	58	135	34	28	3	48	13	34	8	23	------	2
North Carolina	62	18	44	3	16	7	25	4	1	4	2	------	------
North Dakota	13	10	3	4	1	3	2	1	------	2	------	------	------
Ohio	81	14	67	3	5	1	45	3	13	7	3	------	1
Oklahoma	34	23	11	12	4	3	3	6	3	2	1	------	------
Oregon	33	14	19	8	4	------	8	4	5	2	1	------	1
Pennsylvania	134	17	117	2	16	5	60	9	24	1	15	------	2
Rhode Island	14	3	11	1	2	------	6	1	1	1	2	------	------
South Carolina	30	6	24	------	6	1	14	2	3	3	1	------	------
South Dakota	17	7	10	------	3	2	5	3	2	2	------	------	------
Tennessee	46	7	39	------	6	------	27	6	4	1	2	------	------
Texas	100	52	48	30	10	4	21	11	11	7	6	------	------
Utah	9	5	4	1	2	2	1	------	------	2	1	------	------
Vermont	17	5	12	1	3	3	6	------	2	1	1	------	------
Virginia	48	12	36	------	13	1	16	6	6	4	1	1	------
Washington	33	21	12	16	------	------	4	3	8	2	------	------	------
West Virginia	21	11	10	1	3	8	7	1	------	1	------	------	------
Wisconsin	62	31	31	21	3	2	21	7	4	1	2	------	1
Wyoming	6	6	------	5	------	------	------	------	------	1	------	------	------
Outlying parts of the United States													
Canal Zone	1	1	------	1	------	------	------	------	------	------	------	------	------
Guam	1	1	------	------	------	1	------	------	------	------	------	------	------
Puerto Rico	5	1	4	------	1	------	2	1	1	------	------	------	------
Virgin Islands	1	1	------	1	------	------	------	------	------	------	------	------	------

TABLE I-4. Number of institutions of higher education, by control of institution and by state, fall 1965. (From Ref. 9, Table 107, p. 84.)

State	Total	Public			Private		
		State[1]	District or city	Independent of church	Denominational: Protestant	Denominational: Roman Catholic	Denominational: Other
1	2	3	4	5	6	7	8
United States	**[2] 2,184**	**434**	**366**	**490**	**490**	**376**	**28**
Alabama	37	19	----	5	10	3	----
Alaska	3	1	----	----	2	----	----
Arizona	11	5	4	1	1	----	----
Arkansas	19	8	----	3	8	----	----
California	180	19	74	39	27	19	2
Colorado	21	8	5	1	4	3	----
Connecticut	37	5	2	14	1	14	1
Delaware	4	2	----	1	1	----	----
District of Columbia	20	----	1	8	2	9	----
Florida	48	6	23	10	5	4	----
Georgia	51	20	2	10	18	----	1
Hawaii	4	1	----	----	1	1	1
Idaho	9	3	2	----	2	1	1
Illinois	114	6	20	36	28	21	3
Indiana	42	4	1	11	16	10	----
Iowa	51	3	16	7	16	8	1
Kansas	46	6	16	1	16	7	----
Kentucky	38	6	2	6	15	9	----
Louisiana	22	10	----	2	3	7	----
Maine	21	7	----	10	1	3	----
Maryland	44	9	11	11	2	10	1
Massachusetts	100	20	4	52	4	19	1
Michigan	72	11	18	14	15	14	----
Minnesota	48	17	----	7	14	10	----
Mississippi	43	9	16	3	14	1	----
Missouri	64	7	10	12	20	14	1
Montana	11	6	2	1	----	2	----
Nebraska	24	5	6	2	7	4	----
Nevada	1	1	----	----	----	----	----
New Hampshire	14	3	----	5	----	6	----
New Jersey	41	8	2	8	8	14	1
New Mexico	10	7	----	1	----	2	----
New York	189	23	32	58	10	60	6
North Carolina	61	14	4	5	36	2	----
North Dakota	13	8	2	----	1	2	----
Ohio	74	7	5	22	21	16	3
Oklahoma	35	18	5	3	7	2	----
Oregon	32	7	7	5	8	4	1
Pennsylvania	130	15	1	50	32	30	2
Rhode Island	14	3	----	6	----	5	----
South Carolina	30	6	----	7	17	----	----
South Dakota	15	7	----	1	5	2	----
Tennessee	47	7	----	13	25	2	----
Texas	97	20	32	7	30	8	----
Utah	7	5	----	----	----	----	2
Vermont	15	4	----	8	----	3	----
Virginia	45	12	----	9	22	2	----
Washington	33	6	15	2	5	5	----
West Virginia	21	11	----	4	5	1	----
Wisconsin	62	10	21	9	5	17	----
Wyoming	6	1	5	----	----	----	----
U.S. Service Schools	8	8	----	----	----	----	----
Outlying areas	**8**	**4**	----	**2**	----	**2**	----
Canal Zone	1	1	----	----	----	----	----
Guam	1	1	----	----	----	----	----
Puerto Rico	5	1	----	2	----	2	----
Virgin Islands	1	1	----	----	----	----	----

[1] Includes institutions under Federal control (8 U.S. Service Schools and Canal Zone College).

[2] Excludes 46 institutions which reported enrollments only in occupational or general studies programs not chiefly creditable toward a bachelor's degree.

SOURCE: U.S. Department of Health, Education, and Welfare, Office of Education, "Opening Fall Enrollment in Higher Education, 1965"; and "Education Directory, 1964-65, Part 3, Higher Education."

TYPES OF PROGRAMS AND DEGREES

Over half of the institutions as defined by the U.S. Office of Education by academic programs offer combinations of liberal-arts, general, terminal-occupational, and teacher preparatory [categories (3), (5), and (6) of Table I-5]. These same institutions are not responsible, however, for 50% of bachelor's degrees. Category (11) includes institutions organized as universities. As Table I-6 (1965-1966 data) indicates, slightly over half of all degrees are conferred by universities and only 20% of these are advanced degrees. Nearly 60% of all bachelor's are granted by nonuniversities. Public institutions grant four of all degrees to three by private institutions. Private and public four-year institutions grant an equal number of bachelor's degrees; but public advanced degrees outnumber those from private institutions 2:1.

The men outranked women 3:2 in receiving bachelor's degrees and increased that ratio nearly 3:1 for all advanced degrees (actually about 140,000 to 50,000). This probably reflects the current emphasis on the view of the breadwinner making more money if he has a degree.

There is some indication of a sharper leveling off of all degrees than that shown in Fig. I-1. The near plateau for the years 1968 through 1970 may be flatter, judging from later estimates.

TABLE I-5. Number of institutions of higher education, by institutional control and type of program, aggregate United States, 1966-1967.

Highest level of offering and sex of student body	Total	Public[a]		Private[a]				Institutions[b] for men	Institutions[b] for women	Coeducational[b] institutions
		State	District or city	Independent of religious group	Religious group: Protestant	Religious group: Roman Catholic	Religious group: Other			
Total:	2,252	445[c]	361	536[d]	489	391	30[e]	232	283	1,737
(1) Terminal-occupational (below bachelor's degree)	53	13	2	35[f]	-	2	1	3	1	49
(2) Liberal arts and general	172	9[g]	6	56	28	73	-	77	37	58
(3) Liberal arts and general and terminal-occupational	427	41[h]	265	52[i]	57	10	2	4	39	384
(4) Primarily teacher preparatory	64	21	22	11	3	7	-	-	10	54
(5) Both liberal arts and general and teacher preparatory	613	122	4	107	200	177	3	36	151	426
(6) Liberal arts and general, terminal-occupational and teacher preparatory	235	62	52	31	53	35	2	4	29	202
(7) Professional only (not including teacher preparatory)	222	22[j]	2	95[i]	72	19	12	59	2	161
(8) Professional and teacher preparatory	60	7	-	36[k]	9	2	6	4	2	54
(9) Professional and terminal-occupational	45	6	-	31[l]	7	-	1	4	-	41

Highest level of offering and sex of student body	Total	Public[a]		Private[a]				Insti-tutions for men[b]	Insti-tutions for women[b]	Coeducational institutions[b]
		State	District or city	Independent of religious group	Religious group					
					Protestant	Roman Catholic	Other			
(10) Liberal arts and general with 1 or 2 professional schools	153	27	2	35	46	41	2	34	11	108
(11) Liberal arts and general with 3 or more professional schools	208	115	6	47	14	25	1	7	1	200

[a]From Ref. 7, Table 5, p. 14.

[b]From Ref. 7, Table 6, p. 15.

[c]Includes 11 under Federal control.

[d]Includes 32 proprietary.

[e]Includes 2 Greek Orthodox, 12 interdenominational, 7 Jewish, 4 Latter Day Saints, 1 Reorganized Latter Day Saints, 2 Russian Orthodox, 2 Unitarian-Universalist.

[f]Includes 20 proprietary.

[g]Includes 1 under Federal control.

[h]Includes 2 under Federal control.

[i]Includes 1 proprietary.

[j]Includes 8 under Federal control.

[k]Includes 3 proprietary.

[l]Includes 7 proprietary.

TABLE I-6. Bachelor's and higher degrees conferred, by level of degree, sex of student, level of institution, and institutional control: aggregate United States, 1965-1966. (From Ref. 4, Table 2, p.4.)

Level of institution and institutional control	Total, all levels	Level of Degree											
		Bachelor's requiring 4 or 5 years			First-professional requiring at least 6 years			Master's			Doctor's		
		Total	Men	Women	Total	Men	Women	Total	Men	Women	Total	Men	Women
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Total Public-Private													
All Institutions	714,624	524,117	301,051	223,066	31,496	30,071	1,425	140,772	93,184	47,588	18,239	16,121	2,118
Universities	371,147	232,836	144,847	87,989	22,959	21,942	1,017	98,260	66,898	31,362	17,092	15,085	2,007
All Other 4-year	343,477	291,281	156,204	135,077	8,537	8,129	408	42,512	26,286	16,226	1,147	1,036	111
Public													
All Institutions	420,595	313,034	178,428	134,606	12,474	11,922	552	84,313	55,724	28,589	10,774	9,673	1,101
Universities	248,011	167,692	102,558	65,134	11,674	11,162	512	58,106	40,009	18,097	10,539	9,456	1,083
All Other 4-year	172,584	145,342	75,870	69,472	800	760	40	26,207	15,715	10,492	235	217	18
Private													
All Institutions	294,029	211,083	122,623	88,460	19,022	18,149	873	56,459	37,460	18,999	7,465	6,448	1,017
Universities	123,136	65,144	42,289	22,855	11,285	10,780	505	40,154	26,889	13,265	6,553	5,629	924
All Other 4-year	170,893	145,939	80,334	65,605	7,737	7,369	368	16,305	10,571	5,734	912	819	93

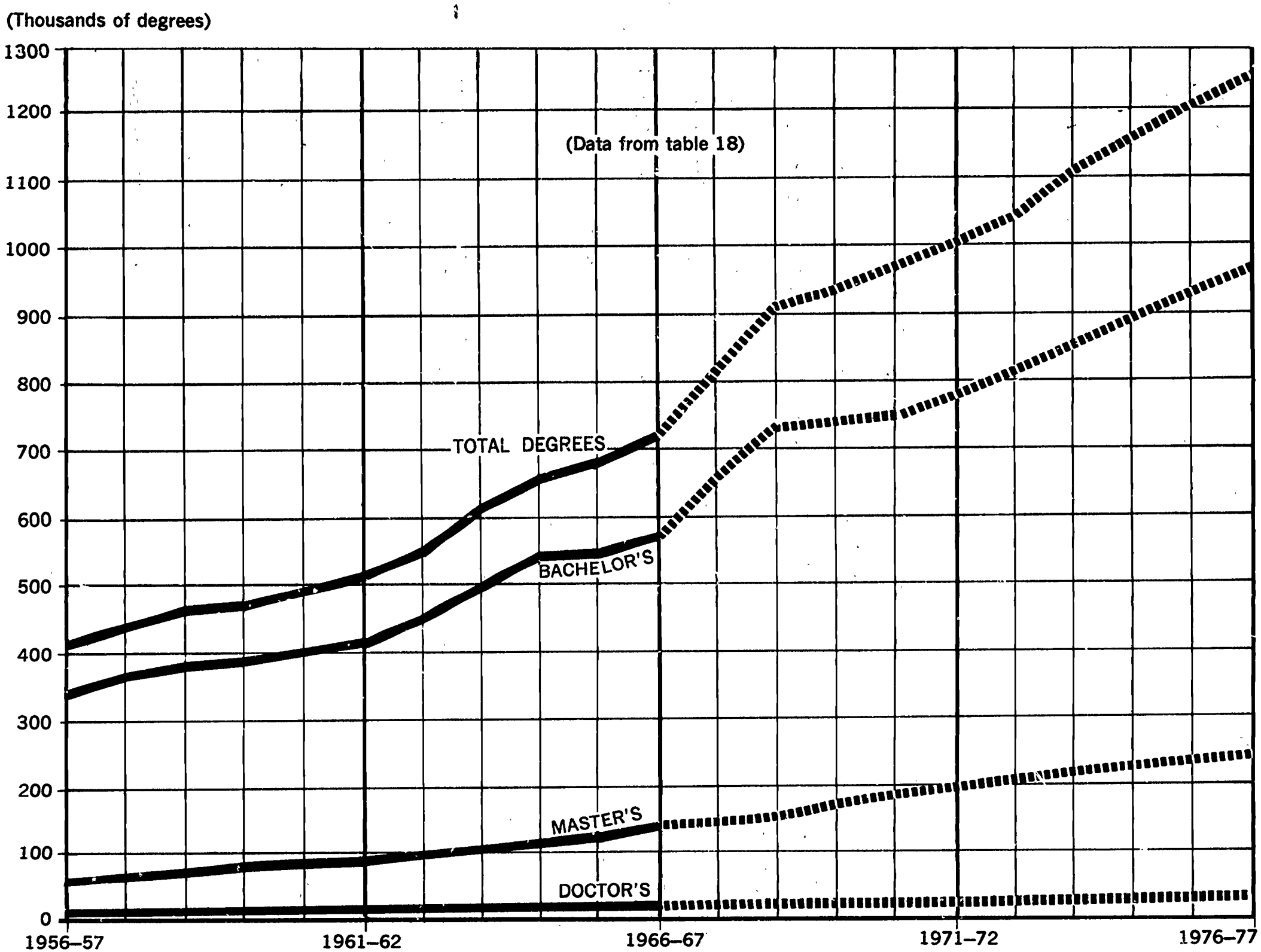


FIGURE I-1. Earned degrees, by level: United States, 1956-57 to 1976-77. (Ref. 5, Figure 4, p. 29.)

Education bachelor's degrees far outnumber the next competitor, the social sciences, as shown in the 1965-1966 figures on Table I-7. These two subject areas, along with business and commerce, account for half of all bachelor's and master's degrees; this is not true at the doctoral level.

ENROLLMENT

Public institutions account for slightly over twice as many students as the private institutions, which are getting a smaller share each year. The private schools had an enrollment increase of 4.6% and 2.7% for 1966 and 1967, respectively, over the previous year, as compared to 9.5% and 10.7% for public institutions. The peakout in percentage of increased total student enrollment is evident in Table I-8, with the 12.2% increase in 1965 being the largest in the last 10 years. The drop to an average of 8.1% for the two years following is indicative of a continuing expected drop in the yearly increase. Although the number of students is expected to increase over the next several years, the rate of increase is expected to drop slightly. Projected estimates are made on the basis of population figures.

One of the continuing problems in comparing enrollment (and faculty) figures has been to reach an appropriate equation

TABLE I-7. Bachelor's and higher degrees conferred, by level of degree, sex of student, and area of study: all institutions, 1965-1966. (Extracted from Ref. 4, p. 8, Table 6.)

AREA OF STUDY	LEVEL OF DEGREE			
	Bachelor's requiring 4 or 5 years	First-professional requiring at least 6 years	Master's	Doctor's
1	2	3	4	5
ALL AREAS	524,117	31,496	140,772	18,239
Agriculture	5,730		1,363	537
Architecture	2,401	198	381	9
City Planning	70		321	3
Biological Sciences	27,010	38	4,235	2,097
Business and Commerce	63,500		12,988	387
Computer science and systems analysis	89		238	19
Education	118,399	22	50,478	3,063
Engineering	35,815		13,678	2,304
English and journalism	42,321	2	6,788	714
Fine and applied arts	18,677	28	5,019	476
Folklore	5		14	3
Foreign languages and literature	15,519	8	3,631	512
Forestry	1,443	23	303	51
Geography	1,934		370	58
Health professions	15,054	13,253	2,867	251
Home economics	5,724		740	54
Law	245	13,442	780	29
Library science	619	23	3,916	19
Mathematical subjects	20,090	3	4,772	782
Military science	1,979			
Philosophy	5,024	12	613	203
Physical sciences	17,185	1	4,992	3,045
Psychology	17,022		2,530	1,046
Records management	98			
Religion	4,036	4,443	1,946	333
Social sciences	93,669		16,460	2,158
Trade and industrial training	2,357		44	11
Miscellaneous fields	8,102		1,305	75

TABLE I-8. Opening enrollment of students, by sex and institutional control: aggregate United States, Fall 1963 to Fall 1967. (Extracted from Ref. 6, p.6, Table 1.)

Enrollment category and year	In all institutions			In publicly controlled institutions	In privately controlled institutions
	Total	Men	Women		
1	2	3	4	5	6
Total, all students[a]					
Fall 1967	6,963,687	4,158,557	2,805,130	4,850,330	2,113,357
Fall 1966	6,438,477	3,880,557	2,557,920	4,381,086	2,057,391
Fall 1965	5,967,411	3,652,675	2,314,736	3,999,940	1,967,471
Fall 1964	5,320,294	3,268,188	2,052,106	3,494,489	1,825,805
Fall 1963	4,800,332	2,972,344	1,827,988	3,090,578	1,709,754
Percent change					
Fall 1966 to 1967	+8.2	+7.2	+9.7	+10.7	+2.7
Fall 1965 to 1966	+7.9	+6.2	+10.5	+9.5	+4.6
Fall 1964 to 1965	+12.2	+11.8	+12.8	+14.5	+7.8
Fall 1963 to 1964	+10.8	+10.0	+12.3	+13.1	+6.8

[a]Includes students whose programs of work consist wholly or chiefly of work normally creditable toward a bachelor's or higher degree and students in 1-, 2-, or 3-year undergraduate programs which are *not* chiefly creditable toward a bachelor's degree but which are designed to prepare for immediate employment or to provide general education.

to convert part-time and extension students into full-time student equivalencies. A recent standard was cited in a U. S. Office of Education publication and is used for the computations in Table I-9.

The definitions necessary to understand the inclusive or exclusive nature of the terms are the same as those in Table I-10. The ratio of women students to men has not changed appreciably over a period of five years. Men outnumbered women 2.9 to 1.8 in 1963 and 4.1 to 2.8 in 1967.

Graduate students in 1967 constituted 13% of all students on campuses. Immediate past years show little variation, although it is anticipated that the percentage may rise as more emphasis is placed on advanced degrees. Absolute figures are shown in Table I-11 and a projection in Table I-12.

Figure I-2 is a graphic representation of graduate-student population. Although this Figure, the Table preceding, and the one to follow are all from the U. S. Office of Education, there are slight variations in the figures. The 10% increase in graduate students per year during the 1960-1967 period is estimated to decrease to about 8½% for the current and next few years

The importance of the graduate programs and its students on library use is discussed later. A recent comparative study concerned with an assessment of quality in graduate education was

TABLE I-9. Opening enrollment of students, by enrollment, category, level of institution, and institutional control: aggregate United States, Fall 1967.

Level of institution and institutional control	All students (Columns 3+6)	Resident students			Extension students	Full-time equivalents[b]
		Total	Full-time	Part-time		
1	2[a]	3[a]	4[a]	5[a]	6[a]	7[a]
Total, public and private						
All institutions	6,963,687	6,670,416	4,826,991	1,843,425	293,271	5,539,223
4-year institutions	5,445,608	5,171,222	4,003,630	1,167,592	274,386	4,484,289
Universities	2,619,097	2,462,760	1,905,678	557,082	156,337	2,143,484
All other 4-year	2,826,511	2,708,462	2,097,952	610,510	118,049	2,340,805
2-year institutions	1,518,079	1,499,194	823,361	675,833	18,885	1,054,933
Public						
All institutions	4,850,330	4,611,744	3,281,231	1,330,513	238,586	3,804,264
4-year institutions	3,475,660	3,254,905	2,575,706	679,199	220,755	2,875,690
Universities	1,903,365	1,775,231	1,437,048	338,183	128,134	1,592,487
All other 4-year	1,572,295	1,479,674	1,138,658	341,016	92,621	1,283,203
2-year instituions	1,374,670	1,356,839	705,525	651,314	17,831	928,573
Private						
All institutions	2,113,357	2,058,672	1,545,760	512,912	54,685	1,734,959
4-year institutions	1,969,948	1,916,317	1,427,924	488,393	53,631	1,608,598
Universities	715,732	687,529	468,630	218,899	28,203	550,997
All other 4-year	1,254,216	1,228,788	959,294	269,494	25,428	1,057,601
2-year institutions	143,409	142,355	117,836	24,519	1,054	126,360

[a]From Ref. 6, p. 7, Table 2.

[b]FTE is full-time plus 1/3 each of part-time and extension. [U.S. Office of Education, *Library Statistics 1966-67; Preliminary Report on Academic Libraries*, OE15065 (Washington, D.C., Government Printing Office, 1967) p. 3.]

TABLE I-10. Total opening fall resident and extension enrollment in all institutions of higher education, by degree status and level: United States, 1968 to 1976[a]. In thousands. (From Ref. 5, p. 11, Table 4.)

Year fall[b]	Total resident and extension degree credit and nondegree credit	Degree credit					Nondegree credit
		Total resident and extension degree credit	Estimated total resident graduate[c]	Estimated resident and extension undergraduate and 1st-professional[d]			Resident and extension undergraduate in vocational or general studies program
				Total	1st-time	Other	
1	2	3	4	5	6	7	8
			PROJECTED				
1968	7,404	6,902	751	6,150	1,491	4,659	502
1969	7,553	7,038	779	6,259	1,567	4,692	515
1970	7,832	7,296	816	6,481	1,651	4,830	536
1971	8,191	7,627	866	6,761	1,731	5,030	564
1972	8,598	8,003	921	7,082	1,807	5,275	595
1973	9,006	8,380	979	7,401	1,872	5,529	626
1974	9,395	8,740	1,032	7,708	1,941	5,767	655
1975	9,772	9,088	1,086	8,002	2,004	5,998	684
1976	10,108	9,398	1,140	8,259	2,050	6,209	710

[a]SOURCES: Enrollment data and estimates are based on U.S. Department of Health, Education, and Welfare, Office of Education publications: (1) "Opening (Fall) Enrollment, in Higher Education," annually, 1956 through 1966; (2) "Resident and Extension Enrollment in Institution of Higher Education," biennially, 1955 through 1963.

[b]Resident enrollment refers to enrollment in classes on the main campus or a branch campus of an institution, irrespective of the student's living quarters.

[c]Includes graduate students in liberal arts and sciences and students taking work beyond the first-professional degree. Graduate enrollment is somewhat higher than enrollment for advanced degrees because graduate enrollment includes students taking work at the graduate level who are not enrolled for advanced degrees.

[d]Includes students studying for degrees such as M.D., D.D.S., D.V.M., LL.B., B.D., and other degrees classified as first-professional.

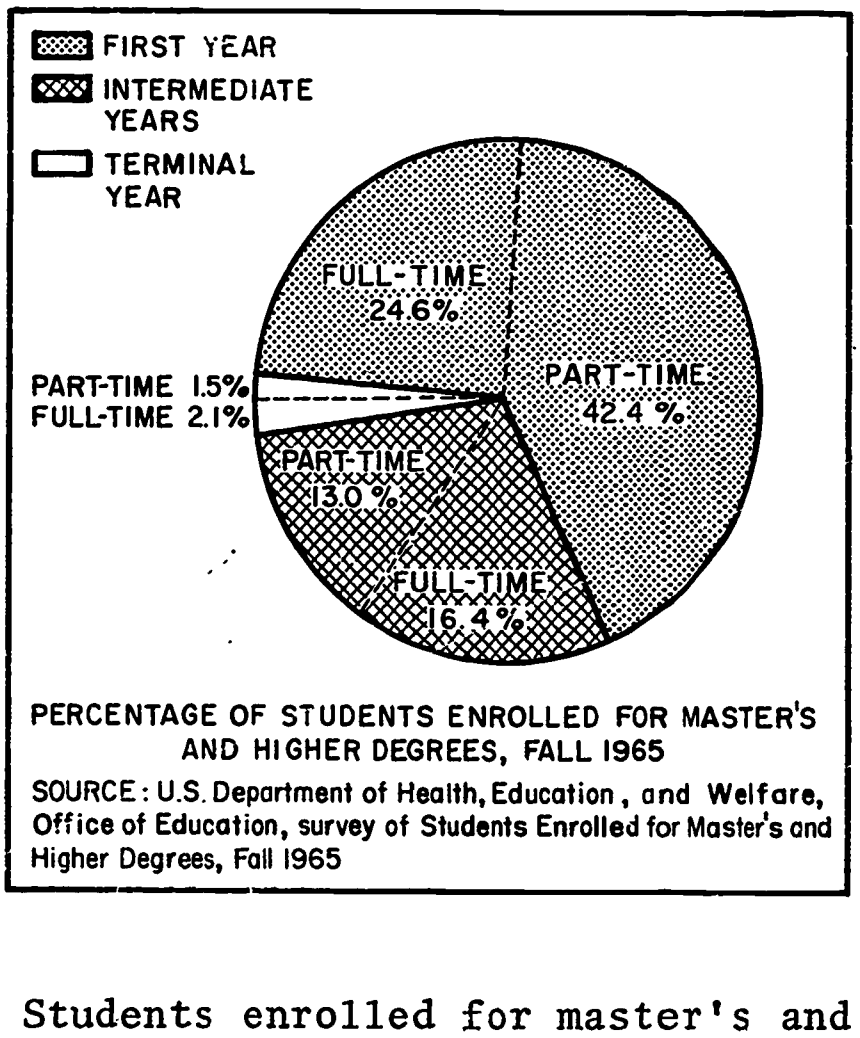
NOTE—Data are for 50 States and the District of Columbia for all years. Because of rounding, detail may not add to totals.

TABLE I-11. Opening enrollment of resident students, by level of enrollment, sex, level of institution, and institutional control: aggregate United States Fall 1967 (From Ref. 6, p. 11, Table 6.)

Level of institution and institutional control	All resident students (Cols. 3+6)	Resident undergraduate			Resident postbaccalaureate		
		Total	Men	Women	Total	Men	Women
1	2	3	4	5	6	7	8
Total, public and private							
All institutions	6,670,416	5,770,451	3,376,336	2,394,115	899,965	633,107	266,858
4-year institutions	5,171,222	4,271,257	2,469,949	1,801,308	899,965	633,107	266,858
Universities	2,462,760	1,867,325	1,141,384	725,941	595,435	440,583	154,852
All other 4-year	2,708,462	2,403,932	1,328,565	1,075,367	304,530	192,524	112,006
2-year institutions	1,499,194	1,499,194	906,387	592,807			
Public							
All institutions	4,611,744	4,086,690	2,385,809	1,700,881	525,054	353,411	171,643
4-year institutions	3,254,905	2,729,851	1,557,697	1,172,154	525,054	353,411	171,643
Universities	1,775,231	1,422,867	854,814	568,053	352,364	257,955	94,409
All other 4-year	1,479,674	1,306,984	702,883	604,101	172,690	95,456	77,234
2-year institutions	1,356,839	1,356,839	828,112	528,727			
Private							
All institutions	2,058,672	1,683,761	990,527	693,234	374,911	279,696	95,215
4-year institutions	1,916,317	1,541,406	912,252	629,154	374,911	279,696	95,215
Universities	687,529	444,458	286,570	157,888	243,071	182,628	60,443
All other 4-year	1,228,788	1,096,948	625,682	471,266	131,840	97,068	34,772
2-year institutions	142,355	142,355	78,275	64,080			

Level of study	Enrollment		
	Total	Full-time	Part-time
First year	359,000	132,000	227,000
Intermediate years	157,000	88,000	69,000
Terminal year	19,000	11,000	8,000
All levels	535,000	231,000	304,000

The first-year level included students who had completed less than one full year of the required study for a master's degree or a higher degree. The intermediate years included students who had completed one or more years of study for a master's or a higher degree. The terminal year included only those students who were expected to complete all doctoral requirements by June 30, 1966.



PERCENTAGE OF STUDENTS ENROLLED FOR MASTER'S AND HIGHER DEGREES, FALL 1965

SOURCE: U.S. Department of Health, Education, and Welfare, Office of Education, survey of Students Enrolled for Master's and Higher Degrees, Fall 1965

FIGURE I-2. Students enrolled for master's and higher degrees, Fall 1965. (From Ref. 9, p. 74, Fig. 7.)

TABLE I-12. Estimated graduate opening fall degree-credit resident enrollment in 4-year institutions of higher education by sex, by attendance status, and by control: United States, 1960 to 1973.[a,b] (From Ref. 5, p. 19, Table 12.)

Year (fall)	Graduate degree-credit enrollment	Sex		Attendance status		Control	
		Men	Women	Full-time	Part-time	Public	Private
1	2	3	4	5	6	7	8
1960	356,000	253,000	103,000	143,000	213,000	187,000	169,000
1961	386,000	273,000	113,000	162,000	224,000	208,000	179,000
1962	422,000	298,000	124,000	177,000	245,000	234,000	189,000
1963	464,000	327,000	137,000	188,000	276,000	267,000	196,000
1964	517,000	363,000	154,000	214,000	303,000	305,000	212,000
1965	582,000	409,000	173,000	254,000	328,000	352,000	230,000
1966	630,000	439,000	191,000	275,000	355,000	387,000	243,000
				PROJECTED[c]			
1967	699,000	488,000	211,000	306,000	393,000	434,000	265,000
1968	751,000	524,000	228,000	329,000	422,000	473,000	278,000
1969	779,000	541,000	237,000	342,000	437,000	497,000	281,000
1970	816,000	565,000	251,000	358,000	457,000	527,000	289,000
1971	866,000	598,000	268,000	381,000	485,000	568,000	298,000
1972	921,000	636,000	285,000	406,000	515,000	610,000	311,000
1973	979,000	674,000	305,000	432,000	547,000	656,000	323,000

[a]SOURCES: Enrollment data and estimates are based on U.S. Department of Health, Education, and Welfare, Office of Education publications: (1) "Opening (Fall) Enrollment, in Higher Education," annually, 1956 through 1966; (2) "Resident and Extension Enrollment in Institutions of Higher Education," biennially, 1955 through 1963.

[b]Total opening fall degree-credit enrollment in 4-year institutions by level and attendance status 1955 to 1966 was estimated from first-term enrollment by level and attendance status reported in "Comprehensive Report on Enrollment" surveys biennially, 1955 through 1961 and in the "Residence and Migration of College Students" survey, fall 1963. The estimates were adjusted to agree with degree-credit enrollment by attendance status.

[c]The projection of graduate opening fall degree-credit enrollment in 4-year institutions of higher education by sex and by control of institution is based on the assumption that in each enrollment category the proportion of total enrollment at the graduate level will continue the 1955-1963 trend to 1976.

The projection of graduate opening fall degree-credit enrollment in 4-year institutions by attendance status is based on the assumption that in each enrollment category the estimated 1965 ratio of full-time enrollment to total enrollment will remain constant to 1976.

Note—Data are for 50 States and the District of Columbia for all years. Because of rounding, detail may not add to totals.

completed and published as what has come to be known as the Cartter report.[11] The reader wishing to explore this subject further is referred to it for a statistical assessment of institutions by subject-discipline peers in the academic community.

Student enrollments by state are available but do not seem to have particular significance or lend much understanding to our overall needs. One Table has been prepared, however, that provides us with a regional view of students (Table I-13). Again, the student population ratios correspond closely to the general population regional ratios.

Of particular significance to the higher-educational system in recent years has been the growth of junior colleges. The junior-college student enrollment has a current ratio of nine public to one private enrollee. The total enrollment growth rate is nearly the same as that for all institutions (Table I-14).

INSTRUCTIONAL AND PROFESSIONAL STAFFS

Most statistical tabulations take into account the differences between those people directly involved in professional instructional programs and professionals involved specifically in research and providing supporting services (general administration, personnel, and libraries). Rarely are the figures for the clerical backups provided. This categorization is useful for the

TABLE I-13. Opening enrollment of students, by enrollment category, region; Fall 1967. (Extracted from Ref. 6, p. 15, Table 9.)

Region and state	All students in survey		Resident students			Extension students	First-time freshmen
	1967	Percent change from 1966	Total	Full-time	Part-time		
New England[a]	453,062	+7.7	419,313	324,916	94,397	33,749	104,204
Mideast[b]	1,373,480	+9.5	1,327,439	867,031	460,408	46,041	264,488
Great Lakes[c]	1,294,660	+7.0	1,262,371	930,880	331,491	32,289	311,425
Plains[d]	588,600	+7.0	556,654	471,129	85,525	31,946	146,210
Southeast[e]	1,144,094	+8.4	1,104,185	910,696	193,489	39,909	296,889
Southwest[f]	561,149	+8.2	547,662	409,804	137,858	13,847	136,278
Rocky Mountain[g]	230,639	+14.0	210,198	169,881	40,317	20,441	52,255
Far West[h]	1,251,485	+7.4	1,178,838	694,308	484,530	72,647	322,828
States and District of Col.	6,911,748	+8.2	6,621,239	4,793,128	1,828,111	290,509	1,640,936

[a] *New England:* Conn., Me., Mass., N.H., R.I., Vt.
[b] *Mideast:* Dela., D.C., Md., N.J., N.Y., and Pa.
[c] *Great Lakes:* Ill., Ind., Mich., Ohio, Wisc.
[d] *Plains:* Ia., Kans., Minn., Mo., Neb., N.D., S.D.
[e] *Southeast:* Ala., Ark., Fla., Ga., Ky., La., Miss., N.C., S.C., Tenn., Va., W.Va.
[f] *Southwest:* Ariz., N.M., Okla., Tex.
[g] *Rocky Mountain:* Colo., Ida., Mont., Utah, Wyo.
[h] *Far West:* Alas., Calif., Haw., Nev., Ore., Wash.

TABLE I-14. Total opening fall degree-credit resident and extension enrollment in 2-year institutions of higher education by sex, by attendance status, and by control of institution: United States, 1960 to 1973.[a] (From Ref. 5, p. 17, Table 10.)

Year (fall)	Total degree-credit enrollment	Sex		Attendance status[b]		Contol	
		Men	Women	Full-time	Part-time	Public	Private
1	2	3	4	5	6	7	8
1960	451,333	282,155	169,178	247,000	205,000	392,310	59,023
1961	517,925	320,156	197,769	293,000	225,000	456,381	61,544
1962	589,529	365,624	223,905	317,193	272,336	519,257	70,272
1963	624,789	386,660	238,129	327,218	297,571	551,308	73,481
1964	710,868	439,509	271,359	396,385	314,483	620,859	90,000
1965	841,437	521,846	319,591	495,454	345,983	737,890	103,547
1966[c]	952,000	575,000	376,000	581,000	371,000	844,000	108,000
				PROJECTED[d]			
1967	1,055,000	641,000	414,000	615,000	439,000	936,000	118,000
1968	1,140,000	689,000	451,000	664,000	476,000	1,014,000	126,000
1969	1,175,000	710,000	465,000	684,000	491,000	1,046,000	129,000
1970	1,232,000	745,000	488,000	718,090	515,000	1,098,000	133,000
1971	1,294,000	779,000	515,000	753,000	541,000	1,154,000	141,000
1972	1,379,000	825,000	554,000	802,000	578,000	1,232,000	148,000
1973	1,458,000	873,000	585,000	847,000	611,000	1,303,000	155,000

[a]SOURCES: Enrollment data and estimates are based on U.S. Department of Health, Education, and Welfare, Office of Education publications: (1) "Opening (Fall) Enrollment, in Higher Education," annually, 1956 through 1966; (2) "Resident and Extension Enrollment in Institutions of Higher Education," biennially, 1955 through 1963.

[b]Total opening fall degree-credit enrollment by attendance status for 1955 through 1961 is estimated from first-term enrollment by attendance status reported in "Comprehensive Report on Enrollment" surveys, biennially, 1955 through 1961.

[c]Estimate based on fall 1966 survey of total degree-credit and nondegree-credit enrollment not reported separately, and on fall 1965 survey of total degree-credit enrollment and total nondegree-credit enrollment reported separately.

[d]The projection of total opening fall degree-credit enrollment in 2-year institutions by sex and control of institution is based on the assumption that total enrollment, expressed as a percentage of population aged 18-21 years, will follow the 1956-66 trend to 1976 in each category of enrollment.

The projection of total opening fall degree-credit enrollment in 2-year institutions of higher education by attendance status is based on the assumption that in each enrollment category the 1965 ratio of full-time enrollment to total enrollment will remain constant to 1976.

purpose of this study since the professionals are the library users and borrowers along with students. The 1968-1969 estimate of the U.S. Office of Education (Table I-15) indicates 3.3 instructional members to 1 professional performing other campus duties; this includes an estimated research staff of 95,000. Total professional staff growth from 1956 through spring 1967 was 100%, or about 9% a year. The projected growth for the following 10 years is put at only 30%, or slightly over 3% a year. The U.S. Office of Education cites its statistical bases for this great decline in growth rate, largely based on population figures. Projections of a 3% growth are made in all categories: instructional, administrative professional support, and professional research staffs. Growth in each of these categories during the previous 10 years was not 100% as the overall increase. For example, the instructional staff fell short of doubling in the 10 years while all other professionals increased 150%. It must be assumed that the projection figures probably do not accurately take into account growth factors such as have worked in the past.

It is possible with the data in this chapter to reach conclusions about student/faculty ratios. This desire should be set aside since such a computation does not include a multitude of influences that are critical in separate campus situations. Also in the context of this study, there is little value for such a figure.

TABLE I-15. Total full-time and part-time professional staff in institutions of higher education: United States and outlying areas, first term, 1961-62 to 1973-74.[a] (From Ref. 5, p. 57, Table 30.)

Year	Total professional staff	Instructional staff			Other professional staff		
		Total	For resident degree-credit courses[b]	Other instructional staff[c]	Total	Administration and services[d]	Organized research[e]
1	2	3	4	5	6	7	8
1961-62	467,990	369,499	312,687	56,812	98,491	48,433	50,058
1962-63[f]	507,000	395,000	336,000	59,000	112,000	54,000	58,000
1963-64	544,152	420,278	358,153	62,125	123,874	58,786	65,088
1964-65[f]	591,000	456,000	389,000	67,000	135,000	64,000	71,000
1965-66[g]	657,000	507,000	432,000	75,000	150,000	71,000	79,000
1966-67[g]	701,000	541,000	461,000	80,000	160,000	76,000	84,000
PROJECTED[h]							
1967-68	758,000	585,000	499,000	86,000	173,000	82,000	91,000
1968-69	796,000	615,000	524,000	91,000	181,000	86,000	95,000
1969-70	805,000	622,000	530,000	92,000	183,000	87,000	96,000
1970-71	826,000	638,000	544,000	94,000	188,000	89,000	99,000
1971-72	854,000	660,000	563,000	97,000	194,000	92,000	102,000
1972-73	888,000	686,000	585,000	101,000	202,000	96,000	106,000
1973-74	922,000	712,000	607,000	105,000	210,000	100,000	110,000

[a]SOURCES: U.S. Department of Health, Education and Welfare, Office of Education publications: (1) "Faculty in Institutions of Higher Education, November 1955"; and (2) "Faculty and Other Professional Staff in Institutions of Higher Education," biennially, first term, 1957-58 through first term, 1963-64.

[b]Includes faculty with rank of instructor or above and junior instructional staff.

[c]Includes instructional staff for extension, resident nondegree-credit course, and instruction by mail, radio or TV, short courses, and individual lessons.

[d]Includes professional staff for general administration, student personnel services, and libraries.

[e]Includes only professional staff engaged specifically for full-time or part-time research and those who have been relieved from some or all other duties in order to perform systematic organized research. Excludes graduate students not performing research at a professional level.

[f]Interpolated.

[g]Estimated.

[h]The projection of total full-time and part-time instructional staff for resident degree-credit courses is detailed in Table 28, footnote 4, of Ref. 5.

The projection of total full-time and part-time other instructional staff, professional staff for administration and services, and professional staff for organized research is based on the percent each was of total full-time and part-time instructional staff in 1963-64. These percentages were 17.3, 16.4, and 18.2 percent, respectively, and are assumed to remain at the 1963-64 level to 1976-77.

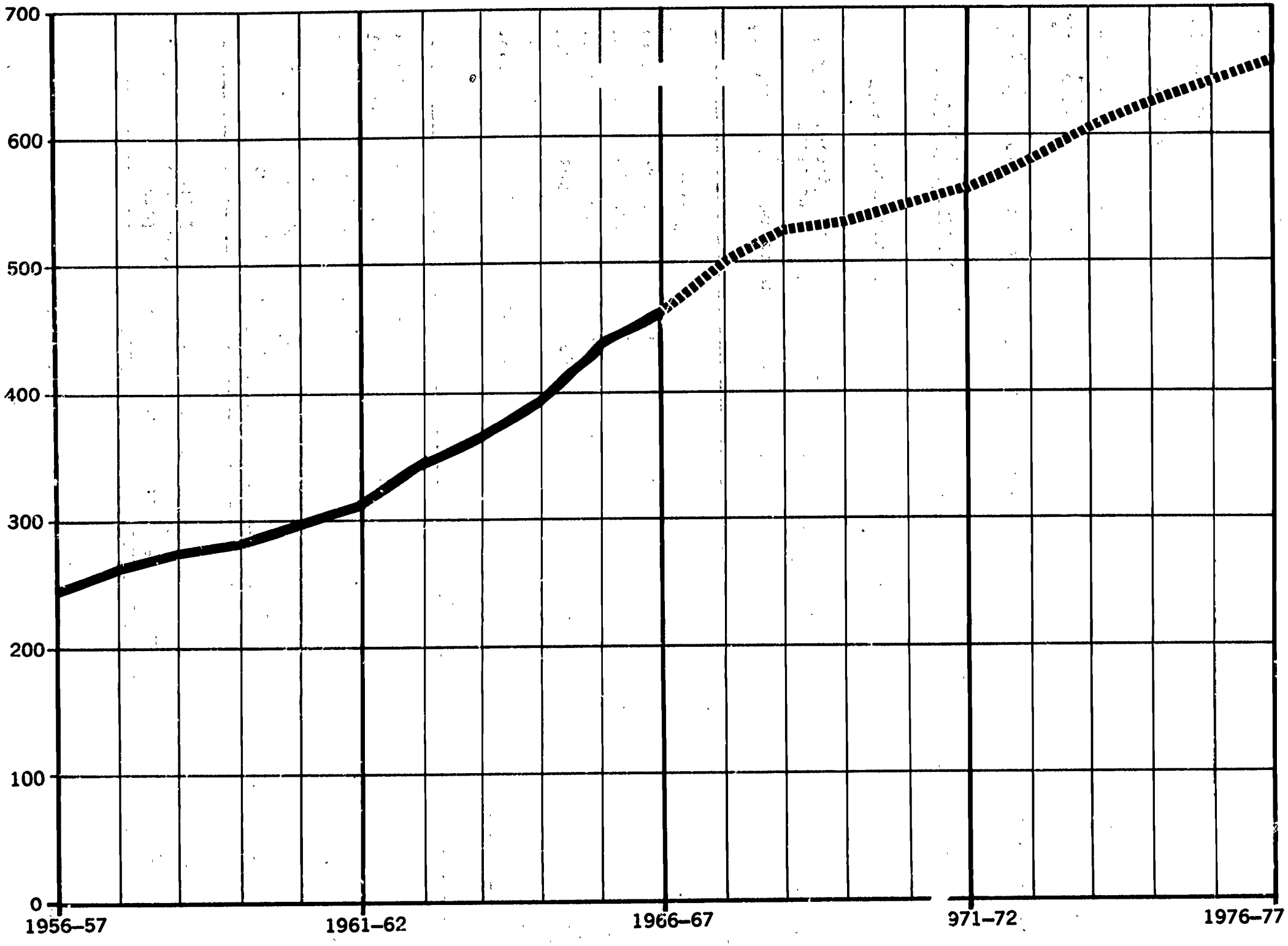


FIGURE I-3. Total instructional staff for resident degree-credit courses in institutions of higher education: United States and outlying areas, 1956-57 to 1976-77. (Ref. 5, Fig. 6, p. 46.)

The plateau of growth in student enrollment is reflected in the U.S. Office of Education's instructional-staff estimates diagramed in Fig. I-3.

Table I-16 gives a more detailed analysis of what specific responsibilities the professionals hold. Although the newest data are for academic 1963-1964, it probably is safe to assume that the ratios between the various categories have not changed even though there have been substantial increases in actual numbers.

The U.S. Office of Education attempted to avoid such routine statistical problems as duplicate counting of people with dual responsibilities, definition of professionals, and related matters. It should be evident that there is room for error in understanding, and applying those distinctions in the counting as well as in the tabulations.

A very difficult area for accurate figures is that of salaries, where reporting is usually not as complete and, therefore, more-extensive extrapolating and guessing is necessary to reach total sample figures. On one survey covering the year 1964-1965, the U.S. Office of Education arrived at a mean of $9,000 for Instructor through Professor ranks for the nine-month academic year, a mean of $11,800 for the 11- to 12-month year (Ref. 9, p. 80). In a study of the following academic year, a mean of $9,081 (for 9 months) was obtained from a much larger sampling.[12] In the latter study, there was little evidence of pay difference between public

TABLE I-16. Faculty and other professional staff in institutions of higher education, by type of position: United States and outlying areas, first term 1959-60 to 1963-64. (From Ref. 9, p. 79, Table 100.)

Type of position	Number of positions		
	1959-60	1961-62	1963-64
1	2	3	4
All types[a]	431,720	475,810	556,904
Professional staff for general administration	19,063	20,686	25,513
Professional staff for student personnel services	15,299	16,722	20,734
Faculty for resident instruction in degree-credit courses	283,080	312,687	358,153
instructor or above	244,461	266,624	305,459
full-time	163,656	178,632	204,561
Junior instructional staff	38,619	46,063	52,694
Faculty for resident instruction in other than degree-credit courses	14,135	13,632	15,115
Extension staff	31,439	31,409	37,768
Other faculty, including instructional staff for courses by mail, radio, or TV, short courses, and individual lessons	11,877	11,771	14,492
Professional library staff	9,939	11,025	12,539
Professional staff for organized research	37,099	50,058	65,088

[a]The sum of the number of persons in all types of positions exceeds the number of different persons because some professional staff serve in more than one capacity. "Total number of positions" represents the sum in all types of positions as classified in the survey questionnaires.

SOURCE: U.S. Department of Health, Education, and Welfare, Office of Education, circulars on "Faculty and Other Professional Staff in institutions of Higher Education."

and private universities, although they were nearly $1,000 ahead of comparable ranks in state and private colleges.

Men outnumbered professional women 3.5:1 in 1963-1964 (Ref. 9, p. 79). Professional staffs in public/private institutions follow the ratio of students within those institutions.

INCOME AND EXPENDITURE

Revenues or income statements for academic institutions are nearly synonymous with expenditures, although the distinction is made in the following Tables. This is most particularly true of public institutions, which often operate on the philosophy that one must spend all of the money available to receive more the next year.

Income figures in Table I-17 seem to show only slight variation between public and private institutions, except in tuition and fees (private schools collect three times as much revenue), and state-government allocations, where the public institutions get 39% of their general income.

It should be noted in these 1963-1964 figures that private institutions were obtaining more Federal research dollars than the public schools. There is no later indication that this general pattern has changed.

The educational and general expenditures (81% of all expenditures) in 1963-1964 in both public and private institutions were

TABLE I-17. Current-fund income of institutions of higher education, by source and control: United States and outlying areas, 1963-64. Amounts in thousands of dollars. (From Ref. 9, p. 88, Table 113.)

Source	Current-fund income, by control of institution					
	Public and private		Public		Private	
	Amount	Percent	Amount	Percent	Amount	Percent
1	2	3	4	5	6	7
Total current-fund income	$9,491,330	100.0	$5,368,679	100.0	$4,222,651	100.0
Educational and general income	7,830,033	81.6	4,396,869	81.9	3,433,164	81.3
Tuition and fees from students	1,899,455	19.8	582,865	10.9	1,316,589	31.2
Federal Government	2,170,749	22.6	1,053,794	19.6	1,116,955	26.5
Research	1,797,095	18.7	754,450	14.1	1,042,645	24.7
Other Federal income	373,654	3.9	299,344	5.6	74,310	1.8
State governments	2,133,665	22.2	2,077,724	38.7	55,941	1.3
Local governments	240,355	2.5	230,404	4.3	9,950	.2
Endowment earnings	266,214	2.8	27,443	.5	238,770	5.7
Private gifts and grants	551,507	5.8	113,857	2.1	437,650	10.4
Other educational and general income	568,088	5.9	310,780	5.8	257,309	6.1
Auxiliary enterprise income	1,610,426	16.8	906,358	16.9	704,068	16.7
Student-aid income	150,871	1.6	65,453	1.2	85,419	2.0

Note.: Because of rounding, detail may not add to totals.

SOURCE: U.S. Department of Health, Education, and Welfare, Office of Education, survey of "Financial Statistics of Institutions of Higher Education, 1963-64."

by percentage very nearly the same. The percent expenditure of the composite budgets of both types of institutions in the general and education categories were

General Administration and Expense	10.5%
Instruction and Department Research	30.6
Libraries	2.6
Physical Plant and Maintenance	7.5
Organized Research	21.5
Other General Expenditures	8.4

Support services account for 29% of the entire expenditure or almost equal to the dollar outlay for direct instruction. Table I-18 gives the details of actual dollar expenditures f the past six years and estimates through 1971-1972. It must be not d that the money is stated in terms of 1966-1967 dollars.

Measurement of relative effectiveness or ability to teach students has been the average expenditure per student, as expressed in Table I-19. This average suffers from the inherent attributes of a learning experience that are not directly tied to dollars. Money having a direct relationship to the transfer of knowledge is basic to the concept expressed in average expenditure per student.

TABLE I-18. Expenditures from current funds and total current expenditures (1966-67 dollars) by institutions of higher education: United States, 1963-1964 to 1971-1972.[a] Amounts in billions of 1966-67 dollars. (Extracted from Ref. 5, pp. 86-88, Table 41.)

Year and control	Expenditure for education and general purposes				Expenditure for auxiliary enterprises and student aid[d]	Total expenditures from current funds	Capital outlay from current funds only	Total current expenditures[e]
	Student education[b]	Organized research	Related activities[c]	Total				
1	2	3	4	5	6	7	8	9
1963-64:								
Total	5.3	2.1	0.5	7.9	1.9	9.8	0.4	9.4
Public	3.1	1.0	0.3	4.4	1.0	5.4	0.2	5.2
Nonpublic	2.2	1.1	0.2	3.5	0.9	4.4	0.2	4.2
1964-65:[f]								
Total	6.0	2.3	0.5	8.8	2.1	10.9	0.6	10.3
Public	3.6	1.1	0.3	5.0	1.1	6.1	0.4	5.7
Nonpublic	2.4	1.2	0.2	3.8	1.0	4.8	0.2	4.6
1965-66:[f]								
Total	6.9	2.4	0.7	10.1	2.4	12.5	0.6	11.9
Public	4.2	1.1	0.4	5.8	1.3	7.1	0.4	6.7
Nonpublic	2.7	1.3	0.3	4.3	1.1	5.4	0.2	5.2
1966-67:[f]								
Total	7.7	2.6	0.8	11.1	2.7	13.8	0.6	13.2
Public	4.7	1.2	0.5	6.4	1.5	7.9	0.4	7.5
Nonpublic	3.0	1.4	0.3	4.7	1.2	5.9	0.2	5.7
PROJECTED[g]								
1967-68:								
Total	8.4	3.0	0.8	12.2	3.0	15.2	0.6	14.6
Public	5.2	1.4	0.5	7.1	1.6	8.7	0.4	8.3
Nonpublic	3.2	1.6	0.3	5.1	1.4	6.5	0.2	6.3
1968-69:								
Total	9.2	3.1	0.9	13.2	3.3	16.5	0.6	15.9
Public	5.6	1.4	0.6	7.6	1.8	9.4	0.4	9.0
Nonpublic	3.6	1.7	0.3	5.6	1.5	7.1	0.2	6.9
1969-70:								
Total	9.6	3.3	0.9	13.8	3.4	17.2	0.6	16.6
Public	5.9	1.5	0.6	8.0	1.9	9.9	0.4	9.5
Nonpublic	3.7	1.8	0.3	5.8	1.5	7.3	0.2	7.1

TABLE I-18. *(continued)*

Year and control	Expenditure for education and general purposes				Expenditure for auxiliary enterprises and student aid[d]	Total expenditures from current funds	Capital outlay from current funds only	Total current expenditures[e]
	Student education[b]	Organized research	Related activities[c]	Total				
1	2	3	4	5	6	7	8	9
1970-71:								
Total	10.1	3.5	1.0	14.6	3.7	18.3	0.6	17.7
Public	6.2	1.6	0.6	8.4	2.1	10.5	0.4	10.1
Nonpublic	3.9	1.9	0.4	6.2	1.6	7.8	0.2	7.6
1971-72:								
Total	10.7	3.7	1.1	15.5	3.9	19.4	0.5	18.9
Public	6.6	1.7	0.7	9.0	2.2	11.2	0.3	10.9
Nonpublic	4.1	2.0	0.4	6.5	1.7	8.2	0.2	8.0

[a]SOURCES: Data are based on statistics in U.S. Department of Health, Education, and Welfare, Office of Education publications: (1) *Statistics of Higher Education, Biennial Survey of Education in the United States*, chapter 4, 1955-56 and 1957-58; (2) *Financial Statistics of Higher Education*, 1959-60, 1961-62, and 1963-64 surveys; and (3) unpublished data in the Office of Education. Conversion to 1966-67 dollars was based on the Consumer Price Index published by the Bureau of Labor Statistics and on the American Appraisal Company Construction Cost Index.

[b]Includes general administration, instruction and departmental research, extension and public services, libraries, and operation and maintenance of the physical plant.

[c]Includes expenditures for such items as laboratory schools, medical school hospitals, dental clinics, agricultural college creameries, connected with instructional programs but not actually integral parts of it.

[d]Auxiliary enterprises include student dormitories, dining halls, cafeterias, student unions, bookstores.

[e]Current-fund expenditures less capital outlay from current funds.

[f]Estimated.

[g]The projections of expenditures from current funds are based on the assumptions: (1) Expenditure per student and the percent of college-age persons attending college, on which expenditures for student education depend, will continue to increase as they did during the years 1956-57 to 1966-67; (2) expenditures for organized research will follow the 1956-57 to 1966-67 trend; (3) the relationship to student education of expenditures for related activities, for auxiliary enterprises, and for student aid will each continue the 1956-57 to 1966-67 trend; and (4) the 1966-67 to 1976-77 expenditures from current funds for capital outlay will approximate 16 percent of total capital outlay.

TABLE I-19. Enrollment, educational and general expenditures, and expenditures per student, by control and level of institution: aggregate United States, fiscal years 1963-64 and 1965-66. (From Ref. 1, Table C.)

Control and level of institution	Total Enrollment (in millions)			Educational and General Expenditures (in millions of dollars)			Average Expenditures per Student		
	1963-64	1965-66	Increase (%)	1963-64	1965-66	Increase (%)	1963-64	1965-66	Increase Amount
All institutions	4.8	5.9	24	$7.5	$10.0	35	$1,555	$1,676	$121
Public:									
Total	3.1	4.0	29	4.2	5.8	38	1,359	1,449	90
Universities	1.3	1.7	24	3.0	3.9	33	2,216	2,379	163
Other 4-year	1.0	1.3	28	.9	1.3	40	909	997	88
2-year	.7	1.0	42	.3	.6	77	427	535	108
Private:									
Total	1.7	2.0	15	3.3	4.2	29	1,911	2,139	228
Universities	.6	.7	14	1.6	2.1	36	2,673	3,192	519
Other 4-year	1.0	1.2	15	1.6	2.0	21	1,586	1,673	87
2-year	.11	.13	21	.08	.11	32	793	868	75

TABLE I-20. EDUCOM institutional data. All institutions have university programs unless differently coded in the Type column. All are coeducational unless otherwise stated following the accreditation statement.

INSTITUTION	CONT.	TYPE	POPULATION Enrl[b]	Professors Total	Full Time	Part Time	Program Level[c]	INCOME & EXPEND. (in millions of $) Total Revenues	Educational & General[d]
University of Akron (N)[a]	P		6	420	280	140	4	$ 10.8	$ 8.8
University of Alabama (S)	P		4	2169	1523	646	4	31.6	24.8
University of Arizona (N)	P		7	1118	974	144	4	55.0	44.2
Boston University (E)	Pr		7	2093	969	1124	4	54.8	41.6
Brown University (E)	Pr		4	491	462	29	4	28.9	23.7
Bucknell University (M)	Pr		4	195	183	12	3	9.5	6.9
University of California (W)	P		7	5053	4416		4	537.4	491.3
Berkeley	P		7	1583	1018	565	4		
College of Medicine	P		1	44	36	8	4		
Davis	P		5	656	271	385	4		
Irvine	P		3	181	162	19	4		
Los Angeles	P		7	1392	1116	276	4		
Riverside	P		4	284	200	84	4		
San Diego	P		3	205	125	80	4		
San Francisco	P		4	444	347	97	4		
Santa Barbara	P		5	442	400	42	4		
Santa Cruz	P		2	94	91	3	4		
City University of New York (M)	P		7	5114	3497	1617	4	104.0	95.8
Brooklyn College	P		7	993	763	230		21.6	18.9
City College	P		7	1698	929	769		30.4	28.6
H. H. Lehman College	P			401	338	63		10.1	10.0
Hunter College	P		7	923	638	285		20.8	19.9
John Jay College	P			75	55	20		1.0	1.0
Queens College	P		7	938	714	224		17.7	16.0
Richmond College	P			86	60	26		2.5	2.5
York College	P								
Cleveland State University (N)	P		5	328	196	132	2	7.9	7.0

INSTITUTIONS	CONT.	TYPE	Enrl.	POPULATION Professors Total	Full Time	Part Time	Program Level	INCOME & EXPEND. (in millions of $) Total Revenues	Educational & General
Colgate University (M), Men only	Pr	LA	3	164	157	7	3	$ 8.0	$ 5.5
University of Colorado (N)	P		7	1250	1155	95	4	76.3	63.4
University of Connecticut (E)	P		6	895	887	8	4	44.1	33.5
Cornell University (M)	Pr		6	2939	2936	3	4	118.6	102.6
Dartmouth College (E), Men only	Pr	LA	4	489	372	117	4	25.8	18.5
University of Dayton (N)	Pr		5	517	364	153	3	19.7	14.4
Drexel Institute of Technology (M)	Pr	IT	5	690	311	379	4	15.4	13.2
Duke University (S)	Pr		5	1025	798	227	4	66.5	58.2
Emory University (S)	Pr		5	1451	669	155	4	25.9	20.1
University of Florida (S)	P		6	1604	1464	140	4	82.5	72.2
Florida State University (S)	P		6	774	742	32	4	39.9	30.6
Georgia Institute of Technology, (S)	P	IT	5	460	404	56	4	18.8	14.4
University of Georgia (S)	P		6	907	901	6	4	52.7	45.8
Grand Valley State College	P	LA	3				2		
University of Hawaii (W)	P		6	988			4	58.6	55.5
Indiana University (N)	P		7	1845			4	121.0	83.4
University of Iowa, (N)	P		6	1193	1112	81	4	82.6	69.0
Iowa State University (N)	P		6	1057	942	115	4	74.2	55.3
Johns Hopkins University (M)	Pr		5	1856	910	925	4	60.6	52.5
University of Kansas (N)	P		6	1472	970	502	4	35.1	27.6
Kent State University (N)	P		7	975	696	279	4	33.9	24.6
Lehigh University (M), Men only	Pr		4	363	324	39	4	16.7	13.2
University of Maine (E)	P		6	543	484	59	4	23.4	17.2
Marquette University (N)	PrC		6	1519	606	913	4	24.4	18.6
University of Maryland (E)	P		7	2039	1684	355	4	99.7	88.1
University of Massachusetts (E)	P		6	999	949	50	4	41.6	39.1
University of Miami (S)	Pr		6	884	782	102	4	36.9	31.1
University of Michigan (N)	P		7	3987	2343	1644	4	202.0	157.0
Michigan State University (N)	P		7	2500	1861	639	4	143.3	106.6
Western Michigan University (N)	P		6	771	698	73	3	34.8	24.8
University of Minnesota (N)	P		7	3254	2111	1143	4	169.3	
University of Missouri (N)	P		6	2503	2150	353	4	108.1	93.0

INSTITUTIONS	CONT.	TYPE	Enrl.	POPULATION Professors Total	Full Time	Part Time	Program Level	INCOME & EXPEND. (in millions of $) Total Revenues	Educational & General
University of Nevada (NW)	P		5	285	252	33	4	$ 17.9	$ 8.3
University of New Hampshire (E)	P		5	484	475	9	4	20.8	17.1
New Mexico State University (N)	P		5	332	262	70	4	24.6	20.8
University of New Mexico (N)	P		6	494			4	33.9	26.9
New York Institute of Technology	Pr	IT	4				2		
New York University (M)	Pr		7	4225	1847	2378	4	144.7	128.1
State University of New York									
Downstate Medical Center (M)	P		2	1810	635	1175	4	14.3	13.3
Maritime College (M)	P	IT	2	68	59	9	2	3.5	2.4
SUNY Albany (M)	P	LA	5	648	596	52	4	19.5	15.1
SUNY Binghamton (M)	P	LA	4	286	275	11	4	10.7	8.6
SUNY Buffalo (M)	P		7	3212	1106	2106	4	63.6	54.6
SUNY Stony Brook (M)	P		4	349	346	3	4	19.1	14.7
Upstate Medical Center (M)	P		2	253	243	10	4	18.4	18.2
University of North Carolina (S)	P		6	3609	1884	1725	4	122.1	93.3
Northeastern University (E)	Pr		7	1287	459	828	4	29.0	23.0
Northwestern University (N)	Pr		6	2159	926	1233	4	61.1	49.8
University of Notre Dame (N), Men only	Pr		5	610	590	20	4	39.4	33.0
Oakland University (N)	P		3	165	148	17	2	8.9	7.0
Ohio State University (N)	P		7	2338	1997	342	4	171.4	154.6
University of Pennsylvania (M)	Pr		6	4223	1636	2587	4	118.0	108.1
Pennsylvania State University (M)	P		7	2288	2082	206	4	115.2	96.6
University of Pittsburgh (M)	Pr		6	1550	1158	392	4	70.6*	57.6*
Polytechnic Institute of Brooklyn (M)	Pr	IT	5	394	286	108	4	12.9	11.7
Princeton University (M) Men only	Pr		4	664	619	45	4	62.5	50.9
Purdue University (N)	P		7	1696	1654	42	4	102.8	77.1
University of Rochester (M)	Pr		5	1678	869	809	4	66.3	63.8
Rose Polytechnic Institute (N), Men only	Pr	IT	2	101	50	51	3	2.3	1.7
Syracuse University (M)	Pr		7	1311	925	386	4	61.8	47.9
Temple University (M)	Pr		7	2396	1324	1072	4	48.6	44.2
Texas A&M University (S)	P		5	766	670	96	4	25.3	18.7
Texas Technological College (S)	P		6	758	668	90	4	25.8	15.6

INSTITUTIONS	CONT.	TYPE	POPULATION Enrl.	Professors Total	Full Time	Part Time	Program Level	INCOME & EXPEND. (in millions of $) Total Revenues	Educational & General
University of Toledo (N)	P		6	631	488	143	4	$ 13.9	$ 11.4
Tufts University (E)	Pr		5	367	301	66	4	24.2	20.9
Tulane University (S)	Pr		5	1426	594	832	4	36.6	30.2
Vanderbilt University (S)	Pr		4	909	587	322	4	41.3	33.6
University of Virginia (S), Men only	P		6	881	715	166	4	51.0	44.5
Virginia Polytechnic Institute (S)	P		5	743	726	17	4	30.6	24.6
Washington University (St. Louis) (N)	Pr		6	2220	854	1366	4	53.5	47.9
University of Washington (NW)	P		7				4	117.4	106.6
Washington State University (NW)	P		6	733	488	207	4	44.7	39.2
Wayne State University (N)	P		7	1624	1178	446	4	61.5	55.5
University of Wisconsin (Madison) (N)	P		7	2119	1966	153	4	186.1	163.2

* Covers eleven-month period

ABBREVIATIONS AND FOOTNOTES FOR TABLE I-20

ABBREVIATIONS

C = Church-Affiliated
Cont. = Control
FA = Fine Arts
IT = Independent Technical School
LA = Liberal Arts
P = Public
Pr = Private

FOOTNOTES

[a] Abbreviations in parentheses following the institution name designate the accrediting agency:
E = New England Association of Colleges and Secondary Schools
M = Middle States Association of Colleges and Secondary Schools
N = North Central Association of Colleges and Secondary Schools
NW = Northwest Association of Secondary and Higher Schools
S = Southern Association of Colleges and Schools
W = Western Association of Schools and Colleges

[b] Enrollment includes all types of students; size designations are
2 = 500-999
3 = 1,000-2,499
4 = 2,500-4,999
5 = 5,000-9,999
6 = 10,000-19,999
7 = over 20,000

[c] Program levels are
2 = Bachelor's and/or 1st Professional
3 = Master's and/or 2nd Professional
4 = Ph.D. or equivalent
5 = Others (footnote)

[d] Total revenues may be interpreted as total expenditures.

Reference Sources No. 2 and 7 were used in collecting the data in Table I-20 Information is for the academic year 1967-68 with a few exceptions which go back one year more.

REFERENCE LIST FOR CHAPTER I

1969

1. Mertins, Paul F. *Financial Statistics of Institutions of Higher Education; Current Funds, Revenues and Expenditures, 1965-66.* Washington, D.C., 1969 (Due for publication in first quarter of 1969). (OE-52010)

1968

2. *American Universities and Colleges*, edited by Otis A. Singletary, 10th Edition, Washington, D.C., American Council on Education, 1968. 1782 p.

3. Barzun, Jacques. *The American University: How it Runs, Where it is Going.* New York, Harper-Row, 1968.

4. Chandler, Marjorie O. and Mabel C. Rice. *Earned Degrees Conferred; 1965-1966.* Washington, D.C., Government Printing Office, 1968. 289 p. (OE-54013-66)

5. Simon, Kenneth A. and Marie G. Fullam. *Projections of Educational Statistics to 1976-77.* Washington, D.C., Government Printing Office, 1968. 122 p. (OE-10030-67)

1967

6. Chandler, Marjorie O. and Mabel C. Rice. *Opening Fall Enrollment in Higher Education, 1967.* Washington, D.C., Government Printing Office, 1967, 136 p. (OE-54003-67)

7. *Education Directory, 1966-1967; Part 3 -- Higher Education,* U.S. Office of Education. Washington, D.C., Government Printing Office, 1967. 252 p.

8. Moore, Raymond S. *A Guide to Higher Education Consortiums: 1965-66.* Washington, D.C., Government Printing Office, 1967. 175 p. (OE-50051)

9. Simon, Kenneth A. and W. Vance Grant. *Digest of Educational Statistics; 1967 Edition.* Washington, D.C., Government Printing Office, 1967. 132 p. (OE-10024-67)

10. U.S. Office of Education. *Directory of U.S. Institutions of Higher Education, Fall 1967*, Washington, D.C., Government Printing Office, 1967. 357 p. (OE-50052)

1966

11. Cartter, Allan M. *An Assessment of Quality in Graduate Education*. Washington, D.C., American Council on Education, 1966. 131 p.

12. National Education Assoc., Research Division. *Salaries in Higher Education, 1965-66*. Washington, D.C., N.E.A., 1966. (Its Research Report 1966-R2)

CHAPTER II

ACADEMIC LIBRARY PROFILE

Relating an academic library to the many facets of an academic community is a most difficult endeavor. The need is obvious and has been done in very different manners for different purposes. For example, the largest professional accrediting agency has established minimum standards of performance for college and university libraries.[1] Because of the weight of the organization, these standards are extensively quoted and used. They suffer from a variety of deficiencies, the major of which are the following.

1. Measurement is based on assumed correlations that have not been rigidly tested; a few have been tested and as rules of thumb serve in lieu of more-rigid specifications.
2. The exceedingly difficult measurements of direct value of information or a printed source to a patron makes the relative importance of each action conditional, fraught with exceptions and doubts. This problem is most obvious in public-service interactions with patrons.
3. The statisical bases used for measurements are matched against individual library figures, which suffer from lack of clarity and completeness.

The degree of variability in value to users is so great that

tendencies to stay away from individual, selective, or qualitative measurements have caused the library world to be criticized for its statistical preoccupation. An English-literature scholar may rate a university library higher if it offers a lookup telephone service on the availability of a specific book, than an agricultural economist who feels that the library ought to be providing him with photocopied contents pages from the current journals in his subject field. These simple examples can be extended into the multitude of public services offered in academic institutions; the weighting is such a difficult procedure and the results so questionable that strict evaluations are rarely attempted. Although we will discuss some of these questions, they will constitute a minor consideration in the profile of an academic library.

The major alternative is the production and use of statistics without representation of the inherent value of the information. The methods by which these basic data have been used to attempt more-realistic evaluations are numerous and inventive; they may not, however, tell us much more than the basic statistical data. In nearly all cases, measurement is structured on a weighted system using routine and often misused library statistics. These usually include volumes in a library, per-student operating expenditure of the library, number of periodical subscriptions

taken, volumes acquired in one year, size of professional and nonprofessional staffs, ratio of library expenditure to the total institutional budget, volumes held per undergraduate, and similar features. These quantitative factors tend to be the ones most often quoted in a quality assessment of an academic library where, in actual fact, it is the policy and service viewpoint of the library that is more of a help or a hindrance in good service and utilization.

An example of a recent attempt to counter some of the usual problems of statistics was accomplished in the Cartter report (Ref. 2, pp. 114-115). A "library-resources index" was established based on volumes held, volumes added per year, and current periodicals titles received. The index (or center registration) was the average number of items per category for all universities in the survey and was set at 1.00; the three separate indices were then averaged. This method was devised to establish a relationship between library resources and the graduate ratings that were the purpose of the survey. The study concluded that "all the universities with over-all faculty quality ratings of . . . 'Strong' and 'Distinguished' scored above 1.4 on the library resources index" (Ref. 2, p. 114). This should be read as a strong positive correlation with about 30 of the 106 libraries in the 1.4 category.

A more thorough study of the correlation of private-college quality education with basic library-operating statistics was accomplished by Jordan.[3] He found a "high" correlation between academic excellence and volumes in the library, number of volumes per undergraduate and per student *salary* expenditure by the library; a "moderate" correlation with the age of the school, library expenditure per student, and number of periodical subscriptions; a "low" correlation with volumes acquired each year and library expenditure as a ratio of total institutional expenditure.

Another major study[4] aimed at predicting the future of 58 research or university libraries based its entire estimates on the same basic statistical data. Factors beyond the scope of the statistical data were relegated outside the sphere of influence. This approach to studies of libraries is common, and, judging from the positive correlations found by Jordan and others, there are valid reasons for so considering them. Even accepting this premise, sweeping generalities from a statistical basis are dangerous. It is very difficult, by example, to show the interlibrary relationships that influence book acquisition and holding policies. Intercampus agreements within the structure of the same administrative institution call for a sharing of volumes that cannot be readily identified in

most statistical evaluations. Regional storage facilities for lesser-used materials and the discarding of jointly held and unneeded materials is not readily accounted in these operational and cumulative holding counts. Yet, they are all very influential on what is available to the library and the services that it offers.

This statistical approach, even with its lack of accurate representation of the entire picture, is central to most academic library discussions. The qualitative and service aspects will be touched on only briefly. Our main concern will be to provide the reader with the size of the problem and a statistical profile of an academic library. Where there are overriding features that are influential and nonevident, a narrative warning will be given. The first is of a general nature and concerned with the fallacies of academic-library statistics. Two recent papers[5,6] have summarized the running battle among accuracy, expediency, and vanity, with the resultant difficulties. Within the past two years, there has been a reexamination of data gathering, definitions, and scope of coverage of the U.S. Office of Education and other agency figures; a more rational, meaningful, and useful program has evolved. These changes which are just appearing do not hinder the library administrator who wishes to make his institution appear more resourceful than it is.

Two examples point up the continuing problems. One is the persistent question of libraries spending the time and effort to provide accurate figures on the books that have been lost and, once having arrived at those figures, having the courage to show them as net losses. A volume-by-volume inventory seems the only acceptable method of determining with any accuracy what is lost. This is hardly ever done in universities and only those titles or volumes that are reported missing over an extended period of time are counted as lost and removed from the cumulative records. This is, by general consensus, but a small percentage of the lost volumes; some recent estimates of lost materials carried on count figures run between 10%-25%. Another example is the difficulty associated with accurate counts of government documents, whether state, federal, or local. Libraries give them a variety of processing treatments while adding them to their collections and they are presented in a greater variety of statistical manners, sometimes involving unintended duplicate counting. As a result, an academic library showing a separate government-document collection of 35,000 pieces of material is offering an easier and more useful interpretation of its resources than a library that merges those same pieces into its general collection, counting single sheets or small pamphlets as documents or volumes. These discrepancies of the past have not often been corrected in the currently cited accretions.

NATIONAL STATISTICS AND TRENDS

The U.S. Office of Education is the collector and publisher of the most-complete and multifaceted statistics and their analysis. The data suffer from lack of timeliness, however; the latest thorough analysis is of the academic year 1963-64, published in 1968 (Ref. 7). (See Table II-1.) The trends can be checked against less-extensive later data, such as the annual figures of the members of the Association of Research Libraries. Any variations noted in other sources will be mentioned if they are significant.

Population figures and the wealth of states show a close relationship to academic-library activities. There is also, of course, the influence, understanding, and respect that education enjoys in some regions or states and not in others. As reported by Samore (Ref. 7, p. 9) in the 1963-64 year, the academic libraries of the states of New York, California, Massachusetts, and Illinois account for 30% of all library volumes held by U.S. institutions of higher education. The same states constitute 27% of the U.S. population. These four states along with Michigan, Pennsylvania, and Texas each added over 500,000 volumes to their academic libraries during 1963-64. In the same years, California, New York, Illinois, Pennnsylvania, Massachusetts, and Texas each had total academic library expenditures over $10 million, with California topping the list with $31.7 million. These states have followed the national academic library budget increase during 1959-66 of

Table II-1. State totals of volumes, personnel, and operating expenditures of higher education: aggregate U.S. 1963-64. (Ref. 7, Table F, p.8.) *Note:* Errors do get into some of these tabulations and the reader must be cautious. E.g., the number of full-time professionals in higher educational institutions in D.C. is really the number of professionals in *all* D.C. libraries.

State or other area	Total number of students (including terminal occupational)	Number of volumes at end of year	Number of volumes added during year	Number of volumes withdrawn during year	Number of physical units of microform at end of year	Number of periodicals being received at end of year	Number of hours of student assistance	Number of hours of other hourly assistance	Personnel in full-time equivalents		Operating expenditures in dollars					
									Professional	Nonprofessional	Total	Salaries	Wages	Books and other library materials	Binding	Other (excluding capital outlay)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Alabama	51,437	2,469,194	130,891	10,903	7,402	17,461	256,875	4,710	140.8	135.3	2,305,630	1,227,391	158,733	711,031	96,346	112,129
Alaska	4,001	135,401	17,489	175	31,417	2,238	18,260	1,141	10.0	11.1	340,938	145,064	34,471	124,020	10,846	26,537
Arizona	50,460	1,481,568	92,594	10,958	183,982	11,393	98,729	16,694	74.5	99.0	1,929,128	803,527	150,874	855,012	55,409	64,306
Arkansas	33,214	1,291,616	67,119	3,750	144,866	10,193	150,217	650	74.2	45.1	1,147,479	585,451	84,705	391,725	38,676	46,922
California	690,727	18,405,745	1,483,042	104,509	1,579,253	216,838	1,735,602	132,112	1,306.2	1,535.1	31,772,482	16,459,347	2,831,162	9,862,118	1,055,585	1,564,267
Colorado	57,813	2,706,544	174,762	27,677	93,098	27,134	206,933	24,646	140.4	172.4	3,178,245	1,605,188	267,127	1,012,318	110,002	183,610
Connecticut	65,410	7,418,523	322,813	147,427	320,204	22,698	107,342	10,377	237.8	331.0	5,140,205	2,656,342	128,810	2,185,176	76,992	92,885
Delaware	10,841	414,193	24,124	1,472	56,772	3,888	23,244		21.7	41.5	497,677	237,845	22,756	195,093	23,427	18,556
District of Columbia	53,946	2,666,425	138,928	4,088	30,554	18,455	221,725	8,488	1,180.7	122.4	2,566,415	1,317,354	257,497	765,221	88,201	138,142
Florida	107,619	3,707,644	265,625	30,004	262,946	35,621	333,675	23,930	265.1	334.3	5,106,679	2,766,340	314,890	1,597,723	163,390	264,336
Georgia	62,344	3,510,000	216,363	18,573	363,265	25,626	252,805	10,867	219.0	199.5	3,752,667	1,965,569	209,269	1,249,562	150,408	177,859
Hawaii	14,493	510,119	38,147	1,974	167,629	3,854	76,033		42.0	39.3	843,285	413,348	91,518	265,869	22,641	49,909
Idaho	17,454	577,688	41,857	3,735	56,566	6,055	67,999	10,688	40.9	37.3	788,294	363,359	73,516	248,302	20,445	82,672
Illinois	263,516	15,968,662	781,494	74,770	868,249	130,634	1,060,293	29,103	694.0	718.7	15,436,247	8,232,924	1,161,820	4,754,790	381,857	904,856
Indiana	118,879	5,912,198	332,235	16,594	343,563	52,457	486,610	31,723	334.9	404.4	6,462,542	3,280,930	570,523	2,014,876	238,700	357,513
Iowa	69,755	3,829,109	203,409	25,532	83,395	26,529	265,546	28,041	173.9	194.7	3,761,418	1,873,715	321,728	1,216,806	165,174	183,995
Kansas	64,417	3,778,406	238,370	16,356	269,957	35,188	352,860	35,445	177.4	148.4	3,370,027	1,514,770	327,628	1,279,683	83,610	164,336
Kentucky	57,853	3,090,040	187,037	25,907	229,50[illegible]	23,952	313,190	13,632	185.5	143.4	3,017,967	1,498,959	229,140	1,015,976	110,638	163,254
Louisiana	69,800	3,646,487	226,143	9,393	396,297	36,372	389,808	19,625	216.6	211.1	4,221,160	2,175,526	312,068	1,390,736	159,105	183,725
Maine	17,317	1,309,062	71,881	9,683	12,550	7,090	66,540	23,205	51.8	47.7	951,872	471,393	87,180	306,597	29,117	57,585
Maryland	75,505	3,795,347	284,865	9,775	28,305	26,955	186,274	19,982	208.8	219.4	4,026,750	2,135,269	201,799	1,392,892	130,272	166,518
Massachusetts	171,172	15,049,149	670,720	100,012	413,517	76,053	547,788	178,110	557.5	765.2	13,265,531	6,910,736	920,310	3,793,091	431,006	1,210,386
Michigan	209,605	8,363,361	528,054	43,106	366,622	56,728	780,502	53,368	458.9	466.2	9,448,429	5,096,184	918,472	2,725,210	262,069	446,494
Minnesota	96,866	4,766,171	242,293	35,803	70,[illegible]45	29,278	345,564	12,514	221.9	178.1	4,296,039	2,178,518	403,745	1,388,134	128,089	197,553
Mississippi	42,327	1,669,449	98,254	4,711	16,[illegible]18	14,481	184,975	8,504	108.0	80.1	1,577,068	796,724	131,547	520,374	79,090	49,333
Missouri	103,015	5,070,683	277,910	28,04[illegible]	327,759	44,765	3[illegible]721	33,108	258.2	291.1	5,227,386	2,530,845	349,007	1,806,992	189,670	348,872
Montana	16,801	722,102	52,221	3,806	70,810	8,053	52,038	5,848	43.5	39.7	742,756	372,425	63,507	250,329	23,689	32,806
Nebraska	41,035	1,857,804	86,593	7,775	23,[illegible]24	16,985	165,556	2,634	95.0	87.4	1,709,917	875,955	145,196	563,647	51,229	73,890
Nevada	5,599	258,912	34,834	295	277,737	2,606	39,311		23.0	31.0	612,767	312,936	48,166	207,063	28,626	15,956
New Hampshire	16,452	1,496,793	75,906	10,423	2,[illegible]36	7,749	57,504	13,372	65.6	100.0	1,387,434	723,575	77,533	446,824	43,606	95,876
New Jersey	110,270	5,090,855	267,130	21,342	310,[illegible]	37,540	229,885	32,270	271.4	332.1	5,326,462	3,003,955	307,547	1,598,648	162,717	253,615
New Mexico	23,081	947,321	73,355	3,053	208,822	20,811	82,396	702	52.4	48.8	1,143,391	532,375	73,811	423,772	56,989	56,444
New York	490,589	22,012,842	1,384,313	157,741	1,466,803	158,078	1,234,529	253,653	1,337.8	1,522.9	26,916,836	14,309,740	2,025,336	8,420,949	686,192	1,474,619
North Carolina	93,045	6,064,668	351,667	18,192	534,916	45,980	485,848	39,221	305.9	343.2	6,710,187	3,094,772	442,826	2,631,985	238,161	302,443
North Dakota	17,618	793,129	45,333	6,901	78,527	6,527	74,530	6,384	38.0	20.1	646,672	312,868	70,976	211,423	23,283	28,122
Ohio	219,250	10,298,778	492,965	31,903	625,851	83,987	684,535	105,889	415.3	489.5	8,914,926	4,551,501	810,304	2,745,267	268,952	538,902
Oklahoma	71,684	3,100,999	196,466	19,524	251,352	22,907	303,646	3,600	139.4	117.9	2,513,574	1,220,994	225,495	845,996	93,016	128,073
Oregon	47,479	2,590,694	197,590	16,035	147,731	22,023	227,508	3,444	153.9	184.1	3,098,871	1,703,199	230,731	936,307	98,194	130,440
Pennsylvania	245,266	12,650,522	745,699	53,783	720,746	84,813	767,742	138,040	693.5	750.8	13,398,997	6,754,591	931,750	4,565,589	490,133	656,934
Rhode Island	25,040	1,562,239	76,768	2,451	114,922	12,456	74,630	7,296	74.1	101.6	1,435,534	760,717	86,334	465,125	48,610	74,748
South Carolina	37,363	2,065,902	121,294	8,886	390,555	14,715	135,916	9,522	93.5	95.2	1,860,518	812,016	110,790	727,807	72,917	136,988
South Dakota	17,244	818,919	43,282	6,510	28,951	7,997	82,430	16,677	41.0	23.3	705,487	328,049	82,548	235,003	27,845	32,042
Tennessee	77,317	3,935,758	230,715	10,662	321,330	28,135	404,533	6,616	199.9	202.0	3,902,859	1,807,706	297,262	1,460,277	136,626	200,988
Texas	237,183	10,386,753	694,179	34,750	423,351	80,641	1,013,820	56,210	492.9	586.7	10,948,385	4,804,367	855,656	4,353,907	373,036	561,419
Utah	47,023	1,905,587	195,138	7,264	268,343	17,262	237,863		84.7	114.8	1,960,498	860,308	243,445	670,441	63,537	122,767
Vermont	15,306	775,528	40,291	8,779	21,386	6,344	44,120	11,330	54.0	50.3	817,945	445,750	55,609	257,740	23,607	35,239
Virginia	79,282	4,378,005	243,582	14,121	358,939	29,159	245,900	29,388	184.9	235.9	3,727,626	1,988,038	244,862	1,206,110	129,909	158,707
Washington	87,884	3,532,908	192,359	15,053	625,147	40,478	336,810	47,718	220.3	301.6	4,784,731	2,616,792	423,638	1,280,064	162,741	281,496
West Virginia	36,134	1,397,826	102,255	8,791	32,656	10,883	135,924	1,600	66.6	90.0	1,472,081	722,189	102,925	507,880	60,236	78,851
Wisconsin	99,533	4,162,176	288,009	22,440	358,189	32,393	299,819	8,261	229.8	231.3	4,488,874	2,269,315	313,940	1,570,764	108,670	226,185
Wyoming	8,542	381,448	21,226	2,084	44,071	2,553	12,305	21,997	17.2	27.0	400,535	175,549	38,777	157,906	13,108	15,195
U.S. Service Schools	14,609	1,040,407	74,795	5,157	367,223	6,758			65.0	78.0	1,326,933	867,115		351,584	44,178	64,056
Canal Zone	924	5,900	3,900			95	600		1.0		25,227	7,700	1,377	15,700	450	
Guam	1,008	17,000	5,000	250		330	780		4.0	5.0	56,872	26,780	1,092	18,000	10,000	1,000
Puerto Rico	32,614	1,284,457	86,941	5,297	136,033	8,495	118,742	20,486	56.7	115.0	1,171,456	690,725	91,809	310,847	30,414	47,661
Virgin Islands	64	5,020	5,020			101	2,592		1.0	1.0	40,515	13,560	1,555	25,100		
Totals	4,795,495	227,067,836	13,615,341	1,268,304	14,918,707	1,761,190	16,440,932	1,572,821	11,862.0	13,298.0	246,680,446	126,206,480	18,965,112	80,533,401	7,891,441	13,082,012

slightly under 20% a year.

The Higher Education Act of 1965 has provided the greatest budget boost for higher education libraries in the past few years. Title IIA of the Act is limited to purchase of library materials (such as books, periodicals, recordings); $24.5 million was granted in fiscal year 1967 (Ref. 8, p. 48). This Federal influence is undoubtedly responsible for the marked trend noted by Samore (Ref. 9, pp. 40-42): "The steady decrease in the per cent of total operating expenditures which are spent for salaries and wages, and the steady increase in the per cent of total operating expenditures which are spent for library materials. In 1959-60 almost 30% of total national library expenditures were spent for library materials; in 1965-66, over 34%."

Of more pertinence than state totals are the national totals shown in Table II-2. Two additional observations and comments are appropriate.

1. The increase in the number of libraries follows closely the academic institutional growth documented in Chapter I. Samore states that the growth is "at an average rate of 100 per year" and assumes a library for each (Ref. 7, p. 4). The greater number of new academic libraries are currently those of the junior colleges.
2. The volumes added since 1959 showed a 10%-15% increase

Table II-2. Summary of college and university library statistics for academic years 1959-65: Aggregate United States.* (Ref. 10, Table B, pp. 6-9.)

ITEM	1959-60	1960-61	1961-62	1962-63	1963-64	1964-65	1966**
1. Number of libraries.....	1,951	1,975	1,985	2,075	2,140	2,168	2,207
2. Number of students served (enrollment).....	3,402,000	3,610,000	3,900,000	4,345,000	4,800,000	5,300,000	5,900,000
COLLECTIONS							
3. Number of volumes at end of year.....	176,721,000	189,110,000	201,423,000	215,000,000	227,000,000	241,000,000	265,000,000 (includes microtext)
4. Number of volumes per student.....	51.9	52.4	51.6	49.4	47.3	45.5	45.8
5. Number of volumes added during year.....	8,415,000	9,396,000	10,900,000	12,300,000	13,600,000	14,000,000	18,000,000
6. Number of volumes added per student.....	2.5	2.6	2.8	2.8	2.8	2.6	3.0
7. Number of periodicals received.....	1,271,000	1,399,000	1,505,000	1,600,000	1,760,000	1,800,000	2,700,000***
8. Number of periodicals per student.....	0.4	0.4	0.4	0.4	0.4	0.3	0.4
PERSONNEL							
9. Total (in full-time equivalents).....	18,000	19,500	21,100	23,300	25,200	27,000	29,000
10. Professional personnel.....	9,000	9,700	10,300	11,200	11,900	12,500	13,000
11. Professional staff as percentage of total staff..	0.50	0.50	0.49	0.48	0.47	0.46	0.45
12. Ratio of professional staff to students.....	1:378	1:372	1:378	1:388	1:401	1:402	1:454
13. Nonprofessional staff.....	9,000	9,800	10,800	12,100	13,300	14,500	16,000
14. Number of hours of student assistance.....	12,062,000	13,204,000	14,161,000	14,519,000	16,400,000	18,000,000	19,000,000

ITEM	1959-60	1960-61	1961-62	1962-63	1963-64	1964-65	1966**
OPERATING EXPENDITURES							
15. Total (excludes capital outlay).....	$137,245,000	$158,904,000	$183,700,000	$213,000,000	$246,000,000	$275,000,000	$320,000,000
16. Expenditures per student...	$40.34	$44.02	$47.13	$50.95	$51.25	$51.89	$54.23
17. Expenditures as percentage of total education and general expenditures.....	3.0	3.1	3.1	3.2	3.3	3.3	3.3
18. Salaries (personnel not on hourly rate).....	$72,495,000	$83,782,000	$95,900,000	$113,000,000	$126,000,000	$138,000,000	$155,000,000
19. Salaries as percentage of operating expenditures.....	52.8	52.7	52.2	53.1	51.2	50.2	49.0
20. Wages (at hourly rates of pay).....	$11,680,000	$13,889,000	$15,500,000	$17,000,000	$19,000,000	$21,000,000	$23,500,000
21. Wages as percentage of operating expenditures.....	8.5	8.7	8.5	8.0	7.7	7.6	7.3
22. Books and other library materials expenditures.....	$40,760,000	$48,301,000	$56,400,000	$65,000,000	$79,000,000	$91,000,000	$111,000,000
23. Such expenditures percentage of operating expenditures..	29.7	30.4	30.7	30.5	32.1	33.1	34.2
24. Binding expenditures.....	$4,852,000	$5,000,000	$6,200,000	$7,000,000	$9,000,000	$11,000,000	
25. Such expenditures percentage of operating expenditures..	3.6	3.2	3.4	3.3	3.7	4.0	3.5
26. Other operating expenditures.....	$7,458,000	$7,932,000	$9,700,000	$11,000,000	$13,000,000	$14,000,000	$19,000,000
27. Such expenditures percentage of operating expenditures..	5.4	5.0	5.3	4.2	5.3	5.1	6.0

* Source: U.S. Office of Education, Library Statistics of Colleges and Universities, 1959/60-1964/65. Institutional Data. Compiled by Theodore Samore.

** Estimated.

*** For 1965-66, the figures are for serials which includes, periodicals, annuals, proceedings, transactions, etc.

each year until 1965-66, when it jumped to 20%, where it seems to be holding. Yet this incredible acquisitiveness has not upheld the number of volumes per student. It probably is safe to assume that the drop in percentage of growth of student enrollment currently evident may bring the volumes per student back up to 50. Other aspects of book or literature growth, personnel, and expenditures will be discussed following an examination of statistics for select types of academic libraries.

COLLEGE, UNIVERSITY, AND RESEARCH LIBRARY PROFILES

The statistical data to help us comprehend the scope of work, size, and operating levels of various types of academic libraries are not as up to date as the previous figures. Supplementary data from less complete but more recent sources will be used.

In the context of a digital-storage feasibility study and EDUCOM's member institutions, it does not seem necessary to concern ourselves with all types of college, professional, and university institutions. Final experiment or design work might settle on one size or one type of institution and a limited format or subject field of literature. All ranges of institutions do not seem appropriate for our consideration, since the complexity of problems and the interest of the membership is centered in the larger and more complex institutional libraries.

Therefore, the data are concerned primarily with two types of institutional libraries: (1) those of liberal-arts colleges with fewer than 10,000 students and (2) those of universities (or research libraries) with over 10,000 students. These types match the U.S. Office of Education data and the university membership of EDUCOM.

Distinctions are often made between research libraries and those primarily instructionally engaged. Thus, the smaller university libraries with few research programs would be predominantly teaching-oriented while the larger universities with extensive research activities and a research-inclined faculty would be apt to have a research-library collection. Within this academic framework and the following three Tables, that distinction is *not* made.

"Library expenditure index" (last line of Tables II-3 through II-6) is the library-operating expenditures as a percentage of the total institutional educational and general expenditures. Table II-6 with a student population between five and ten thousand is presented as a contrast to comparable institutions with a student enrollment over 10,000 in Table II-5.

Two more sources of statistical data must be presented before we look at some of the aspects of the data, comment on them, and point up noticeable and significant trends.

Table II-3. Averages and measures of variability for volumes, personnel, and operating expenditures of public and private liberal arts college libraries: Aggregate United States, 1963-64. (Ref. 7, Table 4A, p 22.)

	Number of institutions reporting	10 percentile	Median	Mean	90 percentile
	(2)	(3)	(4)	(5)	(6)
Volumes at end of year	792	24,625	54,104	79,243	151,727
Volumes added	792	1,550	3,621	4,883	9,927
Volumes withdrawn	660	36	224	476	1,213
Number of all physical units of microtext	576	29	672	4,521	8,165
Number of microfilm at end of year	565	20	497	998	2,407
Number of other forms of microtext	292	20	878	6,986	16,097
Periodicals currently received	791	197	410	540	992
Total number of interlibrary loan transactions	730	9	64	195	407
Number of items loaned	593	2	20	100	177
Number of items borrowed	718	6	43	115	263
Total personnel (FTE)	791	2.0	5.0	8.2	16.0
Professional (FTE)	790	1.0	3.0	4.2	7.8
Nonprofessional (FTE)	695	1.0	3.0	4.5	9.0
Total operating expenditures	792	$19,450	$50,396	$79,382	$148,950
Total salaries and wages	791	$11,626	$28,717	$47,483	$88,019
Salaries (including salary equivalence of CS personnel)	789	$9,800	$24,500	$40,612	$77,249
Wages of student service	757	$1,200	$4,000	$6,081	$11,677
Wages of other hourly assistance	219	$411	$1,698	$4,375	$8,276
Total other operating expenditures	790	$7,227	$20,774	$31,983	$62,343
Library materials	790	$5,955	$17,026	$25,629	$50,605
Binding	758	$360	$1,487	$2,500	$5,178
Other expenditures	758	$584	$2,296	$4,121	$9,708
Expenditure per FTE student	789	$32	$57	$68	$104
Expenditure per FTE faculty member	782	$539	$855	$930	$1,347
Library expenditure index	737	3.4	5.1	5.5	8.0

Table II-4 Averages and measures of variability for volumes, personnel, and operating expenditures of public and private university libraries: Aggregate United States, 1963-64. (Ref. 7, Table 3A, p. 20.)

Item	Number of institutions reporting	10 percentile	Median	Mean	90 percentile
(1)	(2)	(3)	(4)	(5)	(6)
Volumes at end of year	170	152,800	449,562	742,906	1,643,167
Volumes added	170	8,361	28,510	39,549	75,943
Volumes withdrawn	156	186	1,420	4,091	6,503
Number of all physical units of microtext	143	2,088	43,937	77,320	208,772
Number of microfilm at end of year	139	716	4,235	7,715	21,744
Number of other forms of microtext	121	948	55,383	82,515	200,504
Periodicals currently received	170	1,290	3,689	6,035	14,000
Total number of interlibrary loan transactions	168	311	2,081	3,571	8,813
Number of items loaned	168	81	917	2,272	6,303
Number of items borrowed	168	179	959	1,299	2,948
Total personnel (FTE)	170	14.0	53.0	80.3	173.5
Professional (FTE)	170	8.0	21.0	33.4	65.0
Nonprofessional (FTE)	170	6.1	33.1	46.9	104.0
Total operating expenditures	170	$161,488	$542,621	$790,275	$1,472,613
Total salaries and wages	170	$93,167	$302,030	$456,064	$852,122
Salaries (including salary equivalence of CS personnel)	170	$76,630	$262,625	$397,450	$759,472
Wages of student service	166	$7,802	$33,652	$53,682	$104,427
Wages of other hourly assistance	166	$770	$6,300	$15,956	$35,801
Total other operating expenditures	170	$70,934	$224,913	$334,211	$679,610
Library materials	170	$56,836	$176,318	$260,454	$501,312
Binding	166	$5,565	$20,229	$29,082	$54,419
Other expenditures	169	$6,540	$27,758	$45,627	$101,754
Expenditure per FTE student	167	$35	$61	$80	$143
Expenditure per FTE faculty member	164	$402	$728	$790	$1,249
Library expenditure index	149	2.1	3.6	3.7	5.5

Table II-5. Averages and measures of variability for volumes, personnel, and operating expenditures of libraries in 4-year public and private institutions enrolling 10,000 or more students: Aggregate United States, 1963-64. (Ref. 7, Table 15A, p. 37.) *Note:* "4-year institutions" includes universities in this Table.

Item	Number of institutions reporting	10 percentile	Median	Mean	90 percentile
(1)	(2)	(3)	(4)	(5)	(6)
Volumes at end of year	103	172,180	633,393	896,672	1,816,040
Volumes added	103	15,135	37,420	48,503	90,578
Volumes withdrawn	97	336	1,587	4,034	8,374
Number of all physical units of microtext	85	3,085	64,894	95,801	226,282
Number of microfilm at end of year	81	1,726	5,723	9,865	24,585
Number of other forms of microtext	74	2,275	69,649	99,244	213,103
Periodicals currently received	103	1,500	4,618	7,455	16,784
Total number of interlibrary loan transactions	102	315	2,510	4,285	9,700
Number of items loaned	102	54	1,237	2,809	7,017
Number of items borrowed	102	218	1,200	1,476	3,193
Total personnel (FTE)	103	27.0	79.0	103.0	213.6
Professional (FTE)	103	14.0	35.5	44.2	92.5
Nonprofessional (FTE)	103	12.0	42.5	58.7	127.5
Total operating expenditures	103	$319,722	$751,680	$1,039,252	$1,983,266
Total salaries and wages	103	$176,000	$466,493	$612,677	$1,136,118
Salaries (including salary equivalence of CS personnel)	103	$143,014	$383,651	$529,198	$1,017,618
Wages of student service	103	$18,543	$55,375	$73,580	$151,117
Wages of other hourly assistance	36	$882	$9,100	$28,318	$83,669
Total other operating expenditures	103	$137,131	$312,869	$426,575	$783,586
Library materials	103	$112,827	$255,877	$330,565	$592,662
Binding	100	$8,440	$26,000	$36,756	$67,515
Other expenditures	102	$11,000	$37,364	$60,915	$125,701
Expenditure per FTE student	101	$34	$57	$64	$104
Expenditure per FTE faculty member	101	$442	$754	$806	$1,284
Library expenditure index	91	2.4	3.6	3.8	5.7

Table II-6. Averages and measures of variability for volumes, personnel, and operating expenditures of libraries in 4-year public and private institutions enrolling 5,000-9,999 students: Aggregate United States, 1963-64. (Ref. 7, Table 14A, P. 36.)

Item	Number of institutions reporting	10 percentile	Median	Mean	90 percentile
(1)	(2)	(3)	(4)	(5)	(6)
Volumes at end of year	44	60,641	201,954	530,288	987,052
Volumes added	44	5,101	15,888	27,151	67,407
Volumes withdrawn	35	144	1,025	6,095	4,193
Number of all physical units of microtext	33	1,398	9,840	31,701	78,737
Number of microfilm at end of year	32	645	2,870	4,877	8,668
Number of other forms of microtext	25	948	21,693	35,602	78,691
Periodicals currently received	44	600	1,999	3,272	7,109
Total number of interlibrary loan transactions	44	64	663	2,113	6,914
Number of items loaned	44	10	306	1,398	5,089
Number of items borrowed	44	30	344	714	2,093
Total personnel (FTE)	44	9.0	36.0	52.0	115.5
Professional (FTE)	44	4.0	13.5	21.1	43.0
Nonprofessional (FTE)	44	4.0	20.9	30.9	69.0
Total operating expenditures	44	$79,719	$283,312	$455,859	$834,511
Total salaries and wages	44	$52,019	$176,010	$272,277	$589,506
Salaries (including salary equivalence of CS personnel)	44	$44,956	$156,997	$241,699	$552,168
Wages of student service	43	$4,450	$19,637	$28,946	$53,162
Wages of other hourly assistance	13	------	$3,382	$7,746	------
Total other operating expenditures	44	$29,841	$120,917	$183,582	$342,608
Library materials	44	$29,841	$97,654	$146,228	$257,022
Binding	42	$2,004	$9,563	$14,873	$30,340
Other expenditures	42	$2,365	$15,711	$24,259	$47,484
Expenditure per FTE student	43	$19	$48	$72	$128
Expenditure per FTE faculty member	41	$361	$744	$749	$1,258
Library expenditure index	39	2.1	4.1	4.0	6.0

The prestigious association in the academic library world is the Association of Research Libraries, which is 90% university libraries plus a scattering of nonacademic, including such behemoths as the New York Public Library, the Library of Congress, and the John Crerar Library in Chicago. Dedication to research collections is the tie that binds this select group. The Association of Research Libraries annually issues *Academic Library Statistics*[11] covering the collection, personnel, and expenditures of its membership. The 1967-68 tabulation includes 72 large academic libraries ranging from the 7.9 million volumes of Harvard to Georgetown University's specialized and smallest collection of 560,000. Appendix D lists the institutions in the 1967-68 statistics. Table II-7 provides the medians for this large collection group for the past five years. A major change in counting in 1967-68 removed microforms from the volume count and separately accounted for them. This resulted in volume drops in some cases.

In March 1966, an updated printing of the Dunn, Seibert, and Scheuneman[4] statistical study of the past and projected growth of 58 of the members of the Association of Research Libraries was issued. The authors grouped the 58 into four size groups, by a median composite, and first and third quartile libraries. The same factors shown in Table II-7 were used although regrouped and extended in some cases. Additional data factors

TABLE II-7. Association of Research Libraries' *Academic Library Statistics:* Medians for 1963/64 - 1967/68, (Ref. 11. Extracted from 3 annual cumulations.)

		MEDIAN				
		1967-68[a]	1966-67	1965-66	1964-65	1963-64
COLLECTIONS	Volumes in Library	1,202,337	1,235,969	1,201,615	1,138,812	1,069,157
	Volumes Added (Gross)	90,617	79,936	71,316	65,490	59,150
	Volumes Added (Net)	82,895	78,116	66,948	61,593	52,429
	Physical Units of Microforms in Library	290,944	—	—	—	—
PERSONNEL	Prof. Staff FTE	66	63	60	55.5	51
	Non-Prof. Staff FTE	102	100.75	93.25	82	70
	Total Staff FTE[b]	169	160.25	155.5	135.63	116.6
	Student Assistants	FTE: 48	—	hours: 78,559	73,190	67,526
	Lowest Beginning Prof. Salaries Paid	6,800	6,360	6,000	5,700	5,500
EXPENDITURES	Books, Periodicals, etc.	722,941	626,345	537,525	447,912	380,347
	Binding	73,865	63,862	46,483	41,942	37,488
	Total Books and Binding	806,947	691,521	609,132	523,793	444,447
	Total Salaries and Wages[c]	1,105,834	1,040,428	901,375	808,461	695,568
	Other Operating Expenditures	136,490	121,410	87,308	73,063	67,128
	Total Library Operating Expenditures	2,040,689	1,889,659	1,569,456	1,422,495	1,220,764

[a]Prior to 1967-68, microforms were sometimes reported in volume counts.

[b]Excluding Student Assistants. [c]Including Student Assistants.

TABLE II-8. Median Composite Library Based on 58 ARL Libraries, 1950-51 through 1963-64 (Ref. 4, Table 2, p. 13.)

	VH	VA	BX	SX	LPSP	WX	PSS	NPSS	TX	TENR	GENR
1964	1091396	60385	452887	717900	5500	—	51.6	72.6	1214947	—	—
1963	1089902	58576	394554	613713	5200	—	47.5	66.3	1072618	15286	2539
1962	1031781	50463	338616	465692	5052	69095	44.5	58.75	931653	14443	2393
1961	965131	45283	308068	400568	4806	59897	42.5	56.5	849988	13671	2153
1960	917256	42785	261118	389342	4567	49654	41.75	51.75	767104	12875	2029
1959	862921	42731	245893	359720	4400	49399	41.85	48.65	698148	11265	2107
1958	824545	38401	204338	324000	4200	47236	39.15	45.95	633511	11004	1830
1957	804577	34000	177728	268116	4000	40900	38.75	43.05	563249	10461	1808
1956	758568	34400	155315	252562	3600	36650	35.0	42.0	476543	9838	1682
1955	732268	32803	140892	231667	3400	34724	34.5	39.25	458160	9990	1715
1954	691752	32865	136904	223358	3230	32590	33.5	35.2	434652	9365	1605
1953	664496	30646	121261	190982	3200	31969	34.25	32.95	370446	9075	1512
1952	642154	29488	114710	183299	3000	31693	33.0	31.4	354322	9075	1494
1951	615963	29440	108652	179966	2780	30238	34.0	35.0	350869	10093	1664

VH	Volumes held
VA	Volumes added in a year
BX	Money expended for books, periodicals, and binding
SX	Salaries expense
LPSP	Lowest professional salary paid
WX	Wages expense
PSS	Professional staff size
NPSS	Nonprofessional staff size
TX	Total expenditure
TENR	Total reported enrollment
GENR	Reported graduate student enrollment

about the institution were gathered.

Projections to 1980 were made on the basis of past activities and growth, doubling of size of the several factors was computed, and fitted graph lines were plotted. Some of these growth rates and projections will be examined in the sections following. Table II-8 provides absolute figures on the 11 factors for the *median* composite library; the statistics in each case fell between the actual 29th and 30th ranked libraries. The authors chose to show first- and third-quartile libraries because of the "substantial influence" of some libraries at the extremes. They cited the top volume holders (Harvard, Yale, Illinois) as being extremely atypical and influential of the median (Ref. 4, p. 7). This fact must be remembered when considering the median composite figures.

COLLECTION SIZE AND GROWTH

From the summary Tables already presented, it is possible to establish or reaffirm some trends in academic-library-collection growth. Although direct comparisons are difficult because of differences of time and counting methods, the general trends are evident, indisputable, and worthy of note. All statistical comments are based on the U.S. Office of Education, Association of Research Libraries, or Purdue study[4] previously mentioned.

Volumes per student is considered one of the more valuable

measurements of library-collection strength. The aggregate national college and university data (Table II-2) show a figure between 45 and 52 volumes per student during the first half of the 1960's. The tremendous influx of students in the mid-1960's undoubtedly caused the drop that was previously mentioned and that has now been arrested but not really turned upward. This average must be understood in the scope of the tabulations: ALL types of academic libraries. It cannot easily be compared to the 1963-64 figure of 71 volumes per student of the median composite library (Table II-8) computed by Dunn.[4] The 58 university libraries in that study are all basically research-oriented. At this stage of deliberations of digital-storage possibilities, it is difficult to determine which end of the scale is apt to be more influential in localizing and clarifying the proper first step. Volumes per student for the other types and sizes of institutions in the preceding Tables have not been compared because enrollments are not given.

We do, however, have absolute figures on collection holdings. Of surprise and alarm to most nonlibrarians is the size and growth rates of the large university libraries. For example, by 1968, 51 university libraries had over one million volumes each; 18 of those had over two million volumes. Dunn and his colleagues made these observations about the 58 university research libraries they studied:

> ". . . there is little basis for expecting an early deceleration in library growth. In short, the records of growth since 1951, including the most recent years, and the unfaltering growth of even the largest libraries, indicate that this growth will not soon decelerate. Upper limits are not apparently being reached and it seems unlikely that they will even be approached during the fifteen years immediately ahead" (Ref. 4, p. 20).

The median composite library in that 1963-64 study had 1.09 million volumes; projections (Figure II-1) ran to a median of 1.45 million in 1968-69 and between 2.8–3.75 millions in 1980, which seems a conservative projection based on accelerating growth rates. The variation between the Dunn median[4] and the medians of the Association of Research Libraries[11] is minor. All academic institutional aggregates (Table II-2), however, show an *average* of 106,000 to 120,000 volumes held between 1963-64 and 1965-66. All universities (Table II-4) had a median volume collection of 450,000 during 1963-64, while the liberal-arts colleges (Table II-3) held 54,000 volumes during the same period. Notwithstanding supporting figures, the conclusion has been accepted that the small liberal-arts college has a volume-per-student figure near or above the national academic 45-52. The depression of that average is considered to have been caused by the older, medium-sized institutions, usually public, suddenly enlarging enrollments and adding grduate programs without supportive library collections.

The rate of volume growth, which includes monographs and

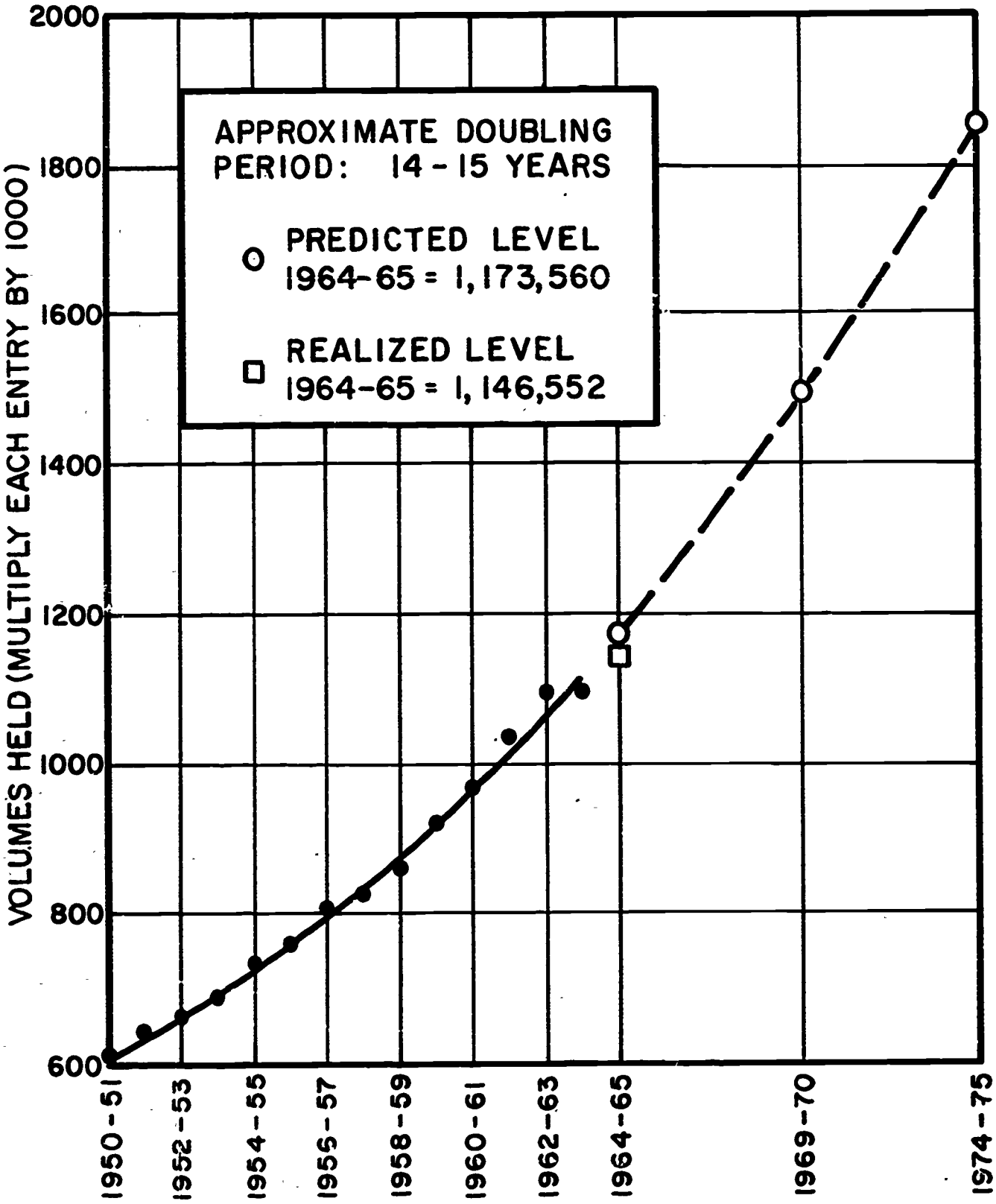


FIGURE II-1. Past and projected volumes held in the median composite library computed by Dunn *et al.* (Ref. 4, Fig. 6, p. 26.) This and Figure II-2 may be compared with the median ARL statistics (Table II-7) for the nearness of the projections beginning with 1965. The ARL median sample is somewhat larger and less rigidly controlled, however.

bound periodicals, is a more meaningful basis for comparison than actual volume counts. The Dunn[4] group of select university libraries' median collection growth (1961-64) was annually 5%-6%, which caused doubling of the collection in 14-15 years. This volume growth rate is about 6.7% (1963-68) for the ARL median library and reflects the recent acceleration previously noted. The liberal-arts and all universities data (Tables II-3 and II-4) indicate a 6%-6.7% annual growth in volumes during 1963-66. It may be deduced that all academic libraries appear to be growing at nearly the same percentage a year, although the actual number, quantity of work, and money involved are incredibly staggering with the half-million volumes and larger holdings.

A similar percentage of growth is also evident in the volumes added per student per year; during 1963-64, the total academic libraries' figure (Table II-2) was 2.8 whereas the Dunn study[4] for the same year was 3.8. Actual volumes added per year and projections from the latter study of research libraries are shown in Fig. II-2. Doubling of the number of volumes added in a year occurs in 9 to 11 years; for all academic libraries (Table II-2) based on the last five years of data, that doubling comes every 6 or 7 years. The latter figure is nearer the ARL median (Table II-7), which doubles its volumes acquired every 7 to 8 years, based on 1963-68. Samore (Ref. 7, p. 17) observed that private universities with half as many students as public universities

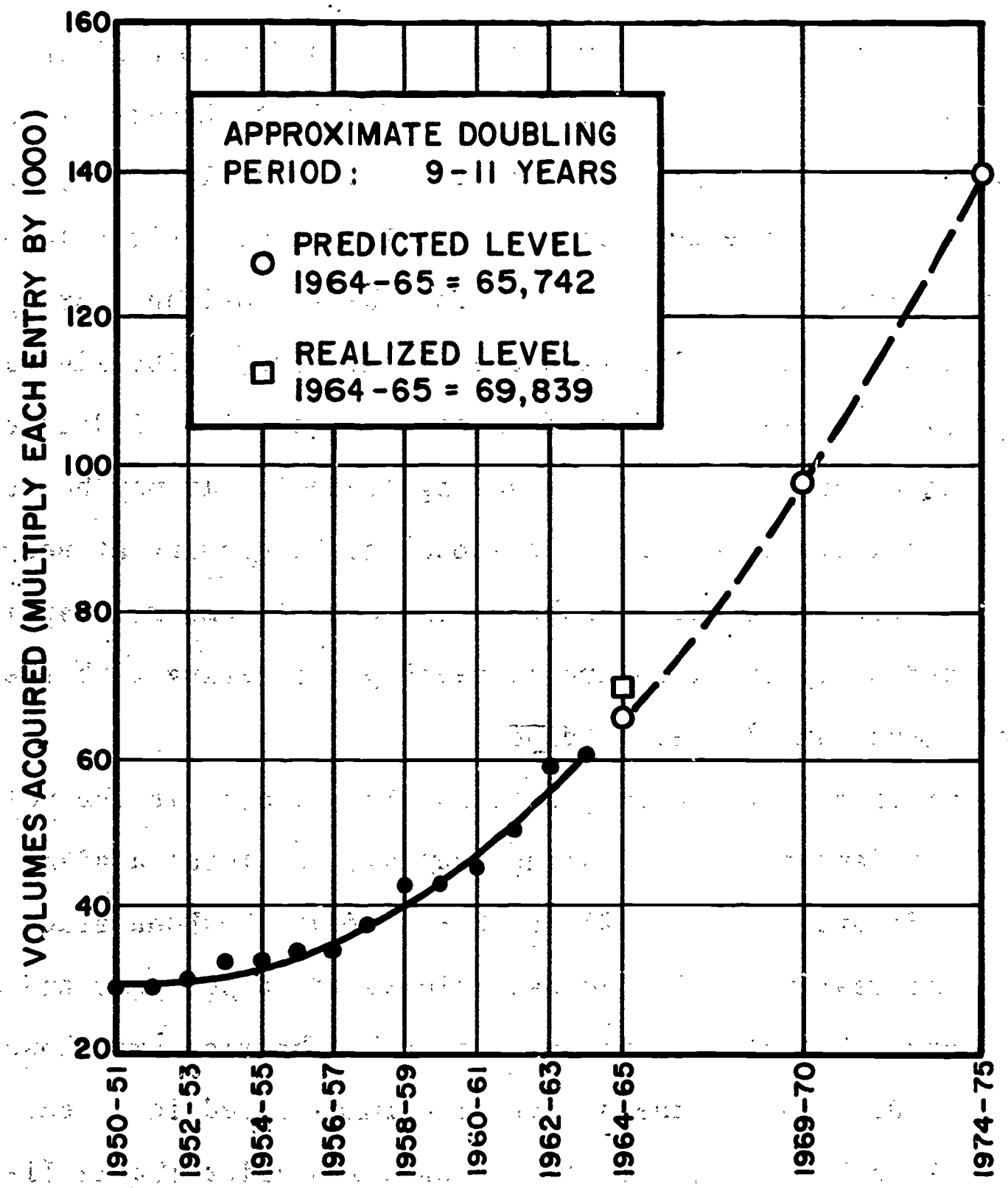


FIGURE II-2. Past and projected volumes acquired yearly by the median composite library. (Ref. 4, Fig. 7, p. 27.)

(1963-64) had only 19% fewer library volumes. The gigantic 7 and 4 million volumes of Harvard and Yale help those figures along. Public institutions which must accept more students than they often wish usually do not provide backup in their libraries equal to that of private schools.

The American Library Association has set a minimum recommended collection size for four-year institutions based on enrollment[1]; 50,000 volumes up to 600 students; 50,000 volumes additionally for each 1,000 students. On this basis, the median composite Dunn library (Table II-8) for 1962-1963 would be about 220,000 volumes *above* the minimum recommendation; it must hastily be added that the recommendations do not apply well to research-university libraries. A four-year institution with 7,500 students (comparable to Table II-6) would need 395,000 volumes to meet the minimum recommendation. A similar institution with 15,000 students (comparable to Table II-5) would need 770,000.

A quantity of volumes counted in these statistics is for periodicals and serials. They are traditionally added to the volume count at the time when they are transformed into a hard volume by binding the separate pieces. Several university-library annual reports were examined [University of Illinois (Chicago), Maryland, Syracuse, and Yale] to determine the percentage of annual volume growth that was periodical or serial binding. About 30% of Yale's annual volume growth over a three-

year sample was by periodicals or serials. The other university libraries ran between 15% and 25% for the years 1965-1967; the average of all those investigated is 23% a year. Those institutions with heavy research emphasis, particularly in the sciences, acquire a higher portion of their annual growth via bound serials and periodicals. All of the libraries in this small survey, with one exception, have relatively extensive research activities. The only one with little or no research activity registered 15%-16% of its annual growth in periodicals. It may be safely assumed that near one-quarter of research-university libraries' annual growth each year is by periodicals; nonresearch and liberal-arts bound-periodical growth is near 10%.

PERSONNEL

The previous Tables have consistently registered the size of the library staff as an indicator of service or operating function. Personnel would not seem to be of great significance in identifying those aspects of the digital-storage concept to be studied, so the comments need only be brief.

The distinction is commonly made in all libraries between professional positions (requiring a master's degree in library science) and supportive nonprofessional and clerical positions. In some large academic libraries, there are professional people such as business managers and personnel officers who do not

hold the library degree, but these are few; professional may here be interpreted as being synonymous with the library-science degree and commensurate responsibilities. University and college administrators have attempted within the past 10 years to install more and more clerical or nonprofessional positions in their staffs by rearranging professional work loads and changing priorities. As a result, fewer than half of the employees in a library are now librarians whereas during 1959-1960, the ratio was 50:50, as Samore points out (Ref. 9, p. 41). A similar trend is evident in the increased employment of student assistants for the more menial and routinized chores in the academic library.

One may refer to the medians given for various types of libraries for exact figures on the numbers of people employed (Tables II-3, II-4, II-5, II-6). The total number of academic professional librarians in 1966 was 14,000 full-time people, augmented by a nonprofessional force of 16,000. The U.S. Office of Education data (Table II-2, corrected for 1966) show an average increase of approximately 9.5% per year of professional librarians' positions, whereas the nonprofessionals increased about 11.7% during the same 1959-1966 period. Growth of the number of professional librarians of the ARL median library (Table II-7) during the past five years was 30% over all as compared to 46% for nonprofessionals. The Dunn[4] median

composite library for an earlier time period shows a comparable growth rate (24%-45%), although the growth-rate difference between the two work groups has been greater in more recent years.

Table II-9 provides a breakdown by type of institution of the academic positions for 1964; the concentrations of personnel will not have varied much since.

Faculty status or rank is granted to professional librarians in many institutions. Liberal-arts colleges and junior colleges tend to grant faculty status, but universities, whether public or private, tend to withhold that status symbol.

EXPENDITURES

The data in the previous Tables indicate several distinct types of library expenditures. We will be concerned with the total organized only into three groups: personnel expenses that include salaried people as well as those on wages; expenditures for the purchase of books and other library materials for public use, together with binding costs; and general operating expenditures that include equipment, telephone, travel, and related items. It is the practice not to include in academic-library figures the capital outlays, maintenance and building costs, or depreciation allowances; none of the following expenditures shows these costs.

Table II-10 has been extracted and computed from the several

TABLE II-9. Number of 11-12 month library positions, by type of position, control, and type of institution: Aggregate United States, September 1, 1964. (Ref. 10. Extracted from Table 16, p. 39.)

Type of position and control	Total	University	Liberal arts	Teachers colleges	Technological	Theological	Other professional	Junior colleges
1	2	3	4	5	6	7	8	9
Public and private total	21,010	12,825	4,794	1,320	547	448	349	727
Chief librarian or director	1,144	132	475	120	41	93	81	202
Associate or assistant librarian	849	190	362	113	23	41	33	87
Department and division heads	1,930	1,036	586	179	64	36	16	13
Heads of school, college, or department libraries	791	651	78	36	7	3	6	10
All other professional assistants	4,807	3,360	931	268	115	52	46	35
All nonprofessional assistants	11,489	7,456	2,362	604	297	223	167	380

TABLE II-10. Academic-library expenditure ranges and percentages

Source of data	Personnel costs	Books, periodicals, and binding	General operating expenditure	Library expenditure as a percentage of institutional expenditure	Expenditure per student
	(As % of total library expenditure)				
National aggregate, 1959-60—1966 (Table II-2)	61.3% to 56.3%	33.3% to 39.7%	5.4% to 6.0%	3.0% to 3.3%	$40.34 to $54.23
Liberal-arts instit. median, 1963-64. (Table II-3)	54.9	40.5	4.6	5.1	$57.00
Universities median, 1963-64. (Table II-4)	55.6	39.3	5.1	3.6	$61.00
Four-year inst. with over 10,000 students. Median 1963-64 (Table II-5)	62.	34.5	3.5	3.6	$34.00
ARL median instit. 1963-64—1967-68. Table II-7)	55.9	37.9	6.2		
Dunn median instit., 1962,1963, 1964 averaged (Table II-8)	53.9	36.8	9.3		$67.00

Tables previously shown and discussed. This compilation is intended to serve as an indication of the general trend or range of figures for the communities of greatest interest.

The most interesting trend is the overall increase that literature and library materials (books, periodicals, binding, recordings, films) have shown as a percentage of the total library budget. During the past half-dozen years, materials for public use have gathered about 1% more of each library budget each year. Personnel costs although increasing 110% between 1959-1960 and 1966 (based on national aggregate figures; Table II-2) have decreased as a part of the total budget on the average of slightly less than 1% per year. The related downtrend of professional growth in relationship to other growth factors has been previously noted.

General operating expenditures have tended to stay around 5.0% of total library expenditures. As institutions grow larger and more expensive machinery is purchased, this percentage is likely to increase slightly.

The American Library Association[1] recommends that an academic-library budget be no less than 3% of the total institutional budget. That standard was probably drawn partially from the data that we are here considering; the U.S. Office of Education national aggregate median runs between 3% and 3.3% (Table II-2). Private liberal-arts colleges and universities tend to be appreciably

above the national average. Universities, public or private, also are above this average, although only slightly. The national average seems to be held down by junior and public liberal-arts colleges.

Dunn (Ref. 4, pp. 28-29) computed for his median, composite university a doubling of total library expenses every 7–10 years and a doubling of book, periodical, and binding costs every 5–9 years. Later cost figures for the institutions from which this median was drawn tend to indicate that the doubling is nearer the lower rather than the upper figures, in both cases 7 and 5, respectively. How long this acceleration can continue without alternate methods or answers is currently a subject of much discussion.

Expenditures per student are not keeping pace with some other, related growth figures. However, the increases, based on the national aggregate figures (Table II-2), have been substantial, approximately 5.8% yearly. Based on the 1963-1964 institutional analyses, liberal-arts colleges and universities of all types rank far above the national average.

Building costs are occasional items only and considered completely separate from most continuing yearly costs. An annual survey of new buildings including costs, sizes, and other pertinent basic data provides us with a quick summary of this less influential factor. The survey of 1968 academic libraries[12]

covered 62 new buildings or major additions to old ones. The average cost per building was $2.4 million and provided an average of 92,000 sq ft at $25/sq ft. The 1968 survey covered more large libraries than usual, which tended to weight some of the figures slightly. Twenty-one of the 62 buildings cost over $2 million each, with the average cost for this group being $4.5 million. These buildings were able to handle an average of 760,000 volumes and provide 1800 seats for readers, all in an average 168,000 sq ft.

REFERENCE LIST FOR CHAPTER II

1. *American Library Association Standards for College Libraries.* Chicago, A.L.A., Association of Colleges and Research Libraries, 1959.

2. Cartter, Allan, M. *An Assessment of Quality in Graduate Education.* Washington, D.C., American Council on Education, 1966. 131 p.

3. Jordan, Robert T. "Library Characteristics of Colleges Ranking High in Academic Excellence," *College and Research Libraries,* 24 (Sept. 1963) 364.

4. Dunn, O.C., W.F. Seibert, and Janice A. Scheuneman. *The Past and Likely Future of 58 Research Libraries, 1951-1980; A Statistical Study of Growth and Change.* Lafayette, Indiana, University Libraries and Audio Visual Center, Purdue University, 1966. 82 p. (Available as ED 021589)

5. Oboler, Eli M. "The Accuracy of Federal Academic Library Statistics," *College and Research Libraries,* 25 (Nov. 1964) 494-6.

6. Chicorel, Marietta. "Statistics and Standards for College and University Libraries," *Colleges and Research Libraries,* 27 (Jan. 1966) 19–22.

7. Samore, Theodore. *Library Statistics of Colleges and Universities, 1963-64.* Washington, D.C., Government Printing Office, 1968. 48 p. (OE 15031-64)

8. *The Bowker Annual of Library and Book Trade Information, 1968,* Edited by Phyllis B. Steckler. New York, R.R. Bowker Co., 1968. 499 p.

9. Samore, Theodore. "College and University Library Statistics and Federal Grants to Academic Libraries," p. 40-48 in *The Bowker Annual of Library and Book Trade Information, 1968.* Edited by Phyllis B. Steckler. New York, R.R. Bowker Co., 1968.

10. *Library Statistics of Colleges and Universities, 1965-66; Institutional Data.* Chicago, American Library Association, Library Administration Division, 1967. 234 p.

11. Association of Research Libraries. *Academic Library Statistics.* A stapled, multilithed compilation of seven to nine sheets each year.

12. Orne, Jerrold. "Academic Library Building in 1968 ...," *Library Journal*, 93 (Dec. 1, 1968) 4493-4497.

CHAPTER III

ACADEMIC INFORMATION NEEDS AND USES

Education's charge is to impart information, develop skills, and create attitudes through an instructional program. This one community in our culture must be totally involved in information transfer. The needs of all academic units for various types of information are well established. The annual money investment by the academic establishment is staggering, as is that of many related sections of society. For example, the sale of college textbooks in 1967 totaled $251 million. A reasoned approach to the concept of digital storage of literature for this community must include an understanding of the total needs and uses of information, regardless of the source or format, who, when, and how, as well as major constraints and influences.

Initial academic concern for information data to aid in management decisions came from librarians and administrators in the 1930's who provided several library-centered studies. Since 1950, the professional societies and federal government agencies have invested much time and money in gaining a better understanding of their functions, needs, and efficiency in the flow of information. A summary examination of the extensive work done in the past 30 years will give us adequate data for a broad characterization in an academic situation.

An annotated *Bibliography of Use Studies* (Davis and Bailey, 1964) and a supplement in 1967 (DeWeese) cite 547 use studies. The literature is extensive and is not repeated here. Rather, the most pertinent studies and summary articles of the past few years will form the basis for the characterizations. The Davis bibliography divides the studies into four major categories by the methodology employed:

1. Citation Analysis: counts and analysis of citations in the literature.
2. Questionnaire: used for a variety of specific, data-gathering purposes.
3. Interview: used for basic data, in-depth analysis, and validation.
4. Circulation or Diary: count of actual use through records.

The methodologies have come under considerable criticism within the past five years. These comments on citation-analysis methods and some basic assumptions used in structuring a study of the use of literature by research biochemists exemplify the problem.

> "How people get information and what they cite are frequently quite different. For instance, it is very unusual for an author to cite the handbooks, the textbooks, and the casual conversations with colleagues that are prime sources of information in most scientific situations. The second fallacy is the extreme subjectivity involved in trying to divine why an author cited a publication. What the author had in mind and what a

> subsequent analyst *thinks* he had in mind could conceivably be quite different. Thus, one can get a very warped impression of total use patterns from cited references, although they can serve as a means of characterizing the use of periodicals, which are what are most frequently cited in papers" (Herner and Herner, 1967, p. 24).

Analogous criticisms can be made of the hypotheses, structures, sampling, and statistical methodology for all the types of studies. One authority is somewhat reassuring about more-recent studies, however:

> ". . . the study of information needs/uses has matured methodologically (in most projects, most of the time), but we now urgently need theories of information-processing behavior that will generate propositions concerning channel selection; amount of seeking; effects on productivity of information quality, quantity, currency, and diversity; the role of motivational and personality factors, etc." (Paisley, 1968, p. 3).

Relating the valid studies to arrive at correlations or general conclusions is also problematical. The authors of a report resulting from an extensive user/needs study of scientific and technical information within the U.S. Department of Defense emphasized this disparity:

> "With such varying and vague methods of measurement, each study can be criticized not only on the basis of the internal data it developed, but also for the lack of any valid way to relate data between different studies. With different, ill-defined, or non-existent units in each study, no method to correlate, or cross tabulate data, can be developed. This has been a major stumbling block . . . [to] . . . broad system design application . . . " (Auerbach Corp., 1965, Vol. 1).

Most of the studies are task- or institution-oriented studies

and, therefore, do not correspond or easily correlate with different populations and purposes. It is possible, however, to draw valid characteristics from the studies; correlations have been made and the resulting conclusion generally accepted (Asheim, 1959; Herner, 1966; Herner and Herner, 1967; Jain, 1967; Chapin, 1966; Knapp, 1959; Paisley, 1968). Profiles and general impressions reached in discrete areas by previous synthesizers will be presented, along with the results of more recent, authoritative studies. The observations and implications must, of necessity, be more generalized than might be wished.

NEEDS, WANTS, USES, AND USERS

As previously mentioned, the earlier studies were concerned with functions in libraries and were not directed toward measuring or characterizing the nonlibrary information sources of the user. This total transfer of information within a community of people or a system has been of particular interest to the information scientist, journal and abstracting publishers, and discipline-oriented professional societies. The libraries centered their investigations on who was using their materials and facilities, how often, and for what purposes. They also used citations in published literature to determine what types of materials were used as source materials regardless of location. Although the information scientist was interested in these questions, he

extended the cycle to the functions preceding publication to learn from what sources the user or generator of information got his data, how he chose his channels of communication, and for what purposes. This leads into verbal as well as publication channels, to information transfer between offices and conference attendees, and to the value, relevance, and timeliness of one method of communication over another.

The scope of this document and the total study is based on the assumption that we are concerned only with library materials. However, the overall information needs and sources of the academic world are so interrelated with the academic library, and any digital storage of its collections, that the two must be placed in perspective to each other. It is conceivable that a digital collection may serve to solve or aid some of the current, nonlibrary information needs and uses. Therefore, an attempt is made to give adequate background so that a rational approach to decisions for possible tradeoffs and merging of concepts or sources can be evaluated.

It is necessary to clarify the grey overlap in meaning of *needs* and *wants*. Few of the studies have taken the time or care to distinguish between what is *needed* by a person and what he merely *wants* as a hedge on a potential need. The number of variations between the two expressions are so great and

the definitions in studies so mixed as to make separation exceedingly difficult. Taking all definitions, methodologies, and objectives into consideration, *needs* must be interpreted in this document as including a rather large expression of *wants*. (For a fuller discussion see O'Connor, 1968.)

TOTAL INFORMATION NEEDS AND USES

Characterizations in this Chapter will be of the total general needs for information in academia and the means by which they are met. The uses/needs directly related to printed materials are treated here as a total problem unrelated to library relationships. The institutional libraries as suppliers of published information will be explored in depth in the following Chapter.

Any analysis of information, its use, and the need for it within a community can be surveyed from a diversity of groupings. The users within that community, likewise, can be studied from an equal number of viewpoints; the user surveys reflect the use of variables in order to arrive at valid and more-precise answers. We need concern ourselves in this study, however, only with those members of the university or college community or analogous groups for whom data exist. This grouping is realistic of the academic information-transfer community:

1. Undergraduate students
2. Graduate students
3. Faculty (teaching)
4. Researchers
5. Administrative and Service Staffs

The functional crossover within these groups is extensive. Portions of upper-level undergraduates have many of the information needs (and solve them in the same way) as graduate students. Teaching faculty members are actively engaged in research projects, some instructionally related. The researchers in an institute affiliated with a university may hold joint appointments whereby the far greater part of time is in research, or vice versa; percentages and combinations of functions make solid lines of discussion very difficult. The personnel statistics in Chapter I provide a degree of magnitude for a weighted consideration of the types of users.

The teaching methods of dispensing and testing on information transfer to undergraduate and graduate students is accomplished in large part by verbal communication and direct contact through written exams and class assignments. This verbal communication decreases as the student progresses, but it remains a dominant force throughout the formal education process. The amount of information imparted at various grade levels has not been well measured, but the assumption is accepted that the major learning is accomplished by the direct teaching-classroom experience.

The verbal receipt of information by the teacher/faculty member is not quantitatively documented. The scientific and technological teacher, however, seems not much unlike his non-teaching counterpart who has been studied (in and out of the academic community) and who gets slightly more than half of his information through verbal communications (Herner, 1966, Vol. 2, p. V-43; Herner and Herner, 1967). Past studies have shown a smaller amount of information flowing to the other subject disciplines by verbal means. Administrative staff members receive by far the greatest amount of their task-related information through verbal communications, although this has not been measured precisely.

Films, audio recordings, videotapes, and related audio-visual media play a less dynamic role than does verbal communication in the academic community. These nonprint materials are used extensively almost exclusively for undergraduate instruction. The dial-access audio and video lectures are increasingly important. Basically, they represent a one-way lecture or instructional period, thereby substituting for direct classroom participation or supplemental readings. The influence of this method of communication on the total information transfer within an academic institution has not been adequately measured to allow for any degree of precise characterization.

Experiments, observations, and unpublished statistical data

account for an additional method of instructional information transfer. This type of material has always been of importance to administrative staffs, researchers in nearly all disciplines, but most particularly to scientists, technologists, and statisticians in the social sciences. Extensive unpublished data banks (or card files) containing public-opinion-poll results exist for the use of the economist or social scientist and similar files are being built and used in other subject areas. The computer and telecommunications capabilities are speeding this use. Similar nonpublished sources of information within the academic community can be found. It is obvious that our academic users of information meet their instructional, task-related, professional, and research needs in vastly varying degrees and combinations of types and quantities. These points are made only to give a relational overview to the use of published literature.

William Paisley (1968, pp. 4-6) categorized the relationships and constraints of the scientist that influence his use and sources of information. His analysis is a useful framework on which the teaching and research faculty members of academia can be viewed. His observations are not as analogous of students or most administrative staffs. The systems affecting the scientist, he feels, form a set of "*almost*-concentric" circles. In decreasing order, he then places the scientist within

1.	His Culture:	The cultural pressures to produce (reports, papers, etc.) and succeed directly influence the information system.
2.	A Political System:	The influence of nationalism, and the sources of money, often choose his research for him.
3.	A Membership Group:	The professional membership community in which he functions and its controlled information channels.
4.	A Reference Group:	Other scientists with similar specializations, training, and excellence of work usually involved in reprint exchange.
5.	An Invisible College (a subset of 4):	"Usually fewer than 100" scientists who know each other and actively share information directly; a tight group.
6.	His Formal Organization:	The work situation that emphasizes lines of responsibility and products; the organization can open or block communications channels.
7.	His Work Team:	Colleagues directly at hand with whom he shares similar purposes, needs, and verbal information.
8.	Himself:	The system of motivation, needs, intelligence, and the structure and experience that settle on relevance and value of information.

The technical man (mostly engineers) in federal government research, development, technology, and engineering functions has been studied extensively. One study of 1375 technical professionals in the U.S. Department of Defense concluded that 42% of the information needed regularly was performance characteristics and

specifications, a large portion of which is in unpublished or restricted format (Berul and Karson, 1966; Auerbach Corp, 1965). The application of these data to the academic community is obvious in some aspects: A digital-storage plan for academia would probably want to exclude performance characteristics and specifications since the instructional use of such material is low. Also, the functioning technical man in that environment will probably not be able to use the system, which is largely the case with current formal systems.

USE OF PUBLISHED MATERIALS

Monographs have been stock in trade for the academic community in nearly all disciplines for two centuries. This premise and its acceptance are manifest in the investment in academic libraries and the textbook industry. Undergraduates are tied to their textbooks. A recent estimate (Chapin, 1966, p. 60) of 21 textbooks purchased per year by a student is probably very nearly correct when one takes into account the purchase and use of paperbacks for course work, along with the traditional textbook. The same author estimates that the average undergraduate spends 3-4 hours per day (five days a week) in reading those textbooks. These figures when compared with other studies (Knapp, 1959, 1966) strongly support the view that a large portion of undergraduate time is spent in reading from one format or another.

The implications of this for a digital-storage system will be discussed in relationship to library use in the following Chapter.

Graduate students approach literature, regardless of its source, with a slightly different view. The undergraduate has been characterized as primarily a feedback chain for information to the instructor, success at learning being rather directly related to successful motivation. The graduate student, however, uses the information more dynamically to achieve a better-defined end and is usually strongly motivated in obtaining it. Studies (Knapp, 1966; Chapin, 1966; Branscomb, 1940) show an increased use of published material for each advanced level and degree, a decreasing use as the experimental and technological features of the work increase. The pattern of use of printed materials by graduate students seems closely to correlate with that of researchers in the same subject disciplines.

Format of published materials is of less significance to the faculty/researcher than to the undergraduate who has his material condensed and packaged for him. Use of formats does vary with subject fields. We will survey these questions and identify some within these groupings:

Humanities and the Arts
Social Sciences
History and Area Studies
Pure Sciences
Natural Sciences
Technologies (Applied Sciences)

Appendix A lists the subject disciplines covered by these six groupings. The nature of the literatures and their uses allow these pragmatic alignments, which will be the usual arrangement throughout this document.

HUMANITIES AND THE ARTS

Few studies exist to show the percentage relationships of use of materials within the humanities or the arts. Most analyses have been of citations and library circulation data, neither of which can tell us of the total literature needs, uses, or activities. Lacking overall data, our statistical considerations must be based on the library studies discussed in the following Chapter.

It is possible to make some general observations, however. To the faculty/research person, the *humanities* (separate from the *arts*) are almost synonymous with the printed word. Although research in some areas—languages as an example—does utilize recordings and mechanical voice analysis, these constitute a small percent of the total information source. The percentage is much higher in the *arts*, where research (or creative work) gets more divorced from the printed matter. Urquhart (1960, p. 122) draws a form-use distinction based on library surveys that is probably valid outside of a library situation:

"A recent study has shown that more than 80 per cent of the items borrowed by university libraries in the sciences were serial publications, whilst in the humanities only one-third were serials."

SOCIAL SCIENCES AND HISTORY, AREA STUDIES

Few firm data exist to support detailed characterizations of the information-gathering and -use habits of this group, as with the humanists. The literature-use data are based on citation-analysis and library-use studies and represent only partially the complete literature uses or needs. These studies will be summarized in the following Chapter, which is dedicated to the use of library materials.

The faculty/researcher in these subject areas has been traditionally drawn as a very heavy user of printed material, as contrasted with the audio-visual and spoken word. The need to establish the exact percentage relationships of the three communications methods may not be critical if one can assume, as most investigators have concluded, that the printed material is the most important source to this group and, therefore, a vital aspect of our literature digital considerations.

Research in these subjects continues to be publication-centered, with one or two possible exceptions. Economics, statistics, and the political sciences have seen a shift in recent years to greater use of numerical data for two reasons: (1) more

data are accumulating (in printed or other formats); (2) the availability of computers has provided a research capability that was previously lacking (Dunn, 1966). Statistical data used in the social sciences were, traditionally, in printed format and distributed widely; the quantity has grown considerably but probably not in proportion to the related research. Specialized nonprinted data banks, proprietary rights, and affluence have changed the growth pattern somewhat. Likewise, there is increased use of artifacts, maps, recordings, and films among faculty/researcher geographers, anthropologists, and sociologists; whether or not it has been at the expense of published literature is not established.

The total literature needs for this group are greater than for any one other method of communication. Training and research methods have provided the people in these subject disciplines, and, more so, in the humanities and arts, with the facility to handle more than one language. They use foreign-language publications and do not purposely disregard foreign literature when pertinent to their subject interests, as is the tendency in the sciences and technologies.

NATURAL AND PURE SCIENTISTS

The paucity of data in the previously mentioned disciplines is not true with scientific literature nor the technologies.

The natural sciences (botany, zoology, earth sciences, biology) bear several of the same features of literature use as the pure sciences (astronomy, chemistry, mathematics, physics, psychology). In an extensive and thoughtful paper, Bernal draws a useful distinction, however:

> "I realise, for instance, that my own experiences, lying in the field of the mathematical-mechanical-physical sciences where much depends on the discovery and application of relatively few *principles*, are biased and do not adequately take account of the needs of the biological-geological descriptive sciences where the problem is to find the relations of vast numbers of originally unconnected *facts*. The problems of storage and retrieval are probably much greater in these fields. This is not only on account of their extensiveness in material but also on account of their much wider time range" (Bernal, 1958, p. 85).

Both groups, particularly in the academic environment, are able to handle foreign-language materials (usually French and German) with some ease, in sharp contrast to the applied scientists (or technologists), who are unwilling to try. However, the scientists use foreign-language literature only when it is essential and readily accessible to them (Herner, 1966, p. V-46). The language problem is relatively minor for scientists because of their subject discipline "language," which is international (Törnudd, 1958, p. 71).

The extensive use of literature by the natural and pure scientist has been explained by educational training but, more so, by the discipline *per se*. Most particularly is this true

with academic teacher/scientists as contrasted with those in industrial, government, and other research establishments (Törnudd, 1958, p. 70). Herner (1958, p. 9) provides additional reasons and characteristics:

> ". . . owing to the high level of sophistication and the narrow fields of specialization in pure science, it is extremely difficult for anyone but the requester himself to perform the selection and interpretation phases of a search. Literature selection and interpretation, and the subsequent process of synthesis, constitute, for the pure scientist, the very essence of creativity."

College teachers of science and technology (in Scandinavia and England) have been shown to be among the heaviest users of literature; like Americans read less (Törnudd, 1958, p. 70). The scientist engaged in his primary-subject discipline, teaching, or research, spends from four to five hours a week reading scientific and technical documents (Bernal, 1948; Shaw, 1956; Vickery, 1961). By far the largest use of literature by the scientist is in journals or periodicals. When research and scientific personnel assume administrative posts, they tend to drop a major portion of their formal literature needs (scientific or otherwise).

The American Psychological Association studied the use of books by psychologists in several working situations in 1964 (APA, 1963, 1965, No.14). One or more books were relevant to the information needs of three-quarters of the respondents,

Book users were more prevalent in colleges and universities than in industrial and government situations.

Additional distinctions can be drawn between some of the science disciplines and the specific purposes to which the literature is put. The general trends and characteristics are not atypical in any subject area; for distinctions within scientific disciplines as well as the technologies, see Törnudd (1958), Bernal (1958), and Vickery (1961) for excellent summaries and overall judgments.

TECHNOLOGIES (APPLIED SCIENCES)

The heavy use of colleagues and other verbal sources by technologists (in engineering, medical sciences, psychiatry, agriculture) and the relatively light use of published sources have been previously mentioned and documented (Herner and Herner, 1967; Allen and Gerstberger, 1967; Auerbach Corp., 1965; Menzel, 1966). Allen and Gerstberger classify the scientist as the producer of "things that work." They also comment on the nature of some of the formal, professional literature that an engineer faces:

> "The principal reason for the reluctance of engineers to use their professional literature is that, for the most part, they cannot understand it. Most of the professional engineering literature is too mathematically sophisticated for the average engineer to comprehend. It is therefore inaccessible to him" (Allen and Gerstberger, 1967, pp.20-21).

The nature of technology and its task-related jobs preordains that the published materials most sought would be specifications, design techniques, processes, statistical data, and quick-reference concepts. These needs are generally met by files of specifications and desk reference books that are in the immediate office (Hogg and Smith, 1958; Vickery, 1961; Berul and Karson, 1966). Rosenbloom and Wolek (1967) found that engineers satisfied 63% of their needs from office files. The major variations to this generalization is the practicing physician who is often separated from colleagues. The following recently published Table summarizes select literature practices by contrasting the pure and applied scientists. Physicians and scientists spend from 2.2 to 5.5 hours a week reading from 4 to 16 journals (Herner, 1966, Vol. 2, p. V-44). These figures more nearly represent the practicing physician, industrial scientist, and technologist. They do not characterize the most book-oriented, information-generating, and research-directed applied scientists in colleges and universities. Several studies substantiate heavier use of printed materials (largely periodicals) by teacher/researchers. It is essential to realize that the numbers of applied scientists in academia are few, and that they form a small percent of the total faculty. These facts must be adjudged carefully when considering the needs of this group for an academic-library digital collection.

Comparison of information practices by type of scientist: pure vs applied. (Herner, 1966, Vol. 2, p. V-25, Table IV.)

Type of Activity	Pure	Applied
Published vs oral sources	Make more use of technical literature	Rely as heavily on personal contacts as on literature (engineers made most use, physicians least use of literature)
Types of literature and tools used	Make less use of unpublished research reports and trade publications. Make more use of research journals, reviews, and indexes and abstracts. Prefer advanced texts and monographs on graduate level or above. Make more use of references in other papers. Make little use of abstract journals	Make more use of unpublished research reports and trade publications. Make less use of research journals, reviews, and indexes and abstracts. Make more use of elementary or undergraduate texts
Age of literature	Use older materials	Use more recent materials
Foreign sources	Make greater use of foreign language literature	Make less use of foreign language literature. Physicians are the smallest users.
Leads	Get less leads from personal recommendations	Get more leads from personal recommendations

The distinction between the working technologist and the research technologist should be made since their needs vary. Bernal (1958, pp. 81-82) expressed the opinion that the research technologist was more important to an information system than the working technologist because of his need for far more information, whereas the need by the working technologist ". . . is less in total quantity, it is of a kind more difficult to find—where it exists at all. . . ."

The International Conference on Scientific Information (1958) devoted one of its seven major areas of discussion to the literature and reference needs of scientists and technologists. Following the 13 papers and discussions, Fussler summarized some points drawn from the deliberations. Five of the seven seem to be pertinent to our observations:

1. "It is evident that the communication of scientific information is a complex and variable matter. It is not evident that our knowledge of these variations is yet as complete as it may need to be.

2. Scientists are likely to learn of major basic developments in their own fields of specialization rather quickly and easily. There is less assurance concerning peripheral information within a specialized field and still less concerning relevant information from other fields.

3. There is rather substantial evidence that scientists are not in many cases notably systematic in covering the literature, and indeed the existing tools are not exploited by users to anything like their full potential.

4. Chance associations of ideas and information appear to be important. If this is true, we should be giving thought to information handling devices that would increase the probability of such events.

5. The studies thus far do not advance an entirely satisfactory explanation of the apparent unsystematic use of available sources and services" (Intern. Conf. Sci. Inform., 1958, p. 310).

A long-time observer and scholar in librarianship and documentation has drawn this narrative characterization:

> "The reading of scientists and engineers, like that of all other human beings, is strongly influenced by the availability of the material to be read. A scientist may be willing to walk a mile for a Camel, but he won't walk very far for a book; if he's not near the book he'd read, he'll read the book he's near. Therefore, those who seek to improve the ability of the scientist to keep abreast of the literature must first direct their attention to the minimization of this intellectual inertia by improving bibliographic and library services. Moreover, dependence upon recorded information varies with the nature of the scientist's work. Research investigators, teachers in academic institutions, and information specialists comprise the largest groups of library users. They are also the greatest contributors to the stocking of the library's shelves, and one may guess that there is a positive relationship between the reading of books and the writing of them. He who runs may read, but he who writes must jolly well read or he will find himself in deep trouble" (Shera, 1966, p. 149).

EPHEMERAL MATERIALS

Little attention has been given to those materials which often do not get retained in many libraries; leaflets, pamphlets, newspapers. Government documents of few pages, industrial annual reports, and procedures manuals are typical of these materials which make the difference between a routine library

collection and that of a research library. We have few firm data outside of the library collection on which to base the use of this type of material and the need for it in the total academic situation. The newspapers initially serve recreational/informational needs and tend to pass on to eventual research use via film. The instructional value of this material seems very questionable to Knapp (1966, p. 101):

> ", . . the evidence on the use of pamphlets, booklets, leaflets, etc., indicates that it occurs everywhere, at all levels of education, and that, in sheer quantity, it is enormous. But the scant attention paid to its educational effectiveness (in comparison with other learning materials, for diverse purposes, and under varying conditions, etc.) suggests that it is not considered a really important type of material."

CHOOSING THE INFORMATION SOURCE

We have considered the sources of information, the uses of those sources, the relative value of literature, and its place in the total system. Throughout the use and choice of the sources are basic elements that provide the necessary criteria for determining or choosing an information channel. These apply, to a greater or lesser degree, to all channels of communication (e.g., verbal communication, publications) and to subject disciplines. Dunn has noted the evidence of this similarity:

> "Whatever one's professional discipline or needs for information, the problems information presents have many common elements—you might say that the problem sets are homomorphic" (Dunn, 1966, p. 207).

Distinguishable features directly affect the choice and use of an information channel. Without the consistent positive performance of some combinations of these features, an information channel will not be long utilized. No accurate ranking is possible for users or all disciplines in the absence of valid proof; however, the first three are probably accurately ranked in order of decreasing importance.

1. Accessibility:	Allen and Gerstberger (1967, p.23) declare this to be the single most important determinant. This is also suggested by others.
2. Ease of Use:	Although closely related to accessibility, a close source tends to be ignored if the intellectual, physical, or social hindrances are great.
3. Reliability and Quality:	If the source consistently provides reliable information, the channel is more apt to be used. The greater the quantity of low-quality information, the less use.
4. Speed:	Those sources which deliver quickly are utilized again and again—most particularly true in the applied sciences.
5. Ability to Answer Specific Questions:	Answering the question instead of referral to another source brings users back.
6. Currency:	Out-of-date information cuts heavily into the use of a source.
7. Ability to Supply Exhaustive Information:	Supplying thorough background information and data, which needed, increases the probability of channel selection.

8. Browsability: There must be the opportunity to adjust needs, expand concepts, and to wander conversationally or physically.

An additional set of elements directly affecting the users but *not* controlled by the source of information has been noted, and some correlated. These influences come from the individual's work situation and personal factors (Rosenbloom and Wolek, 1967):

1. Task or organizational function
2. Seniority or rank
3. Experience in choosing and using information sources
4. Professional activity or orientation
5. Educational level
6. Subject discipline
7. Age of the user
8. Research interests
9. Geography

Additional background on information needs and uses can be obtained from the relevant and useful literature. For an understanding of the total information approach most appropriate to academia, see the well-written and thoughtful articles by Menzel (1964) and Ennis (1964). Paisley (1968) provided a more up-to-date review with an excellent synthesis.

REFERENCE LIST AND BIBLIOGRAPHY FOR CHAPTER III

1968

O'Connor, John. "Some Questions Concerning Information Need," *American Documentation*, 19 (April 1968) 200-203.

Paisley, William J. "Information Needs and Uses," in *Annual Review of Information Science and Technology*, Vol. 3, Chicago, Encylopaedia Britannica, Inc., 1968. p. 1-30

1967

Allen, Thomas J. and Peter G. Gerstberger. *Criteria for Selection of an Information Source*. Cambridge, Alfred P. Sloan School Management, Massachusetts Institute of Technology, 1967. (*Sloan Working Paper* No. 284-67)

DeWeese, L. Carroll. *A Bibliography of Library Use Studies: A Supplement to Davis, R.A. and Bailey, C.A., Bibliography of Use Studies*, appended to Jain, A.K, *Report on a Statistical Study of Book Use* . . . Lafayette, Inc., Library Operations Research Project, School of Industrial Engineering and The University Libraries, Purdue University, 1967. 45 p.

Graham, Warren R., Clinton B. Wagner, William P. Gloege, and Albert Zavala. *Exploration of Oral/Informal Technical Communications Behavior*. Silver Spring, Maryland, American Institute for Research, 1967. 178 p.

Herner, Saul and Mary Herner. "Information Needs and Uses," in *Annual Review of Information Science and Technology*, Vol. 2. Interscience, New York, 1967. p. 1-34

Jain, Aridaman K. *Report on a Statistical Study of Book Use*. Lafayette, Ind., Library Operations Research Project and the School of Industrial Engineering, Purdue University, 1967. 276 p. (A Doctoral thesis is also available as PB 176 525.)

Menzel, Herbert, "Can Science Information Needs be Empirically Determined?" p. 279-294, in Thayer, Lee, editor, *Communication: Concepts and Perspectives*. Washington, D.C., Spartan Books, 1967.

Rosenbloom, Richard S. and Francis W. Wolek. "Technology, Information, and Organization", p. 119-127 in *Information Transfer in Industrial Research and Development*. Boston, Harvard Graduate School of Business Administration, 1967.

1966

Allen, Thomas J. *The Differential Performance of Information Channels in the Transfer of Technology*. Cambridge, Massachusetts Institute of Technology, 1966. 28 p. (*Sloan Working Paper* No. 196-66).

Allen, Thomas J. *Managing the Flow of Scientific and Technological Information*. (Ph.D. Dissertation) Cambridge, Massachusetts Institute of Technology, 1966.

An Economic-Media Study of Book Publishing. New York, The American Textbook Publishers Institute and the American Book Publishers Council, 1966. Various paging.

Berul, L. and A. Karson. "An Evaluation of the Methodology of the DOD User-Needs Study," p. 151-157, in: International Federation for Documentation. *Proceedings*, Vol. 1 of the 1965 Congress; 31st Meeting, Washington, D.C. (ADI *Proceedings*, Vol. 2) Washington, D.C., Spartan Books, 1966.

Boggs, Stephen T. "Information Problems in the Field of Anthropology," p. 175-177, in: International Federation for Documentation. *Proceedings*, Vol. 1 of the 1965 Congress; 31st Meeting, Washington, D.C. (ADI *Proceedings*, Vol. 2) Washington, D.C., Spartan Books, 1966.

Chapin, Richard E. "Use of Printed and Audio-Visual Materials for Educational Purposes by College and University Students," p. 57-71 in *Conference on the Use of Printed and Audio-Visual Materials for Instructional Purposes: First Report*. New York, School of Library Service, Columbia University, 1966.

Darley, J.G. "Information Exchange Problems in Psychology," p. 179-183, in: International Federation for Documentation. *Proceedings*, Vol. 1 of the 1965 Congress; 31st Meeting, Washington, D.C. (ADI *Proceedings*, Vol. 2) Washington, D.C., Spartan Books, 1966.

Deutsch, K.W. "The Information Needs of Political Science," p. 199-203, in: International Federation for Documentation. *Proceedings*, Vol. 1 of the 1965 Congress; 31st Meeting Washington, D.C. (ADI *Proceedings*, Vol. 2) Washington, D.C., Spartan Books, 1966.

Dunn, E.S., Jr. "Information Needs in the Field of Economics," p. 205-207, in: International Federation for Documentation. *Proceedings*, Vol. 1 of the 1965 Congress; 31st Meeting, Washington, D.C. (ADI *Proceedings*, Vol. 2) Washington, D.C., Spartan Books, 1966.

Herner and Company. *A Recommended Design for the United States Medical Library and Information System.* Vol II: *Background Studies.* Chapter V: *User Practices Based on a Review of User Studies.* January 1966. V-1-56.

Jahoda, G. "Information Needs of Science and Technology--Background Review," p. 137-142, in: International Federation for Documentation. *Proceedings*, Vol. 1 of the 1965 Congress; 31st Meeting, Washington, D.C. (ADI *Proceedings*, Vol. 2) Washington, D.C., Spartan Books, 1966.

Judge, P.J. "The User-System Interface Today: National and International Information Systems," p. 37-56, in: *Communications in Science: Documentation and Automation.* Boston, 1966.

Knapp, Patricia B. "Periodicals, Newspapers, and Other Serials, Documents, Technical Reports, and Pamphlets," p. 91-106 in: *Conference on the Use of Printed and Audio-Visual Materials for Instructional Purposes: First Report.* New York, School of Library Service, Columbia University, 1966.

Line, Maurice B. and Mavis Tidmarsh. "Student Attitudes to the University Library: A Second Survey at Southampton University," *Journal of Documentation*, 22 (June 1966) 123-135.

Menzel, Herbert. "Information Needs and Uses in Science and Technology," p. 41-69, in: *Annual Review of Information Science and Technology*, Vol. 1. Interscience, New York, 1966.

North American Aviation. Autonetics Division. *DOD User Needs Study, Phase II.* Final technical report. Anaheim, Calif., November 1966. 3 volumes.

Parker, E.B. "The User's Place in an Information System," *American Documentation*, 17 (January 1966) 26-27.

Raisig, L. Miles, Meredith Smith, Renata Cuff, and Frederick G. Kilgour. "How Biomedical Investigators Use Library Books," *Bulletin of the Medical Library Association*, 54 (April 1966) 104-107.

Shera, Jesse H. "How Engineers Can Keep Abreast of Professional and Technical Developments," p. 147-157, in his: *Documentation and the Organization of Knowledge*. Hamden, Connecticut, Archon Books, 1966. 185 p.

Symposium on Communication in Science: Documentation and Automation, edited by Anthony De Reuck and Julie Knight. Boston, Little, Brown & Co., 1966. 77 p.

1965

Auerbach Corporation. *DOD User Needs Study, Phase I;* "Final Technical Report." 2 Volumes. Philadelphia, Pa., 1965 (AD 615501, 615502)

Carter, Launor, *et al. National Document-Handling Systems for Science and Technology*. New York, John Wiley & Sons, Inc., 1967 (Information Science Series). 344 p. Also published in two volumes in 1965 as government technical reports: PB 168 267-8.

Great Britain Advisory Council on Scientific Policy. "Survey of Information Needs of Physicists and Chemists," *Journal of Documentation*, 21 (June 1965) 83-112.

Pings, Vern M. and Fanny Anderson. *A Study of the Use of Wayne State University Medical Library, Part I.* Detroit, Mich., School of Medicine Library and Biomedical Information Service Center, 1965. (Its Report No. 10)

Urquhart, D.J. "Physics Abstracting--Use and Users," *Journal of Documentation*, 21 (June 1965) 113-120.

1964

Davis, Richard A. and C.A. Bailey. *Bibliography of Use Studies*. Philadephia, Graduate School of Library Science, Drexel Institute of Technology, March, 1964.

Ennis, P.H. "Study of the Use and Users of Recorded Knowledge," *Library Quarterly*. 34 (October 1964) 305-314.

Fleming, P.T. and F.G. Kilgour. "Moderately and Heavily Used Biomedical Journals," *Bulletin of the Medical Library Association*, 52 (January 1964) 234-241.

Kronick, David A. "Varieties of Information Requests in a Medical Library," *Bulletin of the Medical Library Association*, 52 (October 1964) 652-669.

Martyn, John. *Report of an Investigation on Literature Searching by Research Scientistis*. London, Aslib Research Department, 1964.

Menzel, Herbert. "The Information Needs of Current Scientific Research," *Library Quarterly*, 34 (January 1964) 4-19.

1963

American Psychology Association. *Reports of the . . . Project on Scientific Information Exchange in Psychology*. Washington, D.C. Vol. 1, *Overview Report* and *Reports* No. 1-9, 1963; Vol. 2, *Reports* No. 10-15, 1965.

Price, Derek J. de Solla. *Little Science, Big Science*. New York, Columbia University Press, 1963. 119 p.

1961

Fussler, Herman H. and Julian L. Simon. *Patterns in the Use of Books in Large Research Libraries*. University of Chicago Library, 1961. 283 p. and Appendices.

Kilgour, F.G. "Redocrded Use of Books in the Yale Medical Library," *American Documentation*, 12 (October 1961) 266-269.

Meier, Richard L. "Efficiency Criteria for the Operation of Large Libraries," *Library Quarterly*, 31 (July 1961) 215-234.

Vickery, B.C. "The Use of Scientific Literature," *Library Association Record*, 63 (August 1961) 263-269.

Voigt, M.J. *Scientists' Approaches to Information*. (ACRL Monograph No. 24.) Chicago, American Library Association, 1961. 81 p.

1960

Columbia University. Bureau of Applied Social Research. *Review of Studies in the Flow of Information Among Scientists*. New York, The Bureau, 1960. 2 volumes in 1.

Notheisen, Margaret A. *A Study of the Use of Serials at the John Crerar Library*, (Master's thesis) Graduate Library School, University of Chicago, 1960.

Sheniti, Mahmoud. *The University Library and the Scholar; A Study of the Recorded Use of a Large University Library*. (Ph.D. thesis) Graduate Library School, University of Chicago, 1960.

Urquhart, D.J. "The Needs of the Humanities," *Journal of Documentation*, 16 (September 1960) 121-131.

1959

Asheim, Lester. "A Survey of Recent Research," p. 3-26 in Jacob M. Price, Ed., *Reading for Life; Developing The College Student's Lifetime Reading Interest*, Ann Arbor, University of Michigan Press, 1959.

Chapin, Richard E. "Libraries in Freshman Research," *Basic College Quarterly*. (Fall 1959) 35-38.

Knapp, Patricia B. *College Teaching and the College Library*. (ACRL Monograph No. 23) Chicago, American Library Association, 1959. 110 p.

Page, B.S. and P.E. Tucker. "The Nuffield Pilot Survey of Library Use in the University of Leeds," *Journal of Documentation*. 15 (March 1959) 1-11.

1958

Bernal, J.D. "The Transmission of Scientific Information: A User's Analysis," in: International Conference on Scientific Information *Proceedings*, p. 77-95, Washington, D.C., 1958. National Academy of Sciences-National Research Council, 1959.

Halbert, M.H. and R.L. Ackoff. "An Operations Research Study of the Dissemination of Scientific Information," Vol. 1, pp. 195-197, in: *Proceedings* of the International Conference on Scientific Information, Washington, D.C., 1958. Washington, D.C. National Academy of Sciences-National Research Council, 1959. 2 volumes.

Herner, Saul. *The Relationship of Information-Use Studies and the Design of Information Storage and Retrieval Systems*. Washington, D.C., Herner & Co., 1958. 24 p. (RADC-TN-59-136; AD 213 781)

Hogg, I.H. and J.R. Smith. "Information and Literature Use in a Research and Development Organization," Vol. 1, pp. 131-162, in: *Proceedings* of the International Conference on Scientific Information, Washington, D.C., 1958. Washington, D.C., National Academy of Sciences-National Research Council, 1959. 2 volumes.

International Conference on Scientific Information, Washington, D.C., 1958, *Proceedings*. "Area 1: Literature and Reference Needs of Scientists," Vol. 1, p. 9-312.

Menzel, Herbert. "Planned and Unplanned Scientific Communication," Vol. 1, p. 199-244, in : *Proceedings* of the International Conference on Scientific Information, Washington, D.C., 1958. Washington, D.C., National Academy of Sciences-National Research Council, 1959. 2 volumes.

Tornudd, Elin. "Study on the Use of Scientific Literature and Reference Services by Scandinavian Scientists and Engineers Engaged in Research and Development," Vol. 1, p. 19-75, in: *Proceedings* of the International Conference on Scientific Information, Washington, D.C., 1958. Washington, D.C., National Academy of Sciences-National Research Council, 1959. 2 volumes.

1957

Bernal, J.D. "The Supply of Information to the Scientist: Some Problems of the Present Day," *Journal of Documentation*, 13 (Dec. 1957) 195-208.

1956

Bush, G.S., H.P. Galliher, and P.M. Morse. "Attendance and Use of the Science Library at Massachusetts Institute of Technology." *American Documentation*, 7 (Jan. 1956) 87-109.

Shaw, R.R. *Pilot Study on the Use of Scientific Literature by Scientists*. New Brunswick, Graduate School of Library Service, Rutgers University, 1956.

1955

Benson, Charles J. *A Study of the Student Use of Periodicals in a Junior College Library*. (Master's thesis) Graduate Library School, University of Chicago, 1955.

1954

Herner, Saul. "The Information-Gathering Habits of Workers in Pure and Applied Science," *Industrial Engineering and Chemistry*, 46 (1954) 228-236.

1953

Stevens, Rolland E. *Characteristics of Subject Literatures*. (ACRL Monograph No. 6) Chicago, American Library Association, 1953.

1952

Alston, Annie M. *Characteristics of Materials Used by A Selected Group of Historians in Their Research in United States History*. (Master's thesis) University of Chicago, 1952. 86 pp.

1951

McAnally, Arthur M. *Characteristics of Materials Used in Research in United States History*. (Ph.D. thesis) University of Chicago, 1951. 185 p.

1948

Bernal, J.D. "Preliminary Analysis of Pilot Questionnaire on the Use of Scientific Literature," p. 101-102, 589-637, in: *The Royal Society Scientific Information Conference, 1948 Report.*

1940

Branscomb, Harvie. *Teaching with Books; A Study of College Libraries*, Chicago, Association of American Colleges and American Library Association, 1940, 239 p. Republished by The Shoe String Press, 1964.

1935

McDiarmid, Errett W. "Conditions Affecting Use of the College Library," *Library Quarterly*, 5 (1935) 59-77.

CHAPTER IV

ACADEMIC LIBRARY USE AND USERS

In the previous Chapter, we attempted to place in relative importance the avenues of information used and needed by society. The interaction of academic people with a library as a means of receiving their information is relatively low in the pure sciences and technologies and much higher among the social sciences, humanities, and histories. This pattern of use will emerge in detail as we profile academic library use by students, faculties, and researchers. The value of the published literature as used in a library is much higher for some subject disciplines than others. In this Chapter, the several aspects forming the total are *not* weighted to show the relative value or use of the academic library to a user or a specific discipline, nor does it take into account the numerous outside or nonlibrary sources. The economist may use a library for research far fewer times than a technologist. However, if that economist's fewer uses yield 80% of his information needs and the technologist's greater number of uses yields only 25% of his total needs, the value is greater to the person using the facility the fewer times. Such relative and important

evaluations are not inferred except where they represent a direct response to relevant specific questions.

Although the library response to the information needs of society may be relatively minor, that response is great in the academic community and constitutes a sizeable endeavor. We will concern ourselves with that library response for printed materials.

MEASURING LIBRARY COLLECTION USE

As mentioned previously, libraries have measured their collection uses in a variety of ways and for many years, the primary method being counts and analysis of circulation figures. These have been approached from numerous views and the literature has much that we can learn about specific and generalized use, although, as with nearly all use/user studies, these are limited by their task orientation. Studies have been conducted of circulation figures for interlibrary loans, reserved use (or restricted, hourly use), and periodical and monograph borrowing for varying periods of loan. Basically, it is upon these extensive data that use in this Chapter is considered. The results of different techniques and emphases tend to substantiate each other and give us a fairly comprehensive picture, although not a complete one.

Circulation studies do not indicate the complete use of a library collection, so methods have been devised to measure the internal use of materials. A very elaborate data-collecting system is necessary for any shelf or in-library studies to be statistically valid or to provide useful data. Several methods have been used with mixed success (Fussler and Simon, 1961; Dubester, 1961; Meier, 1961). Such studies will be relied upon when they add a dimension of understanding to the total library book-collection use. In-library book-use studies are not numerous, however.

A more common method used by librarians in an effort to comprehend literature use by faculty members has been the analysis of citations in the published works of teachers and researchers. This "citation analysis" method involves counts of citations, categorization, analysis, and, in some cases, comparisons with institutional holdings. It must be understood that this method does *not* give us a registration of actual library use because the materials cited may have been personally owned by the author or seen by another method. It does, however, give us a magnitude or depth of comprehension of literature use that will be compared with actual library use whenever possible.

The questionnaire has been used extensively to learn about

the collection use of a library. Traffic studies and systematic observations also have been used, although *most* often the book-use aspect has not been the main concern and the data were not always useful or valid because of the lack of focus. The statistical validity of some studies is questionable and, therefore, not useful to us.

The major recent work that gives us data on book or periodical use has been concerned with determining criteria for the removal of portions of collections to a storage facility. We will not examine in detail those many studies but draw from them the conclusions that are substantial, substantiated, and directly related to the overall interests of digital storage. Jain (1967) reviewed the use studies that he considered of greatest value; that paper is reproduced as Appendix B of this report. Dr. Jain did an excellent job of identifying and summarizing storage studies and the reader is referred to it for a more detailed discussion and analysis of statistical aspects and methodology.

For the purposes of discussion and localizing of our subject, we will discuss use of printed materials by two basic forms: monographs and periodicals (or serials). Both will be considered for undergraduates, graduate students, faculty, researchers, and staff. A monograph is a printed unit that

is an entity in itself and not published serially (or periodically) in several pieces. The monograph is that unit most commonly described as a "book" and will be used in this sense with only occasional exceptions to accommodate some serials that appear in the book format.

UNDERGRADUATES

Numerous studies over a period of 40 years have given substantial proof of some aspects of library monograph use by students. The most interesting facts are that

(1) nearly all (85%-94%) of the undergraduates' library book use is related to course needs;

(2) undergraduate per-capita use of library books has not changed much in 30 years.

As noted in Chapter III, students concentrate on the use of their textbooks; axiomatically, they delve into library materials only when necessary for the performance of course work. We do not have an accurate measure of the time that students spend with their own textbooks, but we have some figures on the more pertinent question of the undergraduate use of library books. It is necessary to explain the two major use modes of library monographs by undergraduates. A common feature of undergraduate education is peripheral or supplementary reading assigned or suggested by an instructor.

In recent years, when the auxiliary reading was available in paperbacks, the trend has been for students to buy the paperback rather than use the library copies. Referral of several students to time-constrained reading from a very limited number of the same title has led to a reading collection reserved for the purpose. This collection is constantly changing, confined to a special reading area and staff operation, exemplified by hourly or overnight loans and typically one of the busiest spots in a library. This use is completely course-related and the turnover and use of materials per item is far greater than for the general collection. Because of the differing nature, controls, and purposes of the reserve collection, studies usually distinguish between the two.

Studies from the 1930's led Branscomb (1940) to conclude that the undergraduate per-capita withdrawals from the reserve-book collection averaged from 50 to 60 per year. Later studies (Knapp, 1959; Ritter, 1964) show a decided decrease in per-capita reserve-book use. These studies were in small four-year college situations, but the same trend and actual per-capita use is nearly identical in different-sized institutions and curricula (Lane, 1966). Ritter (1964, p. 391) cites these figures drawn from his survey of 92 small college libraries:

Student enrollment		Reserve circulation per capita
669	High	72.0
516	Mean	15.9
521	Median	11.8
325	Low	1.6

This rather startling shift has been generally credited to the extensive use of paperbacks that students purchase as substitutes for hard-bound volumes formerly held by the library (Asheim, 1959, pp. 10-11). An additional factor is the greater student reliance on providing their own backup to their courses, as in the honors programs.

Undergraduate monograph borrowing exclusive of reserve-book circulation does not show a similar downtrend. Rather, students have not been active borrowers in the past and they still aren't. The findings are rather conclusive on this point (Knapp, 1959; Page and Tucker, 1959; Ennis, 1964; Chapin, 1966; Knapp, 1966). Branscomb (1940, p. 36) found that the average student borrowed from a college or university general collection approximately 12 books per year; the same number was also established by Knapp (1959). Ritter's study (1964), previously mentioned, found the median circulation of general collection books to be 28.2 volumes per year per undergraduate. A small university library averaged 29 books

circulated per student during 1959-60. Since this figure included borrowing by a slight graduate population as well, the undergraduate total would be lower. Although the figures vary, the order of magnitude of variation is not so great that we cannot draw a general profile from it. The undergraduate average of 10-20 volumes per capita borrowed from the general collection a year includes the ranges of the valid and broadly structured studies.

Asheim (1959) summarized the findings of numerous studies concerning undergraduate students:

> 8%–15% of the students withdraw no books at all.
>
> About 35% withdraw no more than one book a month.
>
> About 10% withdraw no more than one book during an academic year.

"Thus we find that although the total circulation is fairly high, half of it is accounted for by 20 percent or less of the total student body. And at the other end of the continuum about 15 out of every 100 students apparently can spend a whole year in college without looking at an unassigned book" (pp. 8-9). Chapin (1966, p. 62) concluded that a much larger portion of undergraduates, from one-third to one-half, does not use the general collections in a year. This is closer to the findings of two studies of circulation at Eastern Illinois University, where 62%-63% of the student body borrowed no books from

the general collection in two separate 30-day periods. Knapp prepared this summary Table.

Summary of studies of negligible use of general collection, ten institutions. (Knapp, 1959, p. 23, Table 4.)

Group of students	Period	Percent withdrawing 0 books	Percent withdrawing less than one book per month
2292 students in one university	one-half semester	42.0	66.9
2438 students in five colleges	one year	10.6	55.0
836 men students in five colleges	one semester	36.6	——
486 women students in one college	one year	28.0	——
361 students in one college	one year	——	50.41
About 400 students in same college	one year	——	48.95
738 students at Knox College[a]	one quarter	48.51	65.58

[a]The figures from Knox are for non-bibliography loans, not total non-reserve loans, but the difference is not significant.

To state this phenomenon another way, approximately one-fifth of the undergraduates account for 50% of the general-collection

circulation; half of the students account for 90% of the undergraduate general-collection use.

Profiles have been drawn that show the influence of various factors on the reading habits of students. These are not crucial to our understanding of the total library reading use but provide an added dimension. The specific class, scholastic aptitude, sex, and academic level show definite influences; others are extracurricular activity, subject field, intelligence, age, and past experience in using books and reading. (For additional reading on these aspects see Asheim, 1959; Knapp, 1966; Chapin, 1966; Lane, 1966, and Barkey, 1965.)

UNDERGRADUATE PERIODICAL USE

Evidence to support a systematic profile of student use of periodicals in a library is not great; however, the few studies and the observations reported in the literature tend to reach the same conclusions.

Allowing for variations within subject fields, the findings in the Science Library of the Massachusetts Institute of Technology (Bush, Galliher, and Morse, 1956) still seem to be at the top level of ranges expressed in other findings. That study found that undergraduate periodical use accounted for about 40% of all their library literature uses. This corresponds to a citation analysis of freshmen research papers at

Michigan State University (Chapin, 1959), where periodicals constituted 51% of all citations, an inflated figure based on "research" papers and atypical at least until the students had studied in a subject field in some depth. Only one other study (Kilgour, 1961) indicates such intensity of periodical borrowing, 54% of all items lent to Yale medical students (to the faculty's 64%). These cases have all been high as compared to the average undergraduate use exclusive of extensive subject-discipline or research influences. Borrowing counts alone do not provide a realistic profile of periodical use in a library; these two facts militate against a valid representation by this method:

1. Most college and university libraries do not loan those periodicals which are most heavily used, and, in many cases, none at all.
2. Most student use of periodicals is for short articles that can usually be read and noted without taking the item from the library.

In-library figures would also be necessary for a more nearly correct estimate.

One realistic evaluation of student borrowing is that of the University of Leeds (Page and Tucker, 1959) with a full year's circulation (including periodicals) from a half-million-

volume collection and with representation of subjects in nearly all disciplines. The overall university library borrowing of periodicals by students constituted less than 1% of the total.

These disparities must be understood as extremes. Previous reviewers (Asheim, 1959; Knapp, 1959; Knapp, 1966) and other studies have concluded that 10%-20% of undergraduate use of library materials is with periodicals; during the last two years of academic study, this figure rises by about one-half.

As a generalization, it would not be incorrect to note that the faculty and administration feel that an academic, undergraduate library collection ought to provide

(1) the tools and resources necessary to select and locate materials;

(2) copies in enough supply to satisfy the course-required work;

(3) some broad supplemental coverage with concentration in the historical and current-status aspects of subjects.

The circulation, in-library use, citation, and collection-building patterns tend to support these total-use percentages as representative of a four-year liberal-arts institution:

Subject categories[a]	%
Humanities and the Arts (Literature makes up 25%)	35
Social Sciences	20
History	15
Natural Sciences	10
Pure Sciences	10
Applied Sciences and Technologies	5
General Works, References, Bibliographies	5
	100

[a]Subject categories are those in Appendix A.

GRADUATE STUDENTS

Students pursuing advanced degrees in all disciplines are the heaviest users of academic libraries. Very little of their borrowing is directly course-related and most certainly only a very minor portion is regimented through a reserved or required-reading system. No comprehensive studies of graduate use of materials exist but the pattern of use can be deduced from related studies (Fussler and Simon, 1961; McAnally, 1951; Stevens, 1951).

Branscomb (1940, p. 23) noted a decided increase in borrowing as the student progressed from freshman to graduate student. Only one recent study (Barkey, 1965) shows a reverse trend. Two influences may account for the inversion of this pattern:

1. Periodicals play an increasingly important part in the use of the literature (and the library) as the student

progresses; more and more libraries are not allowing periodicals or journals to be circulated.

2. Circulation figures on which his report is based do not take into account the increased reliance by advanced students on photocopying.

It is very difficult from the figures available to us to arrive at a graduate-student per-capita use of library materials. It can be concluded, however, that the internal library use of all materials is probably triple that of undergraduates and the borrowing is close to double that of the average per capita for undergraduates. Jain (1966) found in a social-science collection that graduate students used library materials three times as much as undergraduates and four times as much as the faculty.

Graduate use of periodicals appears to be about 20%-40% of all use, or double that of undergraduates. An MIT study (Bush, Galliher, and Morse, 1956) concluded that about 65% of items used by graduates were in periodicals. Kilgour (1961) found in the previously mentioned study of Yale medical students that graduate students' use of periodicals was 53%.

It has been found that graduate-student monograph and periodical uses follow the same patterns as the advanced professionals in the same subject disciplines but that the quantity surpasses that of the undergraduate or faculty/teacher. Therefore, the

periodical figures corresponding to subject-discipline uses are not typical of all graduate uses.

FACULTY, RESEARCH, AND STAFF

Faculty members' library use of books or periodicals is rather a difficult item to measure. In addition to the definitions of a faculty/teacher (as contrasted to staff and researcher), there are the problems of cooperation for study purposes, ability of most circulation files to give only gross categorizations, if at all, and the great influence of photocopy and special privileges in this group. However, some data have been gathered and are analogous to the total view.

Broadus (1963) reports these figures based on a semester of monograph circulation in a university with 441 faculty members:

Faculty member	Per-capita circulation for a semester (volumes)	
Professor	5.6	
Associate Professor	7.9	
Assistant Professor	6.6	
Instructor	6.1	
Total population average		6.6

Another small university (200 faculty members) reported 17 volumes per academic year, 1959-1960 (Barkey, 1962). A study of a large university showed approximately eight items borrowed per faculty member per year in a social-science section of a large library collection (Jain, 1966). The range of these three, 6-17, is probably indicative of most university faculties. More-realistic considerations of faculty borrowing (and use) probably can best be made via the subject disciplines. It has been shown (Sheniti, 1960) and is a general truism that library borrowing by faculty members is highly concentrated in the subject areas of the academic department of which the teacher is a member. It is also true that periodicals are of everincreasing importance to all subject-discipline faculty people as they advance in status and professional recognition. Actual borrowing, however, seems heaviest among books, by 2:1 over periodicals in the University of Leeds study (Page and Tucker, 1959, p. 5). Lacking any more detailed views than reported here for an entire faculty, we must attempt to get a better understanding from the subject-discipline approach.

Before discussing subject-discipline use, however, we should examine the researcher and administrative-staff use of monographs. In small colleges, many large colleges, and some universities, the number (or percent) of people who hold

nonteaching or faculty positions is not as great as in those larger universities where the administrative structures are large and the separation of functions is more clearly defined. The joint-appointment arrangements of administrative/teaching faculty is commonplace in the medium-sized, four-year colleges. The size of service staffs is small in this same community. We are perhaps then concerned only with this group as an influence in the medium-to-large-sized universities. The use studies relevant to an academic community do not help us draw a per-capita or use profile for researchers and service staffs. Typical is a study at The University of Michigan, where the distinction is made between the teaching faculty and the researcher, so that we know the number in each group; but, the final compilations and tabulations merge both groups as "Faculty" (Meier, 1961). In a reverse twist, the University of Leeds report (Page and Tucker, 1959) gives the circulation of the two groups but doesn't tell us the population of either.

Representations will have to be made by analogy and observation. Researchers in industrial and nonacademic libraries have been found to be less exploratory of literature than their subject-discipline teaching counterparts in nearly all subject areas except the sciences, and then only when the researcher is forced to do more retrospective searching than the teacher. It cannot

be assumed as we learned in Chapter III that the nonacademic researcher will use a formal library system, as the teaching or academic researcher is more apt to do. Therefore, what we learn in the one situation cannot be readily applied to the other.

Broadus (1963, p. 324) reports a teaching-faculty average of seven books borrowed for a semester for a 368-member faculty. The library staff (a service unit) borrowed 10.1 books per capita during that semester. Whether or not this is indicative is impossible to deduce. Library-staff borrowing surely does not give us clues to other service-staff habits. Leaving this unknown quantity unresolved may not be such a dire problem in the context of this report, if we can accept these facts.

1. Service staffs who borrow library materials constitute a small percentage of the total university population and therefore are not apt to alter or influence greatly experimental or final design considerations.
2. Research staffs in the academic community are at least equal to and may surpass the library monograph borrowing of their teaching counterparts and, therefore, may be viewed as being synonymous in minimal per-capita activity.

Data that allow comparison of a total faculty or service staffs' use or borrowing of periodicals are also very rare.

The approach has usually been by subject fields (McAnally, 1951; Voigt, 1961; Kilgour, 1961; and numerous others) and not of the total faculty, thereby making comparisons and correlations difficult. The University of Leeds study (Page and Tucker, 1959) found the teaching-faculty periodical borrowing to be 34% of all faculty borrowing, the research staff 33%. In the same school, the botany and chemistry faculty/researcher borrowing split 50-50 by format. The reasons stated earlier that make periodical-usage figures less than complete for student use are also true with faculty data; there is also the added influence of personal copies.

SUBJECT-DISCIPLINE MONOGRAPH AND PERIODICAL PATTERNS

We dealt in the previous sections in this Chapter with per-capita borrowing by academic groups. This less-than-definitive representation can be augmented somewhat by an observation of subject-discipline relationships to library borrowing. Observations, proof of activities in the non-academic library community, and hard data on faculty, graduate, and undergraduate use are here merged. Even with these measurements, our picture will not be statistically well-based since correlations by department, class, or subject field are nearly impossible. Graduate students and advanced undergraduates approach the faculty/researcher/teacher patterns within

their respective subject disciplines. We must extend that assumption by making allowances for the variations in the types of user previously listed.

A recent semester study of the classroom faculty members' borrowing of monographs at Northern Illinois University (Broadus, 1963) yielded these results; departments have been regrouped to conform to the subject categories in other sections (see Appendix A). The averages (Table VI-1) are from a limited environment but tend to correspond with actual library use (or observed use) in other types of libraries and institutions. Only a few of the variables that would tell us more have been tested. In an extensive and well-documented study (Fussler and Simon, 1961) at The University of Chicago, which compared use of the same books at Northwestern and the University of California, the authors made this conclusion:

> "The drop in use of all books [as they age] in a subject-area may be seen as the natural outgrowth of the addition of more books to the available universe. Total circulation figures suggest . . . that the number of books read per capita may remain roughly constant even though the number of books in the collection increases" (p. 155).

Their study included all types of borrowers as well as some browsing use. Obviously, this truism has a limit and probably

TABLE IV-1. Faculty borrowing at Northern Illinois University. (Based on data from Broadus, 1963.) Covers one semester.

Subject department of borrower	Total No. of faculty	Per-capita faculty No. of monographs checked out	
Humanities			
English	34	17.0	
Foreign Language	9	15.3	
Philosophy	4	9.3	
Average			13.8
Arts			
Art	12	5.1	
Industrial Arts	11	3.5	
Music	17	4.2	
Average			4.3
Social Sciences			
Business	23	3.6	
Economics	4	9.5	
Education	41	4.7	
Home Economics	9	7.7	
Journalism	3	1.3	
Library Science	4	20.5	
Physical Education	28	0.7	
Political Science	7	16.3	
Sociology-Anthropology	7	6.1	
Speech	21	3.5	
Average			7.4
History and Area Studies			
History	17	15.6	
Natural Sciences			
Biological Sciences	14	13.2	
Earth Sciences	11	4.9	
Average			9.0
Pure Science			
Chemistry	11	6.3	
Mathematics	18	2.5	
Physics	6	21.7	
Psychology	7	2.9	
Average			8.3
Applied Sciences and Technologies			
Nursing Education	6	6.0	

ought to be applied only to academic libraries of over a half-million volumes. The authors of the same study also concluded that there is "very considerable similarity in reading interests of scholars at different institutions" (Fussler and Simon, 1961, p. 123). Low use of a title at one institution is almost certain to show a similar slight use at another.

As explored in Chapter III, the amount of information from printed sources and their formats vary extraordinarily by subject discipline at the advanced levels of work. The following composite Table attempts those ratics. The estimates and ranges were drawn from a variety of sources and studies that are most nearly representative of the university community. It must be understood that they are approximations and in different situations may not be analogous to the entire college or university situation. What appear to be discrepancies are explainable. For example, the rather heavy use of library-owned monographs by technologists partially is explained by the fact that academic, applied scientists often have current (and some back-file) journals in personal or office files. They come to a library for a larger percentage of their monograph needs than those needs represent of their total reading. Another example is the greater use of serials by graduate students in several disciplines which seems accountable by their lack of accessibility to personal files and the concentrated, long-term nature of their graduate

TABLE IV-2. Estimated monograph use as a percentage of total library literature use by disciplines. (It should be assumed that serials constitute the remainder.) (*Sources:* Lane, 1966; Jain, 1966; Herner, 1966; Kilgour, 1961; Bonn, 1963; McAnally, 1951; Wagner, 1959; Sheniti, 1960; Slater, 1964; Raiseg, 1966; Bowen, 1961; Brown, 1956; Trueswell, 1964; Urquhart, 1948; Page and Tucker, 1959; Knapp, 1966; Voigt, 1961.)

Subject categories[a]	Graduates		Faculty-Researchers	
Humanities		**70-80**		**60-70**
Philosophy	80-90		70-80	
Language and Literature	80-90		80-90	
Classics	80-90		80-90	
Social Sciences		**60-70**		**50-60**
Sociology	60-70		70-80	
Economics	60-70		50-60	
Law and Public Administration	70-75		60-70	
History and Area Studies		**65-70**		**60-70**
U.S.	65		65	
Natural Sciences		**40-50**		**30-40**
Biology	40		30-40	
Botany	40		45	
Pure Sciences		**40-45**		**35-45**
Chemistry	40		45	
Physics	40		40	
Technology and Applied Sciences		**35-45**		**30-40**
Agriculture	30-40		40-50	
Medicine	30-45		30-35	

[a]The ranges for the six major subject categories are based on more than the subunit figures given.

research program (evidently not continued after the Ph.D.).

The data that we have used for the bases of these profiles follow to a degree the philosophy expressed by Fussler and Simon (1961, p. 157):

> "Certainly there is loss of accuracy in employing data from one subject-area to predict for another subject-area that we have not studied--though intuition about the properties of large classes of books may be a fair guide. Furthermore, it is necessary to interpolate, extrapolate, smooth curves by eye, and generally to manipulate the observed data in order to come up with any prediction."

A few views should help to characterize some subject-discipline uses.

> ". . . library facilities in the humanities are probably more essential than in the sciences for, without literature, research in the humanities would be almost non-existent" (Urquhart, 1960, p. 123).

Burchard (1965, p. 222) makes a similar observation.

> "The search for the information itself is a major part of his task. It is in this sense that the library for the humanist is truly his laboratory."

Heavy users of the literature who can be designated by subject discipline do not usually delegate their literature

searching and use tasks to others; they tend to do it themselves. On this basis, the fairly heavy academic library users are those people in the humanities (particularly literature), social sciences, and history, with the natural sciences close behind and the pure (or physical) sciences near. The technologists and applied scientists hold the rear.

OBSOLESCENCE

Patterns of use in an academic community can be enhanced by some understanding of rates of obsolescence for monographs and serials. Table IV-3 has been extracted and computations normalized for over two dozen extensive studies analogous to the college/university community as well as from several past summaries and compilations. Although but a rough guide, with several fields of study unrecorded, the data should add focus to our views of library users.

TABLE IV-3. Half-life computations for a university collection.[a]

Half-life is "the time during which one-half of all the currently active literature was published " (Burton and Keebler, 1960, p. 19). Or, to state the concept another way, half-life is a statement of years from the present which would include 50% of the currently used literature.

This composite Table is devised from the numerous citation analyses, circulation studies, and other composite figures previously computed. (Over half of the references at the end of the Chapter were useful.)

Subject categories	Monographs		Serials	
Total Collection (Based on collections to serve teaching and some research in all basic disciplines.)	16-19			24 years
Humanities		22-25		
English Literature and Language	20-25			
Teutonic Language and Literature	28-32			
Philosophy	26-29			
Social Sciences		18-20		
Education	21-23			
Economics	22-24			
Law and Public Administration	15-17			
History and Area Studies		20-25		
Natural Sciences		16-20		8-10
Biology			8-10	
Physiology			7- 8	
Geology			11-12	
Botany			9-11	
Pure Sciences		5- 9		5- 8
Physics	4- 5		2- 4	
Mathematics			8-11	
Psychology	10-11			
Chemistry	5- 6		9-11	
Applied Sciences and Technologies		4- 5		3- 5
Medicine	4- 6		3- 4	
Pharmacy	5			
Engineering	6- 8		5- 7	
Petroleum			2- 3	
Aviation			4- 6	

[a]The basic figures used to compute the subject divisions were treated as of equal significance; that is, no adjustments were made for size of collections, within a university, that might affect heavier or lighter use within disciplines

Fussler and Simon (1961) in the most thorough study of decay in a university environment reached several valid conclusions and hypotheses; these are of particular importance:

1. "As theory would lead us to expect, books that have *never* been used have far less probable future use than books that have been used over the same lifetimes in the library" (p. 270).

As an extension of this, Fussler and Simon proved that the most important factor to determine retirement (or obsolescence) was *past* use. This was also concluded as the one most important criterion by Lister (1967).

2. "We measure decay by the ratio of: (a) the difference between the use in two time-periods, over (b) the use in the earlier time-period. Except for titles published in the most recent period, this measure is quite constant for titles of various ages in the natural sciences. The measure decreases with increasing age in the social sciences and in the humanities" (p. 156).
3. "In its simplest form, the concept for stabilizing the size of a working research collection would demand that age groups of books would decrease in use by the same *absolute* amount each year. Our results suggest that the rate of decay is much closer to a constant *percentage* each year, or—even worse for the stabilization

principle—that the percentage may tend to *decrease* over time. It is also relevant to recall that the rate of input for most subjects at present is much greater than was the rate of input twenty or thirty years ago, a simple arithmetical proposition that militates against the stabilization concept" (p. 156).

4. "Our data suggest that—at least in two [Humanities and Social Sciences] of the three broad subject-areas—the dilution caused by new acquisitions affects *new* books more than *old* books. We would hazard that this also means that dilution affects *heavily used* books by a greater *percentage* than it affects lightly used books. It would be good practice to adjust any set of calculations to reflect this phenomenon" (p.157).

This much more rapid drop in use of "popular" books than less popular ones was also verified in another study (Ernst and Shaffer, 1954).

5. "We might hypothesize that the greater the cumulative nature of the discipline—as in the sciences—and the less the historical, form, or author orientation, the more effective will be functions in which the age of the book is an important variable" (p. 269).

This rule of thumb has been noted by others but not stated quite as clearly.

CONCENTRATION OF USE

Half-life and obsolescence tell much about the possible use of a literature collection, and understanding is furthered by knowing what percentage of books soon after publication have not been used at all and, therefore, how many titles had the concentrated use. This pattern is more easily observed and accepted than it is statistically documented. Fussler and Simon (1961) do have some measurement, however. Of the monograph titles held commonly by three libraries (Chicago, Northwestern, University of California) that were compared for use during the five-year period following the previous decade of publication, these ranges are exemplary:

> Only 30%-45% of the Teutonic Languages and Literature had been used;
>
> 55%-70% of the Economics monographs had been used (pp. 139 and 142).

It must be kept firmly in mind that these figures relate to three large libraries whose collections represent research interests and that, therefore, have a high percentage of material that does not get used. Smaller university and college library collections that do not contain such a large proportion of research materials would probably not show as high a percentage of unused titles. Data to substantiate these points and to draw subject-discipline profiles are not available.

Within the sciences and technologies, the concentration of use of periodicals (or serials) has been tested in several environments, with nearly identical results. An analysis of 128,000 uses of periodicals in the Science and Technology Division of the New York Public Library indicated that the 100 most heavily used titles accounted for 47.8% of the year's use (Bonn, 1963). Urquhart (1959) analyzed 53,000 loan requests completed by the Science Library in London, which has national loaning responsibilities. He found that 80% of the requests were filled by less than 10% of the available serial titles (9,120). The same is true of most fields of the sciences and technologies: the used journals are recent and constitute but a small percentage of the total number currently published.

LANGUAGE

Studies of the influence of language on the use of literature have been numerous and the overwhelming results are the same.

1. Authors and readers are biased towards their own language and tend to ignore materials in foreign languages even to the point of professional peril.
2. Students seem to have no need for foreign-language materials unless they are studying a non-English literature or language.

3. There seems to be no appreciable difference in the use of foreign-language materials within subject disciplines by academicians, except, of course, in foreign-language literatures and languages.

A recent study at Purdue University (Andrews, 1968) typifies academic use of foreign-language materials.

Departmental library	Foreign language	
	% of total sample	% of all circulation in sample
Chemistry	12.4	0.0
Physics	18.4	5.1
Pharmacy	3.6	1.9

BROWSING

A total library use of literature has been attempted in this Chapter, taking into account wherever and whenever possible the in-library use of books and periodicals. The magnitude and importance of this serendipitous device, particularly in the humanities and social sciences, is not well established, although its general value to scholarship and student instruction is often noted (one such: Burchard, 1965, p. 223). In a summary of this important feature and its influence, Fussler and Simon (1961) state:

"We also found that in some subject areas and some kinds of stack-access conditions, there is considerably

more browsing use than recorded use. Furthermore, many books are found by browsing directly, rather than by way of catalogs or bibliographical devices" (p. 276).

"In any given period of time, for books housed in stacks that are open to large segments of the reading population, there is considerably more browsing-use (as measured by the number of 'touches') than recorded-use. The relationship may be of the order of magnitude of 3-9 times as much browsing-use as recorded-use. . . " (p. 204).

As can be seen, not only is a measurement of use difficult to obtain, but even with a slight statistical comprehension the picture is just beginning to come into focus. One must end with rules of thumb and variations that must be understood in relative and approximate terms. To ascribe exacting answers is to have misunderstood the nature of the problem.

REFERENCE LIST FOR CHAPTER IV

1968

Andrews, Theodora. "The Role of Departmental Libraries in Operations Research Studies in a University Library; Part 2: A Statistical Study of Book Use." *Special Libraries* 59 (October 1968) 638-644.

Morse, Philip M. *Library Effectiveness: A Systems Approach.* Cambridge, Massachusetts. The M.I.T. Press, 1968. 207 pp.

Ritter, R. Vernon. "Investigation of Classroom-Library Relationships on a College Campus as Seen in Recorded Circulation and Grade Point Averages." *College and Research Libraries,* 29 (January 1968) 30-40.

1967

Jain, Aridaman K. *Report on a Statistical Study of Book Use.* Lafayette, Ind., Library Operations Research Project and the School of Industrial Engineering, Purdue University, 1967. 276 pp. (A Doctoral thesis also available as PB 176 525.)

Lister, Winston C. *Least Cost Decision Rules for the Selection of Library Materials for Compact Storage.* Purdue University, 1967. 261 pp. (Ph.D. thesis) (Available as Clearinghouse Doc. PB 174 441.)

Long, Dewain O. *Use of the Freshman-Sophomore Library by General College Students.* Minneapolis, General College, University of Minnesota, 1967. 10 pp. (Available as ERIC Doc. ED 019 936)

1966

Chapin, Richard E. "Use of Printed and Audio-Visual Materials for Educational Purposes by College and University Students," pp. 57-71 in *Conference on the Use of Printed and Audio-Visual Materials for Instructional Purposes: First Report.* New York School of Library Service, Columbia University, 1966.

Herner and Company. "User Practices Based on a Review of User Studies," in *A Recommended Design for the United States Medical Library and Information System, Vol. II. Background Studies.* Washington, D.C., Herner and Company, 1966.

Jain, Aridaman, K. "Sampling and Short-Period Usage in the Purdue Library." *College and Research Libraries*, 27 (May 1966) 211-218.

Knapp, Patricia B. "Periodicals, Newspapers, and Other Serials, Documents, Technical Reports, and Pamphlets," in *Conference on the Use of Printed and Audio-Visual Materials for Instructional Purposes: First Report*. New York, School of Library Service, Columbia University, 1966, pp. 91-106.

Lane, Gorham. "Assessing the Undergraduates' Use of the University Library." *College and Research Libraries*, 27 (July, 1966) 277-282.

Raiseg, L. Miles, *et al*. "How Biomedical Investigators Use Library Books." *Bulletin of the Medical Library Association*, 54 (April 1966) 104-107.

Strain, Paula M. "Study of the Usage and Retention of Technical Periodicals." *Library Resources and Technical Services*, 10 (Summer 1966) 295-304.

1965

Barkey, Patrick. "Patterns of Student Use of a College Library." *College and Research Libraries*, 26 (March 1965) 115-118.

Burchard, John E. "How Humanists Use a Library," pp. 219-223 in Carl F.J. Overhage and R. Joyce Harman, Eds., *Intrex; Report of a Planning Conference on Information Transfer Experiments*. Cambridge, Mass., The M.I.T. Press, 1965.

1964

Ennis, P.H. "Study of the Use and Users of Recorded Knowledge." *Library Quarterly*, 34 (October 1964) 305-314.

Ritter, R. Vernon. "Recorded Library Use in Small Four-Year-Colleges, 1962-63." *College and Research Libraries*, 25 (September 1964) 391-392.

Slater, Margaret. *Technical Libraries: Users and Their Demands*. London, Aslib, 1964. 126 pp.

Trueswell, Richard. "Two Characteristics of Circulation and Their Effect on the Implementation of Mechanized Circulation Control Systems." *College and Research Libraries*, 25 (July 1964) 285-291.

1963

Bonn, George S. "Science-Technology Periodicals: A Preliminary Report on a One-Year Use Study at NYPL." *Library Journal*, 88 (March 1, 1963) 954-958.

Broadus, Robert N. "An Analysis of Faculty Circulation in a University Library." *College and Research Libraries*, 24 (July 1963) 323-325.

Cole, P.F. "Journal Usage Versus Age of Journal." *Journal of Documentation*, 19 (March 1963) 1-11.

1962

Barkey, Patrick. "More on the Absent Professors." *Library Journal*, 87 (April 1962) 1346.

1961

Bowen, A. *Non-Recorded Use of Books and Browsing in the Stacks of a Research Library*. Chicago, University of Chicago, 1961, 51 pp. (Master's Thesis)

Dubester, Henry J. "Stack Use in a Research Library." *American Library Association Bulletin*, 55 (November 1961) 891-895.

Fussler, Herman H. and Julian L. Simon. *Patterns in the Use of Books in Large Research Libraries*. Chicago, University of Chicago Library, 1961. 283 pp. and Appendices.

Kilgour, Frederick G. "Recorded Use of Books in the Yale Medical Library." *American Documentation*, 12 (October 1961) 266-269.

Meier, Richard. "Efficiency Criteria for the Operation of Large Libraries." *Library Quarterly*, 31 (July 1961) 215.

Voigt, M.J. *Scientists' Approaches to Information.* Chicago, American Library Association, 1961. 81 pp. (ACRL Monograph No. 24).

1960

Burton, R.E. and Keebler, R.W. "The 'Half-Life' of Some Scientific and Technical Literatures." *American Documentation,* 11 (January 1960) 18-22.

Sheniti, Mahmoud. *The University Library and the Scholar; A Study of the Recorded Use of a Large University Library.* Graduate Library School, University of Chicago, 1960 (Ph.D. Dissertation).

Urquhart, D.J. "The Needs of the Humanities," *Journal of Documentation,* 16 (September 1960) 121-131.

1959

Asheim, Lester. "A Survey of Recent Research," pp.3-26 in Jacob M. Price, Ed., *Reading for Life; Developing The College Student's Lifetime Reading Interest.* Ann Arbor, University of Michigan Press, 1959.

Chapin, Richard E. "Libraries in Freshman Research." *Basic College Quarterly* (Fall, 1959), 35-38.

Hogg, I.H. and J.R. Smith. "Information and Literature Use in a Research and Development Organization," pp. 131-162 in *Proceedings of the International Conference on Scientific Information, Washington, D.C., 1958.* Washington, D.C., National Academy of Sciences-National Research Coucil, 1959, Vol. 1.

Knapp, Patricia B. *College Teaching and the College Library.* Chicago, American Library Association, 1959. 110 pp. (ACRL Monograph No. 23).

Page, B. S. and P.E. Tucker. "The Nuffield Pilot Survey of Library Use in the University of Leeds," *Journal of Documention,* 15 (March 1959) 1-11.

Urquhart, D.J. "Use of Scientific Periodicals," pp. 287-300 in *Proceedings of the International Conference on Scientific Information, Washington D.C., 1958.* Washington, D.C., National Academy of Sciences-National Research Council, 1959, Vol. 1.

Wagner, S.M. *A Study of Book Requests in a University Biology Library.* Chicago, University of Chicago, 1959 (Master's Thesis).

1957

Louttit, C.M. "The Use of Foreign Languages by Psychologists, Chemists, and Physicists." *American Journal of Psychology,* 70 (1957) 314-316.

1956

Brown, C.H. *Scientific Serials.* Chicago, ALA Association of College and Research Libraries, 1956.

Bush, G.S., H.P. Galliher, and P.M. Morse. "Attendance and Use of the Science Library at Massachusetts Institute of Technology." *American Documentation,* 7 (January 1956) 87-109.

1954

Ernest, Martin L. and Bertram Shaffer. *A Survey of Circulation Characteristics of Some General Library Books,* 1954 (Unpublished M.I.T. report).

1951

McAnally, Arthur M. *Characteristics of Materials Used in Research in United States History.* Chicago, University of Chicago, 1951, 185 pp. (Ph.D. Thesis).

Stevens, Rolland E. *Use of Library Materials in Doctoral Research: A Study of the Effect of Differences in Research Method.* University of Illinois, 1951 (Ph.D. Thesis).

1948

Urquhart, D.J. "The Distribution and the Use of Scientific and Technical Information," pp. 408-419 in *Royal Society Scientific Information Conference Report*, 1948

1940

Branscomb, Harvie. *Teaching with Books; A study of College Libraries*. Chicago, Association of American Colleges and American Library Association, 1950. 239 pp. (Republished by The Shoe String Press, Hamden, Conn., 1964)

CHAPTER V

PUBLICATION RATES

Growth rates, concentrations of language, and publishing formats may all serve as deciding factors in select digital-storage experiments or design considerations. They may be very important if the designs, technology, and economic factors are amenable to an operating, long-term system. Brief consideration will be given to those publishing factors which may influence design possibilities. The previously made distinction between monographs and periodicals will be employed here.

MONOGRAPHS

The usual problems of definition, acceptance of standardized methods, timely reporting, and unavailability of data are as common with monograph-production statistics as for many of the topics already discussed. Although UNESCO has standardized counting methods with detailed instructions, the standards were only recently introduced and accepted and are still variously interpreted and compiled in different countries, making comparison difficult. The data of the recently reported years (1964-1966) should be compared with caution.

It must be emphasized that the data provided in Table V-1 include federal and state documents, a relatively new method of counting United States figures. The U.S. Government publishing

TABLE V-1. Monograph title production of the top nine countries of the world. (Ref. 1, pp. 756-760; Ref. 2, pp. 89-92.)

Country	Titles produced in 1966	Range of increase or decrease per year (based on 1964-66)
U.S.S.R.	73,000	-2% to -5%
United States	58,500	6% to 8%
Japan	30,500	5% to 10%
United Kingdom	28,800	3% to 7%
France	23,800	10% to 15%
West Germany	22,700	0% to -1%
Spain	19,000	8% to 10%
India	12,100	0% to -1%
Netherlands	10,600	1% to 3%

Notes to Table V-1

1. Figures include commercial, societal, or government published books or pamphlets of more than 49 pages.
2. Figures are for those monographs which are made available to the public, thereby excluding private or corporate documents of small or nonpublic use.
3. Ephemeral materials and those in which the text is not the most important part are excluded (e.g., music scores).
4. Publications for promotion or advertising purposes are not included.
5. Figures include new titles and new editions of old ones.
6. Multivolume sets are counted as a single title *unless* each volume forms a complete separate whole and has a different title.

TABLE V-2. Five major subject categories as a percentage of total 1966 monograph titles of top four producers (cf. Table V-1). (Ref. 1, pp. 756-760.)

Country	Social sciences	Pure sciences	Applied sciences	Literature	History and geography
Classes:	3 & 3A	5	6 & 6A	8	9
U.S.S.R	22%	9%	46%	12%	3%
United States	18%	11%	13%	25%	12%
United Kingdom	14%	11%	17%	29%	12%
Japan	25%	6%	16%	26%	8%

Note: The U.S. figures contained a large number of monographs not categorized by subject; they have been excluded from consideration in these percentages.

complex, the inherent difficulty of definitions, and recording problems, all must be considered in relating the production to that of other countries. Of the 58,500 titles in the U.S.A, in 1966, approximately 28,000 were federal and state documents. The nongovernment figures will also be considered.

The title figures in Table V-1 have also been categorized into subjects comparable to the Classes established for the Literature-Graphics Study (cf. Chapter VI or Appendix C). Those relationships are shown in Table V-2. The five largest subject categories are shown, with the exception of Russian Fine Arts (Class 7) and Languages (Class 4), which both slightly exceed the History and Geography (Class 9) in that country. Fine Arts

production in Japan is equal to that of the Pure Sciences (Class 5). The similarity of the percentages for the two English-language countries should be noted. Since English is almost exclusively the language represented in college and small-university libraries, literature and the social sciences are probably best represented in collections. Along with the applied sciences, they constitute over half of all the titles published. If one wished to concentrate on a Russian-language digital-storage problem, he might do well to use a subclass of applied sciences. Although variations of monograph publishing are obvious within select countries, the eastern European countries more nearly follow the percentages shown in Table V-2 for the U.S.S.R.; the rest of the world more nearly patterns the U.S.A. and the United Kingdom. Percentage changes in these major subject categories have not been significant in the recent past.

Primary languages used in monographs around the world have varied only slightly in recent years. French and Spanish each account for approximately 10% of the world titles, with German and Japanese both close to the same figure. About 20% of the world's titles are in Russian, although their world influence, while still in that language, is not as great as most of the languages previously mentioned. Approximately 40% of the monograph titles are currently printed in English and that percentage

seems to be increasing slightly. As mentioned in previous chapters, college students make almost no use of foreign-language monographs, and the faculty little more. Foreign languages are encountered largely in research needs and usually in periodical format. However, except for the language and literature fields, foreign-language monographs are too much for most academic people to trouble with. They prefer to wait for the valuable monographs to be translated into English. Therefore, we will take a more concentrated look at the English-language production figures and correlations, since they probably have more relevance. Subject categorization of American commercial publishing for 1966 and 1967 is provided for more-detailed observations.

Of the 27,350 new titles and new editions in 1966, 1900 were textbooks; in 1967, 2100 of the total were textbooks. As mentioned previously, textbooks are not usually collected by academic libraries. Not all of the titles are hard-bound books; in 1966, 9000 titles were in paper, 8000 in 1967.

Commercial American monograph titles produced from 1964 through 1967, comparable to the data presented in Table V-3, show less than a 1% increase per year. World title production is only slightly higher. In American production, the increase and decrease in titles within subject categories varies substantially each year. No significant trends are observable,

TABLE V-3. Commercial American monograph title production by subject classes (cf. Chapter VI and Appendix C) and major imports. (Ref. 2, p. 61.)

Class	1966 Titles	Class % of Total	1967 Titles	Class % of Total	Imports handled by American publishers	
					1966	1967
0: General works and bibliography	650	2.4	550	2.1	100	80
1: Philosophy and psychology	890	3.2	860	3.3	170	120
2: Religion	1,810	6.6	1,860	7.1	280	220
3: Social sciences	3,900	14.3	4,140	15.8	930	840
3A: Education	1,040	3.8	910	3.5	130	100
4: Languages	800	2.9	570	2.2	180	110
5: Pure sciences	2,960	10.8	2,370	9.1	910	640
6: Applied sciences	2,480	9.1	2,430	9.3	660	530
6A: Medicine	1,450	5.3	1,190	4.6	460	330
7: Fine arts	1,830	6.7	1,780	6.8	570	500
8: Literature and fiction	5,850	21.4	5,780	22.2	670	440
9: History and geography	3,690	13.4	3,620	13.9	1,010	780
	27,350		26,060		6,070	4,690

Notes:
1. Juveniles are excluded.
2. Commercial coverage includes nearly all publishers, including university presses and societies; government publications are not included
3. Coverage is the same as specified in Notes 2-5 of Table V-1; Note 6, the change in multivolume set counting, accounts for the slight drop in 1967 figures.

although the Literature and Fiction group (Class 8) has shown the only consistent, yearly increase, albeit small. Judging from the past five years, it seems that publishing and the regeneration of knowledge, or the packaging of information, are in a cyclical pattern approaching a rut. The exponential rate of growth of literature often expressed as the information explosion obviously is not represented in monograph publication.

PERIODICALS

The frequency of periodical production, the multitude of authors and articles and related format features make comparisons with monographs difficult. Periodicals serve specific and different needs; those dissimilarities must be viewed in their own context and not necessarily in relationship to books.

The most striking feature giving rise to concern over the explosion of publishing or information is the control or access problems that the contents of periodicals cause. The multitudinous articles require distinct bibliographic controls, as does each book; whereas the book usually solves its recording with one reference, a periodical generates from 50 to 70 worthy individual article citations per volume. The exponential rate of periodical growth so often mentioned is really a periodical literature (or article) growth. The growth of periodical titles has not been and is not now exponential. For the consideration

of the concept of digital storage of periodicals from cover to cover or of the substantive contents, the literature content rather than the number of titles is more relevant.

Considerable effort has been invested in learning the number of periodicals and serials in the scientific and technological fields, but not in other subject disciplines. In one of the few systematic estimates made, Machlup[3] arrived at an annual growth rate of 4.1% for *all* periodical literature (*not* titles) based on data for 1947-1958. The variously computed rates in the sciences and technologies mostly exceed Machlup's overall figure. They range from 2.9% in psychology to 5.5% in economics ranging over the first 60 years of this century.[4] Price[5] in extensive studies of scientific and technological periodical titles and literature concluded a 7% compounded literature growth that has been substantiated by other investigations. The higher rate is evident in the technological fields but not in the pure and natural sciences.

The actual numbers of extant periodicals or serials is a time-consuming figure to obtain and subject to a wide error factor. Again, the data available are in the applied- and pure-science fields and inference extensions must be made for other disciplines. The surveyors in a recent analysis at the Library of Congress concluded that close to 35,000 periodicals in the sciences and technologies were currently published

around the world.[6] They excluded house organs, most ephemerals, and technical reports in series. In a similar count of currently received titles at the National Lending Library for Science and Technology in London, the total was 26,000 (Ref. 7). Both organizations essentially were using the same definitions. The figure of 30,000 current titles in science and technology seems accepted. The numbers of titles in other subject fields are not well known but estimates are possible, based on some assumptions and observations made in this and other reports. Table V-4 provides a subject analysis of the 193,000 entries in the *Subject Index to New Serial Titles, 1950-1965*, which is discussed more extensively in Chapter VI and also detailed in Table VI-2. The entries represent cataloging data for new serials (including periodicals, house organs, government periodicals, and some ephemerals) received at the Library of Congress for the 16-year period. As the Table and other comparisons indicate, the applied and pure sciences (Classes 5, 6, and 6A) constituted about 33% of all entries. On this basis, we may extrapolate the number of currently published periodicals in the nonscientific and nontechnological fields to be approximately 60,000.

Reading of periodicals, including that done by academics, is concentrated in a very small portion of this total, a portion of great importance to any textual digital-storage experiments. Price makes this statistical estimate based on Urquhart's[8]

observation that 10% of the journals at the National Lending Library for Science and Technology met 80% of the demand: "Thus, journal-dwellers are distributed in the same way as city-dwellers; there is the same tendency to crystallize, and the same balance between the exponential growth of the largest members and the increasing numbers of the smallest. Since the dividing line is drawn at the square root of the total population, we can say that although 30,000 journals exist, half the reading that is done uses only the 170 most popular items" (Ref. 5, p. 75). This concentration phenomenon is most certainly true in other subject disciplines as well. These "core" journals are estimated to be increasing only at the rate of 3% per annum (Ref. 9, p. 40).

The number of more commonly used periodicals and serials can be estimated for all subject fields but only after more-extensive work than represented in the published literature. A recent directory of selected periodicals[10] cites 12,000 current world-wide titles in sciences, technology, and medicine and 18,000 for all other subjects. Two supplementary volumes published in 1967 and 1969 include 7,500 additional titles on approximately the same subject ratio. These go beyond the "core" journals but are representative of the currently most-pertinent research and general-interest periodicals. Studies in several subject disciplines tend to indicate that only about half of the articles published in periodicals are considered economically worthy of

inclusion in indexing or abstracting services. This correlates positively with Ulrich's selected titles.

The mortality rate on periodicals is very high in all subjects. In the applied- and pure-science journals, the rate has been variously computed between 33% and 60% over 20 to 50 years.

The extensive coverage of the entries in *New Serial Titles*, as previously mentioned, provides us with a broad subject breakdown and statistical base from which to view title production in subject disciplines; Table V-4 provides those data. It must be remembered that the coverage is for serial publications, including journals or periodicals, house organs, some serials with distinctive titles, and government serials of more-general interest.

TABLE V-4. Percentage by subject categories of titles in *Subject Index to New Serial Titles, 1950-1965* (Pierian Press, Ann Arbor, Mich., 1968).

Class:	0	1	2	3	3A	4	5	6	6A	7	8	9
%:	7.9	1.0	2.5	29.1	4.7	0.7	7.0	21.2	5.7	5.4	4.4	10.0

In the Library of Congress survey of scientific and technological periodicals (Ref. 6, pp. 191-192), the six most prolific countries were found to produce 55% of all the titles; the technology titles far surpassed (45%-56% of total) the other categories of agriculture, medicine, and the natural and physical

sciences.

Languages in which the world's periodicals are published seem not to vary greatly from those given earlier for monographs. Bourne's paper,[11] which is recommended for a compact summary of specific technological disciplines, cites a UNESCO study that found these language percentages in the scientific and technological periodicals (p. 164).

Language	Percent of total
English	60
Russian	11
German	11
French	9
Japanese	3
Spanish	2
All other	4

These are acknowledged to be calculated estimates intended to show only the order of magnitude. In a similar study of six English-language abstracting and indexing publications in science and technology,[12] English ranged from 50% to 82%, Russian from 4% to 24%, and German from 3% to 17%. The periodicals received at the National Lending Library for Science and Technology[12] closely correspond by language to the UNESCO figures: English,

46%; Russian, 14%; German, 10%; French, 9%; and Japanese, 4%.

The sparse data for the other subject disciplines make comparisons and analogies problematical. However, the percentages and patterns as shown for science and technology and for monographs in all disciplines (Table V-3) are generally accepted and quoted.

LIBRARY COLLECTION RELATIONSHIPS

Firm data on university library collections by subject or format are spotty and inconclusive. At the undergraduate or college level, more information is available and comparison is possible. It is highly conceivable that any textual digital-storage experiments may concentrate on undergraduate literature needs; therefore, three recently published lists of undergraduate collections will be examined. The lists are those of the undergraduate libraries at Harvard University and The University of Michigan and a catalog compiled for the University of California's new college campuses.[13] Comparison is made only with the American commercial monograph figures (in Table V-3), thereby discounting foreign-language titles and periodicals.* The obvious variations are the greater number of titles in languages, literature, and history/geography and the appreciably smaller percentage

*Periodicals are not considered greatly influential since they constitute about 10% of an undergraduate library (cf. Chapter II) and closely correspond to subject patterns of monographs.

TABLE V-5. Three undergraduate library collections compared by subject to American commercial monograph production. (Ref. No. 13, Preface, and No. 2, p. 61.)

Class	Undergraduate collections (%)	American monograph production 1966 and 1967 (%)
0	2.4– 6.0	2.1– 2.4
1 & 2	8.8–12.0	9.8–10.4
3 & 3A	17.3–20.8	18.1–19.3
4 & 8	31.0–37.5	24.3–24.4
5, 6, & 6A	8.0–11.3	23.0–25.2
7	6.9– 8.0	6.7– 6.8
9	17.0–18.7	13.4–13.9

of all scientific and technological books in the undergraduate-libraries collections than are published in the U.S.A. This dissimilarity is not surprising upon consideration of the purposes and clientele of the two sets of data. The publishing figures more closely match the holdings of smaller universities which concentrate on nearly all subject fields in the English language. The larger university and research libraries show greater variation from these percentages because of the influence of graduate programs in select areas or stronger graduate faculties in some disciplines. Correlations at the university level are subject to these and many other influences.

TEXTBOOK INFLUENCE

The data supplied in Table V-3 contain textbook titles that are not usually purchased by academic libraries but that form the basis for most of the undergraduate's reading (cf. Chapter III). New titles and new editions of hardbound textbooks for college use numbered 1540 in 1966 and 1650 in 1967 (Ref. 2, p. 63). No figures are available for paperbound textbooks, although the actual number of units sold each year does exist. Hardbound texts outsell paper texts 3.5 to 2. An estimate of 2000 new titles or editions of college textbooks in 1967 seems conservative.

This critical core of literature might be viewed as an adjunct to a library collection and it is with this intention that Table V-6 is presented; the data might help to place in perspective digital-storage possibilities.

TABLE V-6. Domestic college textbook sales. (Ref. 2, p. 81; and the *1967 Annual Survey of Subscription Reference Book Publishers*, prepared by Stanley B. Hunt & Associates under the auspices of The American Educational Publishers Institute, April 1968. Figures include hardcover and paperback texts.)

	Dollar sales (millions)	All types of textbook sales (%)	Average dollar sale per student capita	Average No. of copies per student capita
1955	$ 53.0	29.1	$19.98	6.31
1960	$ 96.8	31.6	27.02	7.22
1965	$199.9	38.0	36.18	9.33
1966	$239.6	38.0	39.57	10.09
1967	$251.3	40.3	38.65	9.59

REFERENCE LIST AND BIBLIOGRAPHY FOR CHAPTER V

1. United Nations. Statistical Office. *Statistical Yearbook: Annuaire Statistique*, 1967.

2. *The Bowker Annual of Library and Book Trade Information, 1968* Phyllis B. Steckler, Ed., New York, R.R. Bowker Co., 1968. 499 p.

3. Machlup, F. *The Production and Distribution of Knowledge in the United States.* Princeton, N.J., Princeton University Press, 1962.

4. Holt, Charles C. and William E. Schrank. "Growth of the Professional Literature in Economics and Other Fields, and Some Implications," *American Documentation*, 19 (Jan. 1968) 18-26.

5. Price, Derek de Solla. *Little Science, Big Science.* New York, Columbia University Press, 1963. 119 p.

6. Gottschalk, Charles M. and W.F. Desmond. "Worldwide Consensus of Scientific and Technical Serials," *American Documentation*, 14 (July 1963) 188-194.

7. Barr, K.P. "Estimates of the Number of Currently Available Scientific and Technical Periodicals," *Journal of Documentation*, 23 (June 1967) 110-116.

8. Urquhart, D.J. "Use of Scientific Periodicals," pp. 277-290 and Tables II and VII in: *Proceedings* of The International Conference on Scientific Information, Washington, D.C., 1958. Washington D.C., National Academy of Sciences-National Research Council, 1959. 2 volumes.

9. Judge, P.J. "The User-System Interface Today: National and International Information Systems," p. 37-56, in: *Communications in Science: Documentation and Automation*, Boston, 1966.

10. *Ulrich's International Periodicals Directory*, 12th edition, Vols. 1 and 2 and 3 supplements. New York, R.R. Bowker Co., 1967-1969.

11. Bourne, Charles P. "The World's Technical Journal Literature: An Estimate of Volume, Origin, Language, Field, Indexing, and Abstracting," *American Documentation*, 13 (Apr. 1962) 159-168.

12. Wood, D.N. "The Foreign-Language Problem Facing Scientists and Technologists in the United Kingdom—Report of a Recent Survey," *Journal of Documentation*, 23 (June 1967) 117-119.

13. Voigt, Melvin J. and Joseph H. Treyz. *Books for College Libraries; A Selected List of Approximately 53,400 Titles* . . . Chicago, American Library Association, 1967, 1056 p.

CHAPTER VI

EDUCOM LITERATURE-GRAPHICS STUDY

One of the most critical areas of consideration at the EDUCOM fall conference in 1967 was the need to know exactly what types of graphics were represented in the library collections. Probably the single, most critical, technical question in storage of textual material in digital form is that of the methods, means, and possibilities of storing colored plates, half-tones, full tones, line drawings, charts, Tables, and the thousands of variations. A basic first step seemed to be to identify those illustrations by type and quantity in the context of a library in a teaching/research university.

It was hoped that the printing/publishing industry and the literature would provide some basic information derived from production and statistical programs but the data could not be located. Therefore, a survey was performed to collect the basic data in a university library.* The study was conducted during the summer of 1968 at The George Washington University Library; the summary results are included in this Chapter, with additional charts and details in Appendix C. George Washington's extensive teaching

---

*The survey was accomplished by a research/study unit of The George Washington University and paid for by the Radio Corporation of America and the American Educational Publishers Institute.

curriculum, with several doctoral programs, a large student body in an urban setting, most probably offered us as representative a university library collection as we could find. The student body numbers over 18,000 and is spread through nearly all of the subject disciplines, including professional law and medicine. The Library collection of 320,000 volumes represents all major fields to some degree.

SAMPLE

A structured survey with random sampling within subject disciplines was determined most appropriate and feasible. The American monograph title output for 1966 was used as a basis for determination of subject categories and sample sizes. A 5% sampling each of monographs and periodicals was determined adequate, with subject groups based on the Dewey Decimal Classification (Table VI-1).

Numerous questions had to be answered and judgments made in the structuring of the study. Consideration and adjustments were made where necessary for such factors as books charged out, locations of material, actual count of monographs, actual count of serials (or periodicals), definitions for monographs and periodicals, reference and other special collections, translation of Dewey Decimal Classification notations to Library of Congress notations, and several similar less influential factors. (Details on the structuring, the sample, and summation Tables are given as

TABLE VI-1. Subject groupings and sample size for literature-graphics study.

1966 Publication base	Subject categories	Monographs 5% Sample	Actual Survey Count[b] Monographs (vols.)	Actual Survey Count[b] Periodicals (vols.)
650	General works (000-099)	33	34	61
900	Philosophy and Psychology (100-199)	45	45	59
1800	Religion (200-299)	90	90	38
3900	Sociology, Economics, and Law (300-369, 380-399)	195	195	308
1000	Education (370-379)	50	50	108
800	Languages (400's)	40	40	58
2900	[a]Sciences (500's)	145	169	203
2300	[a]Technology (600-609, 620-699)	115	146	172
1400	[a]Medicine (610-619)	70	84	61
2000	Fine Arts (700's)	100	100	62
2800	Literature (800's)	140		
3000	Fiction (if classified, it must be included in 800's)	150	290	103
3500	History, Travel, and Biography (900's)	175	175	131
26950		1348	1418	1364

[a]Date coverage of 1960-1968; all others, 1950-1968.

[b]Actual survey count in this Table is for the Types of Illustrations sample. More volumes were examined than the original 1348 planned for both formats. Because of the invalidity of some data, the sample size varies with the factor under discussion. The largest sample of monographs is 1444 (type size) and 1405 for periodicals.

TABLE VI-2. Percentage coverage comparison by classification of Literature-Graphics Study and periodicals in the *Subject Index to New Serial Titles*.[a]

	LGS %	*NST* %
Class 0		
AC-AG	0.1	1.2
AM-AN	0.4	0.5
AP	1.2	2.0
AS-AZ	0.07	0.6
Z665-9000	2.7	3.6
	4.5	7.9
Class 1		
B-BF	4.3	0.9
Class 2		
BL-BX	2.8	2.5
Class 3		
GF-GT	0.3	2.2
H-HE	6.1	12.3
HG-HZ	4.4	7.0
JA-JX	10.0	4.6
K	1.1	2.1
UV	0.6	0.9
	22.5	29.1
Class 3A		
L-LJ	7.9	4.7
Class 4		
P-PF	4.2	0.7
PG-PM	0.07	0.0
	4.3	0.7
Class 5		
Q-QL	14.8	7.0
QR	0.07	0.0
	14.9	7.0
Class 6		
HJ	2.3	2.4
S-SK	1.1	5.8
T-TX	8.9	10.5
Z4-661	0.3	2.5
	12.6	21.2
Class 6A		
QM-QP	0.7	0.2
R	3.7	5.5
	4.4	5.7
Class 7		
BH	0.07	0.0
CJ & GV	1.0	2.0
M-MT	1.1	1.1
N-NK	2.1	2.1
TR	0.2	0.2
	4.5	5.4
Class 8		
P-PA	1.3	0.5
PG-PZ	6.2	3.9
	7.5	4.4
Class 9		
CB-CE	0.3	0.6
CT	0.07	0.5
D-DX	2.2	4.9
E-F	5.9	1.6
G-GC	1.1	2.4
	9.5	10.0

[a] *Subject Index to New Serial Titles, 1915-1965*. Ann Arbor, The Pierian Press, 1968. 434 pp.

Appendix C.) The oversized materials at George Washington are segregated for economy of shelf space as they are in most large libraries. Volumes over 11½ in. high were shelved separately; these constituted such a small portion of the collection that their influence was minor and they were not surveyed. The reserve-book collection at George Washington was mostly on the regular-collection shelves during the sampling period, so no special study was made of that rotating special collection.

A translation and classification program had to be worked out for the periodical titles because the sample collection was arranged alphabetically by journal title and had no subject organization. A random sample was made on an alphabetical basis and the titles then classed in the broad subject categories originally established. Although the same sample size of 1348 volumes was used, the periodicals could not follow the monograph production figures. The sample size was adjusted to assure a valid representation in subject fields. Entries in the *Subject Index to New Serial Titles* (NST), *1950-1965*, which are recent, comprehensive, world-publication figures, were tabulated by subject categories and compared with like classes from the Literature-Graphics Study sample. The *Subject Index to NST* has 193,000 serial or periodical titles spanning one of the most prolific serial-publishing periods, thus providing a most meaningful and realistic basis for comparison. Table VI-2 indicates the remarkable similarity of our

Literature-Graphics Study (LGS) percentages to those in the *Subject Index to NST*.

The data sheets for the 2600-volume sample were designed to collect basic data on six features:

(1) types of illustrations;

(2) type size used;

(3) page size;

(4) publication date;

(5) language;

(6) number of pages.

The first two elements of data were the prime reasons for the study since these data for a library collection could not be located and they are necessary for consideration of any detailed planning toward digital storage. The other data elements were gathered as verifications of the sample, to show any trends, and to aid in possible correlations.

Summary Tables and characterizations based on these data have been prepared. More-detailed figures are in Appendix C.

Classes 0 through 9 correspond to those subject categories listed in Table VI-1. A more complete classification breakdown is provided in Appendix C.

Class	Includes These Subjects
0	General works, reference tools, indexes, libraries, library science, and bibliographies
1	Philosophy, logic, metaphysics, and psychology
2	Religions and theology
3	Social sciences, including anthropology, manners and customs, economics, transportation, finance, sociology, political science, government, law, and military and naval sciences
3A	Education
4	Philology, linguistics, and languages
5	Science, including mathematics, astronomy, physics, chemistry, geology, natural history, botany, zoology, bacteriology, and biology
6	Engineering, technology, commerce, agriculture, book industries, and trade
6A	Medicine and health sciences and physiology
7	Fine arts, including sports, music, graphic arts, painting, architecture, sculpture and photography
8	All literature, including fiction
9	Civilization, antiquities, history of all countries, places and people, geography and typography

TYPES OF ILLUSTRATIONS

Four categories of illustrations were determined adequate for the purposes of this study. Although there were disagreements on the basis of the definitions and samples used, these proved few and insignificant to the total sampling.

1. *Line Illustrations* Graphic representations of material objects, areas, or life forms in which boundaries are depicted by black lines on a white surface, and in which surface aspects may be depicted by solid or multiple-line areas in either solid black or shadings of gray. In those cases where black occupies more area than white, the criterion is that the black has been imposed on the white rather than vice versa.

2. *Graphs and Charts* Black and white representations in which one factor is matched against one or more other factors within a planar framework on a comparative basis to show growth, decline, rate, or other forms of change. Representation may be by lines of solid or shaded areas of black on white.

3. *Half- or Full Tones* Photographic representations that are reproduced through use of normal black and white negative film or positive; also included are nonphotographic representations in which a significant area of the surface has been masked or screened to the extent that the shading thus produced is vital to the communication of information.

4. *Color Illustrations* Graphic or photographic representations in which color forms an integral part of the content; combinations of black and white (or grays) are excluded.

The surveyors were taught to examine and identify each type of illustration on a page *and* the amount of page space that each type of illustration occupied. Registrations were made in minimum

increments of eighths (e.g., 3/8, 8/8, 1/8, etc.) for each illustration; observation was visual. The one-eighth totals should be viewed as less than absolute, although the control and checks on the sampling seemed to verify that such a relatively small-size registration provided a more correct magnitude of measurement. Two different types of illustrations on the same page were recorded as distinct and unrelated items. It is not possible to get a count of the number of pages that did or did not have illustrations, except when the pages were completely covered with one type of illustration. Therefore, we have a registration of the *incidence* of each type of illustration and the size of that illustration for each volume. These tabulations show for 1364 periodical volumes a total of 160,249 illustration *incidences* as compared to 56,212 in 1418 monographs. Book publishing *in toto* would appear to be one-third as graphic.

Advertisements in periodicals proved a vexatious question. The possibility of digital storage of advertisements seemed less likely from an economic viewpoint than in a periodical volume on a library shelf, where much advertising has been removed before binding. Initially, the advertising illustrations were recorded separately from the nonadvertising materials for those periodical volumes in which the advertisements were bound. This proved an unwieldy undertaking and advertisement counts were stopped after 125 volumes had been surveyed. Those records can be made available

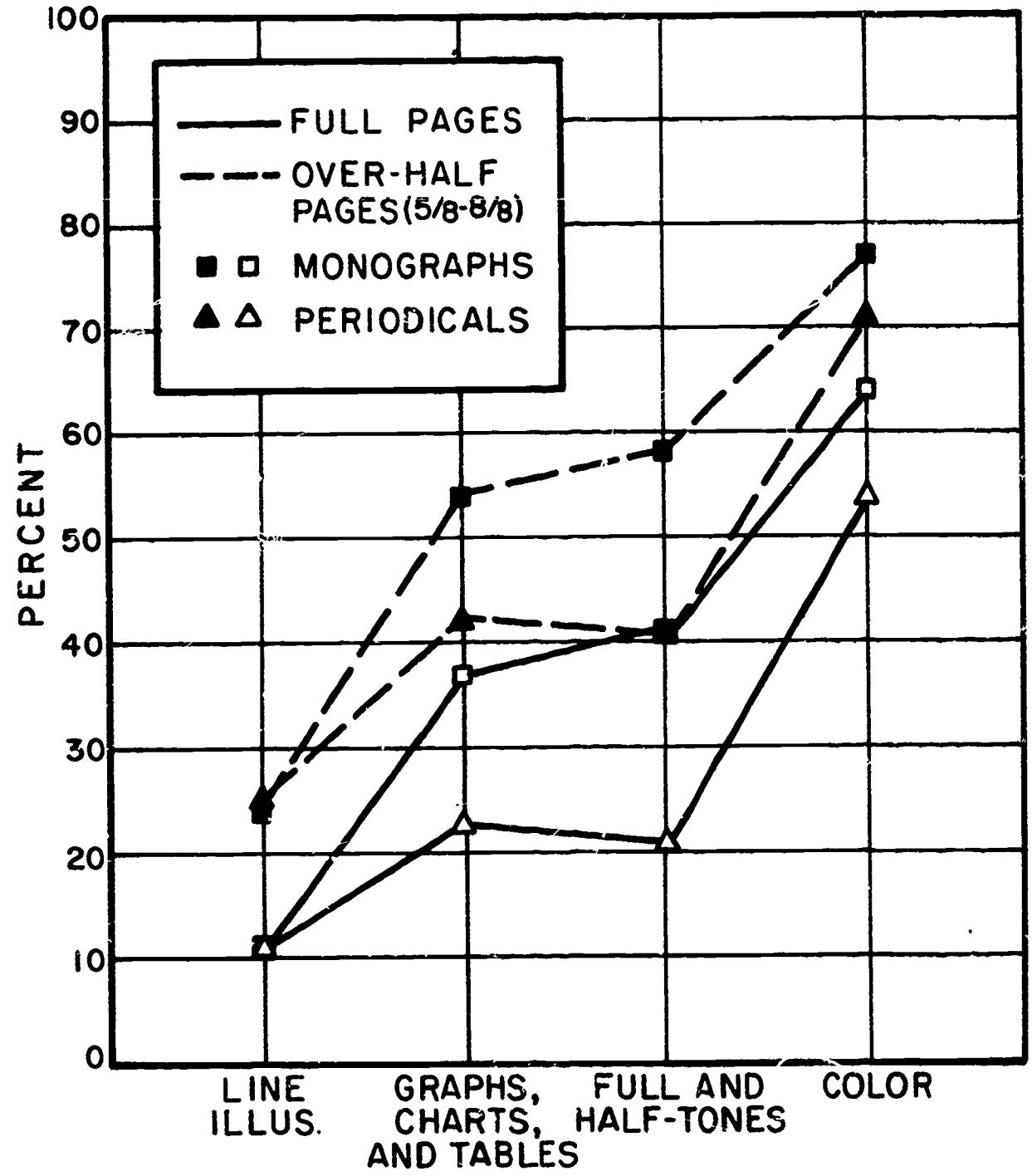


FIGURE VI-1. Full-page and half-page incidence as a percentage of all illustration incidences within its class.

and analyzed. Variations in the number and types of illustrations would be numerous as compared to what has been surveyed and reported here.

Incidences are used as the basic means of comparison. It could be surmised that many more instances of one size of line

drawing is apt to be used in certain situations than others. This is, of course, true, although definitive percentages were not computed; actual counts are recorded in Appendix C. Figure VI-1 gives a pictorial representation that identifies those types of illustrations constituting a half-page or more.

The comparison of percentages of monographs and periodicals that show incidences of specific types of illustrations (Figure VI-2) leads to the conclusion that periodicals have nearly twice as many graphics as monographs, regardless of the type of illustration. Some specific subject fields, of course, tend to weight the scale, making the contrast less dramatic in select subject areas. Figures VI-3 through VI-5 sharpen this picture for us. It should be noted that the fields of the natural and pure sciences, along with the technologies or applied sciences (Classes 5, 6, and 6A), have a heavy influence on any composite figures. For example,

> 66% of the total incidences in monographs are concentrated in Classes 5, 6, and 6A even though these Classes constitute only 28% of the volume count.
>
> Likewise, 56% of all incidences in periodicals are also in Classes 5, 6, and 6A, the volumes for these Classes being 32% of the sample.

No other groups show this marked influence and only slight variations among themselves.

Table VI-3 indicates the relative importance of each illustration type. Colored illustrations appear to be of little total statistical significance when compared with the other illustrations.

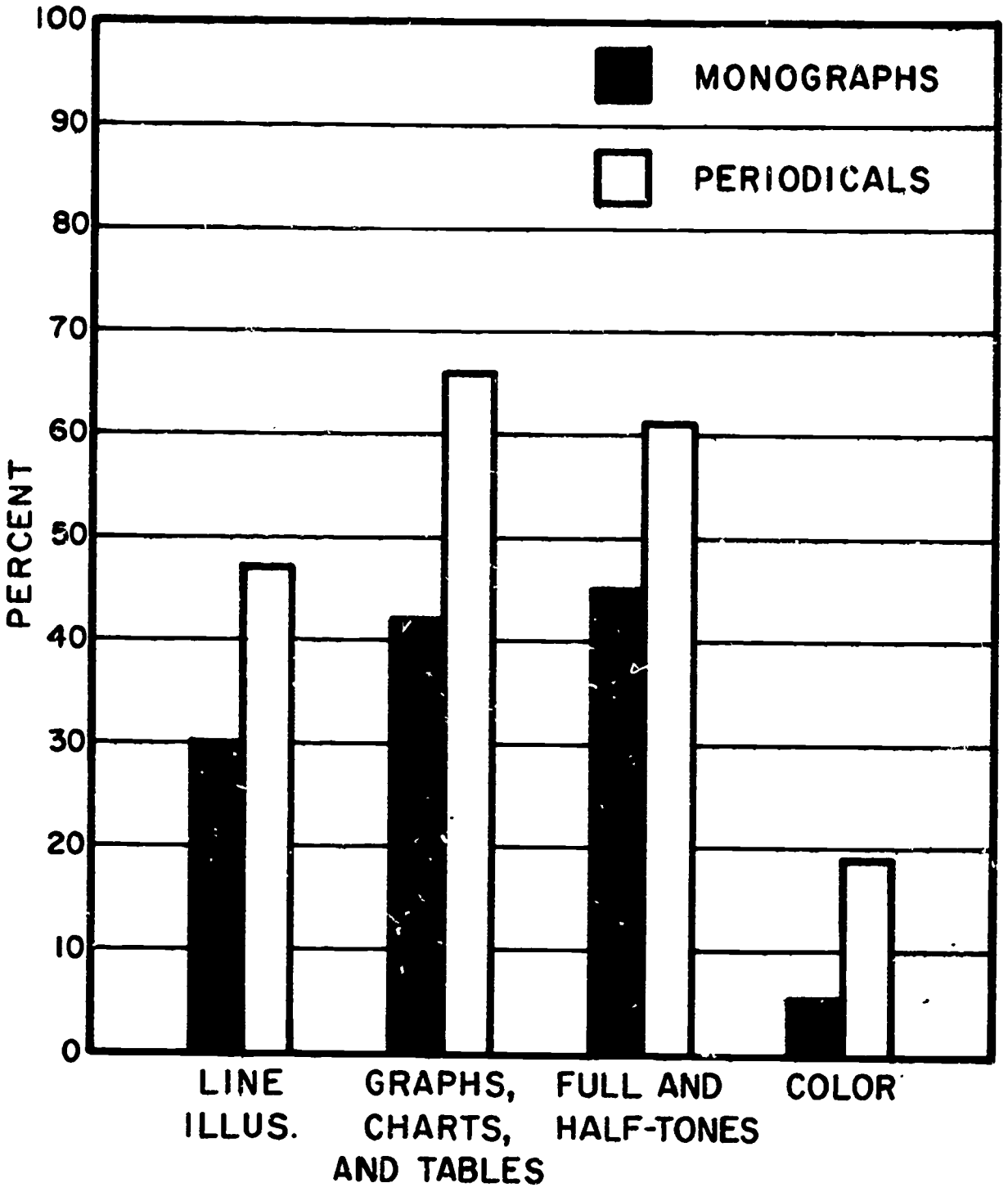


FIGURE VI-2. Percent of monographs and periodicals containing illustrations. The Figure should read thus: 30% of all monographs had a minimum of one line illustration; *or* 70% of all monographs had no incidence of line illustrations. The sample is the same in all four cases; therefore, each illustration is shown in a discrete relationship to the sample.

The immense number of incidences in periodicals would appear to be a function of the number of pages rather than a higher ratio of use, since the incidences per page for three of the types of illustrations are very nearly the same.

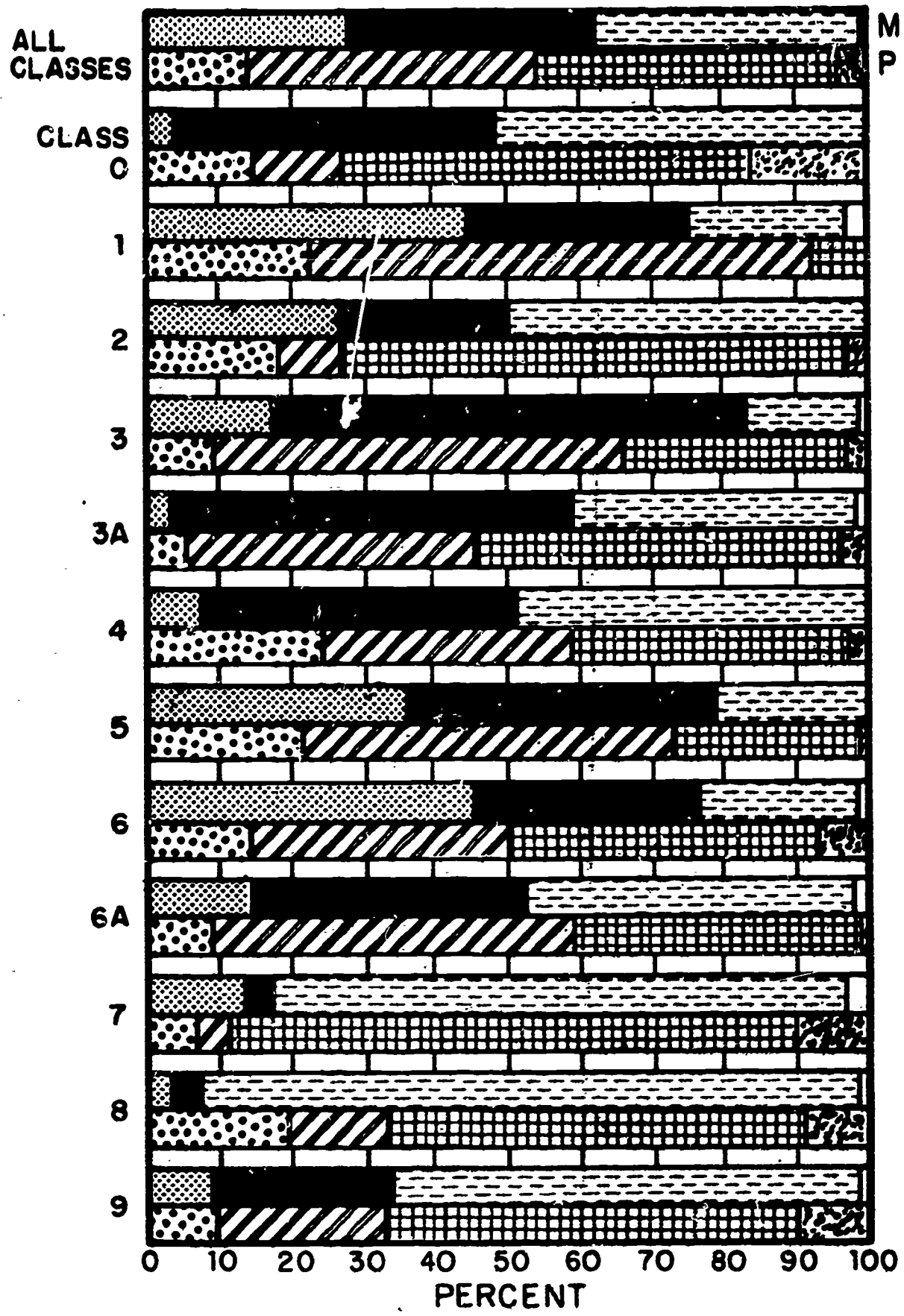


FIGURE VI-3. Percentage of illustration incidences by classification and format. Top bar in each pair represents monographs (M). Bottom bar, periodicals (P).

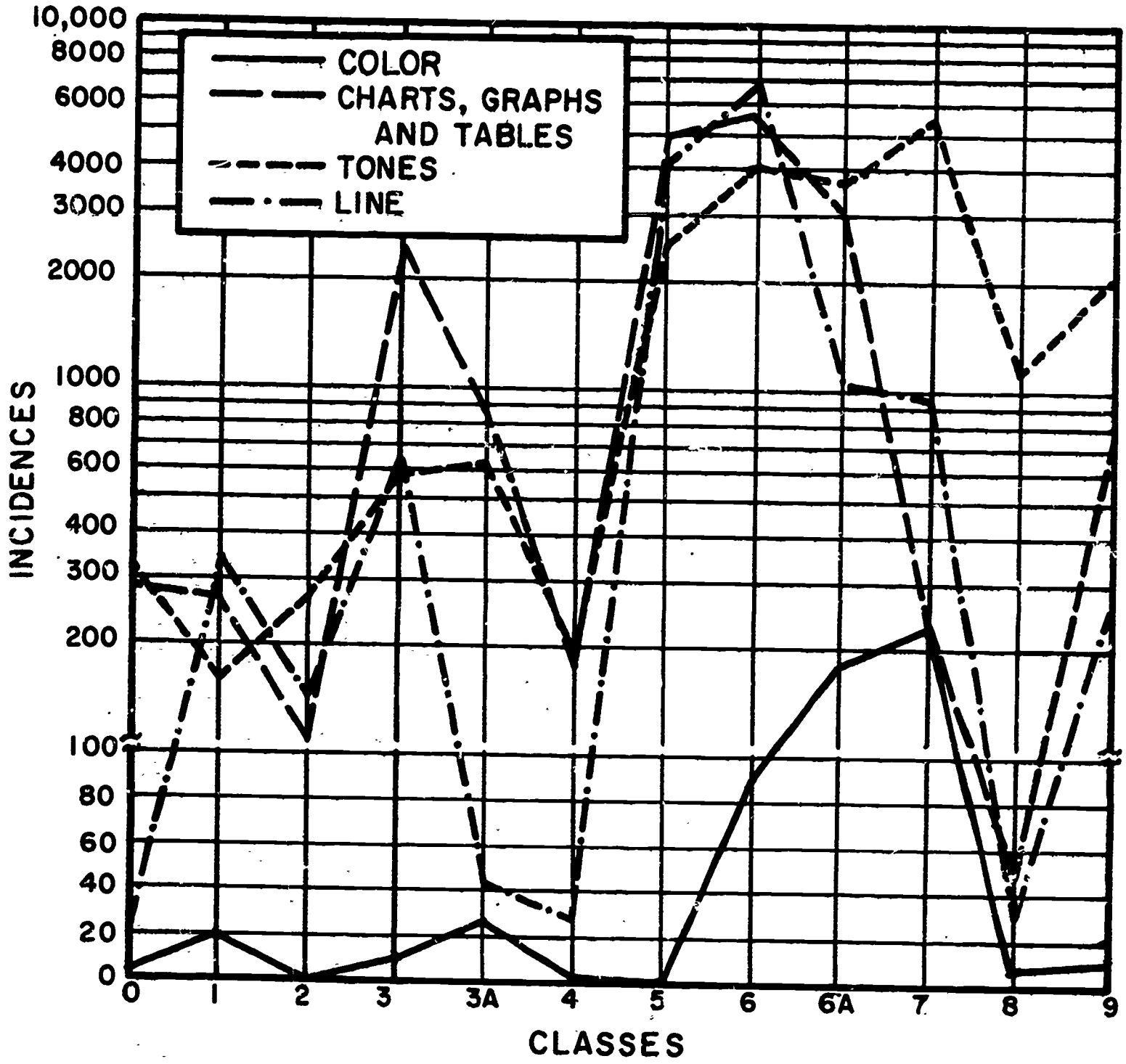


FIGURE VI-4. Incidences of illustrations in monographs within classes.

No attempt was made to determine how many volumes showed no illustration of any type. Judging from the data in Fig. VI-2, the actual incidence frequencies, and the pulling together of the two formats on average incidences per page, we might reasonably

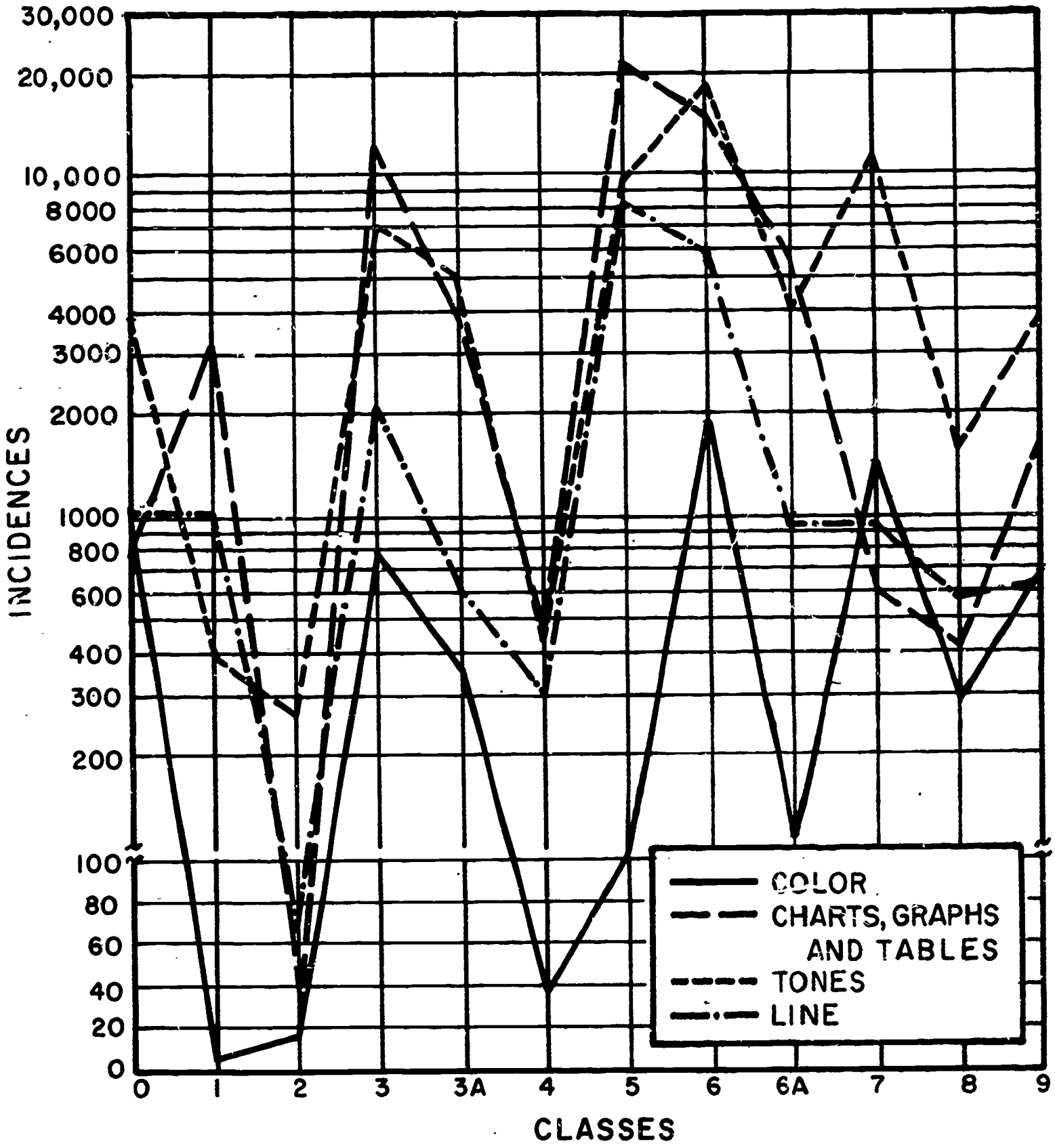


FIGURE VI-5. Incidences of illustrations in periodicals within classes.

conclude that a sizeable portion (probably 25%) of monographs has no illustrations; the periodical proportion is probably less than 5%.

TABLE VI-3. Average incidences per volume by type of illustration. Average is computed by dividing all recorded incidences by all volume counts *having* incidences for the specific type of illustration. Median ranges of 251-300 pages for monographs and 501-599 for periodicals were used to compute illustrations per page.

	Monographs		Periodicals	
	Av/vol.	Illus./each 10 pp.	Av/vol.	Illus./each 10 pp.
Line illus.	38	1.4	36	0.7
Charts, Graphs, Tables	31	1.1	72	1.3
Half- and full tones	33	1.2	81	1.5
Color illus.	8	0.3	27	0.5

Most of the other indicators in the Figures are easily interpreted and tend to correlate with general knowledge of publishing and collections within a university library. For example, Class 7 monographs (Fig. VI-4) show a decided jump in incidences of colored incidences of colored illustrations; Class 7 is Fine Arts and the increase is easily understandable.

SIZE OF TYPE

The second most critical question in the survey is that of printing type. Although there are several questions involved, only the range of type sizes was surveyed. Probably of equal importance is the question of type face. This problem was considered of such difficulty for digital storage that an arbitrary

solution would have to be involved. Because that solution would not be greatly aided by more data and because the gathering of the data would be so expensive, it was ruled out of consideration in the survey.

Type sizes are of vital importance to the digital concept and this graphics study has given us some useful data. The surveyors were asked to locate the smallest as well as the largest type size in each volume that they surveyed. Since these two are often found in footnote material and the title, the initial measurements were easy to get and to check as each page was examined. Measurements were made in type points for the smaller range and at the upper in inches, which were later converted to points. It seemed unduly cumbersome and of little need to have the surveyors use the appropriate point chart for each type face and font, so a common, median size was chosen as a standard. The smallest point size was the most difficult to measure exactly. Because of this, the 4-point and 5-point counts were merged in the final count.

Tabulations in Figures VI-6 through VI-8 (more details in Appendix C) are grouped in a scale showing the smallest-type registration in a volume ranging from 4- and 5- to 10-point; the largest runs from 10 to slightly over 100 points. The largest-type tabulations are in groups of fives, which were considered adequate for this study and more tolerant of errors in large-type measurements.

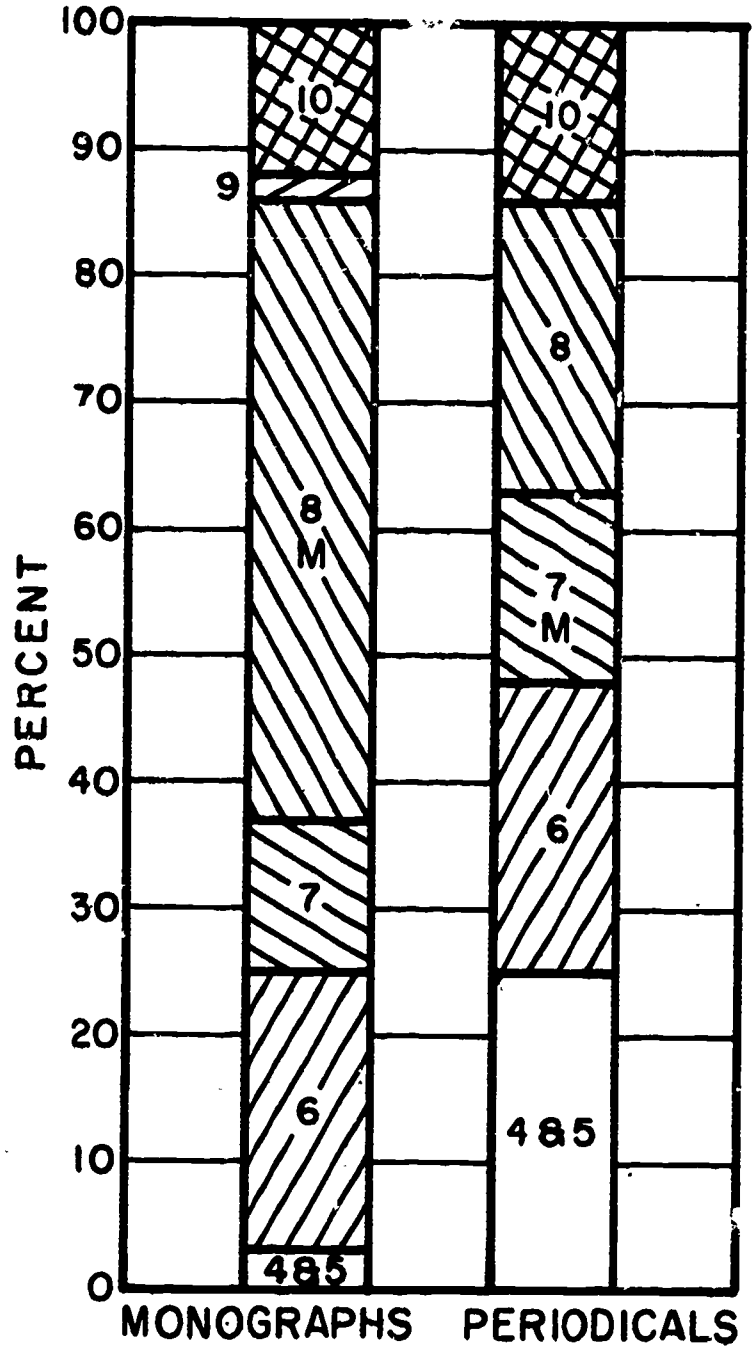
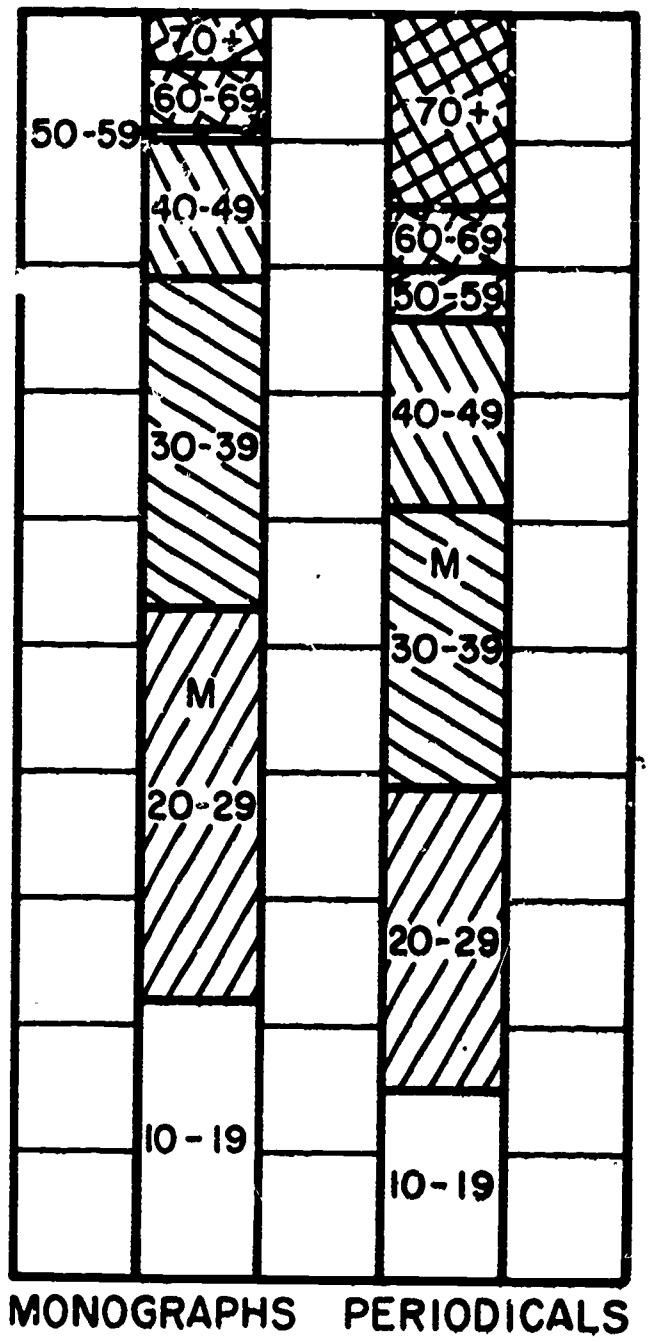


FIGURE VI-6. Smallest-type-size distribution by format. By points.



M = MEDIAN

FIGURE VI-7. Largest-type-size distribution by format. In point ranges.

Several relevant and less obvious observations should be noted—

1. The past assumption that 6-point type would be the smallest critical type size seems to need reassessment. Monographs

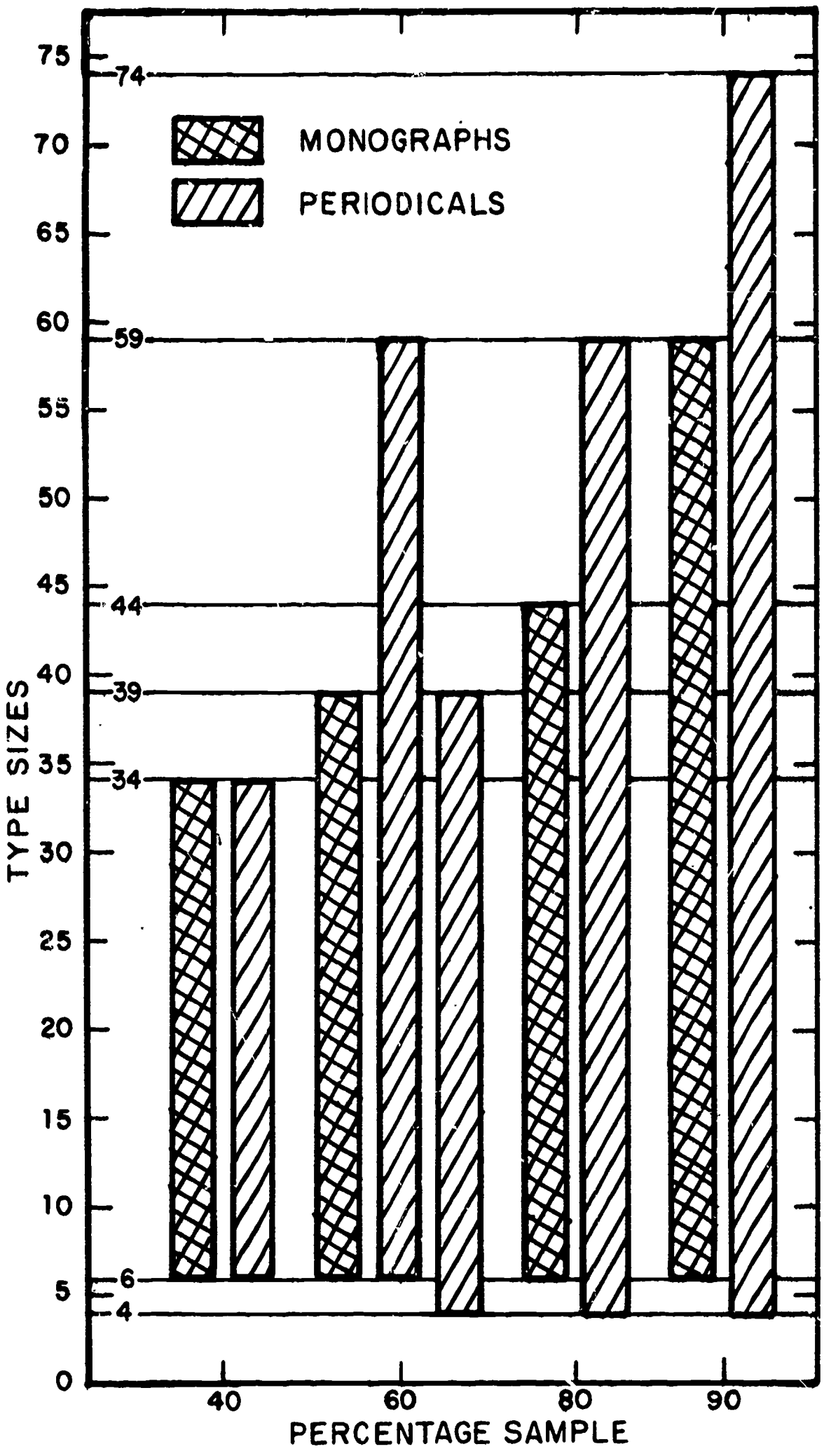


FIGURE VI-8. Type size as a function of monographs and periodicals. Ranges based from median. This Figure may be read thus: A type range of 6-44 points includes 80% of the monographs surveyed; if one wanted to cover 60% of both formats, the type range of 4-39 or 6-59 points would be necessary. *Note:* Not all percentage variations are shown; those grouping nearest the median were considered most important.

with 4- to 5-point type size were only 3% of the monograph sample. However, 25% of the periodicals had 4- to 5-point type.

2. Eight-point in the monographs constituted half of all of the *smallest* types recorded. This is also the monograph median, as contrasted to 7-point for the periodicals. The 6- to 8-point type range for smallest type includes 83% of the monographs; the range must expand to 4- to 8-point in the periodicals to achieve a comparable 86% coverage.

3. In the *largest* type-size registrations, the same expansion is evident in the periodicals; 80% of the monographs fall in the 10- to 39-point range, but to cover an equal portion of periodicals the range is 10-59 points.

4. There seemed to be no preponderance of large or small type within any subject classes; the distribution appears to be random.

5. The wider variation of type size is a feature of periodicals and not monographs. The use of larger sizes might show a positive correlation with the size of the periodical, which is greater on the average than that of a monograph. The heavy use of smaller type size is probably less well understood; one possible explanation is the economic need for compactness. There is little doubt that parameters for type size in a digital form will probably be dictated by the periodicals.

6. The largest-size median does not increase in either format until the smallest size gets to 8 and 9 points; then there is a

decided jump. With the smallest type size of 10 points, the correlated largest-type median drops in both formats to 20-24 points. This reversal of a trend appears to be the result of several influences rather than a single one.

PAGE SIZE

The title page served as the standard in all works; the outside dimensions of the *volume* were not taken. Page size is a more realistic measurement for the concept of digital storage than the covers, although the latter might provide the more useful data for a photostorage system.

Pages were measured for height (depth) and width. Height is the distance up the spine of a book as it stands vertically on a shelf. The data in the following Tables uphold fairly well the rule of thumb of book size, being in a ratio of 2:3, width to height. That is, for a page that measures 6 inches wide, the height will be 9 inches. This 2:3 ratio applies to 78% of the monographs surveyed but to only 64% of the periodicals.

Tabulations were made in half-inches, except at either end of the scale, where they were enlarged to cover a whole inch or more. Therefore, medians and other figures are cited within half-inch intervals. The monograph sample size was 1395 volumes; the periodical, 1359. See Table VI-4.

The segregation of books in libraries by size for economical

TABLE VI-4. Range and medians for page heights and widths (in inches and tenths of inches).

Page width			Page height	
Periodicals	Monographs		Monographs	Periodicals
9.5 -10.9	8.5 - 9.4	High	11.0 -11.4	13.5 -13.9
6.0 - 6.4	5.5 - 5.9	Median	8.5 - 8.9	9.5 - 9.9
4.0 - 4.4	3.5 - 3.9	Low	5.0 - 5.4	5.5 - 5.9

shelf utilization was previously mentioned. The two-size standard for the monographs is evident, with the top height at just under 11½ inches; the periodicals are in one shelving sequence, with a very high maximum. As the data here and in other surveys show, periodicals tend to run between 1 and 1½ inches larger in both dimensions. It is unlikely from the sample and the evidence that the segregation had any influence on the median results.

84% of the monograph volumes' page width ranged between 4½ and 6½ inches; the height range from 7 up to 10 inches included an equal percentage. Comparable figures for periodicals covering 78% of the sample are 4½ up to 8 inches in width and 8½ up to 11 inches in height. The height-range variation is slight between formats, but the periodicals show half again as large a range in width. An inordinate number of oblong periodicals might have accounted for this width variation but there were only 18 periodical and 13 monograph oblongs. See Figures VI-9 and VI-10.

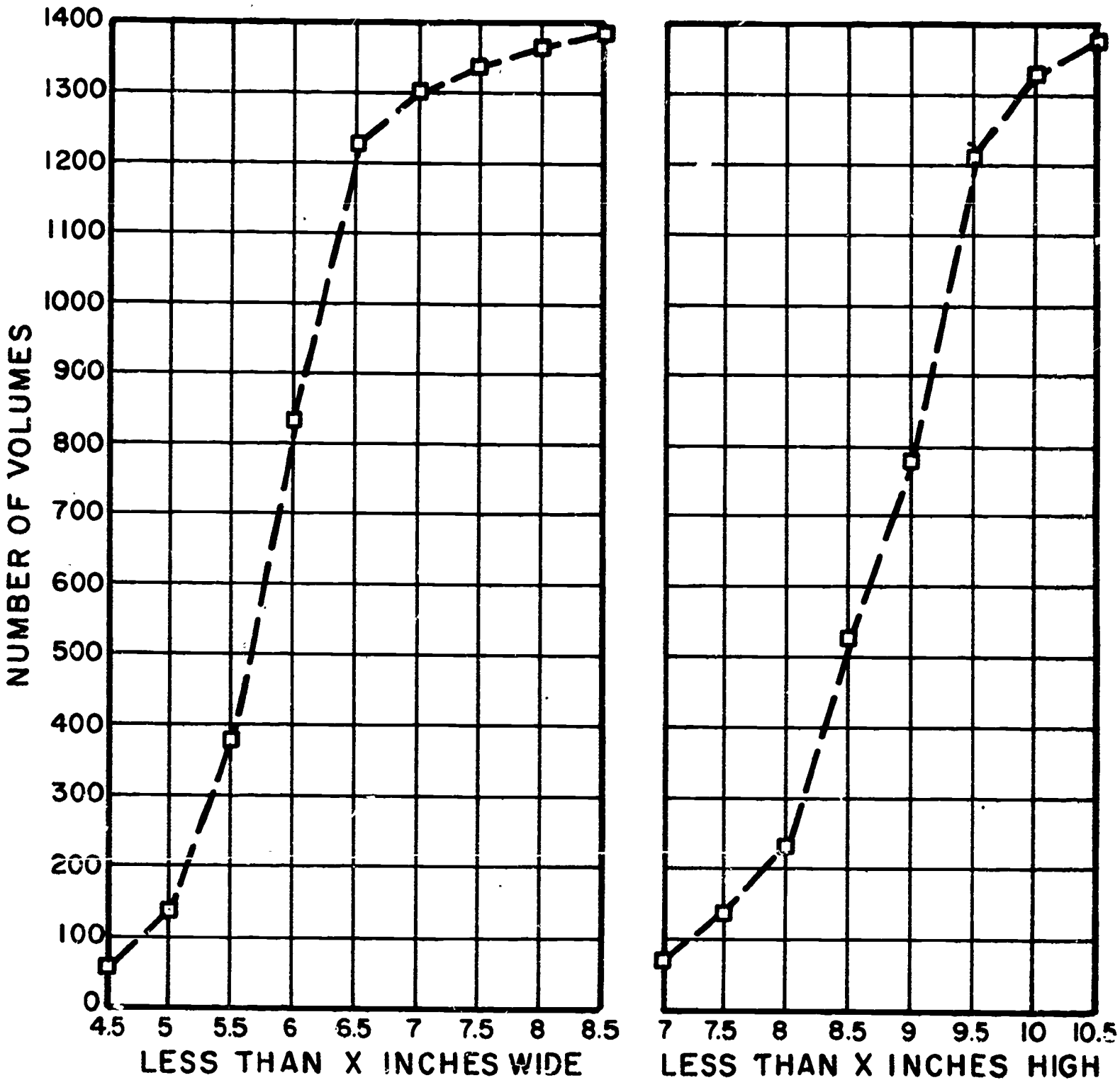


FIGURE VI-9. Monograph volumes by page width and height.

The Class totals were examined and checked for any special influences or deviations from the medians. The variations by Class in either format are rare or, when they exist, are only slight, as

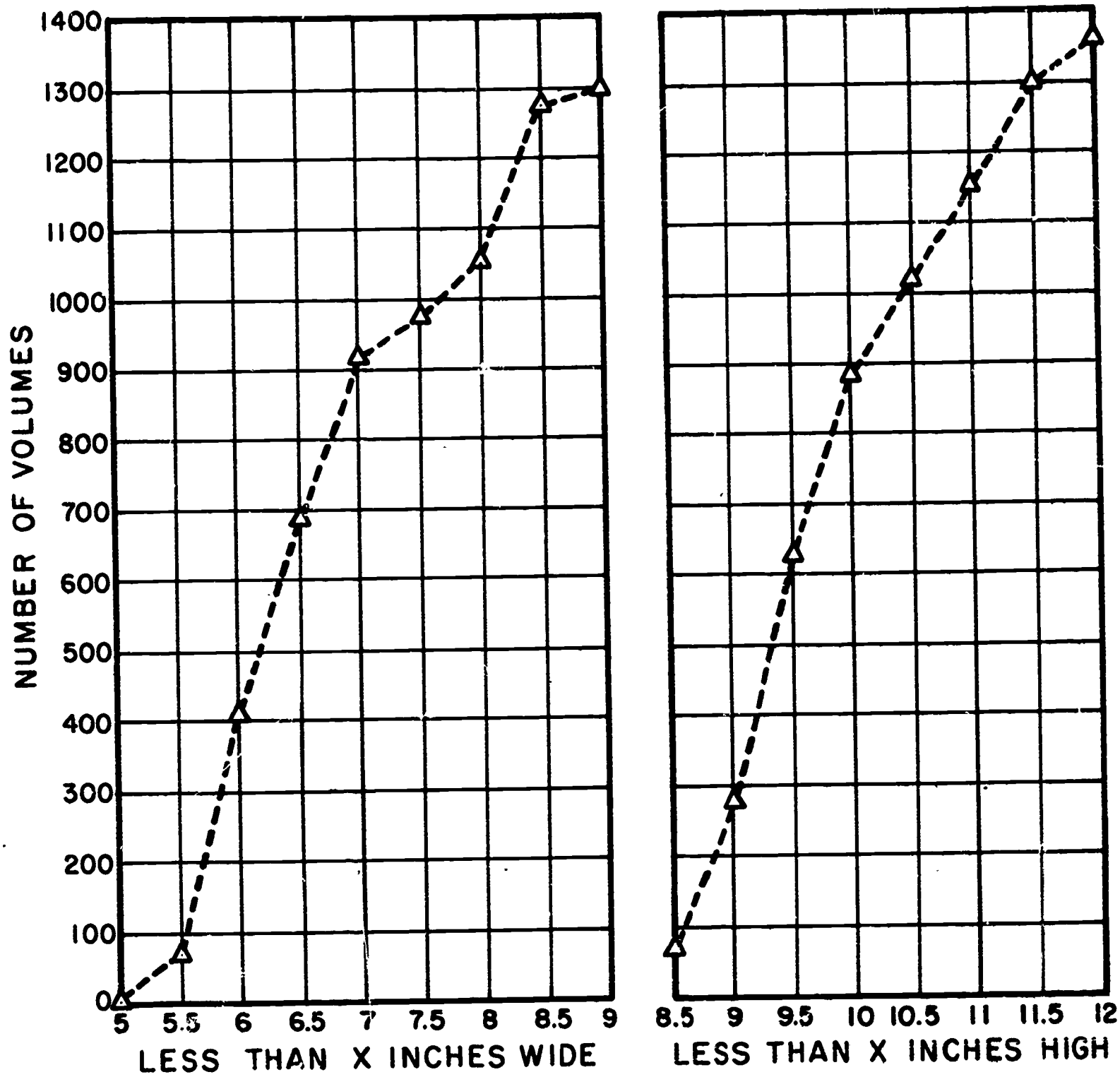


FIGURE VI-10. Periodical volumes by page width and height.

with monographic Class 7 (Fine Arts), where the median for both dimensions is ½ inch larger. The slightly larger art books in Class 7 account for this slight variation. Class 9 (History and

Area Studies) could be expected to be somewhat below the median, but it wasn't. Only in Class 6 (Applied Sciences and Technology) of periodicals was there a major deviation, where the median was about 1½ above the total periodical median.

PUBLICATIC DATE

Cutoff dates were employed in structuring the survey, as explained at the beginning of this Chapter. The rationale for this decision is explained by the obsolescence of literature (see Chapter IV) and by the concept that any digital-storage devices probably could not be concerned in tests, or, finally, with material that is essentially dead. The date of 1950 was established as the terminal date, except for Classes 5, 6, and 6A. The data presented here specify which period is being discussed.

Surveyors were instructed to use the latest copyright date, in volumes having one, or else the title-page date. Registration was made only for the total year, not the months within it. Bound periodicals covering more than one year of publication were counted for each year, since the date of the material is the relevant consideration. This accounts for the 1848 date incidences for periodicals even though the volume population is 1364.

The relevance of these publication-date data is questionable. since the influence of date or trends in publishing cannot be easily correlated with other factors. Publication date in a single-sampling environment is subject to many variations; for example

the university's buying policies are to some degree reflected in the collection holdings and have a subtle influence. A lean fiscal library year might result in lean holdings in that year that are not later made up. These possibilities seem not to have greatly influenced the data, although no rigid testing has been done.

The near-perfect shadowing of the medians in seven of the Classes may be the result of several influences also. The pattern would seem to be free of an overweighting, which could account for any of the unexpected variations. For example, Class 6 should be as up to date in periodicals and monographs as its closely related subject Classes 5 and 6A. The drop in both formats must reflect moreso the nature of the sample collection than any other function. Therefore, the data probably can serve only as a reference point from which the other functions can be viewed. See Figures VI-11 and VI-12.

LANGUAGE INFLUENCES

Decisions on language will be important to a digital-storage experiment in some subject disciplines, although few. As was shown in Chapters III and IV, the use of foreign-language materials within libraries seems largely limited to language or literature studies. This finding is borne out by the George Washington University Library collection as well. Figure VI-13 indicates the very heavy preponderance of English-language materials in both monographs and periodicals.

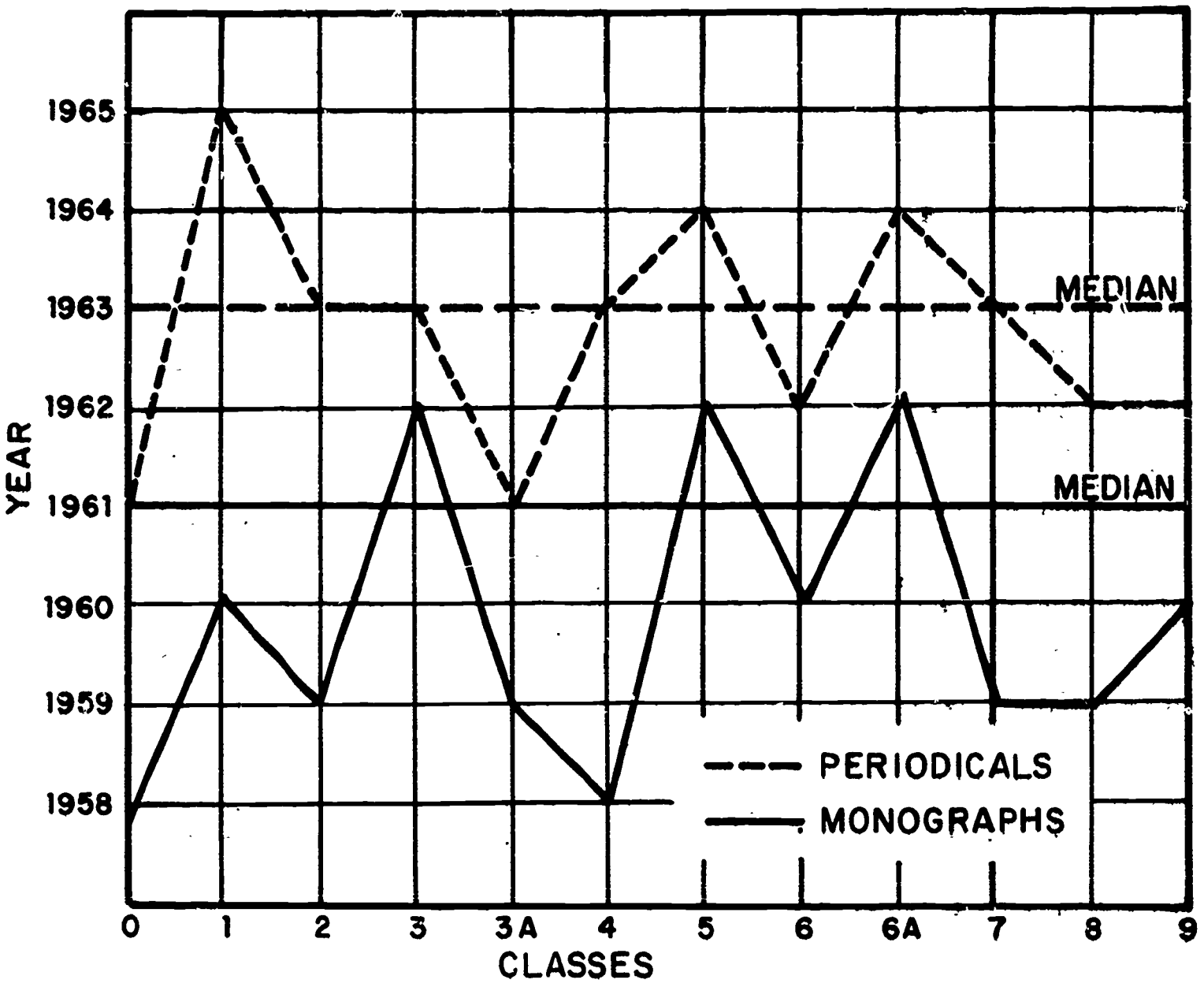


FIGURE VI-11. Median publication dates by Classes (1950-1968 sample).

The population size of both formats was essentially the same (1405) but a larger registration of languages in periodicals was not. This resulted from recording from a periodical each language that constituted a minimum of a quarter of the pages.

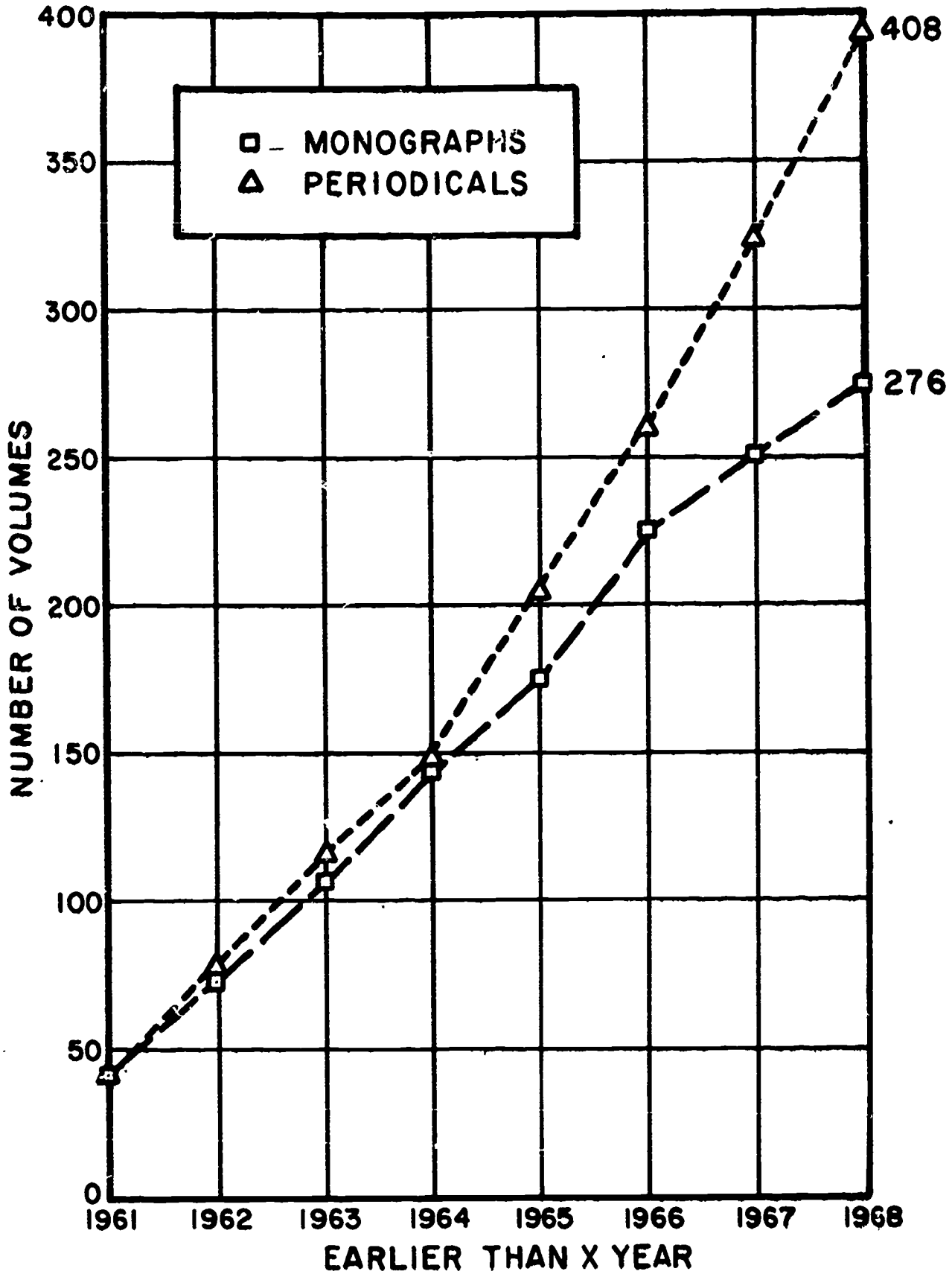


FIGURE VI-12. Date-of-publication cumulative-time distribution during 1960-1968, for Classes 5, 6, and 6A (Sciences, Technologies, and Medicine). *Note:* This does *not* show pre-1960 volumes.

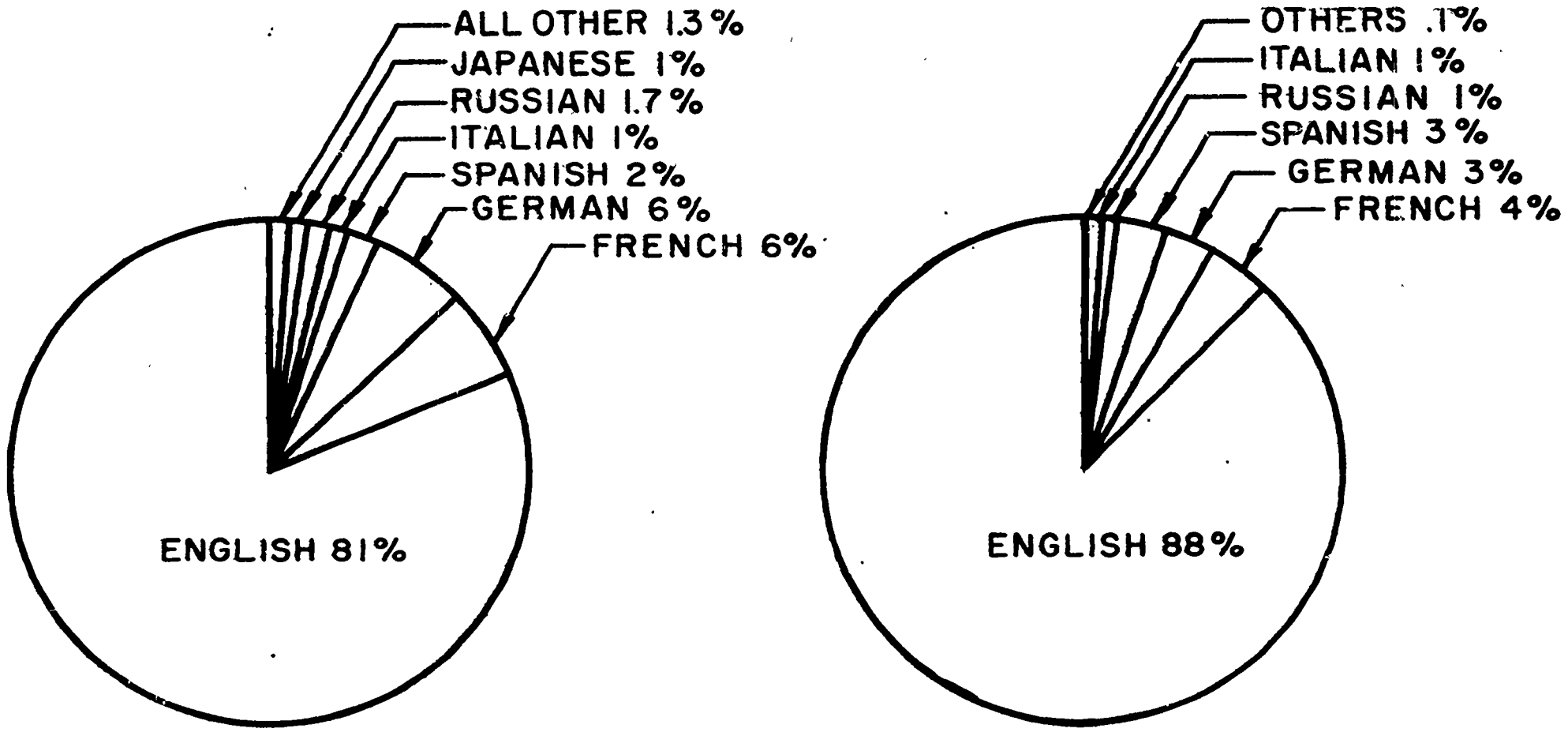


FIGURE VI-13. Language distribution.

Essentially, Classes 4 and 8 (Languages and Literature) change the proportions exceptionally, as might be expected. Of the 166 foreign-language monographs surveyed, 121, or 75%, were in these two Classes. Of the 301 foreign-language representations in periodicals, 107, or 34%, were in Classes 4 and 8. Removing the foreign languages in these two Classes from the overall totals, the English-language percentage increases to 88%-95%. The greater frequency of foreign languages in periodicals than monographs, small though it is, is recorded in Classes 3 and 5 (Social Sciences and Pure Sciences).

The language question may appear to be a relatively minor problem but it has several vexing questions, the prime one being diacritical marks. Acceptance within the academic community of foreign-language material in any form must meet this question and solve it, or else the effort may be wasted.

NUMBER OF PAGES

Storage devices will be concerned with the number of pages in a volume within select subject disciplines and by formats for optimum economics. This survey may help with those decisions. The exact pages of a volume were recorded for a sample of 1400 monographs and 1362 periodicals. Tabulations were made in 50-page units through 499, by hundreds or two hundreds beyond. The measurement is, therefore, more precise up to 500 pages.

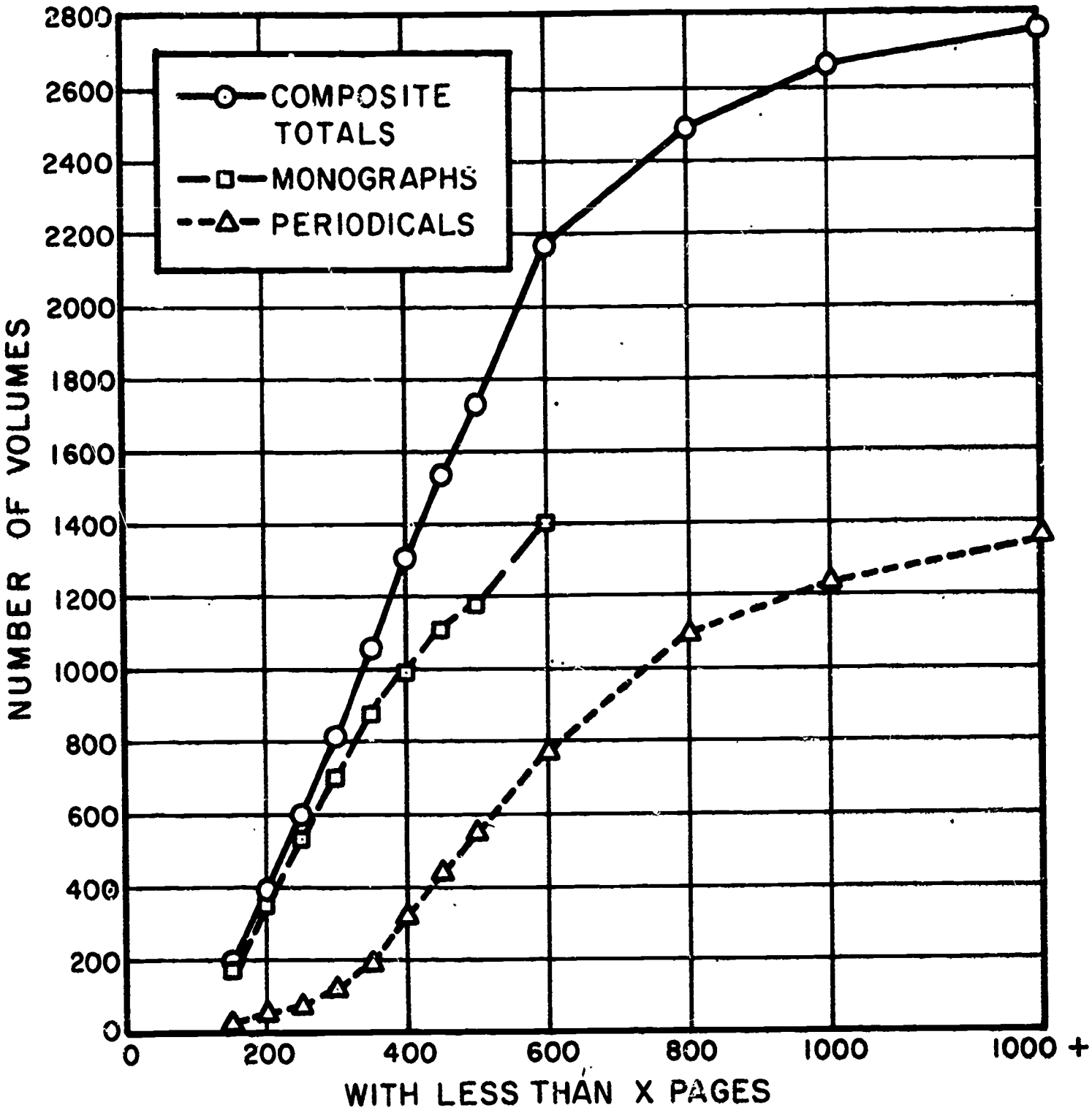


FIGURE VI-14. Number of pages by cumulative volume count.

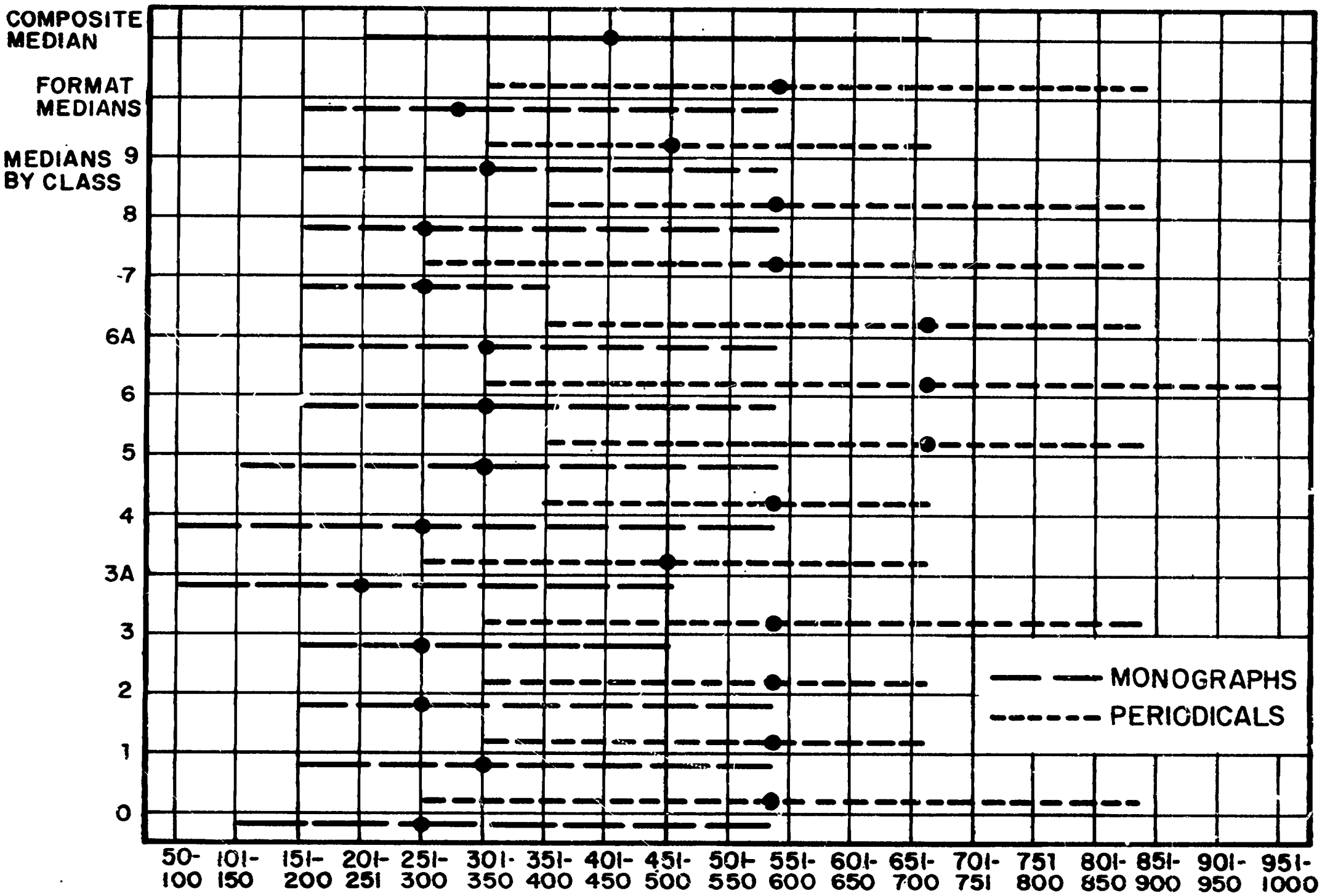


FIGURE VI-15. Formats and Class page medians and 75% volume range.

The median for monographs is precisely at 300 pages; the periodical page median falls almost exactly in the middle of the 501-599 range. This wide variation between the two formats would not be surprising to most library administrators, although the periodical median might be slightly higher than some would have anticipated. The composite median for the two formats falls near the upper level of the 401- to 450-page range. Three subject Classes (5, 6, 6A; Pure Sciences, Technologies, and Medicine) in both formats show the same increased median above that of their respective formats. In the monographs, they range from 301 to 350 pages and in periodicals from 600 through 799. This similarity would tend to substantiate the conclusion that the literature of these subject fields has more pages per volume than other literature subjects. See Figures VI-14 and VI-15.

CHAPTER VII

BASIC ASSUMPTIONS AND RECOMMENDATIONS FOR ACTION

This study began with the postulate that the industrial and equipment technologists for whom it is primarily intended need not make a special study of current technology and its applications. The recommendations in this Chapter, therefore, do not speak directly to the technology except to place its current status in proper relationship to the library and book environments. Thus, recommended action in one area may need to be diminished or magnified, depending upon the judgments that a more intimate knowledge of the technology makes possible. Also, there are several social questions that have not been addressed in this report but that must be measured when serious consideration is given to specific areas of experimentation or development.

Of paramount concern are the legal and copyright limitations and responsibilities in reaching the textual digital-storage state and supplying copies from it. They take on a significance that will have to be addressed and considered in advance of any experiments. A final digital-storage system that excludes copyrighted materials seems improbable and economically questionable, although social and technological approaches might be tested realistically with uncopyrighted literature. A basic assumption on this point is inherent in the concept of this report. That is, the sponsors of

any future endeavors and the commercial publishers must reach agreement prior to major developmental or experimental work.

A related question not addressed in this report is that concerning the photocopying or reproduction now done by libraries or other agencies. A recent, extensive report[1] gives statistical detail and analysis of copyright observance and photocopy practices in college and university libraries. The circulation and use figures presented in Chapter IV do not reflect the burgeoning use of photocopying; its influence, however, on the economics and ultimate use of a digital-storage mode may be considerable.

The political aspects of organizing the information, library, and educational communities to give support to any possible experimentation and development have been left out of this study. Active participation within the education community, proprietary requirements of industrial sponsors, and the private nature of some information may create an atmosphere in which a coordinated effort is difficult. The importance of political considerations arises when management decisions are made to proceed.

Current technological capabilities of achieving a viable digital-storage scheme are paralleled by economic problems. Not only are the developmental and experimental costs high, but implementation, even in a limited manner, requires the best financial talent under the best of arrangements. The problems of balancing the economics of copyright requirements, data inputting, develop-

ment of machinery, and the experimentation must be realistically met. The *a priori* assumption that they will be solved must now be addressed.

REVIEW AND SYMPOSIUM

The detailed information in this document has been included to make possible a determination of which aspect, area, characteristic, or format is best for the testing of equipment, procedures, or technological limitations. Therefore, recommendations have not been made concerning the user, subject disciplines, literature formats, library-collection growth, or the multitude of other factors that may offer the greatest potential success, as these can easily be identified and matched after the technological question to be tested is determined. The recommendations that are given concern the immediate need for action.

The prime decisions now are procedural and organizational.

The first step is to have this document studied by technologists who can match ultimate needs against experimentation needs and the technology available. This can probably best be accomplished in a confined and select community of people.

Recommendation 1

. . . that EDUCOM and the organizers of the 1967 conference identify 15 or 20 technologists interested in and competent to discuss and match technological capabilities with the data in this document.

To the technologists, add an equal number of educational administrators and closely aligned government and society representatives. Eight to ten librarians from academic institutions should be selected also, making a group of approximately 50 persons.

. . . that EDUCOM take the lead in marshalling the talents of this diverse group. There must be a thorough understanding and dedication to the concept that the method of achieving the end product is far too great for any but a joint and concerned effort.

Recommendation 2

. .that EDUCOM form a Planning Committee chosen from the group of 50 (or even in advance of the naming of the participants) with no more than six members. The Planning Committee is to concern itself with the next steps in the process, which would include determination of immediate actions and implementation of them. Its initial decision would be to proceed or not to proceed with additional work on the digital concept.

Recommendation 3

. . . that the Planning Committee arrange a two-day workshop during which the most pertinent questions identified will be addressed and discussed, the format to include

(1) a brief period for clarification or extension of data in this document;

(2) a series of carefully directed, invited papers on the

pressing technological questions. These should not be state-of-the-art reviews except for unpublicized equipment or techniques that hold tremendous potential application;

(3) a minimum of one day should be devoted to achieving the objectives of the workshop—

to determine if developmental or experimental work should proceed,

to determine which jobs are most important and immediate,

to determine how the special tasks are to be apportioned, and

to establish a coordinating, governing body to direct the continued efforts.

Recommendation 4

. . . that the group of 50 establish the principle that consensus of the participants must be reached on the philosophical, operational, experimental, and research schemes.

REFERENCE LIST FOR CHAPTER VII

1967

1. Committee to Investigate Copyright Problems Affecting Communication in Science and Education. *The Determination of Legal Facts and Economic Guideposts with Respect to the Dissemination of Scientific and Educational Information as it is Affected by Copyright--A Status Report*. U.S. Office of Education, Bureau of Research, Dec. 1967.

APPENDIX A

SUBJECT GROUPINGS

Humanities and Arts

Philosophy
Religion
Linguistics and Philosophy
Literature
Languages
Classics
Fine Arts
Applied Arts
Theater
Music

Social Sciences

Education
Sociology
Anthropology and Ethnology
Mythology
Folklore and Popular Customs
Statistics
Economics
Political Science
Law
Geography

History and Area Studies

The Americas
Europe
Africa
Asia
Australia and New Zealand
Oceania
Arctic and Antarctic

Pure Sciences

Astronomy
Bacteriology/Microbiology
Chemistry
Genetics
Mathematics
Physics
Psychology

Applied Sciences and Technologies

Engineering
Medical Sciences (including Psychiatry)
Agricultural Sciences
Architecture

Natural Sciences

Botany
Zoology
Entomology
Geology
Earth Sciences
Biology

APPENDIX B

DR. ARIDAMAN K. JAIN'S REVIEW OF USE STUDIES

This Appendix is intended to serve as a thorough summary or review of several statistical use studies in the academic community. It serves as additional data to Chapter IV. Dr. Jain published this review as Appendix A of his *Report on a Statistical Study of Book Use . . .* , issued in 1967 by the Library Operations Research Project of the School of Industrial Engineering and The University Libraries of Purdue University. That work was in partial fulfillment of the doctoral degree and supported by a National Science Foundation grant. (The entire document is available from the Clearinghouse for Federal Scientific and Technical Information as PB 176525.)

Dr. Jain, The School of Industrial Engineering, and the Purdue University Library graciously acceded to EDUCOM's request to reproduce the entire Appendix as supplementary data for this report.

REVIEW OF USE STUDIES

Many librarians and research workers have been interested in studying the usage of books, journals, and library facilities. Accordingly, a large number of investigations have been carried out at universities, colleges, public libraries, industrial libraries, and other institutions. Davis and Bailey (1964) prepared a bibliography of 438 different use studies conducted up to the year 1963. Deweese (1967) has supplemented the Davis and Bailey bibliography by adding 109 use studies most of which were reported since Davis and Bailey's publication. While going through the published library literature and also the unpublished theses available in the University of Chicago Library, the author found 81 use studies: 45 published research investigations and 36 unpublished M. S. or Ph. D. theses. Thirty-seven published research investigations and 22 theses out of the above 81 use studies are included in the bibliographies of use studies prepared by Davis and Bailey (1964) or Deweese (1967). Thus, 27% of the 81 use studies found by the writer are not included in the bibliographies of use studies. On this basis, the writer estimates that the total number of published and unpublished studies concerning the use of books or library facilities is well over 700.

The fact that a very large number of use studies have been carried

out is certainly indicative of the general interest and the importance of use studies among librarians in particular and research workers in general. Unfortunately, most of the usage studies do not go beyond the presentation of a summary of the data collected. Those few use studies where mathematical models are formulated for the description and prediction of use of books are reviewed in Chapter I and Appendix B. This Appendix reviews most of the use studies which are comparatively more comprehensive and scientific.

1. Usage Studies Before 1950

Several usage studies were conducted before 1950, most of the important ones published will be reviewed here. Adams (1933), Armstrong (1938), Butler (1939), Carnovsky (1932), Cross (1943), Fussler (1948), Gosnell (1943), Johnson (1937), Logsdon (1942), McDiarmid (1934), and Todd (1948) wrote unpublished theses (mostly Ph. D.) connected with the use of books or library facilities. The review in this section is confined to such versions of these as were published or to other published studies.

The earliest published study was conducted by Ranck (1911). He employed a number of boys to go over the shelves of the circulation department of the Grand Rapids Public Library during the Christmas vacation and in early January 1911, noting from the book slips the dates of last use. The total number of volumes was 64,162. Ranck found that over 20% of the volumes were not used for the last two years or more, and about 1% of the volumes did not experience any circulation during their entire history. The details are shown below in Tables A-1 and A-2.

Table A-1

Distribution of "Not-Used" Books by Number of Years Not Used

(based on Ranck's data)

Period of No Use (Years)	Books	
	Number	%
2	3585	5.6
3-4	3623	5.6
5-6	1888	2.9
7-8	1096	1.7
9-10	877	1.4
11-12	593	0.9
13-14	475	0.7
15-16	310	0.5
17-18	137	0.2
19-20	62	0.1
21-22	47	0.1
23-24	64	0.1
Since Acquisition	614	1.0
2 or More	13,373	20.8

Table A-2

Distribution of All and "Not-Used" Books by Class

(based on Ranck's data)

DDC Class of Books	Volumes in Library	Books Not Used Since 1908 or Before	
		Number	%
000	3057	691	22.6
100	1162	250	21.5
200	3023	693	22.9
300	4333	1226	28.3
400	1226	95	7.7
500	4785	911	19.0
600	2667	543	20.4
700	2236	347	15.5
800	6447	1394	21.6
900	17227	4407	25.6
Fiction and Unclassified	17999	2816	15.6
Total	64162	13373	20.8

It must be pointed out that it is quite difficult to make much sense out of the data shown above in Tables A-1 and A-2 because there is no information given on the date of acquisition of the books in the library collection. For example, the class D. D. C. 400 may have had more recent books than other classes and this may explain why the percentage of "not used" books in this class is the lowest. However, considering that this study to identify "dead" books was conducted as early as 1911, one may regard this investigation as a serious beginning.

Eurich (1933a, 1933b) reports two studies on "student's use of the library." The first study is based on the use of books in the University of Minnesota Library during one week in the fall quarter of 1930. The data was collected by saving call slips.

In his first study, Eurich found that about 30% of the books withdrawn from the circulation department during the week were in the field of literature. Approximately one-half of this number were in English literature and one-half in American literature. History ranked second with slightly more than 12% of the total number. Economics ranked third and philosophy fourth. The circulation in all of the other fields was less than 5% of the total.

While the above analysis is based on call slips only, for reserve books Eurich obtained the total number of books for each subject on reserve as well as the withdrawals during the week of study. He computed the ratio of withdrawals to the total number on reserve as shown in Table A-3. This table illustrates the weakness of studying withdrawals only. Considering the percent of withdrawals, one may conclude (as many investigatore seem to conclude) that reserve books on

Education are used more heavily than those on Economics, Psychology, and Sociology, while just the opposite is true if one considers average use per book.

Table A-3

Use of Reserve Books by Subject (based on Eurich's data)

Subject	Number of Books on Reserve	Withdrawals		Ratio*
		Number	%	
History	1652	2241	28.0	1.36
Education	1397	1238	15.4	0.89
Economics	882	957	11.9	1.08
Psychology	397	745	9.3	1.88
Literature	919	615	7.7	0.67
Sociology	426	517	6.5	1.21
Other	1400	1698	21.2	1.21

*This is the ratio of number withdrawn to total number on reserve.

Eurich's second study is concerned with the seasonal variation in the use of reserve books in the University of Minnesota Library. A complete summary of all the books that had circulated in the reserve room during a period of seven quarters during 1928-31 was obtained and the average daily circulation in hundreds of volumes is given as shown in Table A-4.

Table A-4

Average Daily Circulation in Hundreds of Volumes in the Reserve Department, University of Minnesota Library (based on Eurich's data)

Year	Week of Fall Quarter											
	1	2	3	4	5	6	7	8	9	10	11	12
1928-29	8	14	14	16	15	9	10	12	12	13	13	7
1929-30	7	14	14	17	14	12	10	13	12	15	15	4
1930-31	7	14	16	16	12	12	13	13	13	15	15	8
	Winter Quarter											
1928-29	8	16	16	16	13	13	13	13	14	14	10	—
1929-30	10	15	14	14	13	10	11	12	13	15	9	—
	Spring Quarter											
1928-29	9	13	13	14	14	11	12	11	11	13	7	—
1929-30	9	13	13	12	13	11	11	11	13	11	7	—

On the basis of the data shown above, Eurich infers that the pattern of circulation of reserve books is approximately the same for each quarter of the two or three years for which data is available. He says that there is a rise in circulation just before the mid-term examination and again before the final examination. He points out that the data on seasonal variation is very essential for arranging things so that the members of the library staff may serve where they are needed most.

Carnovsky (1933) reports a study of the use of books in a dormitory library of the University of Chicago during the school year 1931-32. There were 1390 volumes in the dormitory library and the per capita

circulation during the year 1931-32 was as follows:

Quarter	Number of Residents	Per Capita Circulation
Autumn	265	4.86
Winter	260	4.30
Spring	235	3.60

Carnovsky divided the students living in the dormitory into three groups (i)Freshmen, (ii)Upperclassmen, and (iii)Graduate students, and studied their use of the library separately. The 103 freshmen living in the dormitory for one or more quarters used the optional titles (placed on open shelves) for various courses as shown in Table A-5. Carnovsky concludes that the amount of reading done by freshmen is disappointing. He says that in the case of each course, were it not for a few individuals who have read somewhat extensively, the average number of books borrowed would be altogether negligible. As in the case of freshmen, he presents data on the use of optional titles by upperclassmen and graduate students.

Table A-5

Total Number and the Number of Titles Used by the Type of Course (based on Carnovsky's data)

Type of Course	Number of Optional Titles	Number of Titles Used					
		0 Times	Once	Twice	Thrice	Four Times	Five or More Times
Humanities	168	68	45	30	11	5	9
Social Sc.	122	81	21	12	6	2	0
Biological Science	75	28	23	12	3	4	5
Physical Sc.	9	0	1	3	0	1	4

Gaskill, Dunbar, and Brown (1934) conducted a study of the use of the Iowa State College Library. The purpose of their study was to ascertain the extent and nature of the use of library books. They counted all students entering the library, conducted personal interviews and collected call slips for all books used in the assigned reading room on certain days during winter quarter of 1933. They found that on the average day 47% of the students (out of 3384) visited the library and checked out 981 books. Of these 981 books, 348 books were withdrawn for home use and 633 books were from the reserve collection to be used within the building. The largest number of students entering the library during a one hour period was 365 from 2:00 to 3:00 p. m. on Sunday. The next most popular hour was 8:00 to 9:00 a. m. Monday-Friday with a mean of 230. Table A-6 on the following page shows the distribution of students visiting the library by the purpose of their visit: "Assigned Reading" (46%) and "Working out Problems" (25%) accounted for 71% of the visits. It is interesting to note that 'assigned reading' was more popular among women students than men students. About 6% of the students came only to study their own books.

Out of the 1042 students interviewed, 87 (or 8%) students failed to secure the material desired. The reasons are shown below:

Reason	Percent of Students Failing to Obtain Desired Material
Checked out to others	60
At bindery	1
Book not in library collection	12
Desired information not available in the books examined	8
Books not accounted for	5
Other	14
Total	100

Table A-6

Distribution of Students Visiting the Library by Purpose of Their Visit (based on Gaskill, Dunbar, and Brown's data)

Group	Total Number Interviewed	Percent of Students Who Came for							
		Assigned Reading	Working out Problems	Specific Books Other than Assigned	General Reading Books	General Reading Magazine	General Reading Newspaper	Studying Own Books Only	Other Reasons
Undergraduate									
Men	563	40	22	7	8	12	15	7	9
Women	365	59	24	8	4	4	10	7	7
Both	928	48	23	7	6	9	13	7	8
Graduate									
Men	83	28	41	12	11	7	17	2	8
Women	31	42	45	0	6	3	10	0	13
Both	114	32	42	9	10	6	15	2	10
All	1042	46	25	8	7	9	13	6	8

McDiarmid (1935) studied the use of books in seven college libraries in the North Carolina Area, during the spring semester of 1932-33 with respect to the following four characteristics (i) sex of the user, (ii) class of the user, (iii) scholarship of the user, and (iv) environment of the institution. He found that women read more heavily than men. The average number of titles borrowed during the spring semester was 22.17 and 13.17 for women and men respectively. Freshmen and sophomores borrowed fewer books than junior and seniors as shown below:

Class	Number in Group	Average Number of Titles Borrowed
Freshmen	747	15.75
Sophomores	619	16.06
Juniors	465	19.31
Seniors	448	22.00

McDiarmid found that good students tend to borrow, on the average, more titles than poor students:

Grade Average	Number in Group	Mean Number of Titles Borrowed
3.60-5.00	447	22.65
2.60-3.59	1123	19.10
1.60-2.59	644	16.61
0.20-1.59	64	11.56

A comparison of the average number of titles borrowed per student for the seven institutions revealed significant differences. In fact, McDiarmid says that institutional differences outweigh those of sex, class, and scholarship. He concludes that institutional objectives, methods of instruction, and provisions for library service are more

important in determining the extent to which students use the library than such factors as the distribution of the student body by sex and class groups.

Stieg (1942) reports a study of the use of the Hamilton College Library conducted during 1938-40. He found that students consistently withdrew more books during the second semester than during the first as shown in Table A-7. Stieg mentions two factors which may cause heavier use during the second semester: (i) term papers, special reports, etc. are usually due during the second semester; (ii) more advanced courses are offered during the second semester. He points out that if heavier use during the second semester is common to many institutions, figures for the academic year cannot be based on samples made during one semester only.

Stieg also presents his results using median number of titles as a measure of use. Classifying the books as "curricular" and "noncurricular", he gives the extent of use of these two types of titles separately for the four classes of students.

Stieg (1943) collected data for one more year from the Hamilton College Library and analysed the use of books for three years (1938-1941) by the date of publication. He found that about 80-84% of the titles circulated by Hamilton College Library were published after 1900 as shown in Table A-8.

Stieg also found that the majority of the books which circulated more than once were published after 1930. Tabulating the results separately for each subject, he concludes that most of the subjects follow the overall pattern shown in Table A-8. Stieg says that a study

Table A-7

Mean Number of Titles Withdrawn by Class and Semester

(based on Stieg's data)

Class	Mean Number of Titles Withdrawn Per Student			
	1938-39 (361 Students)		1939-40 (418 Students)	
	Sem. I	Sem. II	Sem. I	Sem. II
Freshmen	3.72	7.84	2.90	5.32
Sophomores	5.83	10.51	6.97	8.35
Juniors	8.82	12.58	10.97	16.05
Seniors	10.49	13.79	12.13	18.67
All	7.22	11.18	12.10	20.10

of the use of book collection at Hamilton College Library reveals facts whose usefulness more than justifies the time and energy that was spent in collection of data. He adds that these facts are especially valuable in deciding how much money to spend on the purchase of what books.

Davidson (1943) conducted a study of the use of books in Muhlenberg College Library during September 1942. He confined his study to 2131 books added to the main book collection during September 1, 1940-September 1, 1941 and studied their circulation during two year period from September 1, 1940 to September 1, 1942. He found that 45% of these 2131 books circulated one or more times during the two year period.

Table A-8

Percent Titles Circulated by Year of Publication

(based on Steig's data)

Year of Publication	Percent of Titles Circulated in Year		
	1938-39	1939-40	1940-41
1940-41		0.3	5.1
1930-1939	41.0	35.1	35.8
1920-1929	21.3	22.5	22.2
1910-1919	12.3	14.2	11.5
1900-1909	9.0	10.2	9.5
1890-1899	5.9	6.4	5.1
1880-1889	2.5	3.2	2.7
1870-1879	1.9	1.7	1.8
1800-1869	2.1	3.3	3.0
1500-1799	0.3	0.3	0.3
Not Available	3.7	2.8	3.0
Total	100.0	100.0	100.0

Percent circulation for different classes are shown below:

Class	Number of Titles	% Titles Circulated
General works	17	35
Philosophy	61	66
Religion	214	37
Social Sciences	302	38
Philology	63	24

(Continued)

Class	Number of Titles	% Titles Circulated
Science	220	60
Useful Arts	136	38
Fine Arts	77	60
Literature	479	38
History	397	39
Fiction	165	84
Total	2131	45

Of the above 2131 books, 995 were gifts. These gift books were used much less than the purchased books as is shown below:

Type of Book	Number of Titles	Number of Circulations	Average Circulation
Purchased	1136	2887	2.5
Gift	995	996	1.0
Total	2131	3883	1.8

In view of the low circulation of gift titles, Davidson suggests a reduction in the number of gift books accessioned. Besides the 2131 books under study, he also found the total circulation of the 57,869 titles which were acquired by the library before September 1, 1940. The results are given below:

Period of Acquisition	Number of Titles	Number of Circulations	Average Circulation
Sept. 1, 1940-Sept. 1, 1941	2,131	3,883	1.8
Before Sept. 1, 1940	57,869	14,173	0.2
Total	60,000	18,056	0.3

It is clear that recent acquisitions had much better circulation than older acquisitions.

Gosnell (1944), the present director of libraries at New York University, reports a study on obsolescence of books in college libraries based on the dates of publication of titles included in three lists: (i) Shaw list, (ii) Shaw supplement, and (iii) Mohrhardt list. He tried the following curve: $y = y_o b^x$

where y_o = the number of titles at the maximum or initial point

x = time elapsed

y = the number of titles after time x

He defines $w = 1-b$

= the annual rate of decrease

= the rate of obsolescence

He used the method of least squares to fit the data from three lists to the above function and obtained the value of w for 19 different subjects. For illustration, w values for a few subjects are given in Table A-9. The rank correlation between the obsolescence rates for the Shaw List and Shaw Supplement is 0.53; between Shaw List and Mohrhardt List is 0.84; between the Shaw Supplement and Mohrhardt List is 0.66. Gosnell concludes that there is substantial agreement about w for each subject in the three lists.

Table A-9

Rate of Obsolescence by Subject and List

(based on Gosnell's data)

Subject	100 w for the List		
	Shaw '31	Shaw Supplement	Mohrhardt
Physical Education and Health	21.6	31.3	16.2
Economics	13.2	19.1	15.2
Chemistry and Physics	12.9	23.4	21.7
Botany and Zoology	7.9	14.7	14.0
Mathematics	6.0	1.5	6.2
Philosophy	4.2	3.6	7.4
All	8.1	8.4	9.6

Gosnell also took samples from the shelf list of five local libraries for four subjects and found a strong agreement between the libraries and the lists in relative ranks of the coefficients for each subject, though the coefficients are lower for the libraries than for the lists. He says that it is difficult to interpret the difference between the library and the list and points out the need for further research in this area.

Urquhart (1948) conducted a questionnaire survey of the readers of the publications borrowed from the Science Museum Library, England to determine how references to publications are obtained, what the expected information is required for, and whether, in fact, the publications contain the desired information. No earlier survey of this type has

been traced. The questionnaires were dispatched folded over the covers of publications borrowed during November 17-29, 1947. About 50% of the questionnaires issued were returned. A breakdown of the returned questionnaires by the year of publication of the borrowed material is as follows:

Year of Publication	Questionnaire Returned Number	%	% Returned per Publication Year
1947 (part)	94	27	27.0
1946	26	7	7.0
1941-45	74	21	4.2
1931-40	117	33	3.3
1921-30	26	7	0.7
Before 1920	17	5	---

As in the case of several other studies reviewed earlier, it must be pointed out that in the absence of any information on the composition (with respect to the publication dates) of the total library collection, it is not possible to draw any definite conclusions about obsolescence of library material from the preceding data. Of course, it is clear that 88% of those who returned the questionnaire borrowed material which was published after 1930.

Urquhart found that abstract and references in other literature were the most important sources of reference to the literature borrowed. The number of reasons for which a publication was used appears to increase with its age. (Table A-10)

About 77% of those who returned the questionnaire found the desired information in the publications borrowed. The failure to find the

Table A-10

Percent Publications by Reason for Use

(based on Urquhart's data)

Type of Use	% Publications Used During the Period			
	1947 (part)	1941-1945	1931-1940	All
Theoretical research	24	15	46	26
Experimental details	17	20	54	27
Experimental results	11	16	49	20
Technical development work	29	45	43	30
General information	26	20	26	20
Total*	107	116	218	123

*Exceeds 100 due to more than one reason for use reported by some readers.

desired information appeared to be unaffected by the use for which the information was required. North America (50%) and Great Britain (25%) were the origin of 75% of the publications borrowed, all other countries accounting for the remaining 25%.

2. Usage Studies at University of Chicago

Fussler and Simon (1961) have conducted a very large study on the use of books at University of Chicago. Among those who have written theses at the University of Chicago connected with the use of books or library facilities are the following in chronological order: Carnovsky (1932, Ph. D.), McDiarmid (1934, Ph. D.), Armstrong (1938, M. S.), Butler (1939, Ph. D.), Logsdon (1942, Ph. D.), Fussler (1948, Ph. D.),

Todd (1948, M. S.), Curtis (1951, M. S.), Middleswart (1951, M. S.), Smith (1951, M. S.), Hintz (1952, Ph. D.), Trace (1953, M. S.), Davis (1954, M. S.), Knapp (1957, Ph. D.), Wagner (1959, M. S.), Given (1960, M. S.), Notheisen (1960, M. S.), Sheniti (1960, Ph. D.), Spyers (1960, M. S.), Bowen (1961, M. S.), and Woods (1965, M. S.). Of the 22 studies mentioned above, the three conducted by (i) Middleswart, (ii) Sheniti, and (iii) Fussler and Simon are far more detailed and more directly concerned with use of books than the remaining studies. Therefore, these three studies only will be reviewed in this section.

Middleswart (1951) conducted a study of social sciences and humanities books in the University of Chicago Library with the following objective: to determine the proportion and type of books which are used infrequently and which, therefore, might be considered for storage. He obtained a sample of 1234 titles (containing 3139 volumes) acquired before January 1941 by sampling shelf list. He computed the % not used and the average use (for books for which circulation was known) in each of the following four subject areas: (i) Philosophy, (ii) American History, (iii) Sociology, and (iv) Literature. From his data (Table A-11) he concludes that the rate of use of a book decreases as its age increases in the library.

It must be pointed out that the last two lines in the last table are based on longer period of time than the first two lines. For this reason, it is not easy to see that '% not used' increases and 'average use' decreases with age. However, it seems that if Middleswart had computed '% not used' for a fixed length of time then it would have been much easier to notice the pattern of obsolescence.

Table A-11

Percent Not Used and Average Use by Subject and Age

(based on Middleswart's data)

Years Following Acquisition	% Not Used* (Average Use) in Subject			
	Philosophy	American History	Sociology	Literature
1-5	61(2.8)	82(0.8)	60(2.8)	51(1.9)
6-10	78(0.9)	82(0.8)	65(2.0)	56(1.7)
11-20	70(1.1)	59(1.5)	65(1.8)	44(2.3)
21-50	59(2.1)	38(3.6)	61(1.9)	44(3.0)

*The first number in each column is % not used and the second number, within parenthesis, is the average use.

The average use shown above was broken down further by the actual year of publication, the year of acquisition, the lapse of time between publication and acquisition, and the type of material for each of the four subject areas. Here, to indicate the type of results obtained by Middleswart, only the breakdowns corresponding to the year of acquisition and the lapse between publication and acquisition for Philosophy will be reviewed. Table A-12 shows the average circulation per period of time for philosophy books for different years of acquisition. Here again, it is easy to compare the first two columns but difficult to make comparisons between the first two and the last two columns. Though it is difficult to interpret the figures shown in Table A-12 because they are not based on use during a fixed length of time (the last figure in each column is likely to be based on a shorter length of time than the remaining figures in the same column) it seems that average use per

Table A-12

Average Use by Year of Acquisition
(based on Middleswart's data)

Year of Acquisition	Average Use per Book for the Period (in years) Following Acquisition				Total Use in Library*
	1-5	6-10	11-20	21-50	
1890-1900	0.0	0.0	0.1	2.1	2.4
1901-1910	1.3	1.4	1.7	3.5	9.5
1911-1920	0.7	0.7	1.3	0.8	3.7
1921-1930	2.2	1.6	1.4		5.5
1931-1940	6.4	1.2			19.9

*i.e., the cumulative number of uses per book

book per year during the first five years in the library is increasing with time.

Table A-13 shows the average use per book for 1, 2-5, 6-20, and 21+ years of time between publication and acquisition. Middleswart concludes that average use seems to decrease as the lapse of time between publication and acquisition increases.

Middleswart also investigated the relationship between the circulation of a book during its first five years in the library and its circulation in later periods. He found a very high positive correlation between initial and later use of a book. (Table A-14).

Table A-13

Average Use by Age and Lapse of Time Between Publication and Acquisition

(based on Middleswart's data)

Lapse of Time (years) Between Publication and Acquisition	Average Use per Book for the Period (in years) Following Acquisition				Total Use in Library
	1-5	6-10	11-20	21-50	
1	4.8	1.0	1.1	1.4	15.4
2-5	1.4	1.0	1.7	3.1	6.7
6-20	0.7	0.4	0.5	2.4	3.9
21+	0.7	0.8	1.0	1.8	3.3

Table A-14

Average Use in the Subsequent Period by Use in the First Five Years

(based on Middleswart's data)

Use During the First Five Years	Average Use per Book per 5-Year Period for the Period (in years) Following Acquisition			Total Use in Library
	6-10	11-20	21-50	
0	0.10	0.15	0.08	0.7
1	1.00	0.40	0.01	2.5
2-5	2.10	1.00	0.66	6.3
6 or More	4.90	2.25	0.93	32.7

It may be noted that this table is much easier to interpret than the preceding three tables because here the average use is based on a fixed length of time (5 years). On the basis of his findings Middleswart concludes that it is possible to identify less frequently used books which might be considered for storage.

Sheniti (1960) conducted a very thorough study of recorded faculty use at the University of Chicago. His objectives were to explore:

(i) some general characteristics of the scholar's use of the university library in relation to his field of specialization;

(ii) some characteristics of the scholar's use in relation to the subject content of the material;

(iii) some characteristics of the scholar's use in relation to a particular library system.

He collected data on all library materials which were charged out to faculty* members during the period May 22-May 26, 1956. There were 15,357 pieces of print charged to 650 faculty members. These 650 faculty members constituted 52% of the estimated total of the 1261 faculty members in the University of Chicago at that time.

Sheniti presents a number of tables giving the % of the subject distribution of the faculty loans as well as the number of borrowers and items borrowed separately for each department affiliation of the faculty members. From these tables he concludes that the loans to faculty members of each division reflected a major concentration of materials within the subject areas of the appropriate division. He gives the distribution of faculty charges by country of publication separately for each department within each division. The division summaries are shown in Table A-15. A similar breakdown is given for the language of publication which follows the same general lines as the country of publication. Shaniti points out that the figures for items in English exceed almost without

---

*The term faculty includes professor, associate professor, assistant professor, instructor, lecturer, research associate, and research assistant.

Table A-15

Distribution of Used Items by the Country of Publication
(based on Sheniti's data)

Division	Number of Items Used	% Material Published in							
		USA	UK	France	Germany	Scandi-navia	Belgium and Holland	USSR	Other
Biological Science	532	58.6	14.0	4.3	16.0	1.9	1.5	0.8	2.9
Physical Science	703	52.5	13.6	3.5	17.4	1.6	0.8	1.7	8.9
Humanities	5,502	31.8	21.1	18.6	13.0	2.1	2.2	0.6	10.6
Social Science	3,012	61.6	16.2	4.9	8.6	0.5	0.5	0.9	6.8
All*	15,357	50.6	19.6	9.4	10.9	1.2	1.0	0.6	6.7

*Includes departments other than those included in the above four divisions.

exception the figures for the U. S. A. and U. K. combined, and the figures for French and German exceed the combined figures for France and Germany. Sheniti says that this observation seems to be due to the fact that these languages are the languages frequently used by minor publishing countries.

Sheniti found that two thirds or more of the library material checked out by faculty members in humanities and social sciences division was in the form of monograph. On the other hand, faculty members in the biological sciences and physical sciences borrowed about an equal number of monographs and of serial publications (Table A-16).

Sheniti broke down the library materials borrowed by the source of publication and found that trade publications accounted for almost three fourths of the library materials borrowed. Government documents, learned society publications, and academic institution publications came next in the order listed. The details are shown in Table A-17.

Table A-16

Distribution of the Used Items by Division and the Type of Material

(based on Sheniti's data)

Division	Number of Items Checked-out	% Check-out			
		Monograph	Serial	Thesis	Other
Biological Science	532	48.7	49.1	0.9	1.3
Physical Science	703	52.9	43.8	2.3	1.0
Humanities	5,502	72.2	25.0	0.9	1.9
Social Science	3,012	66.0	29.1	3.8	1.1
All	15,357	69.4	26.7	1.8	2.1

Table A-17

Distribution of Used Items by Division and the Source of Publication (based on Sheniti's data)

Division	Number of Items Used	% Items Published by				
		Trade	Govt. Doc.	Learned Society	Academic Inst.	Other
Biological Science	532	64.5	1.1	19.4	10.9	4.1
Physical Science	703	61.0	7.8	21.2	8.8	1.2
Humanities	5,502	77.1	9.2	7.3	4.4	2.0
Social Science	3,012	65.5	16.7	7.4	7.3	3.1
All	15,357	74.5	9.5	8.0	5.6	2.4

He found that 85% of the library material checked out by faculty members was published since 1900. It is very interesting to recall that Stieg (1943) made the same observation earlier. Divisionwise, faculty members in the biological sciences, physical sciences, and social sciences were using more recent material than those in the humanities (Table A-18). Sheniti also studied (i) average lapse in years between publication and acquisition, (ii) number of copies in the Chicago University Library, (iii) time of last use, and (iv) total previous use of the library material checked out by faculty members after dividing the library material into the following subject groups: (a) humanities, (b) social sciences, (c) physical sciences, (d) biological sciences, (e) technology, (f) bibliography, and (g) other. He found that, on an average, humanities and other items had a longer lapse between acquisition and publication than items in the remaining subject groups. About 84% of the library

Table A-18

Distribution of Used Items by Division and Year of Publication

(based on Sheniti's data)

Division	Number of Items Used	% Published in				
		1940-56	1920-39	1900-19	1850-99	Up to 1849
Biological Science	532	49.4	26.7	8.3	11.3	4.3
Physical Science	703	54.8	32.1	9.6	2.7	0.8
Humanities	5,502	25.1	28.5	19.0	16.5	10.9
Social Science	3,012	48.9	29.4	10.9	8.2	2.6
All	15,357	45.8	27.5	11.7	11.5	3.5

material in each of the seven subject groups (used by faculty members during May 22-26, 1956) was checked out last sometime during 1951-56. It can be said that Sheniti achieved the objectives he set out for himself and explored certain useful characteristics of the scholar's use of library material in some detail.

Fussler and Simon (1961) conducted a very large study with the following fundamental question in mind: will any kind of statistical procedure predict, with reasonable accuracy, the frequencies with which groups of books with defined characteristics, are likely to be used in a research library? Two subordinate but very closely related questions which they wanted to investigate are: (i) what kind of statistical functions are most effective for predicting use among little-used books in a research library?, (ii) what accuracy can be anticipated for statements about: (a) the number of books that will be taken to storage with

a specified function generated from a specified size of sample? (b) the number of books that will be withdrawn from storage for use in future periods?

For this study Fussler and Simon obtained systematic samples of books from the shelf list in two widely different subject areas: Teutonic literatures and languages, and economics; they did the same but with smaller systematic samples in many other subject-areas. The sampling plan selected was a measured, systematic sample. A random sampling plan was rejected as the standard method, though it was employed to take a sample in Teutonic languages and literatures for comparison with the systematic sampling plan. The over-all sample of monographs consisted of 9,058 titles.

Fussler and Simon developed functions to identify monograph titles for storage for three different situations: (i) where no record of past use is available, (ii) where a record of use for the past five years is available, and (iii) where a record of past use for twenty years may be established for most titles.

A. Functions for Libraries with No Records of Prior Use

1. Use as a Function of Publication Date (Function 1)

Figures A-1 and A-2 show the distribution of mean use in 1954 – 1958 by publication date for Teutonic languages and literatures, and economics respectively. From these two figures it is clear that by all three dependent-variable indicators, the slopes of the functions for the economics samples are considerably steeper and more consistent beginning with 1913 than are the slopes for Teutonic languages and literatures.

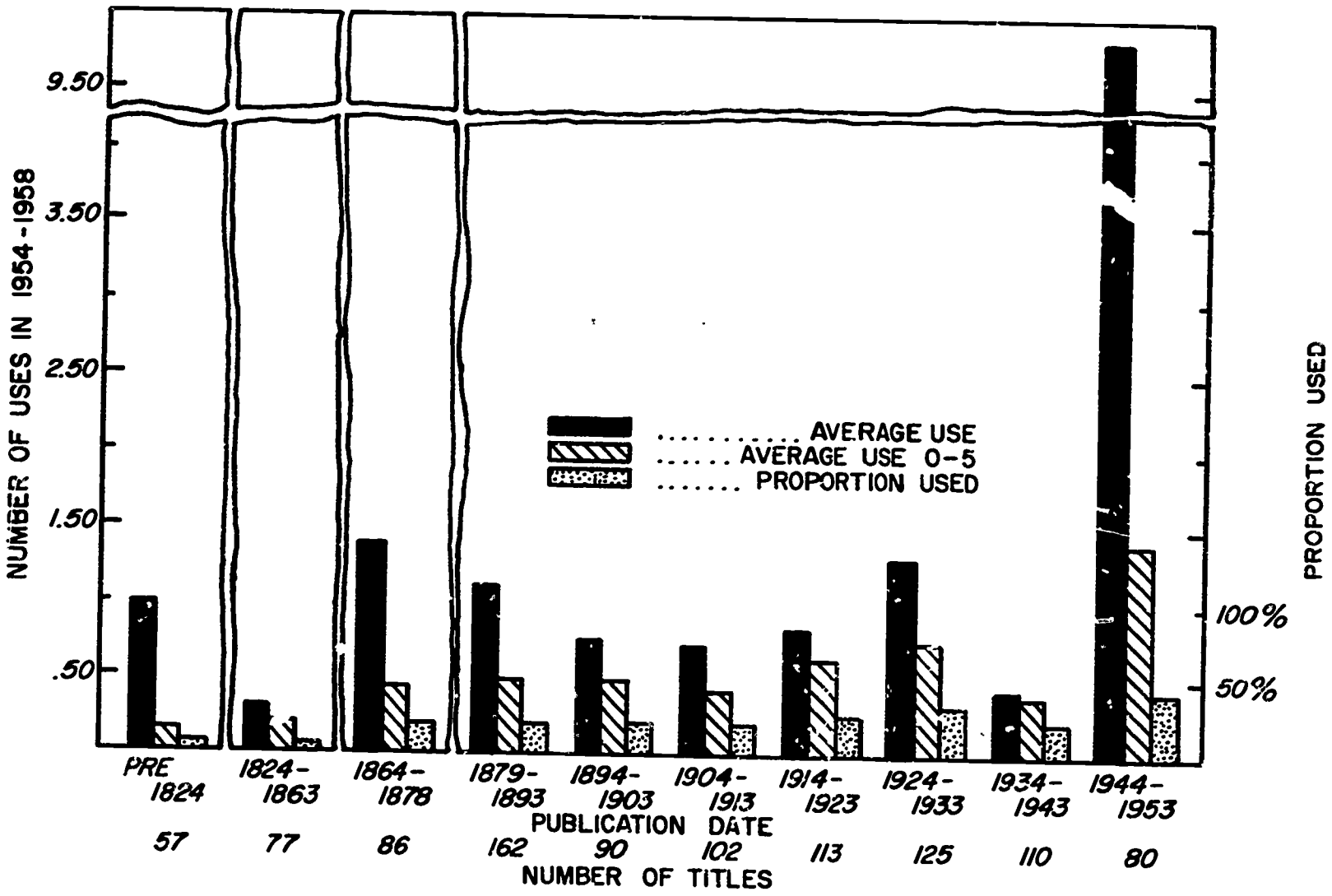


Figure A-1. Use in 1954-58 by Publication Date for Teutonic Languages and Literature Monographs

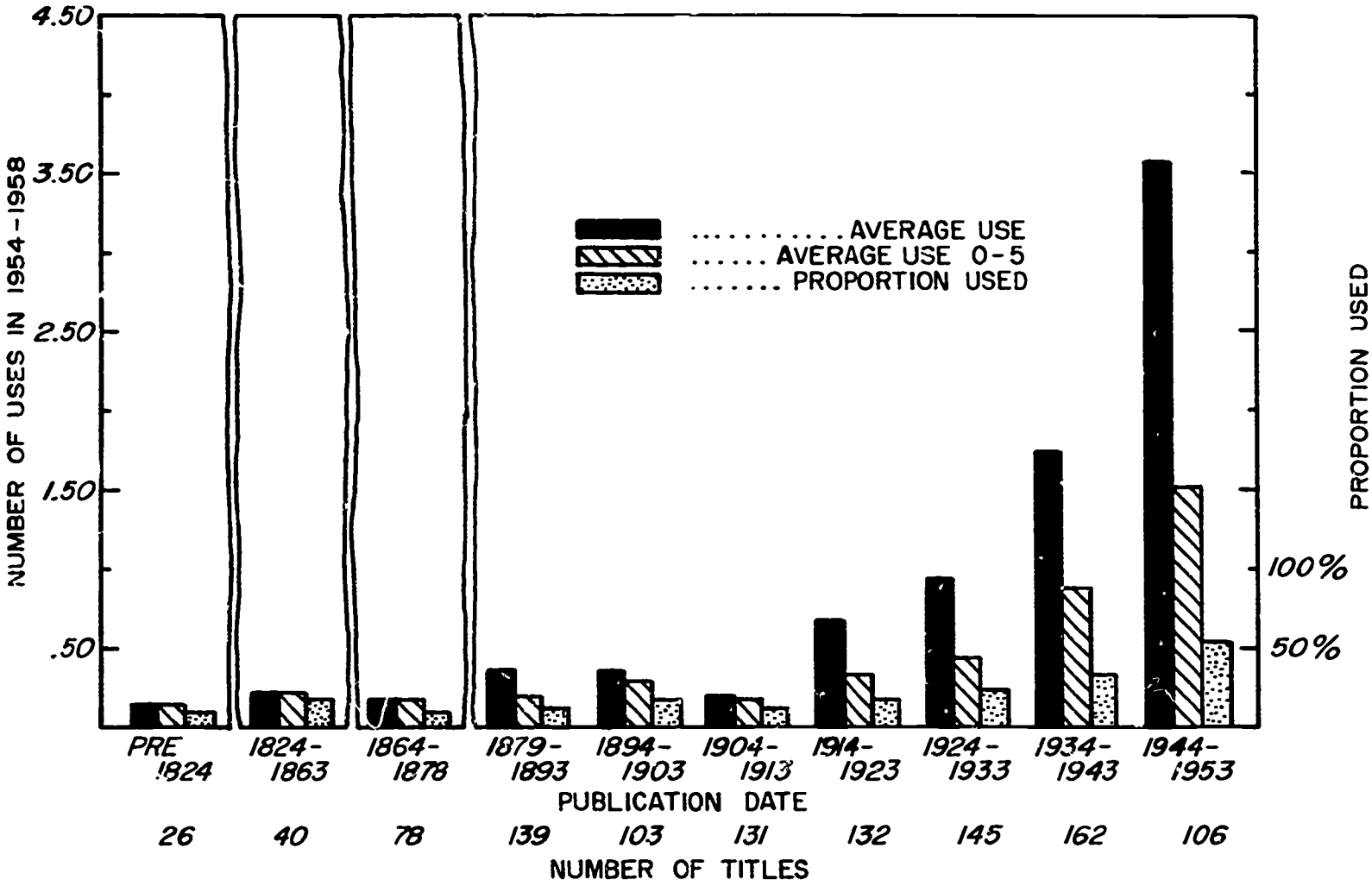


Figure A-2. Use in 1954-58 by Publication Date for Economics Monographs

2. Use as a Function of Accession Date (Function 2)

   Like publication date, accession date is also a measure of the age of the book. Figures A-3 and A-4 present use in 1954-58 as a function of accession date for Teutonic languages and literatures and economics monographs respectively. Fussler and Simon conclude that use regressed on accession date produces less satisfactory results than the use regressed on publication date.

3. Use as a Function of Publication and Accession Dates (Function 3). The authors subtracted from their sample all titles acquired after 1939 (i.e. less than 20 years old) and constructed a use on publication date function and called it function 3. Fussler and Simon conclude that function 3 seems to do little better than functions 1 or 2.

4. Use as a Function of Publication Date and Language (Function 4)

   It was found that the inclusion of language as a variable strengthens the technique considerably.

5. Formal Multiple Linear Regression Functions of Publication Date, Accession Date, and Language (Function 5)

   Fussler and Simon conclude that the formal regression function does not give substantially better results than function 4.

B. Functions that Require Five-Year Past Use Records

1. Use as a Function of Publication Date and Use in the Last Five Years (Function 6)

   In this function all titles that were used in the period 1949-1953 were subtracted from the original sample and function 1 applied to the rest of the sample. It was found that function

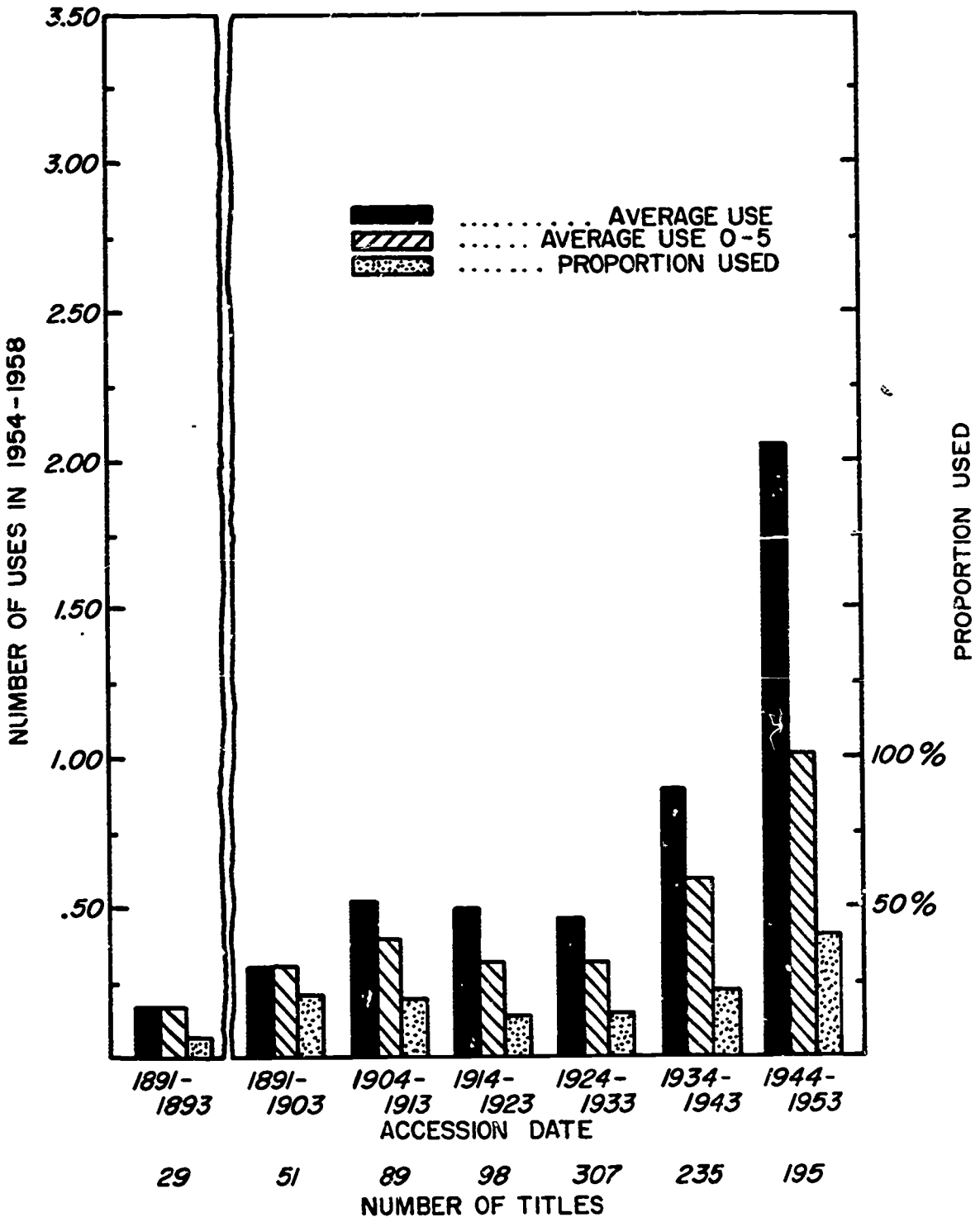


Figure A-3. Use in 1954-58 by Accession Date for Teutonic Languages and Literature Monographs

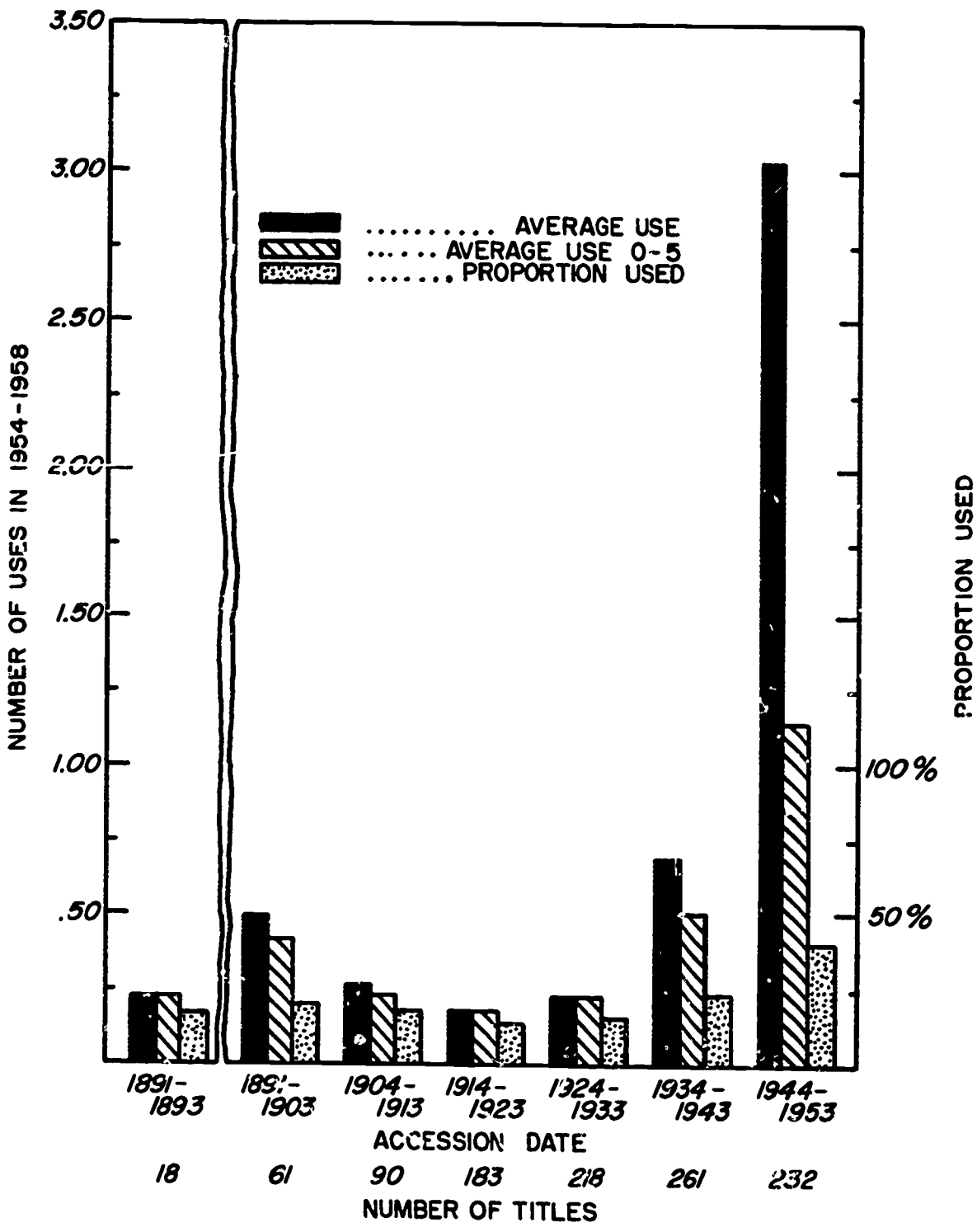


Figure A-4. Use in 1954-58 by Accession Date for Economics Monographs

6 does improve on mere age functions.

2. Use as a Function of Publication Date, Language and Use in the Past five Years (Function 7)

   Except for the addition of language as a variable, function 7 is similar to function 6 in its construction. This function was found to improve on function 6 as well as upon function 3.

3. Formal Multiple Linear Regression Functions of Accession Date, Publication Date, Language and Use in the Last Five Years (Function 8).

   The results of this function were found to be no better than the results of function 7.

C. Functions Employing Long Records of Past Use

1. Use as a function of Years since Last Use (Function 9)

   Function 9, employing "years since last use" as the only variable gave strikingly good results.

2. Use as a Function of "Years since Last Use" and "Years since Accession" (Function 10)

   Function 10 is similar to function 9, but it also takes account of whether or not a title has ever been used. This function was found to give very satisfactory results.

3. Formal Regression Functions of "Years since Last Use", Publication Date and Language (Function 11)

   This function was not found to be more satisfactory than function 9.

Fussler and Simon also made a comparative study of book use in several institutions and found a considerable similarity in reading

interests of scholars at different institutions. Since there appeared to be both substantial similarities and differences in the composition of collections at different institutions, they point out the need of a survey of a collection before deciding anything about titles to be sent to storage. They also developed functions for identifying serial volumes for storage. These functions are based heavily on "age". Fussler and Simon studied browsing and non-recorded use by inserting a brief questionnaire in the sample monographs and serials and they conclude that the relationship between browsing-use and recorded-use seems to be approximately linear within homogeneous groups of books.

3. Other Use Studies During 1950-66

The use studies conducted at M. I. T. and Purdue University during 1950-1966 are reviewed in the next section. The use studies conducted at other institutions are reviewed in this section.

3.1 Studies Based on Current Use

Webb (1950) Librarian of Union College, reports that out of a total collection of 135,000 volumes in his library, 90,000 volumes did not circulate during the previous year and he estimates that 66,000 volumes were not used in the previous five years. He feels that roughly half of the total collection should be kept in a consolidated warehouse within eight hours distance. He comments on the ordering of books by professors: "Some professors are good book buyers, others never buy a book, and still others order books with little or no consideration. Then there are books purchased by a professor on a special grant to promote his personal research. When that research is done and his reputation made,

he moves from your college to some larger institution and you are left with several thousand dollars worth of good books which no one else will use." Though Webb may be overcritical of professors' buying habits, he suggests a valid reason for "good" books not being used. Regarding text books, he adds that as new books come out, as professors move on, as new ideas change the content of the course, these books duplicated many times are certainly ready for discard.

Randall (1959) reports a study of the use of periodicals and reports at two libraries: Arnold Engineering Development Center (AEDC) Library in U. S. A. and Royal Aircraft Establishment (RAE) Library in U. K. Both libraries provide the customary information services to aeronautical and allied engineering personnel. The data at RAE Library was collected for 1154 reports on loan in December 1957 and for all periodicals returned to the library during 1957. On the other hand, the data at AEDC library was collected for three months from October through December 1958. Randall observes that one of the obvious differences between British scientists and engineers and their American counterparts is the willingness of the RAE Library users to borrow American produced information. American scientists make much more use of reports from universities and commercial firms than British scientists (Table A-19). Less than 10% of the reports borrowed at RAE and AEDC Libraries were published before 1951. Of the remaining, about 20% were published during 1951-1954 and about 70% after 1954. About 45% of the periodical issues borrowed from the RAE were domestic and less than a third were of American origin. The AEDC users borrowed 80% domestic and 20% imported periodical issues. Randall ranks the periodical titles borrowed by the users of the two libraries and notes some facts about the two libraries

which may explain the observed differences between the usage patterns of the two libraries.

Table A-19

Distribution of Reports Borrowed by Source of Publication

(based on Randall's data)

Source of Publication	Reports Borrowed			
	Number		%	
	RAE	AEDC	RAE	AEDC
United Kingdom	239	136	20.7	7.8
United States				
NASA	598	423	51.8	24.2
Universities	73	501	6.3	28.8
Commercial Firms	45	296	3.9	17.0
Government Agencies	95	245	8.3	14.0
Other Countries	67	86	5.8	4.9
International Organizations	37	57	3.2	3.3
Total	1154	1744	100.0	100.0

Kilgour (1961, 1962, 1964, 1966) reports four different use studies conducted at Yale University either by himself or in collaboration with other investigators. The first study (1961), is on the recorded use of books in the Yale Medical Library. His sample of 3230 volumes was obtained by picking every fifth book slip saved after cancellation during October 10, 1960 - June 30, 1961. Table A-20 shows the breakdown of the sample by the type of borrower.

Table A-20

Books and Periodicals Borrowed by the Type of Borrower
(based on Kilgour's 1961 data)

Borrower	Number Borrowed			% Books
	Books	Journals	Both	
Faculty	380	677	1057	36
Student	902	1056	1958	46
Other	103	112	215	48
Total	1385	1845	3230	43

It is clear that faculty members borrow about twice as many journals as books while students and others borrow about equal number of books and journals. Kilgour also gives a breakdown of the books borrowed by the date of publication. Following is a summary of his breakdown:

Date of Publication	Books Borrowed	
	Number	%
1957-1960	532	38
1953-1956	346	24
1949-1952	212	15
1911-1948	295	21
Before 1911	32	2

It can be seen that 98% of the books borrowed were published after 1910. Similarly, 77% of the books borrowed were published after 1948 and 62% of the books borrowed were published during the last 8 years.

Kilgour's second study (1962) was designed to identify the most frequently used journal titles of recent date of publication to guide

the acquisition of mul' .ple subscriptions. At the same time, data was collected to distinguish heavily used back sets. On January 15, 1961 the Yale Library had a collection of nearly 100,000 journal volumes and was receiving 1,437 journal titles in the fields of medicine and biology. The usage data for this study consists of all cancelled charge forms for volumes returned during October 10, 1961 to January 15, 1961.

Kilgour presents a list of all journal titles for which one or more of the following three conditions is satisfied:

(i) Volumes published during 1956-60 were used 3 or more times during the survey period.

(ii) Volumes published during 1951-55 were used 5 or more times.

(iii) Volumes published through 1950 were used 5 or more times.

The above list is supposed to contain all important journal titles. He then gives a listing by rank of 104 most heavily used journals published during 1956-60. The first 37 journals in this list furnished 49 percent of the recorded use and the first 86 journals accounted for 73 percent of the recorded use.

Kilgour's third study (1964) was in collaboration with Fleming, the Columbia Medical Librarian, and it was carried out to produce a title list of current Biomedical journals supplying upwards of 75 percent of demand at the Columbia and Yale Medical Libraries. The data for this study was collected for six months (January through June, 1962) at Columbia University and one year (July 1961 through June 1962) at Yale University by saving cancelled charge slips for Journal issues published from 1959 through June 1962. At the time of this study Columbia University was receiving nearly 2000 journals and Yale was receiving over

1500 journals. It was found that a core of 262 journals supplied 80 percent of use of titles published in the 1959 to mid-1962 period. Kilgour and Fleming give a list of 67 journals which supplied slightly more than 50% of demand at Yale and Columbia.

In the Yale study conducted during three months at the end of 1960 and beginning of 1961, it was reported that 37 of the 1437 journals received furnished 49% of recorded use. In the yale component of the current study, 69 of 1551 journals supplied 50% of use. Kilgour and Fleming say that the difference between 37 and 69 calls for elucidation, but no definite explanation has been developed. However, they suggest that the longer the circulation data are collected, the larger the number of charges for little used materials. In view of this they rightly suggest that such statements as "sixty-nine of 1551 titles supplied 50% of use" should be qualified by the period of time during which the observation was made and also perhaps by the number of loans analyzed.

Comparison of the twenty most heavily used titles in the Yale component with the twenty most heavily used in the 1960 study showed that only fifteen titles are common to both. This shows that the use of current journals is an ever-changing, dynamic activity.

Kilgour's fourth study, (1966), was in collaboration with Raisig (who was the principal investigator), Smith and Cuff. While the previous three studies were concerned with the use of biomedical journals, the fourth study deals with the use of biomedical books. The main objective of this study was to answer the question: "For what purposes do biomedical research people use library books?" As in the case of the other three studies, data for this study was collected by saving cancelled

charge slips during the period March 19 through August 14, 1964. Also, 430 interviews with faculty members and post-doctoral fellows who returned books were conducted using a questionnaire.

Of the 13,704 items returned during the survey period, 7,718 (56%) were serials and 5,986 (44%) were monographs. Researchers (faculty members and post-doctoral fellows) returned 2,735 items, of which 831 (30%) were monographs. The researchers gave the following replies when asked about how they learned of books they borrowed:

Method of Learning	Researchers Number	%
Personal Recommendation	60	12.4
Previous Use	72	14.9
Citations from Another Published Source	97	20.0
Library*	117	24.2
Browsing	104	21.5
Miscellaneous	34	7.0
Total	484**	100.0

* Library includes (i) monthly accessions list, (ii) card catalog, (iii) new book shelf, and (iv) help from librarian.

** Exceeds 430, the number of researchers, due to multiple methods mentioned by some researchers.

The researchers were also asked about how they use library books. Their replies were as follows:

Method of Use	Researchers Number	%
General Information	232	28.0
Fact Finding	105	12.6
Bibliographic	75	9.0
Lecture Preparation	91	11.0
Research		
Looking for Ideas	47	5.7
Looking for Specific Information	220	27.7
Substantiating Personal Point of View	15	1.8
Miscellaneous	35	4.2
Total	830	100.0

It is clear that 35% of book use is directly related to research and 11% of books withdrawn were used for lecture preparation. A frequency distribution of the books withdrawn by the year of publication (given below) reveals that nearly three-fifths of the borrowed books appeared in the last five years and four-fifths in the last decade.

Year of Publication	Books Withdrawn Number	%
1964 (part)	15	3.5
1963	77	17.9
1962	69	16.1
1961	40	9.4
1960	42	9.7
1959	20	4.7
1958	26	6.1
1957	19	3.9
1956	16	4.2
1955	13	3.1
1954	18	4.1
up to 1953	74	17.3

Broadus (1963) reports a study of faculty circulation at a mid-western university library. He collected data by saving charge slips during spring semester, 1962. The average number of books checked-out per faculty member was 5.6, 7.9, 6.6 and 6.1 for professors, associate professors, assistant professors and instructors respectively. He also presents the observed circulation of books by department of faculty members. He notes that the high average of the library science department (20.5 books per faculty member) was exceeded only by physics (21.7 books per faculty member).

Trueswell (1964, 1965) reports the results of a study at Northwestern University Libraries. In his first report he gives the distribution of circulated books in Deering and Technological Institute Libraries by age and period since last circulation. He obtained the

sample of circulated books by saving charge slips in Deering Library (on October 8, 1963) and Technological Institute Library (October 3-9, 1963). He found that 50% and 66% of the circulation in Deering and Technological Institute Libraries respectively was acquired during the last 10 years. Table A-21 gives the distribution of circulated books by period since last circulation. It will be seen that books in Technological Institute Library circulate faster than those in Deering Library. For example, the percentage of books not circulated during the preceding five months was 26% for Technological Library and 51% for the Deering Library.

Table A-21

The Distribution of Circulated Books by Period Since Last Use (based on Trueswell's data)

Period Since Last Use (Months)	% of Sample Not Previously Charged Out During the Cumulative Time Period	
	Deering	Tech. Inst.
1	89	79
2	76	49
3	68	42
4	59	34
5	51	26
6	49	25
7	42	23
8	39	19
9	38	17
10	35	16
11	32	13
12	29	12
18	24	9
24	17	6
36	11	3

In his second report, Trueswell (1965) makes use of the data presented in the first report to develop a method for thinning a library's stacks. As shown in Table A-21 above, 3% of the sample in Tech. Library

was not charged out during the previous 36 months. Or, 97% of the current circulation is made up of books that have been charged out one or more times during the previous 36 months. Trueswell found that for Tech. Library 99% of the current circulation was charged out during the previous eight year period. On this basis he suggests the following decision rule for thinning stacks: remove all books that have not circulated during the previous eight year period.

Assuming that the circulation pattern obtained from the current circulation sample is roughly equivalent to the circulation patterns for each of the past eight years, Trueswell estimates that approximately 25% of the current holdings of the Tech. Library would satisfy over 99% of the current circulation requirements. Similarly, a figure of about 40% is obtained for the Deering Library.

Strain (1965) conducted a study of book circulation pattern at Space Guidance Center Library, Oswego, New York. She found that the ratio of annual circulation to the total collection was close to one for the past five years. She reports that in her library which had 13,-165 volumes at the end of 1963, books borrowed per employee increased from 2.0 in 1959 to 2.7 in 1963. The engineering and research areas, which include about 30% of the plant population, are responsible for about 50% of library circulation.

When Strain plotted the monthly circulation and reference figures for the past five years, she noticed some distinct and consistent patterns of seasonal variation: July and December were low points and August and October were the busiest months. She found that about 25% of the total collection was in circulation on February 24, 1964. The

Space Guidance Library has the policy of not demanding books back without a valid reason. Strain found that about half of the books taken out in a month are returned within the month in which they were borrowed.

Mueller (1967) conducted a study in six different suburban community libraries in Chicago region with populations ranging from 4,000 to 35,000 to compare the circulation of old and new non-fiction titles. For each of the six libraries he obtained:

(i) the total number of titles held at the beginning of the survey period* (these titles are called "old"),

(ii) a listing of all titles acquired and made available for circulation during the survey period (these titles are called "new"),

(iii) the number of times each "new" title circulated during the survey period.

Mueller reports that the average annual circulation per title is not affected by the size of the library. The size of the total collection was 8,700 for the smallest and 43,700 for the largest of the six libraries. But, the average annual circulation was in the range 5.1-6.8 for all the six libraries as shown below:

Library	Total No. of Titles in Collection	Average Annual Circulation per Title
I	43700	5.1
II	19800	6.4
III	18500	6.6
IV	18500	5.4
V	8700	5.8
VI	11300	6.8

Since the "new" titles had been added to all six libraries at a constant rate over the 12-month periods, the average availability time

---

*The survey period was not the same for all the six libraries. It was a 12-month period during January 1, 1961 - May 31, 1963.

for a "new" title was six months. Mueller, therefore, doubles the observed circulation of "new" titles (Table A-22).

Table A-22

Comparative Circulation of Old and New Non-fiction Titles

Library	Old Titles		New Titles	
	No.	Circulation per Title	No.	Circulation per Title
I	15,303	3.48	2,420	8.00
II	3,897	4.82	812	8.45
III	4,266	3.57	731	4.15
IV	7,012	2.56	528	9.58
V	1,761	4.37	320	5.82
VI	2,291	3.71	384	4.53

Mueller observes that libraries I, II and IV had a high "new" title circulation rate while the libraries III, V, and VI had no substantial difference between the "new" and the "old" title circulation rates. A similar pattern was observed when the total collection was broken down by subject matter of the book. By personal observation, he found that libraries I, II, and IV had special tables or shelves where "new" books were displayed and allowed to circulate for a limited period of time before they were merged into the total collection. He attributes the higher use of "new" titles to greater visibility and accessibility provided by special shelving and points out that a librarian can shape the reading patterns of his patrons by differential accessibility of parts of the book-collection.

Barkey (1965) reports a study conducted at the Eastern Illinois

University Library. He collected data on use of books by saving call slips during Spring, 1962 and Fall, 1963. He found that 62 - 63% of the students did not borrow any book while the others borrowed one or more as shown below:

Period	Total No. of Students	% Students Borrowing			
		0	1	2 or 3	4 or More
Spring 1962	2967	63	9	13	15
Fall 1963	3847	62	12	14	12

Parkey found that the average number of books borrowed per student in class was higher for freshmen and graduate students than for sophomores, juniors, seniors and special and other students. His study seems to indicate that lower the grade point average the fewer the library withdrawals. The average number of books borrowed did not seem to be affected by sex.

3.2 Studies Based on Questionnaire Surveys

Stevens (1951) drew a random sample of 100 doctoral dissertations in 5 subject fields from 3 research libraries between 1930 and 1948 for analysis of citations. His objective was to compare availability of materials needed for historical and experimental research. He shows that historical research makes demands which cannot be satisfied by a single library whereas experimental research, which makes use of a smaller body of literature more frequently, often can be supported by a single research collection. He suggests that cooperative specialization and storage library plans should be based on the principle of separation of library materials according to type of research in which they will be

useful, rather than according to subject field.

Buddington (1951) carried out a questionnaire survey of students in 24 junior and senior high schools with a total enrollment of 17,616. He tabulated the answers to questions regarding their opinion of the library in general, what books they had used and their class in school. Following Gosnell (1944)'s method, he reports the obsolescence rate of 16.5% and 9.0% for engineering and liberal arts books respectively.

Cyphert (1957) gathered data from 73 three-year junior high schools with enrollments of 500 to 1500 by using a questionnaire. He reports that school libraries are most often visited by students in English, Social Studies and core areas.

Ducat (1960) gathered data from 3 secondary schools in the Middle West by using a questionnaire. He describes such characteristics as sex, grade. I. Q., and reading level of users and non-users. He reports that only a small percentage of students make regular and frequent visits to school library; more good students than poor students make use of the school library; and most students use the public library as a complement to the school library.

Meier (1961) reports a study on efficiency criteria for the operation of large libraries. He develops the concept of "item-use day". He defines "item" as an entry in the catalog or inventory. "Use" is defined by the population of users when interviewed about what they did with the item when it came into their hands. "Day" is defined in the ordinary way. By questionnaire survey Meier found that books accounted for 44% of the use, journals, 36%, abstracts, indexes, and bibliographical sources, 10%, encyclopedias and handbooks, 5% and government

publications, 5%. Faculty use was found to be rather stable over the year but student use was highly variable.

Nicholson and Bartlett (1962) conducted a survey at M. I. T. Libraries during May 11 through May 19, 1959. The persons entering the libraries were classified into two groups and given two different forms: those affiliated with M. I. T. and those not affiliated. Table A-23 gives the total number of M. I. T. affiliated persons interviewed and the use made by these people. As expected, the research staffs' use of the library for research purposes was high, 74.6%. Graduate and undergraduate students' use for class preparation amounted to 52.4% and 71.9% respectively.

Table A-23

Total Number of Interviewees Affiliated to M.I.T. and Their Use of Library (based on Nicholson and Bartlett's data)

Type	Total Number Interviewed	% Use for				
		Class Preparation	Gov't Sponsored Research	Industry Sponsored Research	Personal Research	Other
Faculty or Staff	949	31	15	8	33	13
D S R* Staff	281	17	38	12	25	8
Graduate Student	2850	52	7	3	27	11
Undergraduate	3706	72	0	1	14	13
Other	271	27	12	6	25	30
Total	8057	56	6	3	22	13

*Division of Sponsored Research

There were 603 outside users who were interviewed. Of these, 20.5% came from industry, 3.8% from government organizations and 62.4% from other educational institutions. About 46% of the outside users came on week ends.

Nicholson and Bartlett give the hourly average of people entering the libraries from 8 a. m. through 11 p. m. On all days the heaviest use was between 1 and 2 p. m. They report that the information drawn from this survey has been helpful in planning the hours during which the libraries are open and the types and the number of personnel needed.

John Hopkins University (1963) reports an operations research and systems engineering study in its research library. This report covers three principal areas of investigation: (i) A study of library usage, (ii) A study of circulation control using electronic data processing equipment, and (iii) An analysis of the library as an inventory system. The review here is confined to the first area only. The primary purpose of this survey of library usage was to construct a picture of the activities which make up a library day.

The data for this study was obtained by conducting a questionnaire survey during April 8 - May 12, 1962, in three groups of libraries: (i) Main Reading Room (M. R. R.), ii) Classics and History Libraries together as the Humanities and Social Science Group (Hum. & Soc. Sci.), and (iii) Ames, Latrobe, Maryland, Mergenthaler, Remsen, and Rowland Libraries combined as the Science and Engineering Group (Sci.& Engr.). The extent to which library patrons were engaged in different activities is shown below:

Activity	% Library Patrons in		
	Sci.& Eng.*	Hum.& Soc.Sci.*	M.R.R.*
Used Books from Reserve Shelf	28.8	18.6	13.2
Browsed on New Book Shelf	13.5	17.0	9.6
Browsed through Books on General Shelves	9.5	8.0	6.2
Browsed through current periodicals	23.8	18.9	25.1
Searched for Nonreserve Material	41.4	34.8	30.7
Returned Books Previously Checked out	21.8	26.1	18.2
Consulted Librarian	2.1	2.8	0.7
Conducted Personal Business	9.8	12.2	10.1
Used Own Material	44.0	42.5	57.1

* Many patrons reported more than one activity. Therefore, the sum of percentages exceeds 100 in each library.

It is clear that the most frequent activity was to use one's own material. Search for nonreserve material was the next most frequent activity among library patrons. A detailed breakdown of the patrons who searched for nonreserve material is given in the report both by the type of search: (a) search only for specific item(s), (b) search only for material on a subject and (c) search for both specific item(s) and material on a subject; and also by the method of search: (i) used catalog(s) to locate material, and (ii) did not use catalog(s) to locate material.

A question was included on the questionnaire which asked each respondent if he had browsed through the books on the general shelves and if so how many of the books he was charging out had been found in that

way. The response was as follows:

Library Group	% Charge Outs That Arose from Browsing
Science & Engineering	17.7
Humanities & Social Science	7.6
M. R. R.	8.3

On the basis of this data, it is concluded in the report that browsing is not inconsequential particularly in the science and Engineering branch libraries.

Using the data collected, the report discusses the effect of the removal of books from open shelves under a storage policy. The following conclusion is stated: About 40 to 50% of the patrons would have been affected but little by the storage plan, 30 to 40% would have been affected moderately, and about 20% would have been affected considerably.

In order to ascertain the usefulness of circulation volume as a predictor of the intensity of use of material within the library, data on the reported number of items used within the library but not charged out and the reported number of items charged out were collected. The square of sample correlation coefficient was 0.025, 0.044, and 0.737 for Sci. & Engr., Hum. & Soc. Sci., and M. R. R. Library respectively. It is concluded in the report that correlation for M. R. R. Library is spurious and circulation volume is not suitable as an index of the intensity of use of material within the library.

Slater (1964) conducted a pilot investigation of the use of 25 technical libraries and information units in British industrial firms,

government laboratories, academic institutions and learned societies during 1962 and 1963 using a questionnaire. This study had three main aims: (i) determination of user demands, (ii) classification of user groups, and (iii) estimation of the significance of the above two for librarians. Total number of respondents was 589.

Regarding the user demands, Slater found that 66% of the demands were directly required by work, 25% of the demands arose indirectly from work and 9% of the demands were not connected with work at all. About 41% demands were for simple, practical information, 29% for background and study material, 24% for ideas, stimulation and guides to further reading, and 6% for other reasons. When asked about motivation for their demands, 21% demands were for keeping in touch with current developments in one's field, 20% for filling in background of past research in one's field, 15% for obtaining information for use in peripheral professional or semiprivate activities, 14% for obtaining small practical details about equipment or material for immediate use in current work, and 30% for other needs.

Regarding user groups, Slater reports that 60% of the respondents were scientists, 25% engineers and 15% non-technical personnel. It is pointed out that employer appears to be a more important conditioning factor in general patterns of library usage than discipline. Scientists made more visits to the library than the other two groups. A high percentage of scientists' demands sprang directly from their current work, and fell within the stated official subject-scope of the library. On the other hand, engineers and non-technical personnel made demands on the library arising only indirectly from their current work. Also, the

engineers and non-technical personnel were much more likely than the scientists to ask the librarian for help. The engineer got what he wanted less often than the scientist or the non-technical man.

Academic employees were the heaviest library users in terms of frequency of visits per customer. Industrial personnel and users of learned society libraries were more likely than government or academic users to make preliminary attempts to get hold of required information before visiting a library. Demands of industrial and government users tended to be of the fairly short-term practical variety. On the other hand, the demands of academic and learned society users were more likely to be more directly related to their work than those of the other groups.

On the basis of the quantitative data collected from questionnaires and from direct observation of the co-operating libraries and librarians, Slater makes some observations on libraries and librarians in her report. She says that in 58% of all cases the survey library was the first resort of respondents in their search for the required information and document. And, in 83% of all cases complete satisfaction was obtained from the survey library and the search ended there.

Snyder (1965) reports the results of a study conducted by a group of five faculty members at Pennsylvania State University. The objective of the study was to prepare a plan for a model library system for the University. The review here is confined to the portion of the study dealing with analysis of the use patterns in Penn State Library. The data for this study was collected in three parts. First, during two sampling periods (weeks 2-3, 7-8) in Summer term, 1964 trained observers observed 3,290 users in the library. Each user was classified as to his

status and the nature of the material he was using. The second set of data consisted of 370 interviews with graduate and undergraduate students chosen at random from the 3,290 users in the first set of data. The last set of data consisted of 657 interviews (28% of the resident faculty at University Park and on the Commonwealth campus who were sent an opended questionnaire) with faculty members.

Snyder found that graduate students comprise more than half of the library users and are nearly twice as numerous as undergraduates in the libraries. There were 2,947 graduate students and 4,264 undergraduates enrolled during the summer term; thus 66% of the graduate student body uses the library compared to 24% of the undergraduates. Faculty use represents about 12% of the 1,530 members in residence at University Park during the summer term, 1964. Snyder concludes from her data that the better an undergraduate student's grade point average, the more likely he is to use the stacks. She adds that the major of a student is an important variable in library use patterns, but there is no difference between the likelihood of use by men and women in each major.

4. Use Studies Conducted at Massachusetts Institute of Technology and Purdue University

4.1 Massachusetts Institute of Technology

Bush, Galliher and Morse (1956) report a study on attendance and use of the M. I. T. Science Library. They collected data for their study by asking 50% of all persons entering the library during January 5-9, 1955 to fill out a questionnaire. They present a table showing the number of persons from each department who filled out questionnaires and

also the ratio of the number of questionnaires to the total number of persons registered in each department. They point out that the nine departments whose specialized material is concentrated in the Science Library rank highest in relative number of visits. A considerable number of persons who enter the Science Library use it only as a study hall in which to use their own material as shown below:

Department	Ratio of Study Hall Use to Library Use* for			
	Undergraduate	Graduate	Staff	Total
Chemistry	1.13	0.24	0.07	0.34
Biology	2.22	0.50	0.00	0.90
Physics	1.03	0.48	0.00	0.74
Mathematics	1.00	0.18	0.00	0.62
Other	2.14	0.50	0.06	1.04

*"Study Hall Use" represents those who used their own material only. "Library Use" represents those who used library facilities either exclusively or in conjunction with their own material.

Bush, Galliher and Morse give two tables on the use of library materials. The first table gives the data concerning the withdrawal of library materials by department and status of the borrower. The second table gives similar information regarding the library material consulted in the library without being withdrawn from the library. They conclude that there does not appear to be a significant difference between the science and the non-science departments. They gathered data on failure by the library to meet demands for material and found that the chief cause of failure to meet demands arises from material being out on loan. Defining effectiveness as the ratio of material used to material

demanded, the Science Library is 85% effective in supplying books, 93% effective in periodicals and 89% effective over-all.

Bush, Galliher and Morse show a plot of the number of attendees n(t) staying longer than t hours, versus t. The mean length of stay is about 63 minutes, nearly 20% of the visitors stay two hours, and 10% stay nearly three hours. The curve,

$$n(t) = n_1 e^{-t/t_1} + n_2 e^{-t/t_2}$$

which is based on the assumption that there are two sorts of visitors, n_1 of them with mean stay t_1, and n_2 of them with mean stay t_2, is a good fit to their data with $n_1 = 105$, $t_1 = 50$ min. and $n_2 = 170$, $t_2 = 100$ min.

Defining each action of the attendees: consulting a book, periodical or report in the library, withdrawing one of them, or consulting the catalog once, as a unit measure of use of the library (called "task"), Bush, Galliher and Morse present a table giving the total and the average number of tasks performed by department and status of the attendees. They note that only 8.4% tasks consisted of withdrawals, 91.6% being "on the spot" use of the library. They suggest the following model for studying the number of tasks performed:

$$N_k = N \frac{A^k}{1 + A}$$

where N_k = Expected number of users who perform at least k tasks before leaving the library

N = Total number of users

A = Mean number of tasks performed by a user during a visit to the library

Gonzalez (1962) extends the concept of "task" introduced by Bush,

Gelliher and Morse (1956). He defines eight types of "tasks". For example, his A-Task is consulting a bound or unbound periodical and his B-Task is consulting a technical report, a specific single book, a thesis, or a new book. Defining

N = number of tasks performed during a visit to the library

and L = length of stay in the library in minutes

he fitted the following regression

$$L = 18.84 + 8.52\ N\ .$$

The above model does not differentiate between different types of tasks. Gonzalez generalized the above model to the following:

$$L = \alpha + \sum_{i=1}^{8} \beta_i N_i$$

where N_i = number of tasks of type i .

He presents a table which gives the average number of tasks observed for different types of users. From his data, Gonzalez concludes that freshmen consult and withdraw more books than the other undergraduate categories. He adds that except for periodicals consulted, and perhaps catalog use, the activities of the undergraduate group are lower than those of the graduates.

Briggs (1962) reports a study with the objective of describing how the M. I. T. Science Library is used. He fitted the following distribution function to the observed residence times of a sample of users:

Percentage of users whose total residence time is less than t minutes =

$$1 - e^{-t/60}$$

He found that in-room use accounted for about 87% of the time spent in the library as follows:

State	% Total Time
In-room use of unbound periodical	16.2
In-room use of restricted reference	20.2
In-room use of own material	50.2

He also reports on his study of the circulation check-out time.

Rolfe, Terninko and Whitehead (1962) conducted a study of in-library use of books. They selected a sample of 101 volumes from the M. I. T. Science Library and placed behind the circulation desk of the library. The space normally occupied by each of these 101 volumes was filled with a wooden dummy which carried information identifying the volume and a direction to the special reserve collection at the circulation desk. They found that book and journal usage rate appears to be independent of age since acquisition. The majority of in-room uses of journals and reference books is for a short period of time, 76% of the uses being for 20 minutes or less. On the other hand, in-room uses of books are for longer periods than those of periodicals and reference books. They found a positive correlation between the in-room use and circulation-use of books with average monthly circulation of 0.6 or less. But, for books with average monthly circulation higher than 0.6 they found a negative correlation. It is stated that the books with high circulation rate may be such that they are of little use for short period of time in library, but must be used for a longer period of time at home.

Besides the study of in-library use of 101 volumes discussed above, Rolfe, Terninko and Whitehead also investigated the problem of "unavailable" volumes in the library. An "unavailable" volume could be in one of three locations: (i) on the tables in the library, (ii) on various

trucks scattered throughout the library, and (iii) behind the circulation desk waiting to be reshelved. They estimate that, on an average, a book is "unavailable" for about 9 hours after a library user leaves it on a table and there are about 300 "unavailable" books in the library.

Dawson (1962) discusses two Markov Models - one with eleven states and the other with three states - for predicting the future circulation of a book on the basis of its immediate past circulation. In his second model, the three states are 0 circulation per year, 1 or 2 circulations per year and 3 or more circulations per year. From a sample of 305 books he computes and presents the state probability vectors for 9 years and also the transition probabilities. He tried several functions and found the following to be a close approximation to his observed transition probabilities:

$$P_{00}(n) = \frac{9}{10} - \frac{3}{8}\left(\frac{8}{10}\right)^n$$

$$P_{01}(n) = \frac{1}{10} + \frac{2}{8}\left(\frac{8}{10}\right)^n$$

$$P_{02}(n) = \frac{1}{8}\left(\frac{8}{10}\right)^n$$

$$P_{10}(n) = \frac{4}{10}$$

$$P_{11}(n) = \frac{4}{10}$$

$$P_{11}(n) = \frac{4}{10}$$

$$P_{12}(n) = \frac{2}{10}$$

$$P_{20}(n) = \frac{6}{10} - \frac{5}{8}\left(\frac{8}{10}\right)^n$$

$$P_{21}(n) = \frac{4}{10}$$

$$P_{22}(n) = \frac{5}{8}\left(\frac{8}{10}\right)^n$$

Dawson also tried another method of finding the transition probabilities. He divided the total circulation period of a book into three parts (0-3 years, 3-7 years and over 7 years) and assuming a constant transition matrix within each of the three periods, he computed the three transition matrices corresponding to the three circulation periods.

Jacob (1963) conducted a questionnaire survey in the M. I. T. Science Library to gather data on in-room users and their use of library items. Subject card catalog and reserve book shelves were also sampled. Defining a = age = 1962 - year of publication, the following density function was fitted to the age distribution of used open shelf books

$$f(a) = 0.097\ e^{-0.097a}$$

where $\frac{1}{0.097} = 10.3$ = sample average age

Similarly, the distribution of used reserve books is

$$f(a) = 0.11\ e^{-0.11a}$$

and the distribution of used journals is

$$f(a) = 0.039\ (0.935)^a + 0.188\ (0.53)^a$$

It must be pointed out Jacob's sample of books is not random. Also, he does not comment on the goodness of fit of the above distributions.

Shaffer and Ernst (1954), Rothkopf (1962), Dawson, Aldrin and Gould (1962) and Morse (1965) have also conducted book-use studies at M. I. T. These studies are reviewed in Chapter I and Appendix B.

4.2 Purdue University

The writer (1966) conducted a study on sampling and short-period usage in the Purdue Library. The method of data collection and the development of the concept of "relative use" in that study are discussed in Chapter IV. Here, only the results are reviewed.

The over-all relative use of monograph titles in DDC* 330-339, DDC 340-369, and DDC 370-379 were 110, 83, and 374 respectively. Edcuation (i.e. DDC 370-379) titles had three to four times as much usage as titles in DDC 330-339 (Economics) and DDC 340-369 (Law, Public Administration and Social Welfare). This was mainly because many high school teachers took courses in education at Purdue during the summer session. The pattern is expected to be quite different during the regular semesters.

Use and Age of Title. Table A-24 presents the Purdue Library's holdings and relative use by year of publication. It is clear that, generally speaking, relative use decreased monotonically with age (i.e. the number of years since the date of publication) for DDC 330-339 and DDC 340-369. But for DDC 370-379 the pattern was quite different: titles published before 1904, during 1904-1913, and 1934-1943 had about the same relative use which was higher than the relative use for titles published during 1914-1933. Table A-25 shows that the pattern by year of accession was similar to that by year of publication.

Use of Foreign Books. From Table A-26 it is clear that the relative use was higher for titles published in the U. S. A. and England

*Dewey Decimal Classification.

Table A-24

Library's Holdings and Relative Use by Year of Publication

Year of Publication	Number in DDC 330-339	Number in DDC 340-369	Number in DDC 370-379	Percent in DDC 330-339	Percent in DDC 340-369	Percent in DDC 370-379	Relative Use in DDC 330-339	Relative Use in DDC 340-369	Relative Use in DDC 370-379
Pre-1904	14	12	13	3.2	3.4	3.0	43	42	231
1904-1913	28	18	27	6.3	5.1	6.2	46	22	274
1914-1923	36	17	41	8.1	4.8	9.4	39	24	85
1924-1933	45	30	42	10.1	8.4	9.6	80	43	148
1934-1943	73	62	58	16.5	17.4	13.2	86	44	238
1944-1953	105	82	81	23.7	23.1	18.5	118	77	347
1954-1964	139	133	169	31.4	37.5	38.7	165	135	598
Not Available	3	1	6	0.7	0.3	1.4	67	0	67
Total	443	355	437	100.0	100.0	100.0	110	83	374

Table A-25

Library's Holdings and Relative Use by Year of Accession

Year of Accession	Number in DDC 330-339	Number in DDC 340-369	Number in DDC 370-379	Percent in DDC 330-339	Percent in DDC 340-369	Percent in DDC 370-379	Relative Use in DDC 330-339	Relative Use in DDC 340-369	Relative Use in DDC 370-379
Pre-1924	52	29	45	11.7	8.2	10.3	23	14	184
1924-1933	33	25	41	7.4	7.0	9.4	94	24	83
1934-1943	75	50	69	16.9	14.1	15.8	77	40	83
1944-1953	80	69	73	18.1	19.1	16.7	110	61	203
1954-1964	197	177	197	44.5	49.9	45.1	148	126	621
Not Available	6	5	12	1.4	1.4	2.7	117	0	42
Total	443	355	437	100.0	100.0	100.0	110	83	374

than for those published in France, Germany, and other countries. It may be pointed out that in the Purdue library about 85% of titles in DDC 330-339 and DDC 340-369 and 94% of titles in DDC 370-379 were published in the U. S. A.

Table A-26

Library's Holdings and Relative Use by Country of Publication

Country	Number in DDC			Percent in DDC			Relative Use in DDC		
	330-339	340-369	370-379	330-339	340-369	370-379	330-339	340-369	370-379
U. S. A.	378	306	410	85.3	86.2	93.8	111	91	387
England	23	26	6	5.2	7.3	1.4	222	46	667
France	8	4	4	1.8	1.1	0.9	50	25	100
Germany	5	8	4	1.1	2.3	0.9	20	0	0
Other	29	11	13	6.6	3.1	3.0	34	45	15
Total	443	355	437	100.0	100.0	100.0	110	83	374

Table A-27 shows that the relative use was the highest for titles in English for each of the three DDC groups. The next important language from the point of view of usage was French. It is interesting to note that all used titles (i.e. samples H and I) in DDC 340-369 were in English.

It must be mentioned that since 94% or more of the titles in the Purdue Library in DDC 330-379 are in English, it is necessary to use larger sample sizes before any definite conclusions can be drawn regarding relative use of titles in languages other than English.

Table A-27

Library's Holdings and Relative Use by Language of Title

Language	Number in DDC			Percent in DDC			Relative Use in DDC		
	330-339	340-369	370-379	330-339	340-369	370-379	330-339	340-369	370-379
English	417	338	427	94.1	95.2	97.7	116	87	382
French	9	4	5	2.0	1.1	1.2	44	0	60
German	4	10	4	0.9	2.8	0.9	25	0	0
Other	13	3	1	3.0	0.9	0.2	0	0	0
Total	443	355	437	100.0	100.0	100.0	110	83	374

Usage by Class of User. Table A-28 shows the home usage of monograph titles in DDC 330-379 by class of user. It is clear that graduate students used the library three times as much as undergraduates and four times as much as faculty. This is in close agreement with the findings of Snyder (1965).

Table A-28

Use of Titles by Class of User

User		Number of Titles Used	
Class	Number	Total	Per 100 Persons
Undergraduate	2,444	216	8.8
Graduate	3,497	875	25.0
Faculty	1,023	66	6.5
Other	3,821	368	9.6
Total	10,785	1,525	14.1

Where are the Titles? Every librarian would like to know where his books are: how many are checked out, how many are on shelves, etc. An inventory of titles in sample S for Education (DDC 370-379) was

carried out on July 22-23 (Table A-29). "Not traceable" means not accounted for by any of the previous categories. It was thought that some of these might be back* on shelves after the summer session and accordingly two more rounds were made on August 14 and 17 respectively. During these rounds twenty-two of eighty-one "not traceable" titles were found, and the remaining were considered either missing or mis-shelved. The estimate of the availability on shelves (65 per cent) is quite close to that of Trueswell (1964).

Table A-29

Where are the Titles?

Where?	Shelf List Sample	
	Number	Per Cent
On shelves	286	65.4
Checked out	20	4.6
On reserve or reference	26	6.0
On indefinite loan	20	4.6
Known missing in 1960	4	0.9
Not traceable	81	18.5
Total	437	100.0

Regression Models and Storage functions. The library's holdings and relative use by language, country, year of publication, and year of accession are presented in Table A-30. The classification based on the above four factors is as detailed as possible subject to the small samples S, I, and H. Regression functions have been developed from the data in Table A-30. On the basis of these regression functions or the data in Table A-30 storage functions were developed.

* Could be due to in-library use, in transit, records under process, etc. during July 22-23.

Table A-30

Library's Holdings and Usage (S, I, H) by Language, Country, Year of Publication and Year of Accession

DDC	Language	Country	Year of Publication	Year of Accession	Number in Sample S*	Number in Sample I*	Number in Sample H*	Percent S	Percent R*
		U. S. A.	1954-64	Any	110	45	154	24.8	181
			1944-53	Any	90	40	67	20.3	119
			1924-53	Any	103	25	51	23.3	74
			Up to 1923	After 1943	8	7	1	1.8	100
	English		Up to 1923	Up to 1943	64	17	13	14.4	47
		England	After 1923	Any	17	25	22	3.8	276
330-339			Up to 1923	Any	6	2	2	1.4	67
		Other	Any	Any	19	3	8	4.3	58
	Not English	Any	Any	Any	26	4	1	5.9	19
			1954-64	Any	111	61	107	31.3	151
			1944-53	Any	70	33	27	19.7	86
		U. S. A.	1924-43	Any	88	28	9	24.8	42
			Up to 1923	After 1943	2	4	1	0.6	250
	English		Up to 1923	Up to 1943	33	2	5	9.3	21
		England	Any	Any	26	6	6	7.2	46
340-369		Other	1954-64	Any	3	2	4	0.9	200
			Up to 1953	Any	5	0	0	1.4	0
	Not English	Any	Any	Any	17	0	0	4.8	0
			1954-64	Any	157	363	625	35.9	629
			1944-53	Any	75	94	180	17.2	365
		U. S. A.	1924-43	Any	95	86	106	21.7	202
			Up to 1923	After 1943	20	4	12	4.6	80
	English		Up to 1923	Up to 1943	62	31	87	14.2	190
		England	Any	Any	6	9	31	1.4	667
		Other	Any	Any	12	0	3	2.8	25
	Not English	Any	Any	Any	10	0	3	2.2	30

*S, I and H stand for Shelf list, in-library use and home-use respectively. R denotes the relative use.

Table A-31 shows the storage functions for Economics monograph titles. It is encouraging to note that the results of storage functions for DDC 340-379 are quite similar to those in Table A-31 for DDC 330-339. These decision rules are relatively simple to apply and easy to communicate to the patrons. However, the evaluation of these functions has to be made by the administrators of the library with respect to its over-all goals.

Table A-31

Storage Functions for Economics (DDC 330-339) Monograph Titles

Storage Function		Per Cent Titles Stored	Upper Cutting Point	Per Cent Use Generated by This Group
1. Use as a function of publication date (assuming monotonicity)	(i)	10	1915	4.3
	(ii)	20	1927	8.6
	(iii)	30	1935	15.8
2. Use as a function of accession date (assuming monotonicity)	(i)	10	1921	2.1
	(ii)	20	1934	9.4
	(iii)	30	1940	16.2
3. Use as a function of publication date excluding post 1943 accessions	(i)	10	1917	4.1
	(ii)	20	1929	8.2
	(iii)	30	1936	15.6
4. Use as a function of publication date, accession date, language and country (multiple linear regression)	(i)	6	All not in English	1.0
	(ii)	20	All in (i); English titles published in USA before 1924 and accessioned before 1944	7.2
	(iii)	26	All in (ii); English titles published in England before 1924; English titles published in other countries	10.2

Usage of Library Facilities. A questionnaire survey was conducted in a part of the Purdue General Library (not restricted to social sciences only) to study the patrons' purposes of visit and preferences, etc. This survey was in operation for a few hours on each day during July 21-August 7, 1964 and 212 completed questionnaires were received.

Table A-32 summarizes the replies regarding the purpose of visit to the library. In (ii) a patron has been counted more than once if he reported more than one purpose. "Use of own material," "use of library material," and "check out for home use" were mentioned by 60 per cent, 54 per cent, and 20 per cent of the persons respectively. About 8 per cent reported "other" (or personal business). According to the Johns Hopkins study about 10 per cent of the patrons conducted personal business, and about 50 per cent used their own material.

Table A-32

Purpose of Visit to the Library

Part	Purpose	Persons	
		Number	Per Cent
(i)	Use of own material only	69	33
	Use of library material only	44	21
	Check-out for home use only	7	3
	Other only	17	8
	Use of library and own material	40	19
	Use of library material and check-out	17	8
	Use of own material and check-out	5	2
	Use of library and own material and check-out	13	6
	Total	212	100
(ii)	Use of own material	127	60
	Use of library material	114	54
	Check-out for home use	42	20
	Other	17	8

When asked "If checking out items now, did you intend when you came, to borrow them or did you get interested in them as a result of browing?", "came to borrow," "result of browsing," and "both" were

mentioned by 59 per cent, 34 per cent, and 7 per cent respectively of those who replied to this question.

About 46 per cent of library patrons "preferred" and 29 per cent "did not prefer" to use library material in the library rather than checking it out for home use. The reasons for those preferring the library are: better study atmosphere (46 per cent), to avoid mislaying of material (17 per cent), easier to refer to other sources (12 per cent), save the trouble of carrying it home (8 per cent), etc. Similarly, the reasons for those not preferring the library are: more comfortable at home (40 per cent), need for longer period (29 per cent), can use at leisure (16 per cent), use in conjunction with own material or typewriter (7 per cent), etc.

The library patrons who used library material during "this visit," were asked the reason for use of the library material in the library. The replies were as follows:

Reason	Persons	
	Number	Per Cent
Own Interest	69	45
Course assignments	52	34
Needed for term paper	51	34
Study for course examination	28	18
Other	16	11
Total*	152	100

*The actual sum of "Persons" exceeds total because of multiple reasons.

On an average a library patron spent 2.2 hours in the library and used three titles during one visit. Thus, he spent approximately 0.7 hours per title used in the library. This may be compared with the

usage of 7.7 hours per title at home obtained by a survey of material used at home during the same period.

This investigation was mainly exploratory and was used as a guide for the more complete study discussed in this thesis. Patterns of use in Fall and Spring could be quite different from the patterns in Summer. It is, therefore, advisable to analyze data on use throughout the year. The experience gained from this investigation and the similarity of some results obtained by Johns Hopkins University (1963), Trueswell (1964), Snyder (1965) and Writer (1966) led to a search for mathematical models for describing and predicting use of books. These mathematical models are discussed in Chapters I and II.

APPENDIX C

LITERATURE-GRAPHICS STUDY: BACKGROUND, DETAILS AND TABLES

This Appendix provides the details on the EDUCOM Literature Graphics Study which are summarized in Chapter VI. There is no attempt to make this Appendix self-standing; it should be used jointly with Chapter VI. As an example, the medians and other comparisons given in Chapter VI are not again supplied here. The contents have been divided into

Part I: The George Washington University and Libraries

II: Dewey Decimal Classification Translation to Library of Congress Classification

III: Determining the Sample at George Washington University Library

IV: Sample Graphic Study Data Sheets

V: Summary and Grand Totals for

- Types of Illustrations
- Type Sizes
- Page Sizes
- Publication Date
- Language
- Number of Pages

The physical examination of the volumes was accomplished by a research-study unit of George Washington University on contract to EDUCOM and underwritten by The Radio Corporation of America and The American Educational Publishers Institute.

Part I: The George Washington University and Libraries

George Washington University is a private, coeducational university with no religious affiliation, located in downtown Washington, D.C. It offers the bachelor's degree in five colleges and schools: liberal arts and sciences, education, engineering and applied science, government and business administration, and public and international affairs. The Graduate School of Arts and Sciences offered the doctorate only until 1967-68, when the master's programs were transferred from the University's Columbian College of Arts and Sciences. Master's are offered in a variety of disciplines, with the Master of Music and Master of Urban and Regional Planning being recent additions. Professional and advanced degrees in law and medicine are also offered. Of the 308 doctorates awarded in the last decade, nearly all were equally divided between the biological and social sciences; within those fields, education, psychology and bacteriology are the most commonly granted degrees. Non degree-granting courses are offered on and off campus; the continuing-education program of the law school is very active.

Student enrollment was 13,000, with a full-time equivalency of about 8,500 in academic 1966-67. The teaching staff is approximately 1,600, with a full-time equivalency of 950. (FTE is computed on the same basis as outlined in Chapter I.) The full-time equivalency ratio of students to teachers is 9:1. About 10% of the students live in dormitories.

Total revenue for 1966-67 was $38.6 million, including $9. million of sponsored research. Nearly half of the income is from tuition and student fees.

George Washington University is a member of a five-university consortium in Washington, D.C., which provides for some inter-university graduate programs and the framework for inter-library cooperative sharing.

The Libraries

The central library is a thirty-year-old, multi-story building in the heart of a campus which is cut through with city streets. Only two branch libraries of any accountable size exist: one for law, with about 75,000 volumes, and the medical library with approximately 35,000 volumes and many blocks removed from the main campus. The University Library houses approximately 320,000 volumes, which make the campus total 400,000-450,000 volumes. This is approximately 50 volumes per FTE student, which is nearly identical to the national academic library ratio for all students (not FTE). During the past five years, the libraries have averaged 18,000 new volumes a year. About 3,000 periodical titles are received currently; 3,000 reels of microfilm have been accumulated.

For the last 4-5 years, the total library budgets have ranged between $400,000-500,000, with slightly over half going to salaries. Acquisition expenses during the same period were $130,000 to $160,000. Binding accounted for another $20-30,000. The $36.

library expenditure per student (not FTE) in 1965-66 was appreciably below the U.S. Office of Education's previous two year's national academic library average of $51. per student. The library expenditures are near 2% of the University's education and general expenditures, which is about a whole percentage point below the national academic library average.

The immense bibliographic resources of the District of Columbia have influenced the building of collections of local universities, including George Washington. This regression factor has been diminished in recent years, however.

Part II: Dewey Decimal Classification Translation to Library of Congress Classification

The monograph data base used for a sampling distribution (cf., Chapter VI) was structured on the Dewey Decimal Classification System. Conversion tables had to be prepared for the Library of Congress Classification, which is used by the George Washington Library. The conversion used is shown in the table following. It is impossible to make a direct one for one translation. The organization of knowledge and the relationships expressed in the two classifications prohibit an easy and clear conversion. Overlap and related problems have been kept to a minimum and cannot be detrimental to the overall sampling.

The average number of volumes per linear foot was computed by measurement and count within subject sub-sections. The average volumes per linear foot for each Class are shown in the table.

TABLE C-1: DEWEY DECIMAL TO LIBRARY OF CONGRESS CLASSIFICATION

Class 0: General Works (11 vols. per linear foot)		
Dewey Decimal	Subject or Form Description	L. C. Equivalent
000-009	Reference, Yearbooks, History of Learning	AG, AY, AZ
010-029	Library Science	Z665-9000
030-039	Encyclopedias	AE
040-049	Collected Essays, Polygraphy	AC
050-059	Periodicals	AP*
060-069	Societies, Academies	AM, AS
070-079	Newspapers	AN*

(Con't)

Class 0: General Works
(11 vols. per linear foot)

Dewey Decimal	Subject or Form Description	L.C. Equivalent
080-089	General Collections and Antholo-gies	AC
090-099	Rare Books	Z665-9000**

*AP's: Periodicals were not included in the monograph survey.
AN's: Newspapers were not surveyed.
** : Rare books (Z665-9000) were not included in survey.

Class 1: Philosophy
(10 vols. per foot)

100-109	Collections, history, systems	B
110-129	Metaphysics, purpose of man, epistemology	BD
130-139	Parapsychology, occultism	BF
140-149	Critical philosophy, naturalism, related philosophies	B
150-159	Psychology	BF
160-169	Logic, induction, analogy	BC
170-179	Ethics	BJ
180-199	Critical philosophy, naturalism, related philosophies	B

Class 2: Religion
(10 vols. per foot)

200-219	Religions, mythology, science and religion	BL
220-229	Bible	BS
230-279	Christian Doctrine, Theology, Devotional and Church	BT-BV
280-289	Christian Denomination and Sects	BX
290-299	Comparative Religions	BL, BP

Class 3: Social Science
(10.5 vols. per foot)

300-309	General and theoretical sociology	H, HM
310-319	Statistics	HA
320-329	Political science	HX, JA-JV
330-339	Economics	HB-HD, HG-HJ

(Con't)

Class 3: Social Science
(10.5 vols. per foot)

Dewey Decimal	Subject or Form Description	L.C. Equivalent
340-349	Law	JX, K
350-359	Administration	U, V, JF-JV
360-369	Social welfare	HS, HV
380-389	Public services	HE-HJ
390-399	Social institutions. Manners and customs	GF-GT, HN-HQ

Class 3A: Education
(11 vols. per foot)

370-379	Education	L-LJ

Class 4: Languages
(11 vols. per foot)

400-419	General and comparative, philology	P, PB1-431
420-429	English Language	PB1200-3030, PE
430-439	German	PD
440-449	French	PC2000-3999
450-459	Italian	PC1001-1999
460-469	Spanish and Portuguese	PC4000-5000
470-489	Latin and Greek	PA
490-499	Other languages	PC600-900, PG-PM

Class 5: Pure Science
(11 vols. per foot)

500-509	General Science	Q
510-519	Mathematics	QA
520-529	Astronomy	QB
530-539	Physics	QC
540-549	Chemistry	QD
550-569	Geology and Paleontology	QE
570-579	Biology and Anthropology	QH
580-589	Botany	QK
590-599	Zoology	QL, QR

(Con't)

Class 6: Technology
(10 vol. per foot)

Dewey Decimal	Subject or Form Description	L.C. Equivalent
600-609	General	T
620-629	Engineering	TA-TF
630-639	Agriculture	S-SK
640-649	Home Economics	TX
650-659	Business and Finance	Z4-661, HJ
660-669	Chemical Technology	TN-TR
670-689	Manufacturers	TX-TX
690-699	Building	TG-TP, TS-TT

Class 6A: Medicine
(12 vols. per foot)

610-619	Medical Science	QM-QP, R

Class 7: Fine Arts, Amusements, Esthetics
(11 vols. per foot)

700-709	Philosophy of Fine Arts and Esthetics	N, BH
710-719	Landscape Gardening	SB469-479
720-729	Architecture	NA
730-739	Sculpture	NB
740-749	Drawing, Decorative Arts	NC, NK
750-759	Painting	ND
760-769	Engraving	NE
770-779	Photography	TR
780-789	Music	M-MT
790-799	Sports and Recreation	CJ, GV

Class 8: Literature
(11 vols. per foot)

800-809	General History and Criticism, Rhetoric	PN
810-819	American	PS, PZ
820-829	English	PR, PZ
830,839	Germanic	PT
840-869	French, Italian, Spanish, Portuguese	PQ
870-889	Latin and Greek	PA
890-899	Other Literatures	PG-PM

(Con't)

Class 9: History
(11 vols. per foot)

Dewey Decimal	Subject or Form Description	L. C. Equivalent
900-909	Civilization	CB-CE, D
910-919	Geography and Travel	G-GC
920-929	Biography	CT
930-939	Ancient History	DE-DF
940-949	Europe	DA-DD, DG-DR
950-959	Asia	DS
960-969	Africa	DT
970-979	North America	E, F1-2150
980-989	South America	F2200-3800
990-999	Oceania and the Polar Regions	DU-DX

Part III: Determining the Sample at George Washington University Library

Having the Library of Congress Classification equivalents and the number of volumes to be samples in each Class, it was next necessary to determine the number of volumes in those Classes at the George Washington Library in order to reach random sample frequencies. Shelves within subject sub-groups were measured, converted to total volume counts, and this compared with the total number of volumes in the group to be surveyed, which provided the random sample frequencies. Table C-2 shows the procedure for Class 9.

TABLE C-2: DETERMINING RANDOM SAMPLE FREQUENCIES FOR GEORGE WASHINGTON MONOGRAPHS

CLASS 9
(175 Volumes to be Examined)

Classification Group	Linear Feet x 11 = Volumes	% of Total Volumes in Class	Classification Gp.% of 175	Random Sample Freq.
CB-CE	100 1100	3	5	220
CT	35 390	1	2	195
D-DX	2100 23100	58	102	226
E-F	1300 14300	36	63	227
G-GC	70 770	2	3	255
Total Vols. in Class 9	39660	100	175 Volumes	

The linear measurements were converted to volumes and a total computed for the Class. The percent that each subgroup formed of the total Class was determined and this percent of the 175 Class Sample

was determined. For example, in CB-CE, five volumes were found to be the proper portion of the total 175 volumes in the Class, as based on the George Washington Library holdings in these subject groups. The total number of volumes in the subgroup was then divided by the number of volumes to be sampled, which determined the random sample frquency; that is, every 220th volume in sub-class CB-CE was surveyed. This allowed for sampling the entire length of the CB-CE holdings in the George Washington Library.

Procedures were worked out to overcome split collections (medicine, for example), procedures for determining volumes when the sample fell outside the scope of the study (before 1950, for example), and numerous other procedural and collection holding problems.

The periodical collection at George Washington is not organized by subject, but alphabetical by title. Periodical definitions were not carefully determined. Instead, the policies employed at George Washington which placed the periodicals and serials in a special alphabetical title collection served as the basis for definition. Any serial which was classified and in the monograph collection was considered a monograph. George Washington Library tends to place annual reports, proceedings of societies and academies, and monographic serials in the monograph collection; that

is, they subject-classify them. Consequently, the alphabetical periodical collection more nearly matches the concept of periodicals and journals than serials.

A random-sample frequency was determined on an alphabetical-title basis as for the monograph subject classification. The monograph sample size of 1364 was also used for the periodicals. (The average volumes per linear foot were 7.) The proper portion of periodical volumes in each alphabetical-title group was surveyed and these worksheets along with some subject description of the titles were used to classify each title. This method of alphabetical-title approach spread across the subject disciplines in a proportion nearly equally to the world-wide serials collected and cataloged at the Library of Congress and represented in *New Serial Titles* for the past 15 years. This relationship is shown in Chart VI-2. Some corrections of deficiencies were necessary and the sample size was enlarged.

Part IV: Sample Graphic-Study Data Sheets

Data-gathering sheets were devised and tested. Surveyors were required to check and supply some information which was not vital but which served as an accuracy check. Insufficient or inaccurate data accounted for less than a 2% sample loss within any one survey factor. Most of the registrations on the sample data sheets are self-explanatory.

Largest type size was recorded in picas, which were later converted to type points on the basis of 12 points to one pica. The segregation of eighths of pages under the types of illustrations greatly facilitated counting of each eighth illustration incidence.

NATIONAL RESEARCH COUNCIL
AMERICAN GEO Physical Union Transactions –

N-36

GRAPHIC-STUDY DATA SHEET

Monograph _____
Periodical ✓
Classification Number:

(Class 0)
AC-AG
AM
AS-AZ
Z 665-9000

(Class 1)
B-BF
BJ

(Class 2)
BL-BX

(Class 3)
GF-GT
H-HE
HG-HZ
JA-JX
K (Law)
UV

(Class 3A)
L-LJ

(Class 4)
P-PF
PG-PM

(Class 5)
Q-QL
QR

(Class 6)
HJ
S-SK
T-TX
Z 4-661

(Class 6A)
QM-QP
R (Medical Library)

(Class 7)
BH
CJ
GV
M-MT
N-NK
TR

(Class 8)
P-PA
PG-PZ

(Class 9)
CB-CE
CT
D-DX
E-F
G-GC

Page Sizes (Width and Length in inches):

6½ by 9½

Number of Pages:

642

Date of Publication:

1950
1951
1952
1953
1954
1955
1956
1957
1958
1959
1960
1961
1962
1963
1964
1965
1966
1967
1968

Type Sizes
Smallest 5
Largest 3P [Pica]

Language
English
French
German
Spanish
Italian
Russian
Japanese

Illustrations in eighths

Line	Charts, Graphs and Tables	Half or Full Tone	Color
1	111111	1111	
2			
	22		
33			
4444			
	33	333	
	4	4444	
77			
	55	5	
8	6666	666	
	7		
88888			
8888			
88888	888888		
8888	88888888	88888	
8888	8		

25 15

120

GRAPHIC-STUDY DATA SHEET

Monograph ✓
Periodical
Classification Number:
(Class 0)
AC
AM
AS-AZ
Z 665-9000
(Class 1)
B-BF
BJ
(Class 2)
BL-BX
(Class 3)
GF-GT
H-HE
HG-HZ
JA-JX
K (Law)
UV
(Class 3A)
L-LJ
(Class 4)
P-PF
PG-PM
(Class 5)
Q-QL (circled) 103 rd
QR
(Class 6)
HJ
S-SK
T-TX
Z 4-661
(Class 6A)
QM-QP
R (Medical Library)
(Class 7)
BH
CJ
GV
M-MT
N-NK
TR
(Class 8)
P-PA
PG-PZ
(Class 9)
CB-CE
CT
D-DX
E-F
G-GC

Page Sizes (Width and Length in inches): 6 x 9

Number of Pages: 369

Date of Publication:
1950
1951
1952
1953
1954
1955
1956
1957
1958
1959
1960
1961
1962
1963
1964
1965
1966
1967 (circled)
1968

Type Sizes
Smallest 8
Largest 2 1/2 p[ica]

Language
English (circled)
French
German
Spanish
Italian
Russian
Japanese

Illustrations (in eighths)

Line	Charts, Graphs and Tables	Half or Full Tone	Color
	883883	888884	
	888645	434483	
	584556	654868	
	368288	988585	
	448886		
	426345		
	454 54		
	582648		
	645843		
	585		

Part V: Summary and Grand Totals for Surveyed Factors

Types of Illustrations

Chapter VI has a description of the criteria used to categorize the illustrations and the reader is referred to it for clarifications. Monograph and periodical registrations are treated separately in these tables. The survey sample size for types of illustrations was 1418 monographs and 1364 periodicals.

It must be understood that the figures shown are individual incidences within factors of eighths of a page. For example, a monograph half-page with color would have been recorded as one incidence of 4/8 of a page of color. If the same page had a line illustration covering an eighth of the page, another registration was made in the line category for 1/8 incidence.

Table C-3 CUMULATIVE ILLUSTRATION INCIDENCES AND PERCENTAGES BY CLASS

Mono-graphs		Class 0	1	2	3	3A	4	5	6	6A	7	8	9	Total
Line	No.	22	359	147	623	44	29	4289	7956	1075	941	32	252	15769
	%	4	44	27	17	3	7	36	45	14	14	3	8.6	28
Chart	No.	283	267	118	2443	862	178	5057	5519	3030	240	50	773	18820
	%	44	33	23	66.6	56	44	43	31	38	3	4	25	34
Half Tone	No.	338	161	270	591	619	199	2502	4018	3666	5517	1160	2004	21045
	%	52	20	50	16	40	49	21	23	46	80	92	66	37
Color	No.	3	20	0	10	27	2	0	90	181	227	7	11	578
	%	.1	3	0	.4	1	0	0	1	2	3	1	.4	1
Total	No.	646	807	535	3667	1552	408	11848	17583	7952	6925	1249	3040	56212
	%	100.1	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.

Periodicals		0	1	2	3	3A	4	5	6	6A	7	8	9	Total
Line	No.	1019	1047	68	2066	538	306	8198	5942	910	927	572	640	22233
	%	15	22	18	9	5	24	21	14	9	6	19	9	14
Chart	No.	793	3370	32	12869	4017	471	20165	14750	5219	601	413	1663	64363
	%	12	70	9	57	40	38	52.5	36	50	5	14	24	40
Half Tone	No.	3884	395	269	7062	5042	437	9899	18898	4160	11403	1767	3945	67161
	%	57	8	70	31	51	35	26	46	40	79	58	57	42
Color	No.	1104	5	16	778	355	39	102	1889	114	1414	291	685	6792
	%	16	.1	3	3	4	3	.5	7	1	10	9	10	4
Total	No.	6800	4817	385	22775	9952	1253	38364	41479	10403	14345	3043	6993	160549
	%	100.	100.1	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.

Table C-4 ILLUSTRATIONS IN MONOGRAPHS

Total Incidences of Line Illustrations

	Class												
Size of Illus.	0	1	2	3	3A	4	5	6	6A	7	8	9	Total Incidences
1/8	0	78	8	15	0	1	938	1318	56	104	0	69	2587
2/8	5	63	3	83	5	2	1283	1822	194	169	4	68	3701
3/8	2	58	118	155	5	9	860	1517	317	169	7	41	3258
4/8	1	56	3	98	8	5	620	1378	196	89	5	28	2487
5/8	4	28	3	35	10	4	131	361	90	39	6	11	722
6/8	5	10	0	62	4	2	193	554	105	25	3	9	972
7/8	4	13	2	16	3	0	24	154	7	132	1	0	356
8/8	1	53	10	159	9	6	240	852	110	214	6	26	1686
Total Incidences	22	359	147	623	44	29	4289	7956	1075	941	32	252	15769
No. of Vols. with Illus.	5	14	13	53	9	6	107	106	23	55	5	19	415
Vols. with NO Illus.	29	31	77	142	41	34	62	40	61	45	285	156	1003

70% Sample with NO Illus.

Table C-5 ILLUSTRATIONS IN MONOGRAPHS

Total Incidences of Charts, Graphs & Tables

	Class												
Size of Illus.	0	1	2	3	3A	4	5	6	6A	7	8	9	Total Incidences
1/8	0	54	5	60	3	1	231	365	36	19	2	8	784
2/8	17	36	4	335	47	19	499	664	320	29	4	58	2032
3/8	38	76	9	532	96	27	882	807	595	34	5	65	3166
4/8	22	45	9	352	95	21	617	791	648	16	6	56	2678
5/8	26	16	8	149	120	20	354	285	323	22	9	38	1370
6/8	39	8	14	136	114	36	320	432	250	14	8	15	1386
7/8	22	7	13	32	62	6	66	96	96	12	0	8	420
8/8	119	25	56	847	325	48	2088	2079	762	94	16	523	6984
Total Incidences	283	267	118	2443	862	178	5057	5519	3030	240	50	773	18820
No. of Vols. with Illus.	13	5	14	113	28	13	132	128	64	30	4	61	605
Vols. with NO Illus.	21	40	76	82	22	27	37	18	20	70	286	114	813

57% Sample with NO Illus.

Table C-6 ILLUSTRATIONS IN MONOGRAPHS

Total Incidences of Half & Full Tones

	Class												
Size of Illus.	0	1	2	3	3A	4	5	6	6A	7	8	9	Total Incidences
1/8	0	17	31	0	2	1	84	189	15	351	6	29	725
2/8	16	20	40	4	34	14	185	371	213	584	43	110	1634
3/8	36	35	37	90	139	20	411	843	505	696	122	132	3066
4/8	30	34	25	55	122	19	427	735	829	844	119	163	3402
5/8	59	12	15	20	101	34	219	287	398	205	136	62	1548
6/8	57	7	4	34	93	25	227	243	331	270	170	61	1522
7/8	27	2	6	6	17	1	45	157	87	32	32	10	422
8/8	113	34	112	382	111	85	904	1193	1288	2535	532	1437	8726
Total Incidences	338	161	270	591	619	199	2502	4018	3666	5517	1160	2004	21045
No. of Vols. with Illus.	8	11	16	53	15	23	125	100	50	69	79	102	641
Vols. with NO Illus.	26	34	74	142	35	27	44	46	34	31	211	73	777

55% Sample with NO Illus.

Table C-7 ILLUSTRATIONS IN MONOGRAPHS

Total Incidences of Color Illustrations

Size of Illus.	Class 0	1	2	3	3A	4	5	6	6A	7	8	9	Total Incidences
1/8	0	1	0	0	0	0	0	0	1	0	0	0	2
2/8	0	3	0	0	4	0	0	15	18	1	0	0	41
3/8	1	2	0	0	5	0	0	10	15	4	0	0	37
4/8	1	7	0	1	4	0	0	3	24	10	0	0	50
5/8	0	1	0	0	2	0	0	5	8	24	0	0	40
6/8	1	0	0	8	3	0	0	1	11	9	0	0	33
7/8	0	0	0	0	0	0	0	2	1	0	0	0	3
8/8	0	6	0	1	9	2	0	54	103	179	7	11	372
Total Incidences	3	20	0	10	27	2	0	90	181	227	7	11	578
No. of Vols. with Illus.	2	5	0	7	1	1	7	10	19	21	4	2	69
Vols. with NO Illus.	32	40	90	188	49	39	162	136	75	79	286	173	1349
													95% Sample with NO Illus.

Table C-8 ILLUSTRATIONS IN PERIODICALS

Total Incidences of Line Illustrations

Size of Illus.	Class 0	1	2	3	3A	4	5	6	6A	7	8	9	Total Incidences
1/8	244	126	29	459	95	30	1107	1420	57	135	180	34	3896
2/8	191	223	19	366	103	103	1736	1247	185	171	201	86	4631
3/8	108	307	5	385	99	114	1845	1136	236	154	83	99	4571
4/8	78	181	8	386	85	19	1424	876	193	136	36	111	3533
5/8	39	53	2	77	27	3	541	254	76	30	2	42	1146
6/8	67	73		78	39	10	576	429	79	70	28	95	1544
7/8	38	26		31	7	2	238	128	21	43	1	23	558
8/8	274	58	5	284	83	25	731	452	63	188	41	150	2354
Total Incidences	1019	1047	68	2066	538	306	8198	5942	910	927	572	640	22233
No. of Vols. with Illus.	27	26	13	120	48	19	133	118	36	31	24	47	642
Vols. with NO Illus.	34	33	25	188	60	39	70	54	25	31	79	84	722

53% Sample with NO Illus.

Table C-9 ILLUSTRATIONS IN PERIODICALS

Total Incidences of Charts, Graphs & Tables

	Class												
Size of Illus.	0	1	2	3	3A	4	5	6	6A	7	8	9	Total Incidences
1/8	61	224	9	1241	296	34	1696	1356	461	19	132	47	5576
2/8	106	469	8	1825	529	76	2791	2107	709	85	119	171	8995
3/8	134	944	5	2102	571	85	3983	2831	1078	96	49	356	12234
4/8	114	511	1	1613	448	74	3739	2588	994	121	44	229	10476
5/8	67	317	1	698	232	23	2262	1393	563	35	14	149	5754
6/8	75	230	4	881	241	33	2049	1188	490	76	9	138	5414
7/8	14	91	0	342	82	10	396	291	118	5	12	34	1395
8/8	222	584	4	4167	1618	136	3249	2996	806	164	34	539	14519
Total Incidences	793	3370	32	12869	4017	471	20165	14750	5219	601	413	1663	64363
No. of Vols. with Illus.	31	38	9	216	82	26	174	136	57	28	23	78	818
Vols. with NO Illus.	30	21	29	92	26	32	29	36	4	34	80	53	466 34% Sample with NO Illus.

Table C-10 ILLUSTRATIONS IN PERIODICALS

Total Incidences of Half & Full Tones

	Class												
Size of Illus.	0	1	2	3	3A	4	5	6	6A	7	8	9	Total Incidences
1/8	719	3	9	1257	262	47	860	3133	356	977	247	164	8034
2/8	668	16	44	1144	446	103	1109	3077	535	1183	233	305	8863
3/8	662	71	71	1443	1009	107	2016	3790	969	2166	429	574	13307
4/8	411	41	21	850	964	56	895	2918	776	1734	181	725	9572
5/8	205	61	1	422	471	13	1551	1599	516	1212	77	309	6437
6/8	321	70		511	489	3	772	1539	320	1039	152	225	5441
7/8	65	1	2	134	76		309	261	72	286	63	70	1339
8/8	833	132	121	1301	1325	108	2387	2581	616	2806	385	1573	14168
Total Incidences	3884	395	269	7062	5042	437	9899	18898	4160	11403	1767	3945	67161
No. of Vols. with Illus.	46	24	15	124	69	19	151	147	47	48	53	88	831
Vols. with NO Illus.	15	35	23	184	39	39	52	25	14	14	50	43	533 39% Sample with NO Illus.

Table C-11 ILLUSTRATIONS IN PERIODICALS

Total Incidences of Color Illustrations

Size of Illus.	Class 0	1	2	3	3A	4	5	6	6A	7	8	9	Total Incidences
1/8	81	4		18	2			26		6	8	10	155
2/8	143			87	28		6	146	4	21	6	44	485
3/8	91	1		149	24		12	107	8	48	12	43	495
4/8	241		1	127	25		11	192	9	65	58	89	818
5/8	58			29	3		5	116		111	38	60	420
6/8	102			74	31	4	16	90		72	57	31	477
7/8	42			10			10	44	10	34	22	111	283
8/8	346		15	284	242	35	42	1168	83	1057	90	297	3659
Total Incidences	1104	5	16	778	355	39	102	1889	114	1414	271	685	6792
No. of Vols. with Illus.	20	4	2	50	19	4	14	68	11	27	13	16	248
Vols. with NO Illus.	41	55	36	258	89	54	189	104	50	35	90	115	1116

81% Sample with NO Illus.

Type Sizes

Monographs and periodicals are tabulated separately in the tables which follow on type-size registrations. The reader is referred to Chapter VI for a general discussion of how type size was obtained. Pica counts for the largest size in a volume were converted to type points on the basis of 12 points to one pica.

The valid sample size was 1450 monograph and 1352 periodical volumes.

Monographs

TYPE SIZE GRAND TOTALS & PERCENTAGES

TABLE C-12

Largest	Smallest 4 & 5		6		7		8		9		10		Totals	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%
10-14	3	7.0	17	5.3	7	3.8	22	3.1			10	5.8	59	4.0
15-19	14	32.5	69	21.3	33	18.3	85	12.0			55	32.2	256	17.7
20-24	13	30.2	106	33.1	54	30.0	183	25.9			53	31.0	409	28.3
25-29	2	4.6	10	3.1	10	5.5	17	2.4					39	2.7
30-34	6	13.9	39	12.1	27	15.0	89	12.6			23	13.4	184	12.7
35-39	2	4.6	45	14.0	24	13.3	118	16.7	1	4.2	7	4.1	197	13.6
40-44	1	2.3	7	2.1	7	3.8	40	5.7			6	3.5	81	4.2
45-49	1	2.3	13	4.0	9	5.0	63	8.9	8	33.3	3	1.7	97	6.7
50-54			2	.6	1	.6	7	1.0			5	2.9	15	1.0
55-59													0	0
60-64	1	2.3	5	1.5	7	3.8	39	5.5	8	33.3	3	1.7	63	4.3
65-69							6	.8			1	.6	7	.5
70-74			4	1.2			17	2.4	3	12.5	5	2.9	29	2.0
75-79							-	.6					4	.3
80-84			1	.3	1	.6	3	.4	1	4.2			6	.4
85-89							4	.6					4	.3
90-99			1	.3					2	8.3			3	.2
100+			1	.3			9	1.3	1	4.2			11	.8
Total	43	99.7	320	100.1	180	99.7	706	99.9	24	100.0	171	99.8	1444	100.0
%	2.9		22.1		12.6		48.8		1.6		11.8		99.8	

Periodicals

TYPE SIZE GRAND TOTALS & PERCENTAGES

TABLE C-13

Largest	Smallest 4 & 5		6		7		8		9		10		Totals	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%
10-14	2	.6	5	1.7	6	3.0	9	2.9			8	4.2	30	2.2
15-19	30	8.7	32	10.6	22	10.9	46	14.7			43	22.6	173	12.7
20-24	62	18.0	60	19.8	47	23.4	80	25.6	1	100.0	56	29.5	306	22.6
25-29	6	1.7	6	2.0	2	1.0	4	1.3			3	1.6	21	1.6
30-34	33	9.6	33	10.9	21	10.4	41	13.1			14	7.4	142	10.5
35-39	48	13.9	40	13.2	22	10.9	39	12.5			12	6.3	161	11.9
40-44	10	3.0	25	8.3	14	7.0	18	5.8			9	4.7	76	5.6
45-49	45	13.1	24	7.9	17	8.5	23	7.3			11	5.8	120	8.9
50-54	20	5.8	3	1.0	3	1.4	9	2.9			8	4.2	43	3.2
55-59	2	.6	3	1.0	4	2.0	2	.6			1	.5	12	.9
60-64	13	3.8	11	3.6	10	5.0	13	4.2			9	4.7	56	4.1
65-69	3	.9	8	2.6	1	.5	4	1.3			2	1.1	18	1.3
70-74	20	5.8	12	4.0	5	2.5	11	3.5			4	2.1	52	3.8
75-79	9	2.6	1	.3	1	.5	0	0			3	1.6	14	1.0
80-84	2	.6	1	.3	2	1.0	1	.3			1	.5	7	.5
85-89	2	.6	4	1.3	0	0	1	.3			0	0	7	.5
90-99	8	2.3	19	6.3	11	5.5	5	1.6			1	.5	44	3.3
100+	29	8.4	16	5.3	13	6.5	7	2.2			5	2.6	70	5.2
Total	344	100.0	303	100.1	201	100.0	313	100.1	1	100.0	190	99.9	1352	99.8
%	25.4		22.4		14.8		23.0		.1		14.0		99.7	

Table C-14 MONOGRAPH TYPE-SIZE TOTALS

Smallest Size: 4 & 5 Point

Largest Point Size	Class												Total Volumes	
	0	1	2	3	3A	4	5	6	6A	7	8	9		
10-14							1	1	1				3	
15-19							10	2	2				14	
20-24							8	2	3				13	M
25-29							2						2	
30-34							5	1					6	
35-39							2						2	
40-44							1						1	
45-49							1						1	
50-54														
55-59														
60-64								1					1	
	0	0	0	0	0	0	30	7	6	0	0	0	43	

M = Median

Table C-15 **MONOGRAPH TYPE-SIZE TOTALS**

Smallest Size: 6 Point

Largest Point Size	Class												Total Volumes	
	0	1	2	3	3A	4	5	6	6A	7	8	9		
10-14		2	1	4			1	3	5		1		17	
15-19		2	1	19			6	17	12	3	1	8	69	
20-24		4	11	21			10	18	15	9	1	17	106	M
25-29				4			1			2		3	10	
30-34		2		15			1	5	3	4	5	4	39	
35-39			2	13	1	2	4	9	4	1	8	1	45	
40-44				3					1	1	1	1	7	
45-49		1	3	1	1	2			1	1	3		13	
50-54				1				1					2	
55-59														
60-64	1		1		1	1					1		5	
65-69														
70-74	2		1								1		4	
75-79														
80-84	1												1	
85-89														
90-99	1												1	
100+					1								1	
	5	11	20	81	4	5	23	53	41	21	22	34	320	

M = Median

Table C-16 MONOGRAPH TYPE-SIZE TOTALS

Smallest Size: 7 Point

Largest Point Size	Class 0	1	2	3	3A	4	5	6	6A	7	8	9	Total Volumes	
10-14		1		4						1		1	7	
15-19		2	3	9			1	7	3	5	1	2	33	
20-24		5	6	22				5	3	3	2	8	54	M
25-29				8								2	10	
30-34				9			2	5		4	3	4	27	
35-39			3	3	3		2			1	6	6	24	
40-44				1				1		1	1	3	7	
45-49	1		2							1	3	2	9	
50-54											1		1	
55-59														
60-64			2	2	1						1	1	7	
65-69														
70-74														
75-79														
80-84					1								1	
	1	8	16	58	5	0	5	18	6	16	18	29	180	

M = Median

Table C-17 MONOGRAPH TYPE-SIZE TOTALS

Smallest Size: 8 Point

Largest Point Size	Class 0	1	2	3	3A	4	5	6	6A	7	8	9	Total Volumes	
10-14		4	4	8			1	3			1	1	22	
15-19		2	3	26			14	15	7	7	3	18	85	
20-24	1	16	9	25			18	26	7	12	45	24	183	
25-29				10			1			2		4	17	
30-34		1	1	10			7	3		4	50	13	89	M
35-39	5	2	11	7	5	2	6	4	4	3	45	24	118	
40-44				3			2				22	13	40	
45-49	5		11		17	4		2			19	5	63	
50-54										1	3	3	7	
55-59														
60-64	4		3	1		6		1		1	23		39	
65-69					6								6	
70-74	4			1		1	1	1			9		17	
75-79					3						1		4	
80-84	1					1				1			3	
85-89					2						2		4	
90-99														
100+	3				3			1			2		9	
	23	25	42	91	36	14	50	56	18	31	225	95	706	

M = Median

Table C-18 MONOGRAPH TYPE-SIZE TOTALS

Smallest Size: 9 Point

Largest Point Size	Class 0	1	2	3	3A	4	5	6	6A	7	8	9	Total Volumes	
35-39						1							1	
40-44														
45-49					1	7							8	
50-54														
55-59														
60-64					2	5			1				8	M
65-69														
70-74						2				1			3	
75-79														
80-84						1							1	
85-89														
90-99						2							2	
100+	1												1	
	1	0	0	0	3	18	0	0	1	1	0	0	24	

M = Median

Table - C-19 MONOGRAPH TYPE-SIZE TOTALS

Smallest Size: 10 Point

Largest Point Size	Class 0	1	2	3	3A	4	5	6	6A	7	8	9	Total Volumes	
10-14			2	1			4	2		1			10	
15-19		1		5			29	7	5	6	1	1	55	
20-24	1		3	9			18	2	4	10	1	5	53	M
25-29														
30-34			1	2			3	1	2	6	7	1	23	
35-39				2							5		7	
40-44			3				1		1		1		6	
45-49	1										1	1	3	
50-54			2				1			1	1		5	
55-59														
60-64	1										2		3	
65-69												1	1	
70-74	1		1			1					1	1	5	
	4	1	12	19	0	1	56	12	12	24	20	10	171	

M = Median

Smallest Size: 12 Point

In Classes 5 and 7 there were six monographs with 12-point type as the smallest. The largest type size for these six ranged between 20 and 34 points.

Table C-20 PERIODICAL TYPE-SIZE TOTALS

Smallest Size: 4 & 5 Point

Largest Point Size	Class 0	1	2	3	3A	4	5	6	6A	7	8	9	Total Volumes	
10-14		1								1			2	
15-19	2	2	1	4	3	1	12	1	1			3	30	
20-24	1	3		12	4		18	8	4	1	1	10	62	
25-29				2	1		1		2				6	
30-34	1	1		8	3	2	6	4	1		6	1	33	
35-39	2	2		11	3	2	15	6	3	1	2	1	48	M
40-44				3	2	1	1			1	1	1	10	
45-49		1		14	1	6	7	9	3	2	1	1	45	
50-54			11		1	1	1	4				2	20	
55-59	1			1									2	
60-64	2			3	1		1	2	2	1		1	13	
65-69	1			1						1			3	
70-74	2			2	2		3	6		2	1	2	20	
75-79	1			3			1	2		1	1		9	
80-84	1							1					2	
85-89									2				2	
90-99				1	3			4					8	
100+	5			2	2		1	8	4	6	1		29	
	19	10	12	67	26	13	67	55	22	17	14	22	344	

M = Median

Table C-21 PERIODICAL TYPE-SIZE TOTALS

Smallest Size: 6 Point

Largest Point Size	Class 0	1	2	3	3A	4	5	6	6A	7	8	9	Total Volumes	
10-14		1				2	1		1				5	
15-19		2	1	6	2	3	4	3	1		1	9	32	
20-24	4	2	3	13	6	1	9	7	4	5	2	4	60	
25-29				3	1			1		1			6	
30-34		2		5	5		9	4	1		2	5	33	
35-39	2	3	3	7	2	1	8	4	2		7	1	40	M
40-44	4			4	5	1	1	4		1	4	1	25	
45-49		1		5	3		4	3	1		3	4	24	
50-54	1	1			1								3	
55-59										1		2	3	
60-64	1		1	1				5	2		1		11	
65-69	2		1					2	1	1	1		8	
70-74	1			4		2		2	1	2			12	
75-79								1					1	
80-84					1								1	
85-89								3	1				4	
90-99				4	3	1	1	3	2	5			19	
100+	1			2			4	3	3	1	1	1	16	
	16	12	9	54	29	11	41	45	20	17	22	27	303	

M = Median

Table C-22 PERIODICAL TYPE-SIZE TOTALS

Smallest Size: 7 Point

Largest Point Size	Class 0	1	2	3	3A	4	5	6	6A	7	8	9	Total Volumes	
10-14				1	2		2	1					6	
15-19	2	1		2	3	2	2	1	2		2	5	22	
20-24	2	7	2	8	4	3	6	1	3	1	2	8	47	
25-29											2		2	
30-34		1		7	1	1	3	2	2		1	3	21	M
35-39			2	6			4	3			3	4	22	
40-44				7				4			2	1	14	
45-49		2	1	1	3	1	2	3		2		2	17	
50-54				1		1	1						3	
55-59	1			1							2		4	
60-64				2	1	1	1	2	1	1		1	10	
65-69				1									1	
70-74				1			1	3					5	
75-79					1								1	
80-84								1		1			2	
85-89													0	
90-99				1	3			3		2	2		11	
100+	4			2	2		2	2	1				13	
	9	11	5	41	20	9	24	26	9	7	16	24	201	

M = Median

Table C-23 PERIODICAL TYPE-SIZE TOTALS

Smallest Size: 8 Point

Largest Point Size	Class 0	1	2	3	3A	4	5	6	6A	7	8	9	Total Volumes	
10-14		2	1	2			1		1		1	1	9	
15-19	2	4	1	15	4	1	7	4			2	6	46	
20-24	1	7	3	22	3	5	11	4	1		11	12	80	
25-29				4									4	
30-34	1	1		10	3	2	5	4	2	5	1	5	41	M
35-39	1		1	3	2	4	11	4	1	4	6	2	39	
40-44	3			6	1	1	3	2				2	18	
45-49			1	3			5	4		2	6	2	23	
50-54				2	1		1	3		1	1		9	
55-59								2					2	
60-64	3			2	1	1	3	1	1			1	13	
65-69										2	2		4	
70-74				5	1		2		1	2			11	
75-79													0	
80-84			1										1	
85-89				1									1	
90-99				2	1	1				1			5	
100+				1		1		3		1		1	7	
	11	14	8	78	19	16	49	31	7	18	30	32	313	

M = Median

Table C-24 PERIODICAL TYPE-SIZE TOTALS

Smallest Size: 9 Point

Class 8 had one volume with 9 point as smallest and 20-24 largest. No other incidences reported.

Table C-25 PERIODICAL TYPE-SIZE TOTALS

Smallest Size: 10 Point

Largest Point Size	Class 0	1	2	3	3A	4	5	6	6A	7	8	9	Total Volumes	
10-14	1			6	1								8	
15-19	1	7	1	16	1	2	4	3			2	6	43	
20-24	2	3	5	15	4	4	6	1	1	1	6	8	56	M
25-29				2		1							3	
30-34	1			4	1		1					7	14	
35-39				4	1		3	1			1	2	12	
40-44		1		3		1	3					1	9	
45-49		1	1	3	1			1			3	1	11	
50-54			3	2			1	1		1			8	
55-59				1									1	
60-64	2		1	1			1		1		3		9	
65-69				1				1					2	
70-74					3							1	4	
75-79								2			1		3	
80-84				1									1	
85-89													0	
90-99				1									1	
100+				1	2				1		1		5	
	7	12	11	61	14	8	19	10	3	2	17	26	190	

M = Median

Page Sizes

Page size was measured on the title page so the data represent actual pages rather than the covers of a volume.

Valid sample sizes were 1404 monographs and 1366 periodicals.

Not recorded on the monograph tabulations are 9 volumes between 3.5-3.9 inches wide and 5-7 inches tall. All were in Class 8.

Likewise, six periodical volumes in Classes 3 and 8 are not recorded on the tabulations. They ranged from 4 to 5 inches wide and 7 to 9 inches high.

Table C-26

MONOGRAPH PAGE-SIZE TOTALS

Height (inches) \ Width	4.0-4.4	4.5-4.9	5.0-5.4	5.5-5.9	6.0-6.4	6.5-6.9	7.0-7.4	7.5-7.9	8.0-8.4	8.5-9.4	Total	
5.0-5.4							1	1	4		6	
5.5-5.9				1					4	2	7	
6.0-6.4	14	1	0							1	16	
6.5-6.9	16	14	1	1							32	
7.0-7.4	10	36	18	3	1						68	
7.5-7.9	2	23	34	34							93	
8.0-8.4	2	7	124	159	5	1			1		299	
8.5-8.9	1		61	157	30	1				1	251	M
9.0-9.4			2	93	303	20	4	2	1	2	427	
9.5-9.9			2	7	50	40	12	4			115	
10.0-10.4					3	16	18	10	6		53	
10.5-10.9							2	5	4	6	17	
11.0-11.4								1	3	7	11	
	45	81	242	455	392	78	37	23	23	19	1395	
				M								

M = Median

Table C-27

PERIODICAL PAGE-SIZE TOTALS

Height (inches) \ Width	5.0-5.4	5.5-5.9	6.0-6.4	6.5-6.9	7.0-7.4	7.5-7.9	8.0-8.4	8.5-9.4	9.5-10.9	Total
5.5-5.9		1					2		1	4
6.0-6.4									1	1
6.5-6.9										
7.0-7.4	4		1							5
7.5-7.9	12			1					4	17
8.0-8.4	23	9	2	1					8	43
8.5-8.9	20	161	10	13	3				2	209
9.0-9.4	6	144	139	50	2	1	1			345
9.5-9.9		25	103	117	7	1	1	1		255 M
10.0-10.4		2	17	45	33	31	13			141
10.5-10.9			1	4	5	27	93	3		133
11.0-11.4			1		4	16	94	26	2	143
11.5-11.9					2	4	19	14	2	41
12.0-12.4								1	6	7
12.5-12.9								1	5	6
13.0-13.4									4	4
13.5-13.9									7	7
	65	342	274	231	56	80	221	48	42	1361

M

Table C-28

MONOGRAPH PAGE SIZE

4.0-4.4 Inches Wide

Height (inches)	Class 0	1	2	3	3A	4	5	6	6A	7	8	9	Total Volumes
6.0-6.4				1							7	6	14
6.5-6.9						1	2		1	1	7	4	16
7.0-7.4		1	1	1		1	1			1	4		10
7.5-7.9						1					1		2
8.0-8.4						1					1		2
8.5-8.9						1							1
Total	0	1	1	2	0	5	3	0	1	2	20	10	45

Table C-29

4.5-4.9 Inches Wide

	0	1	2	3	3A	4	5	6	6A	7	8	9	
6.0-6.4											1		1
6.5-6.9										1	12	1	14
7.0-7.4			2	3	1	1	1	1	1	2	21	3	36
7.5-7.9	2	1	1	1	1	3	2			1	9	2	23
8.0-8.4				2							5		7
Total	2	1	3	6	2	4	3	1	1	4	48	6	81

Table C-30 MONOGRAPH PAGE SIZE

5.0-5.4 Inches Wide

Height (inches)	Class 0	1	2	3	3A	4	5	6	6A	7	8	9	Total Volumes
6.0-6.4													0
6.5-6.9										1			1
7.0-7.4	1	1	3	2			2			1	7	1	18
7.5-7.9	1		2	1		3	1	3	2	2	12	7	34
8.0-8.4	1	7	10	38		2	8	4	8	6	8	32	124
8.5-8.9		6	5	13			2	5			13	17	61
9.0-9.4		1					1						2
9.5-9.9						1						1	2
Total	3	15	20	54	0	6	14	12	10	10	40	58	242

Table C-31

5.5-5.9 Inches Wide

	0	1	2	3	3A	4	5	6	6A	7	8	9	
5.5-5.9							1						1
6.5-6.9								1					1
7.0-7.4				1							1	1	3
7.5-7.9				5	1	2				1	8	17	34
8.0-8.4	4	4	12	32	6	3	11	11	10	10	35	21	159
8.5-8.9	5	5	17	11	9	2	21	19	7	10	45	6	157
9.0-9.4	2	1	6	20	7	1	17	16	4	2	14	3	93
9.5-9.9				2	1			1			3		7
Total	11	10	35	71	24	8	50	48	21	23	106	48	455

Table C-32 MONOGRAPH PAGE SIZE

6.0-6.4 Inches Wide

Height (inches)	Class 0	1	2	3	3A	4	5	6	6A	7	8	9	Total Volumes
7.0-7.4				1									1
7.5-7.9													
8.0-8.4	1	1					1			2			5
8.5-8.9	1	1		8		1	7	2	2	5	2	1	30
9.0-9.4	4	11	12	41	13	6	55	60	27	16	28	30	303
9.5-9.9	3	2	1	5	7	4	2	5	3		14	4	50
10.0-10.4						1				2			3
Total	9	15	13	55	20	12	65	67	32	25	44	35	392

Table C-33

6.5-6.9 Inches Wide

	0	1	2	3	3A	4	5	6	6A	7	8	9	
8.0-8.4										1			1
8.5-8.9												1	1
9.0-9.4						1	6	1	3	2	4	3	20
9.5-9.9	1		1	2	1	3	8	5	4	6	3	6	40
10.0-10.4	2			1		1	4		4	3		1	16
Total	3	0	1	3	1	5	18	6	11	12	7	11	78

Table C-34 MONOGRAPH PAGE SIZE

7.0-7.4 Inches Wide

Height (inches)	Class 0	1	2	3	3A	4	5	6	6A	7	8	9	Total Volumes
5.0-5.4			1										1
9.0-9.4				1				1		1		1	4
9.5-9.9	1		1	1			2		1	3	2	1	12
10.0-10.4	2		1				4	2	2	4	1	2	18
10.5-10.9										1	1		2
Total	3	0	3	2	0	0	6	3	3	9	4	4	37

Table C-35

7.5-7.9 Inches Wide

	0	1	2	3	3A	4	5	6	6A	7	8	9	
5.0-5.4			1										1
9.0-9.4								1		1			2
9.5-9.9	1							1		2			4
10.0-10.4					2		1		1	4		2	10
10.5-10.9		1					1		2	1			5
11.0-11.4		1											1
Total	1	2	1	0	2	0	2	2	3	8	0	2	23

Table C-36 MONOGRAPH PAGE SIZE

8.0-8.4 Inches Wide

Height (inches)	Class 0	1	2	3	3A	4	5	6	6A	7	8	9	Total Volumes
5.0-5.4			4										4
5.5-5.9			4										4
8.0-8.4										1			1
9.0-9.4		1											1
10.0-10.4	1		1					2			2		6
10.5-10.9	1						1	1		1			4
11.0-11.4								1	1	1			3
Total	2	1	9	0	0	0	1	4	1	3	2	0	23

Table C-37

8.5-9.4 Inches Wide

	0	1	2	3	3A	4	5	6	6A	7	8	9	
5.5-5.9			2										2
6.0-6.4			1										1
8.5-8.9										1			1
9.0-9.4								1		1			2
10.5-10.9							1	1		1	3		6
11.0-11.4				1			1	2	1	1	1		7
Total	0	0	3	1	0	0	2	4	1	4	4	0	19

Table C-38 PERIODICAL PAGE SIZE

5.0-5.4 Inches Wide

Height (inches)	Class 0	1	2	3	3A	4	5	6	6A	7	8	9	Total Volumes
7.0-7.4	2										2		4
7.5-7.9				2	1		1	1	1	2	4		12
8.0-8.4	1	3		3	2	1	2	2		1	6	2	23
8.5-8.9	1	1		5	2	1	1		1	1	4	3	20
9.0-9.4				1		1	3					1	6
Total	4	4	0	11	5	3	7	3	2	4	16	6	65

Table C-39

5.5-5.9 Inches Wide

	0	1	2	3	3A	4	5	6	6A	7	8	9	
8.0-8.4				1		3	3	1			1		9
8.5-8.9	7	15	7	29	18	12	14	9	4	1	18	27	161
9.0-9.4	10	11	6	43	8	4	12	3		6	15	26	144
9.5-9.9			2	12			5				1	5	25
10.0-10.4									1			1	2
5.5-5.9					1								1
Total	17	26	15	85	27	19	34	13	5	7	35	59	342

Table C-40 PERIODICAL PAGE SIZE

6.0-6.4 Inches Wide

Height (inches)	Class 0	1	2	3	3A	4	5	6	6A	7	8	9	Total Volumes
7.0-7.4					1								1
8.0-8.4				1								1	2
8.5-8.9	1		2	2		1				1	3		10
9.0-9.4	7	7	4	33	9	13	20	10	6	2	8	20	139
9.5-9.9	1	6	3	16	9	5	23	9	8	1	10	12	103
10.0-10.4		3		2	3	2	1				3	3	17
10.5-10.9												1	1
11.0-11.4								1					1
Total	9	16	9	54	22	21	44	20	14	4	24	37	274

Table C-41

6.5-6.9 Inches Wide

	0	1	2	3	3A	4	5	6	6A	7	8	9	
7.5-7.9				1									1
8.0-8.4				1									1
8.5-8.9	1			10	1						1		13
9.0-9.4			2	30	1	2	6	4	1		1	3	50
9.5-9.9	2	6	8	12	12	6	27	10	10	1	7	16	117
10.0-10.4	7		1	4	5		13	8	4	1		2	45
10.5-10.9										1	3		4
Total	10	6	11	58	19	8	46	22	15	3	12	21	231

Table C-42 PERIODICAL PAGE SIZE

7.0-7.4 Inches Wide

Height (inches)	0	1	2	3	3A	Class 4	5	6	6A	7	8	9	Total Volumes
8.5-8.9										3			3
9.0-9.4				1	1								2
9.5-9.9							7						7
10.0-10.4		1		9	4	4	8		1		3	3	33
10.5-10.9		1		2	1		1						5
11.0-11.4								3			1		4
11.5-11.9							2						2
Total	0	2	0	12	6	4	18	3	1	3	4	3	56

Table C-43

7.5-7.9 Inches Wide

Height (inches)	0	1	2	3	3A	Class 4	5	6	6A	7	8	9	Total Volumes
9.0-9.4											1		1
9.5-9.9				1									1
10.0-10.4		2	1	7	3		11	4	2		1		31
10.5-10.9		1		4	1	1	6	13	1				27
11.0-11.4	1			3	2		1	8	1				16
11.5-11.9							2	2					4
Total	1	3	1	15	6	1	20	27	4	0	2	0	80

Table C-44 PERIODICAL PAGE SIZE

8.0-8.4 Inches Wide

Height (inches)	Class 0	1	2	3	3A	4	5	6	6A	7	8	9	Total Volumes
9.0-9.4											1		1
9.5-9.9					1								1
10.0-10.4	1			3	2	1	5		1				13
10.5-10.9	4	1	1	28	5	1	13	19	7	13	1		93
11.0-11.4	4			15	8		7	40	8	10		2	94
11.5-11.9	1		1	3			7	3	1	3			19
Total	10	1	2	49	16	2	32	62	17	26	2	2	221

Table C-45

8.5-9.4 Inches Wide

	0	1	2	3	3A	4	5	6	6A	7	8	9	
9.5-9.9							1						1
10.5-10.9				2				1					3
11.0-11.4	1			10			3	7	1	3		1	26
11.5-11.9			1	1	1		3	1	2	3		2	14
12.0-12.4							1						1
12.5-12.9				1									1
5.0-5.5					1								1
5.5-5.9							1						1
Total	1	0	1	14	2	0	9	9	3	6	0	3	48

Table C-46 PERIODICAL PAGE SIZE

9.5 + Inches Wide

Height (inches)	Class 0	1	2	3	3A	4	5	6	6A	7	8	9	Total Volumes
5.5-5.9					1								1
6.0-6.4				1									1
7.5-7.9				2				2					4
8.0-8.4	2				1		1	2			2		8
8.5-8.9				1	1								2
11.0-11.4										2			2
11.5-11.9				1				1					2
12.0-12.4	1							1		4			6
12.5-12.9	2			1				1		1			5
13.0-13.4					1			2		1			4
14.0-14.4	3							4					7
Total	8	0	0	6	4	0	1	13	0	8	2	0	42

Publication Date

The statement in Chapter VI about procedures on publication dates is definitive and the reader is referred to it.

Sample size of monographs was 1410, periodicals 1848. The expanded size of the periodicals was necessary because the surveyors did not respect the 1960 cut-off date in the sciences and had to add to the sample.

Table C-47

DISTRIBUTION OF PUBLICATION DATE IN MONOGRAPHS

	Class 0		1		2		3		3A		4		5		6		6A		7		8		9		Total	Total
Year	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1950	2	5.9	3	6.7	4	4.4	5	2.6	0		0		1	.6	8	5.4	1	1.1	4	4.0	11	3.8	14	8.1	53	3.7
1951	0		1	2.2	2	2.2	7	3.6	6	12.0	4	10.0	6	3.6	9	6.1	4	4.7	6	6.1	17	5.9	9	5.2	71	5.0
1952	1	2.9	3	6.7	8	8.9	6	3.1	5	10.0	5	12.5	3	3.0	10	6.8	1	1.1	1	1.0	16	5.5	8	4.6	69	4.9
1953	1	2.9	2	4.4	5	5.5	4	2.1	2	4.0	0		5	3.0	5	3.4	2	2.3	6	6.1	9	3.1	16	9.2	57	4.0
1954	1	2.9	1	2.5	5	5.5	7	3.6	2	4.0	0		6	3.6	5	3.4	3	3.5	7	7.1	11	3.8	3	1.7	51	3.6
1955	5	14.7	0		7	7.8	6	3.1	4	8.0	2	5.0	4	2.4	4	2.7	1	1.1	3	3.0	18	6.2	4	2.3	58	4.1
1956	2	5.9	4	8.9	1	1.1	8	4.1	0		1	2.5	5	3.0	7	4.8	3	3.5	3	3.0	18	6.2	9	5.2	61	4.3
1957	2	5.9	2	4.4	8	8.9	3	1.5	1	2.0	6	15.0	4	2.4	4	2.7	4	4.7	5	5.0	14	4.8	5	2.9	58	4.1
1958	3	8.8	3	6.7	3	3.3	11	5.7	3	6.0	2	5.0	9	5.4	5	3.4	4	4.7	4	4.0	17	5.9	12	6.9	76	5.4
1959	0		2	4.4	3	3.3	7	3.6	5	10.0	3	7.5	6	3.6	5	3.4	5	5.9	3	3.0	16	5.5	4	2.3	59	4.2
1960	1	2.9	2	4.4	4	4.4	7	3.6	1	2.0	4	10.0	16	9.6	17	11.6	8	10	3	3.0	18	6.2	8	4.6	89	6.2
1961	3	8.8	1	1.1	13	14.4	11	5.7	1	2.0	1	2.5	13	7.9	14	9.5	5	5.9	7	7.1	17	5.9	5	2.9	91	6.4
1962	1	2.9	5	11.1	5	5.5	16	8.2	5	10.0	3	7.5	15	9.0	12	8.2	7	8.3	6	6.1	17	5.9	11	6.3	103	7.3
1963	2	5.9	5	11.1	5	5.5	14	7.2	3	6.0	2	5.0	18	11.0	9	6.1	8	10.	4	4.0	17	5.9	12	6.9	99	7.0
1964	3	8.8	2	4.4	4	4.4	19	9.8	3	6.0	2	5.0	14	8.5	11	7.5	7	8.3	15	15.1	20	6.9	16	9.2	116	8.2
1965	5	14.7	4	8.9	3	3.3	18	9.3	6	12.0	4	10.0	17	10.3	7	4.8	5	5.9	11	11.1	18	6.2	21	12.1	119	8.4
1966	1	2.9	2	4.4	8	8.9	21	10.7	2	4.0	1	2.5	11	6.7	11	7.5	5	5.9	9	9.1	31	11.	9	5.2	111	7.9
1967	1	2.9	3	6.7	2	2.2	16	8.2	1	2.0	0		9	5.4	4	2.7	11	13.0	2	2.0	4	1.4	6	3.5	59	4.2
1968	0		0		0		8	4.1	0		0		1	.6	0		0		0		0		1	.6	10	.8
TOTAL	34	99.7	45	99.0	90	99.5	194	99.8	50	100.	40	100.	165	99.6	147	100.	84	99.9	99	99.8	289	100.1	173	99.7	1410	99.8
Percents of Population Surveyed	2.4		3.2		6.4		13.7		3.5		2.8		11.7		10.4		5.9		7.0		20.5		12.3			

Table C-48

DISTRIBUTION OF PUBLICATION DATE IN PERIODICALS

	Class 0		1		2		3		3A		4		5		6		6A		7		8		9		Total	Total
Year	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1950	3	3.7	2	2.6	1	1.7	12	2.8	5	2.8	1	1.1	9	3.8	10	4.8	2	2.9	4	4.4	7	4.6	4	2.2	60	3.2
1951	2	2.4	1	1.3	0		9	2.1	3	1.7	0		6	2.5	4	1.9	2	2.9	2	2.2	4	2.7	5	2.8	38	2.1
1952	3	3.7	0		0		8	1.9	4	2.3	0		3	1.3	1	.5	1	1.4	3	3.3	4	2.7	3	1.7	30	1.6
1953	4	4.9	1	1.3	0		16	3.7	5	2.8	2	2.2	5	2.2	8	3.8	0		4	4.4	4	2.7	4	2.2	53	2.9
1954	2	2.4	0		4	6.9	16	3.7	4	2.3	2	2.2	4	1.7	3	1.4	1	1.4	2	2.2	2	1.3	5	2.8	45	2.4
1955	2	2.4	2	2.6	2	3.4	12	2.8	6	3.4	2	2.2	3	1.3	4	1.9	0		1	1.1	1	.6	5	2.8	40	2.2
1956	3	3.7	1	1.3	1	1.7	10	2.3	7	4.0	0		0		3	1.4	3	4.4	4	4.4	2	1.3	6	3.4	40	2.2
1957	3	3.7	1	1.3	1	1.7	7	1.6	7	4.0	3	3.3	3	1.3	3	1.4	4	5.8	3	3.3	2	1.3	3	1.7	40	2.2
1958	2	2.4	0		0		7	1.6	6	3.4	2	2.2	8	3.4	5	2.4	1	1.4	2	2.2	3	2.0	7	3.9	43	2.3
1959	2	2.4	2	2.6	1	1.7	7	1.6	14	8.0	2	2.2	5	2.2	8	3.8	1	1.4	1	1.1	7	4.6	5	2.8	55	3.0
1960	8	9.7	3	3.8	6	10.3	20	4.7	18	10.3	14	15.4	15	6.3	19	9.0	7	10.2	4	4.4	12	8.0	11	6.2	137	7.4
1961	8	9.7	3	3.8	6	10.3	29	6.8	15	8.6	6	6.5	16	6.7	18	8.6	3	4.4	5	5.5	17	11.5	16	9.0	142	7.7
1962	5	6.1	1	1.3	6	10.3	31	7.2	12	6.9	5	5.6	17	7.1	19	9.0	2	2.9	6	6.5	18	12.0	19	10.7	141	7.6
1963	3	3.7	0	7.7	4	6.9	32	7.5	14	8.0	7	7.6	15	6.3	11	5.4	5	7.2	11	12.1	11	7.3	16	9.0	135	7.3
1964	6	7.3	8	10.2	4	6.9	46	10.7	17	9.7	12	13.2	29	12.1	17	8.1	11	15.9	11	12.1	14	9.3	12	6.7	187	10.1
1965	8	9.7	11	14.1	5	8.6	48	11.2	12	6.9	9	9.8	29	12.1	20	9.5	7	10.2	10	11.0	15	10.0	19	10.7	193	10.4
1966	11	13.4	22	28.2	8	13.9	67	15.7	12	6.9	13	14.3	42	17.6	18	8.6	5	7.2	9	9.9	14	9.3	27	15.2	248	13.4
1967	7	8.5	13	16.7	8	13.9	48	11.2	14	8.0	11	12.1	28	11.7	27	12.8	14	20.3	8	8.8	13	8.7	11	6.2	202	10.9
1968	0		1	1.3	1	1.7	3	.7	0		0		1	.4	12	5.7	0		1	1.1	0		0		19	1.0
TOTAL 82	99.8		78	100.1	58	99.9	428	99.8	175	100.0	91	99.9	238	100.0	210	100.0	69	99.9	91	100.0	150	99.9	178	99.8	1848	99.9
Percents of Population Surveyed	4.4		4.2		3.1		23.2		9.5		4.9		12.9		11.4		3.7		4.9		3.1		9.6			

Language

The following tables indicate the basic data for the narrative concerning language in Chapter VI. Monographs and periodicals are treated separately.

The total valid sample was 1405 monographs and 1408 periodicals. No monographs had two languages representing major portions of a volume. Such was not the case with the periodicals, where major portions in different languages were evident. The 1408 periodical volumes had 1588 language incidences. The reader is referred to Chapter VI for the specification on what constituted a language incidence.

Table C-49

LANGUAGE MONOGRAPHS

Class	English Vol.	%	French Vol.	%	German Vol.	%	Spanish Vol.	%	Italian Vol.	%	Russian Vol.	%	Japan. Vol.	%	Others Vol.	%	Grand Total
0	29	2.3	1	1.9	2	4.7	1	2.4	0	0	1	7.1	0	0	0	0	34
1	41	3.3	1	1.9	2	4.7	0	0	0	0	1	7.1	0	0	0	0	45
2	97	7.8	2	3.8	1	2.3	0	0	0	0	0	0	0	0	0	0	100
3	187	15.1	0	0	0	0	4	9.7	0	0	2	14.2	0	0	0	0	193
3A	49	3.9	1	1.9	0	0	0	0	0	0	0	0	0	0	0	0	50
4	19	1.5	6	11.5	1	2.3	0	0	0	0	8	57.1	0	0	0	0	34
5	160	12.9	0	0	4	9.5	0	0	0	0	0	0	0	0	0	0	164
6	143	11.5	0	0	1	2.3	1	2.4	0	0	1	7.1	0	0	0	0	146
6A	84	6.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	84
7	90	7.2	1	1.9	5	11.9	2	4.8	0	0	1	7.1	0	0	0	0	99
8	177	14.2	36	69.2	22	52.3	31	75.6	15	100	0	0	0	0	2	100	283
9	163	13.1	4	7.6	4	9.5	2	4.8	0	0	0	0	0	0	0	0	173
Total	1239	99.5	52	99.7	42	99.5	41	99.7	15	100	14	99.7	0	0	2	100	1405
Percentage of grand Total	88.2		3.7		3.0		2.9		1.1		1.0				.1		100%

Table C-50

LANGUAGE PERIODICALS

Class	English Vol.	%	French Vol.	%	German Vol.	%	Spanish Vol.	%	Italian Vol.	%	Russian Vol.	%	Japan. Vol.	%	Others Vol.	%	Grand Total
0	58	4.5	5	5.3	2	2.3	1	2.5	0	0	0	0	0	0	3	8.3	69
1	58	4.5	6	6.4	7	7.8	1	2.5	1	6.2	0	0	0	0	2	5.5	75
2	35	2.7	0	0	3	3.3	1	2.5	0	0	0	0	0	0	0	0	39
3	288	22.3	27	29.3	11	12.3	10	25.	3	18.7	4	14.3	1	100.	6	16.6	350
3A	108	8.3	1	1.7	1	1.1	1	2.5	1	6.2	0	0	0	0	0	0	112
4	45	3.4	15	16.1	16	17.9	18	46.1	7	43.7	9	33.3	0	0	8	22.2	118
5	190	14.7	15	16.1	28	31.4	0	0	4	25.	8	29.6	0	0	8	22.2	253
6	172	13.3	3	3.2	1	1.1	0	0	0	0	1	3.7	0	0	0	0	177
6A	61	4.7	2	2.1	1	1.1	0	0	0	0	0	0	0	0	0	0	64
7	61	4.7	4	4.3	0	0	0	0	0	0	0	0	0	0	0	0	65
8	82	6.3	8	8.6	14	15.7	7	17.9	0	0	3	11.1	0	0	2	5.5	116
9	129	10.	7	7.5	5	5.6	0	0	0	0	2	7.7	0	0	7	19.4	150
Total	1287	99.4	93	100.6	89	99.6	39	99.0	16	99.8	27	99.7	1	100	36	99.7	1588
Percentage of grand Total	81.0		5.8		5.6		2.4		1.		1.7		.06		2.2		99.7%

Number of Pages

The total valid sample was 1400 monographs and 1362 periodicals.

The surveyors entered the figure appearing on the final numbered page for nearly all volumes; however, there were exceptions. Volumes with separately paged, major sections, as is frequently the case with bound periodicals, were totalled. A volume with unnumbered pages was measured in inches and converted to pages on the basis of five hundred pages to one inch. Advertisements paged separately were not counted in the total pages.

Table C-51 NUMBER OF PAGES — MONOGRAPHS

Pages	Class 0	1	2	3	3A	4	5	6	6A	7	8	9	Total
1-50	2	0	0	0	1	0	5	1	0	5	4	0	18
51-100	2	1	1	4	5	6	2	4	1	7	16	1	50
101-150	4	4	8	7	6	3	20	11	4	9	16	11	103
151-200	3	8	12	23	7	4	21	11	10	17	43	17	176
201-250	3	2	17	31	5	5	13	19	9	12	38	30	184
251-300	2	5	16	33	1	4	17	12	12	15	33	19	169
301-350	3	5	9	30	6	2	22	17	12	12	30	29	177
351-400	1	3	4	25	3	1	13	12	9	12	24	4	111
401-450	5	5	4	15	2	4	12	14	8	4	23	20	116
451-500	0	3	5	7	3	4	12	2	3	3	13	17	72
500 +	6	9	14	19	5	6	29	43	16	5	48	24	224
Total	31	45	90	194	44	39	166	146	84	101	288	172	1400

Table C-52 NUMBER OF PAGES — PERIODICALS

Pages	Class 0	1	2	3	3A	4	5	6	6A	7	8	9	Total
1-50						1							1
51-100				1				3		1	1		6
101-150	1	1	2	6		2	1	2		1		3	19
151-200	1			3	3		2	2	1	3	1	2	18
201-250	1	1	2	9	3		1	4		1			22
251-300	6	3	1	6	11		4	5		3	2	6	47
301-350	2	6	1	15	8	1	13	10	2	3	3	8	72
351-400	1	4	5	31	12	9	22	14	4	2	10	17	131
401-450	8	5	2	24	12	5	10	11	4	4	7	22	114
451-500	5	6	5	24	12	3	9	13	4	7	21	15	124
501-599	8	12	12	52	19	12	38	7	9	9	18	21	217
600-799	14	15	7	75	20	19	52	32	20	16	26	26	322
800-999	8	2	1	34	3	5	25	29	9	7	9	8	140
1000 +	6	4		27	5	1	25	40	8	5	5	3	129
Total	61	59	38	307	108	58	202	172	61	62	103	131	1362

APPENDIX D

Libraries Listed in the Association of Research Libraries' Academic Library Statistics, 1967/68. (a nine-sheet processed document)

UNIVERSITIES

Alabama
Arizona
Boston University
British Columbia
Brown
California, Berkeley
California, Los Angeles
Chicago
Cincinnati
Colorado
Columbia
Connecticut
Cornell
Duke
Florida
Florida State
Georgetown
Georgia
Harvard
Illinois
Indiana
Iowa
Iowa State
Johns Hopkins
Joint University
Kansas
Kentucky
Louisiana State
McGill
Maryland
Massachusetts Institute of Technology
Michigan
Michigan State
Minnesota
Missouri
Nebraska

UNIVERSITIES

New York University
North Carolina
Northwestern
Notre Dame
Ohio State
Oklahoma
Oklahoma State
Oregon
Pennsylvania
Pennsylvania State
Pittsburgh
Princeton
Purdue
Rochester
Rutgers
St. Louis
Southern California
Southern Illinois
Stanford
SUNY-Buffalo
Syracuse
Temple
Tennessee
Texas
Texas A&M
Toronto
Tulane
Utah
Virginia
Washington
Washington State
Washington University (St. Louis)
Wayne State
Wisconsin
Yale

These institutional libraries were included in the Dunn, Seibert and Sheuneman report (Chapter II, Ref. 4) with the exception of: Universities of Alabama, Arizona, British Columbia, Connecticut, Georgia, Toronto, and Georgetown, McGill, Oklahoma State, Southern Illinois, St. Louis, and Tulane Universities, plus SUNY-Buffalo.