ABSTRACT
        Critical to the youthful user of the library is his
comprehension of subject headings. This study undertook an
investigation of two aspects of the subject headings for juvenile
literature: first, an analysis of the vocabulary levels employed in
the four systems of subject headings currently in use; second, a
specific analysis of the Machine Readable Cataloging (MARC) system
and a comparison of how its subject headings for 437 children's books
compare with the readability levels for those texts. The four systems
were found to be only slightly different. The Library of Congress
system rated at grade level 7.7, the Sears system at 6.9, the MARC
system at 6.4, and the Library of Congress--Juvenile system 6.0 The
comparison between the MARC system subject headings and the
readability level of the corresponding text revealed no relationship
between the two. Combining these findings with data concerning the
nationwide reading level, it was found that for children reading
above the national norm, the subject catalog can provide access to 70
percent of juvenile reading material. Using nationwide comprehension
scores, it was estimated that only 29 percent of children's reading
material is accessible through the subject catalog. (EMH)

CHILDREN'S ACCESS TO INFORMATION IN PRINT:

AN ANALYSIS OF THE VOCABULARY (READING) LEVELS

OF SUBJECT HEADINGS AND THEIR APPLICATION

TO CHILDREN'S BOOKS

By JOY KAISER MOLL

A thesis submitted to

The Graduate School

of

Rutgers University

in partial fulfillment of the requirements

for the degree of

Doctor of Philosophy

Written under the direction of

Professor Henry Voos

of the Graduate School of Library Service

and approved by

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New Brunswick, New Jersey

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ABSTRACT OF THE THESIS

Children's Access to Information in Print:

An Analysis of the Vocabulary (Reading) Levels

of Subject Headings and Their Application

to Children's Books

by JOY KAISER MOLL, Ph.D.

Thesis director: Professor Henry Voos

Current educational emphasis on independent study and individualized instruction make ease of access to library materials important. This study investigated two aspects of children's access to information in a library. First, the vocabulary levels of four basic subject heading lists were analyzed to determine which provides easiest access to information by being most readable. Second, the access provided to children's books by MARC (Machine Readable Cataloging, U.S. Library of Congress) juvenile subject headings was investigated. The reading levels of the subject headings were compared to the reading levels of the books they described.

Analyzed for vocabulary level were 301 Library of Congress subject headings (LC); 284 Library of Congress headings for children's literature (LC Jr.); 300 Sears, 10th edition, headings (Sears); and 296 Library of Congress juvenile headings from MARC tapes (MARC). Analyzed for grade-level readability were 437 children's books published in 1970 and 1972 whose subject headings corresponded

to the 296 MARC juvenile headings.

Vocabulary levels of the four subject heading lists were measured by the Dale-Eichholz Words We Know (The Ohio State University) comprehension data and lognormal frequency data from the Carroll, Davies, and Richman Word Frequency Book (Houghton-Mifflin). A simplification of the Dale-Chall readability formula, developed and validated as part of the study, measured grade-level readability of the 437 books.

Analysis of the vocabulary level data for the four subject heading lists using means and standard deviations, relative and cumulative frequencies showed that the LC list has the highest vocabulary level (grade 7.7), followed, in descending order, by Sears (grade 6.9), MARC (grade 6.4), and LC Jr. (grade 6.0). Pearson correlation coefficients and the chi-square test indicated some relationship between a lognormal vocabulary frequency level and grade levels of vocabulary comprehension. However, interval relationships between the frequency and the comprehension measures were not determined.

The access to information provided by the comparison of MARC headings with the readability level of corresponding books was determined by the difference between the MARC heading vocabulary level and the corresponding book readability level, by chi-square, and by Pearson correlation coefficients. All three analyses indicated no apparent relationship between subject heading vocabulary level

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and book readability level. Mean grade level of book read-ability was 7.462 with a standard deviation of 2.329. The variation of the mean from 1970 to 1972 was less than 2%.

For a child reading at or above national norms, the subject catalog can provide access to 70% of juvenile books. Applying data from national studies of children's reading comprehension levels to these findings, only 28% of children's books are accessible through the subject catalog.

The study concluded that the subject catalog does not provide effective access to information for children. The utility of school library instruction in the subject catalog is questioned: The vocabulary levels of the subject heading lists were shown to be higher than the vocabulary levels of the average adult in the United States as determined by two national studies. Because of vocabulary difficulties with the catalog, because subject heading vocabulary levels are independent of book readability levels, and because the catalog user faces additional problems of structure and conceptualization not considered by this study, the subject catalog is considered a tool for trained librarians rather than children or the general public.

ACKNOWLEDGMENTS

Several persons have suggested that an index would be needed to acknowledge the help of the many people who have contributed to this study. Following the focus of the study, however, the acknowledgments are catalogued by subject area:

THE FAMILY

THE RUTGERS FACULTY

EMPLOYERS AND ASSOCIATES

THE AUTHORS OF THE TWO MEASURES USED

THE LIBRARY OF CONGRESS

OTHER LIBRARIES

PUBLISHERS

RESEARCH ASSISTANTS

Each individual made a contribution without which the research could not have been completed. This brief, categorical thank-you cannot begin to express my gratitude and appreciation for the wealth of support they contributed to the study.

My major adviser, Dr. Henry Voos, and my husband, Andy, merit special thanks. Dr. Voos' creativity and breadth of knowledge have been indispensable in helping to bring together ideas from several disciplines to focus

Thompson, Principal, made released time available.

THE AUTHORS OF THE TWO MEASURES USED--Dr. Edgar Dale of The Ohio State University, and Dr. John B. Garroll, Senior Research Psychologist, Educational Testing Service, analyzed data and suggested several methodological modifications.

THE LIBRARY OF CONGRESS--Mr. Edward J. Blume, Chief, Subject Cataloging Division, and Miss Treva Turner, Children's Cataloging Section, facilitated data gathering.

OTHER LIBRARIES--The Drexel University Library; Moorestown (New Jersey) Free Library; Cherry Hill (New Jersey) Public Library; Anne Arundel County (Maryland) Media Centers, Mrs. Cora Kenney, Coordinator, Media Services; Riverside (New Jersey) High School Library; and Moorestown (New Jersey) Public Schools Media Centers provided books for supplemental data gathering.

PUBLISHERS--Houghton-Mifflin Company; David McKay Company; Scholastic Book Services; SamHar Press; Prentice-Hall; Parents' Magazine Press, Macrae Smith; Macmillan Company; Creative Educational Society (Mr. J. F. Brown); Harvey House; Grosset and Dunlap; Essandess Division of Simon and Schuster, Inc.; Dutton Publishing Company; Doubleday, Inc.; Children's Press; U.S. Dufour Editions; Addison Wesley; and Association Press each contributed books which could not be found in libraries.

RESEARCH ASSISTANTS--Jean Culp, Genevieve Downes, Sandra Krott, Patricia Marr, Barbara Powell, Sheila

Schneider, Virginia Sheppard, Kuna Yankell, and the Moorestown (New Jersey) High School 1975 Honors English Class learned more about readability analysis and children's literature than they really wanted to know.

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"A symbol cannot represent its meaning to someone
who has no experience with the thing signified.
The writer and his reader must see the world in
the same way."

--Roger Brown
Words and Things:
An Introduction to Language

CHAPTER I

BACKGROUND OF THE STUDY

Statement of the Problem

The major purpose of the study was to determine
chldren's access to information in print through the
library's subject catalog. Two aspects of access to
information were investigated. The first aspect was an
analysis of the vocabulary levels of four basic subject
heading lists used by library catalogers. The second
aspect was an investigation of the application of MARC
subject headings to recently published (1970 and 1972)
books for children. The purpose of the second aspect of
the study was to determine if the reading level of the
subject headings corresponded to the reading levels of
the books they described.

Introduction to the Problem

Current educational emphasis on independent study
and individualize instruction make ease of access to
library materials increasingly important. The library
has the responsibility for providing students with a wide
variety of diverse materials to meet their individual
curricular and recreational needs. The success or failure

the child meets in his early searches for information in
the library may influence his attitudes about the library
for years to come. This study investigated a basic tool
providing access to information in libraries: the subject
catalog.

The investigation was based on concepts from three
separate but related disciplines. The first, in the broad
field of education, is the measurement of readability. The
second, in the field of traditional librarianship, is sub-
ject cataloging. The third, in the field of information
science, is communication.

As the area of overlap of these three concepts
increases, the probability of providing the user with easy
access to information via the subject catalog also
increases. This overlap can be represented by a Venn
diagram as follows:

EDUCATION   LIBRARIANSHIP

Readability   Subject
                     cataloging

Communication

INFORMATION SCIENCE
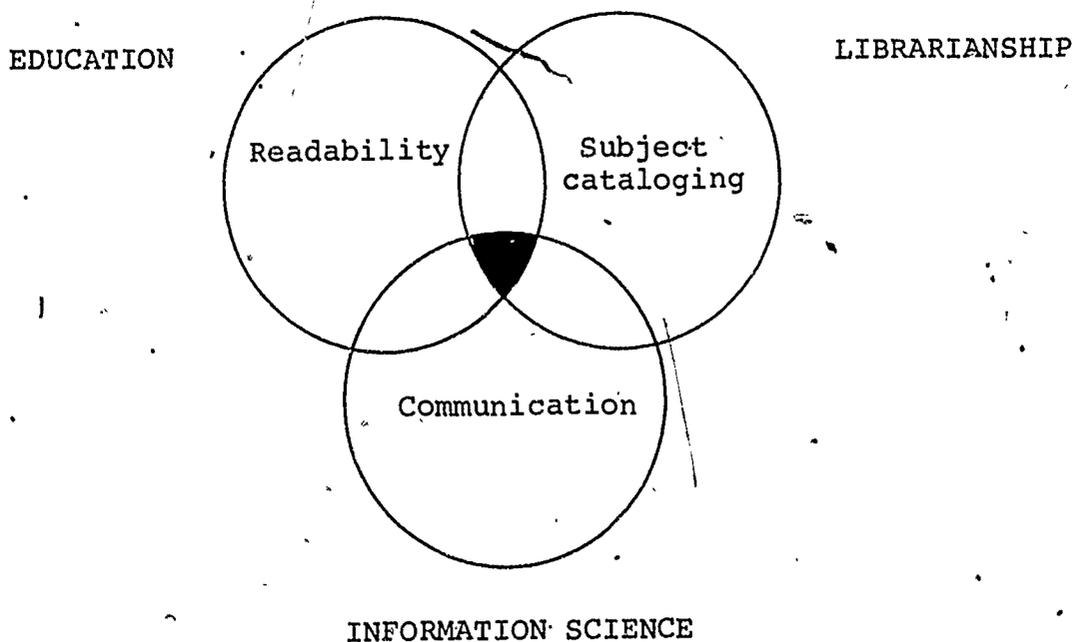
Information scientists would consider the subject catalog a data base. To communicate effectively with a data base and get information out of it, the user must formulate his questions using terms from the same thesaurus or subject heading list which the compiler of the data base used in the construction of the data base.

Educators in the area of readability measurement would consider the headings in the subject catalog as a list of vocabulary terms out-of-context. The user of the catalog must be able to read and comprehend these terms (subject headings) if the catalog is to be a useful tool for locating information.

Librarians have traditionally considered the subject catalog an access point or index to the library's collection. In compiling this index, the subject cataloger assigns subject headings to books and other materials using the vocabulary he has at his command. A cataloger's vocabulary is generally the vocabulary of an adult person with a graduate level education and a broad framework of knowledge. This broad framework includes a background of many concrete experiences as well as abstract concepts developed through the education of an academically oriented mind. Experiences and concepts are both reflected in the extent of a person's vocabulary.

Ludwig Wittgenstein has said: "The limits of my language are the limits of my world."[1] The linguistic

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[1]Walter R. Fuchs, _Cybernetics for the Modern Mind_ (New York: The Macmillan Company, 1971), p. 42.

limits of the world of subject catalogers as it overlaps with the linguistic limits of the world of school children are the basic interest of this study.

Assumption

The assumption was made that subject access through a library catalog is a useful key to information in the library's collections.

Definitions

1. _Subject headings_ in library catalogs are terms and phrases intended to provide direct and specific approaches to definite areas of knowledge. They are not index entries dependent on the phraseology of individual titles. They preserve some traces of hierarchical classification in their frequent use of a subdivision or an inverted phrase instead of a more linguistically natural adjective before noun approach.[2]

2. _Readability_ is a term which has come to be used in three ways:

1) To indicate legibility of either handwriting or typography.
2) To indicate ease of reading due to either the interest-value or the pleasantness of writing.
3) To indicate ease of understanding or comprehension due to the style of writing.[3]

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[2] Wyllis E. Wright, "The Subject Approach to Knowledge: Historical Aspects and Purposes," in _The Subject Analysis of Library Materials_, ed. by Maurice F. Tauber (New York: Columbia University, 1953), p. 10.

[3] George R. Klare, _The Measurement of Readability_ (Ames: Iowa State University Press, 1963), p. 1.

Readability in this study is used to indicate ease of understanding or comprehension.

3. <u>Vocabulary</u> is the "stock of words used by or known to a particular person or group of persons."[4] This stock of words has the communicative function of giving expression to concepts and ideas.

4. <u>Children</u>, for the purposes of this study, are students generally between the ages of 10 and 14 whose vocabulary levels are within the averages determined by reading specialists for grades 5 through 8.

5. <u>Communication</u> has been defined as "the eliciting of a response"[5] and as "all of the procedures by which one mind may affect another."[6] Both definitions apply to the subject catalog as the medium used by its compilers to transmit information to library users about the contents of the library's collection.

Limitations

The study was limited to testing the vocabulary levels of subject headings used for children's books.

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[4]<u>The Random House Dictionary of the English Language</u> (College ed.; New York: Random House, Inc., 1969), p. 1473.

[5]Frank E. X. Dance, "Toward a Theory of Human Communication," in <u>Human Communication Theory: Original Essays</u>, ed. by Frank E. X. Dance (New York: Holt, Rinehart and Winston, Inc., 1967), p. 289.

[6]Claude E. Shannon and Warren Weaver, <u>The Mathematical Theory of Communication</u> (Urbana: The University of Illinois Press, 1949), p. 3.

The study did not evaluate the degree of generality
or specificity of a subject heading.

The study evaluated subject headings as terms, not
phrases, because subject headings in a library catalog
stand alone as indicative of the content of the material
they describe. This treatment of subject headings as sep-
arate words or terms corresponds to the component of the
reading process known as word perception. In reading, this
is the ability to identify words accurately and to associ-
ate with each word the meaning that the author (cataloger)
had in mind. This is considered a basic part of the read-
ing process. Without this ability, subsequent steps (such
as comprehension of ideas, reaction to these ideas, and
combining new ideas with old) cannot take place. This
ability to perceive accurately the meaning of the vocabu-
lary terms assigned to a book by a subject cataloger also
corresponds to the information scientist's concern with
the semantic problems of communication and the library
cataloger's concern with precision or specificity of a
subject heading.

The study did not examine the form of subject head-
ings such as the compound heading, the inverted heading,
the subheading, the subdivision of a place, or the
phrase.

The study did not examine the file structure of the
subject catalog, its "see" and "see also" references, its
hierarchical nature of preference for specificity to

generality in choosing descriptive headings, or its chrono-
logical division of the history of a country.

CHAPTER II

RELATED LITERATURE

Research in Readability

In the area of measurement of readability, studies
are divided into two groups. One group measures vocabulary
comprehension in the context of a paragraph or other mean-
ingful piece of writing. A thorough survey of this area is
the Master's thesis of Nancy Kelly.[1] An older study by
George Klare[2] details the history of readability formulae,
explains the basic considerations in determination of read-
ability, and provides an extensive bibliography on the sub-
ject. Both these studies agree that the Dale-Chall for-
mula[3] to determine readability is a valid measure for
predicting the school grade level of vocabulary in context.
This formula will be used to measure the reading level of
children's books in this study.

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[1]Nancy Leonard Kelly, "A Comparison of Readability
Formula Ratings with Written Cloze Text Scores on Primary
Level Reading Material" (unpublished Master's thesis,
Graduate School of Education, Rutgers University, October,
1971).

[2]George R. Klare, The Measurement of Readability
(Ames: Iowa State University Press, 1963).

[3]Edgar Dale and Jeanne S. Chall, "A Formula for
Predicting Readability: Instructions," Educational
Research Bulletin, XXVII (February 18, 1948), 37-54.

Vocabulary comprehension can also be measured by testing or estimating knowledge of individual terms. Studies have directly tested children in various grades for recall and application of meaning of individual terms. Vocabulary testing of large groups of children has been the work of Edgar Dale.[4] Seashore and Eckerson[5] studied the vocabularies of college undergraduates to investigate the relation of vocabulary size to other intellectual abilities. The most recent, as yet unpublished, study is the work of Dale and Eichholz.[6] This study tested groups of children throughout the United States to determine which words they could both read and use. A preliminary study was published as Children's Knowledge of Words.[7] Data from the unpublished Dale-Eichholz study was used to measure the readability of individual subject headings.

A second school of thought on the readability of individual vocabulary terms argues that frequency of the

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[4]Edgar Dale, "Familiarity of 8000 Common Words to Pupils in the Fourth, Sixth, and Eighth Grades" (Columbus: Bureau of Educational Research, The Ohio State University, n.d.).

[5]R. H. Seashore and L. D. Eckerson, "Measurement of Individual Differences in General English Vocabularies," Journal of Educational Psychology, XXXI (January, 1940), 14-38.

[6]Edgar Dale and Gerhard Eichholz, Words We Know: A National Inventory (Columbus: The Ohio State University, to be published).

[7]Edgar Dale and Gerhard Eichholz, Children's Knowledge of Words (Columbus: The Ohio State University, 1961).

term in print and knowledge of the term by children are closely correlated. This is the basis of the work by Thorndike and Lorge,[8] E. W. Dolch,[9] and, more recently, by Carroll, Davies, and Richman.[10] Carroll, Davies, and Richman's work was investigated as part of this study as an alternative way of measuring knowledge of vocabulary.

Research in Subject Cataloging for Children

The library literature about subject cataloging for children is scant. Most of the material describes practices in particular libraries or provides opinions about children's usage of subject headings. There are only three brief studies and one piece of major research devoted to subject headings for children. Two of the brief studies compare subject headings for children's materials using different lists. Thera Cavender compared Rue's list with Sears' 7th edition and concluded: "Children's libraries, whether school or public, with a small open shelf collection and a librarian who knows her book stock well, have little need for the special subject

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[8]Edward L. Thorndike and Irving Lorge, The Teacher's Word Book of 30,000 Words (New York: Teachers College, Columbia University, 1944).

[9]E. W. Dolch, "Vocabulary Burden," Journal of Educational Research, XVII (March, 1928), 170-183.

[10]John B. Carroll, Peter Davies, and Barry Richman, The American Heritage Word Frequency Book (Boston: Houghton Mifflin Company, 1971).

terminology or the expanded headings of research librar-

ies."[11] A second study, by Florence DeHart, compared the

subject headings of printed catalog cards commercially

available from four sources. The results showed a great

dissimilarity in the headings, no standardizations. DeHart

concluded that policies for applying subject headings

should be clearly established and carried out uniformly

to assure standardization.[12] A third study again promotes

standardization of cataloging.[13]

The one major piece of research devoted to subject

headings for children is almost 30 years old: the Master's

thesis of Eloise Rue written in 1946 on preferences of

children for subject heading form.[14] Rue outlines seven

general patterns resulting from the analysis of question-

naires of children's subject heading preferences:

1. Simple concepts expressed in simple terms are chosen
   most frequently by younger children and children of
   low IQ's.
2. Conversely, complex terms and terms of fine distinc-
   tions are more frequently selected by older children

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[11]Thera P. Cavender, "A Comparative Study of Sub-
ject Headings for Children's Materials," Journal of Cata-
loging and Classification, XI (January, 1955), 13-28.

[12]Florence E. DeHart, "Standardization in Commer-
cial Children's Cataloging: A Comparative Study of 100-
Odd Titles," Library Journal, XCV (February, 1970), 744-
749.

[13]Jessica L. Harris and Theodore C. Hines, "LC /
Cataloging as a Standard for Children's Material," Library
Journal, XCVII (December 15, 1972), 4052-4054.

[14]Eloise Rue, "Preferences of Elementary School
Children for Subject Heading Form" (unpublished Master's
thesis, University of Chicago, August, 1946).

and children of higher IQ's than they are by the
younger children and those with low IQ's.

3. Catalog usage of terms appears to be an influence
   in choice of terms only when practice in use of the
   catalog·has been prevalent.
4. Terms used in the course of study appear to have
   been a factor influencing the selections.
5. Special group experiences or characteristics are
   evident as influences.
6. There is evident preference for some forms rather
   than others.
7. In the vexing problem of place versus subject, the
   children choose place names with much greater fre-
   quency. Possibly this is another evidence of the
   appeal of the simple, easily visualized concept
   rather than complex, abstract ideas, or possibly
   emphasis on place in the social studies, especially
   geography and history.[15]

The Concept of Communication
in Information Science

Information Science has often been called the dis-
cipline which provides the theoretical basis for the prac-
tice of librarianship.[16] A key aspect of this theoretical
basis and of the discipline itself is the concept of com-
munication: the interaction between the source of informa-
tion and the receiver (user) of the informational message.
Shannon and Weaver's classic study in communication theory
defines communication as "all of the procedures by which
one mind may affect another."[17] Shannon and Weaver divide

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[15]Ibid., p. 171.

[16]Robert S. Taylor, "Professional Aspects of Infor-
mation Science and Technology," in Annual Review of Infor-
mation Science and Technology, Vol. I (New York: Intersci-
ence Publishers, 1966), p. 20.

[17]Claude E. Shannon and Warren Weaver, The Mathe-
matical Theory of Communication (Urbana: The University of
Illinois Press, 1949), p. 3.

communications problems into three levels: (1) the techni-

cal level, concerned with the accuracy of transmission of

the symbols of communication; (2) the semantic level, con-

cerned with the precision with which the transmitted sym-

bols convey the desired meaning; and (3) the effectiveness

level, concerned with how the received meaning affects

behavior.[18]

Subject cataloging and librarianship are concerned

with the semantic level. The field of education is concerned

with the effectiveness level. If the library is to

provide effective access to its collection by subject cata-

loging to enable education to accomplish its objectives of

independent study and individualized instruction, then sub-

ject catalogers must look at the information scientist's

studies of the application of vocabulary and language to

particular groups of users.

Shannon and Weaver state that

language must be designed [or developed] with a view to
the totality of things that man may wish to say; but
not being able to accomplish everything, it, too,
should do as well as possible as often as possible.[19]

Information scientist Brian Vickery expresses this

in terms of subject cataloging:

Subject description as it is done by humans is a three-
stage operation. First, text is scanned to determine
its meaning, its information content. Second, a deci-
sion is made as to which parts of the document content
are to be recorded in view of the objectives of the

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[18]Ibid., p. 24.

[19]Ibid., p. 27.

system.   Third, the document content selected to be recorded is expressed in the language used in the system.[20]

The area of overlap (see Venn diagram, p. 2) of all three disciplines focuses on the ability of the user to read, to understand, and to be able to manipulate the terms assigned to library materials by subject catalogers to provide access to needed information.

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[20]Brian C. Vickery, <u>On Retrieval System Theory</u> (2d ed.; London: Butterworths, 1965), pp. 21-22.

CHAPTER III

RESEARCH DESIGN AND SAMPLE SELECTION

Summary of Research Design

The research in this study was divided into two
parts. The first part examined three basic subject head-
ing lists and one set of applied subject headings.[1] The
subject heading lists are the tools the subject cataloger
uses to index a collection of materials. A stratified
random sample of the subject headings (terms) in each list
was analyzed for school grade level of vocabulary compre-
hension. Two measures were used to make this analysis.
The first was Dale and Eichholz's Words We Know.[2] This
measure analyzed comprehension as actually demonstrated by
groups of children nationwide.

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[1]Barbara M. Westby, ed., Sears List of Subject
Headings (10th ed.; New York: H. W. Wilson Co., 1972);
Marguerite V. Quattlebaum, ed., Subject Headings Used in
the Dictionary Catalogs of the Library of Congress (7th
ed.; Washington, D.C.: Library of Congress, 1966); Subject
Headings for Children's Literature: A Statement of Prin-
ciples of Application and a List of Headings that Vary from
Those Used for Adult Literature (Washington, D.C.: Subject
Cataloging Division, Processing Department, Library of
Congress, 1969); U.S. Library of Congress, Subject Headings
for Juvenile Materials, MARC Tapes, 1970 and 1972.

[2]Edgar Dale and Gerhard Eichholz, Words We Know:
A National Inventory (Columbus: The Ohio State University,
to be published).

Dale-Eichholz's measure is an indication of the
vocabulary which the child commands as he attempts to use
the subject catalog and elicit information from it.   The
second measure was the Carroll, Davies, and Richman list
of word frequency.   This list contains words to which the
intermediate-grade-level child has been exposed through
texts, trade books, and magazines.[3]   This measure reflects
the attempts of adults to communicate with children through
the written word.   The comparison of these two measures
applied to subject headings should be an indication of the
effectiveness of the communication of the library catalog
with children.

The second part of the study investigated the
application of juvenile subject headings from the Library
of Congress' MARC (Machine Readable Cataloging) tapes to
children's books published in 1970 and 1972.   The years
1970 and 1972 are recent ones reflecting current practice
of the cataloging principles instituted by the Library of
Congress' Children's Literature Cataloging Office in Novem-
ber, 1966.[4]   The selection of two recent years also pro-
vides a basis for comparing cataloging practice.

A sample of these books and their subject headings

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[3]John B. Carroll, Peter Davies, and Barry Richman,
The American Heritage Word Frequency Book (Boston: Hough-
ton Mifflin Company, 1971.

[4]Treva Turner, "Cataloging Children's Materials at
the Library of Congress," The Quarterly Journal of the
Library of Congress, XXX, No. 2 (April, 1973), 152.

were selected from the MARC tapes. The MARC tapes were
used because they are the most complete and up-to-date data
base in the United States for the cataloging of juvenile
books. In addition, Library of Congress cataloging is gen-
erally considered the national standard for children's
cataloging in the United States.[5] Library of Congress
cataloging is used by most commercial forms processing
books for libraries and providing catalog cards as part
of their service. The reading levels of the books in the
sample were determined by using the Dale-Chall formula for
readability.[6]

. The vocabulary levels of the subject headings
assigned to each book were compared to the reading level
of the book itself. This compared the vocabulary level of
the cataloging terms to the reading level of the book
cataloged.

Hypotheses

Two of the subject heading lists, Sears and MARC,
are subsets of the LC list used for different purposes.
LC Jr. is a separate listing of simplified words developed
to be used for juvenile materials. Sears is an abridgement
of the LC list developed for small and medium-sized

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[5]"Cataloging of Children's Material," ALA Bulle-
tin, LXIV (July-August, 1969), 894.

[6]Edgar Dale and Jeanne S. Chall, "A Formula for
Predicting Readability: Instructions," Educational
Research Bulletin, XXVII (February 18, 1948), 37-54.

libraries. The MARC juvenile headings are a combination of some LC headings and some LC Jr. headings. MARC headings are subject headings which have actually been applied to specific materials.

The expectations of the study were that the LC headings would have the highest reading level, followed, in descending order, by Sears, MARC, and LC Jr. However, to facilitate measurement and statistical analysis, the hypothesis for vocabulary level measurement is stated in the null form. By stating that all four lists are equally readable, a common point of equality is established against which differences can be measured.

Hypothesis 1: The Sears List of Subject Headings, 10th edition; Subject Headings Used in the Dictionary Catalogs of the Library of Congress, 7th edition; Library of Congress Subject Headings for Children's Literature; and MARC Subject Headings for Juvenile Materials (see footnote 1) are all equally readable.

The expectations of the second part of the study were that the research would prove a relationship between subject heading vocabulary level and book readability levels. Again, to facilitate measurement and statistical analysis (especially in the chi-square test), the hypothesis is stated in the null form.

Hypothesis 2: The vocabulary level of the subject headings assigned by the Library of Congress to juvenile books published in 1970 and 1972 is independent of the

readability level of the books the subject headings describe.

Sample Selection: Subject Headings

The Universes. The 7th edition of the Subject Headings Used in the Dictionary Catalogs of the Library of Congress (hereafter referred to as LC) contains approximately 38,000 terms. This count does not include terms listed in the supplements. The Sears List of Subject Headings, 10th edition (hereafter referred to as Sears), has approximately 5,800 terms. Library of Congress Subject Headings for Children's Literature (hereafter referred to as LC Jr.) has 288 terms. Because of the small size of this universe, the entire population was analyzed. The juvenile subject headings on the Library of Congress' MARC tapes (hereafter referred to as MARC) for 1970 and 1972 constituted a universe of 1,705 subject headings. A sample of 296 headings was selected from these tapes.

Method for Determining Sample Size. The method for determining the sample size was based on the four grade levels used in the definition of children (grades 5, 6, 7, and 8 [see p. 5]) and on a level of significance of 5%. (The level of significance is the probability of rejecting a true null hypothesis.)[7]

Sears, LC, and MARC were each considered to be an

_____

[7]Sidney Siegel, Nonparametric Statistics for the Behavioral Sciences (New York: McGraw-Hill Book Company, 1956), p. 9.

infinite universe for two reasons. First, each subject
heading list is open-ended. That is, subject headings are
both added to and dropped from the lists. Second, current
statistical practice regards any population over 1,000 as
infinite.[8]

Using a standard statistical formula[9]

$$n = z^2 \left[\frac{K - 1}{K^2 E^2}\right]$$

n = sample size

E = .05 level of significance

where z^2 = the square of the number of standard deviations
from the mean of the grade levels (Z = 2.39)

K = number of grade levels (K = 4)

the sample size (n) equals 428.

From this, the following table can be set up for
varying values of E and n:

E	n
.01	10,710
.04	669
.05	428
.06	298
.10	107

Using this table, the sample size 298 was selected
for the infinite populations of Sears, LC, and MARC. This
sample size provides for an assumed error of ± 6% between

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[8]Morris Hamburg, Basic Statistics: A Modern
Approach (New York: Harcourt Brace Jovanovich, Inc.,
1974), p. 19.

[9]Murray R. Spiegel, Schaum's Outline of Theory
and Problems of Statistics (New York: McGraw-Hill Book
Company, 1961), p. 158.

the mean of the sample and the mean of the universe. The

sample size, originally computed for a significance level

of 5%, now has a significance level of 6%. However, this

sample size (298) is numerically comparable to the quantity

of subject headings in LC Jr. (288). The entire universe

of LC Jr. was analyzed. The loss of 1% in significance was

compensated for by a gain in ability to compare roughly

equal quantities of data from each universe. Also, to

raise the significance level by 1% would have meant

increasing the sample size by 30%.

Stratification of Samples. Once the total sample

size was determined for the subject heading lists, the

sample was stratified to achieve a proportional distribu-

tion of headings representative of the size of each alpha-

betical category in the MARC lists.

To validate the stratification, the proportions

were compared by rank order correlation (Kendall's tau)

with the data in Bourne and Ford's[10] and Ohlman's[11] stud-

ies of frequency of occurrence of initial letters in

English subject words. The frequency ranking of initial

letters from the stratified sample of subject headings for

juvenile literature extracted from the MARC tapes correlated

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[10]C. P. Bourne and D. F. Ford, "A Study of the Sta-
tistics of Letters in English Words," _Information and Con-
trol_, IV (March, 1961), 50.

[11]Herbert Ohlman, "Subject Word Letter Frequencies
with Applications to Superimposed Coding," _Proceedings of
the International Conference on Scientific Information_, Vol.
2 (Washington, D.C.: National Academy of Sciences, 1959),
p. 92.

.76 with the Bourne and Ford list and .82 with the Ohlman list (Table 1).

Using the Rand Corporation's tables of random numbers,[12] subject headings were selected from the subject heading lists according to the stratification. Because of the characteristics of the Dale-Chall measure (later described), proper names and geographical names generally were not included in the samples.

Sample Selection: Books

The subject heading sample drawn from the juvenile headings in the MARC tapes was used as the basis of selection for books for readability comparisons. All books having copyright dates of 1970 and 1972 and a juvenile subject heading in the MARC tapes were pulled.

The quantity of books described by each juvenile subject heading varied widely. Most subject headings described only one book. A few subject headings (science fiction, fantasy, folklore, etc.) described nearly 100 books each. Because of this variation in quantity of books per subject heading, one or two books were selected for readability analysis. For each subject heading in the MARC sample, a juvenile book having a 1970 publication date and/ or a 1972 publication date was randomly selected from the MARC tapes.

[12]Rand Corporation, A Million Random Digits with 100,000 Normal Deviates (Glencoe, Ill.: The Free Press, 1955).

TABLE 1.--Comparative Ranking of Initial Letters of Subject
Words in English by Frequency of Occurrence

Bourne-Ford[a]	MARC juvenile	Ohlman[b]
S	C	C
P	S	S
C	A	P
T	P	A
A	M	B
D	B	M
M	F	T
R	T	R
B	E	E
I	D	F
E	U	D
F	W	G
H	G	H
L	H	I
G	N	L
W	R	N
N	I	W
O	L	O
V	O	V
J	J	U
U	K	J
K	V	K
Q	Z	Q
Y	Q	Y
Z	Y	Z
X	X	X

Kendall's Tau
   Bourne-Ford with MARC 76
   Ohlman with MARC 82

[a]See footnote 10.

[b]See footnote 11.

Two frequently used subject headings were selected
for an in-depth examination of the readability levels of
the various books each heading described. The headings
selected were DOGS-STORIES and FOLKLORE: the MARC print-
outs for 1970 and 1972 listed 43 DOGS-STORIES and 93 books
of FOLKLORE. These subject headings also represented an
extreme of vocabulary level for frequently used headings
drawn in the sample. Dale's analysis for DOGS-STORIES
lists 97% of fourth-grade students comprehending the term.
The Carroll, Davies, and Richman frequency index for DOGS-
STORIES is high at 60.6 (in a range of 30.9-70.3; see
p. 28 for an explanation of frequency index). Dale lists
FOLKLORE as comprehended by only 67% of sixth-grade stu-
dents (a 66% comprehension score would make this an eighth-
grade word; see p. 31). The frequency index is also low
at 37.9. Eleven DOGS-STORIES and 21 books of FOLKLORE, a
proportional 25% sample of the total books listed in each
category for 1970 and 1972, were randomly selected for
readability analysis.

The sample of books analyzed for readability was
267 books published in 1970, 138 books published in 1972,
11 DOGS-STORIES, and 21 books of FOLKLORE. A total of 437
books were analyzed for readability.

CHAPTER IV

ANALYSIS OF VOCABULARY LEVELS

OF SUBJECT.HEADING LISTS

Description of Vocabulary Measures of
Word Comprehension and Word Frequency

When a child approaches the subject catalog seeking
information on a particular topic, he is beginning his
search for information from a point already familiar to
him. This point of familiarity may be no more than the
knowledge of a term he wishes to find in the catalog. The
term the child wishes to find may be associated with his
school work, may come from reading or exposure to some
other form of media. The term is in some way associated
with his background, his age, education, experience, and
personality. These factors contribute to a set of con-
cepts which influence the choice of term the child will
use to search the library's subject catalog. A child may
use simple terms of a general nature having a high fre-
quency of usage in the language. A high school or college
student may search for a term introduced as part of his
studies. A professional person may use a very specific
term having a low frequency of usage but familiar to him
from his training and background in a particular discipline.

Reading specialists disagree on the precise rela-
tionship of word comprehension to word frequency rankings
of vocabulary in a language. There is almost universal
agreement that a basic core of words of high frequency in
a language is comprehended at a very early age by nearly
all persons using the language. The disagreement arises
in relating word frequency to word comprehension after the
basic core of language begins to disperse into subject and
discipline areas. This dispersion is best illustrated by
a schematic diagram (Figure 1) by Gertrude Hildreth pub-
lished in a paper on spelling lists and vocabulary stud-
ies.[1] Hildreth's ideas were, perhaps unknowingly, fol-
lowed by Carroll, Richman, and Davies in the construction
of their Word Frequency Book as they list the dispersion
into subject categories for each word type in the corpus.

One measure for frequency and one for comprehension
were each investigated. The main reason for using a fre-
quency measure as well as a comprehension measure is based
on the focus of the study: the subject catalog as a point
of access to information. Access to information involves
communication. The relationship of comprehension (the
child's point of access) to frequency (the adult-compiled
data base) would indicate the amount of communication pos-
sible between the data base and the child.

[1]Gertrude Hildreth, "An Evaluation of Spelling
Word Lists and Vocabulary Studies," Elementary School
Journal, LI (January, 1951), 259.

FINE ARTS
APPLIED ARTS
LITERATURE
NATURAL SCIENCE
PHYSICAL SCIENCES
MATHEMATICS
ECONOMICS
SOCIAL STUDIES
CIVICS AND GOVERNMENT
PHILOSOPHY
THE PROFESSIONS
COMMERCE, BUSINESS
TRADES, INDUSTRY
SPORTS
AVOCATIONS
MISCELLANEOUS

40,000 words
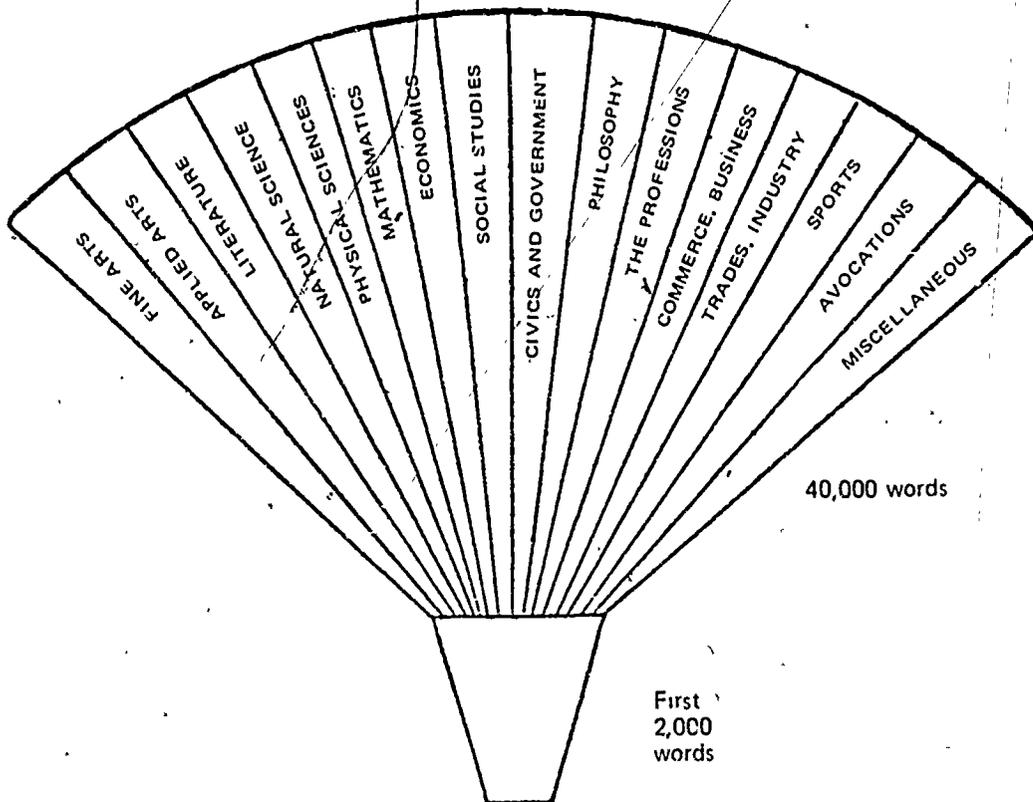
First
2,000
words

Figure 1.   Schematic diagram illustrating rapid expansion
            in vocabulary beyond the first two thousand
            words.

A secondary reason for using both measures was
based on the hope that the study might find some useful
relationships or areas of interchangeability between the
two measures. The assumption that frequency is a measure
of comprehension has never been thoroughly tested. This
study, using two recently developed measures, seemed an
opportunity for initial investigation which should not
be missed.

Carroll, Davies, and Richman
Measure of Word Frequency

The word frequency list compiled by John B. Car-
roll, Peter Davies, and Barry Richman[2] is the result of
research to provide a basis for selection of entries in
the American Heritage Intermediate Dictionary. The word
frequency list (corpus) is referred to as the AHI list or
the AHI corpus. Word frequency lists represent the vocab-
ulary of the adult author as he communicates with the
child. As Peter Davies has put it, "the Corpus is a
reflection of the culture talking to its children."[3]
For years the frequency list compiled by Edward L. Thorn-
dike and Irving Lorge has been used as a measure of vocab-
ulary comprehension.[4] The most recent edition of this list

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[2]John B. Carroll, Peter Davies, and Barry Richman,
The American Heritage Word Frequency Book (Boston: Hough-
ton Mifflin Company, 1971).

[3]Ibid., p. vii.

[4]Edward L. Thorndike and Irving Lorge, The Teach-
er's Word Book of 30,000 Words (New York: Teachers Col-
lege, Columbia University, 1944).

is now over 30 years old and out-of-date. In addition, the
assumption that frequency is a measure of comprehension has
never been thoroughly tested. The assumption that fre-
quency is a measure of comprehension was challenged by
Edgar Dale over 40 years ago. Dale claimed that frequency
lists only indicate the relative familiarity and unfamil-
iarity of a word within the corpus itself.[5] The AHI corpus
is recent (1971). The list is extracted from 5,088,721
words (tokens) of running text drawn in 500-word samples
from 1,045 published intermediate level juvenile trade,
text, and reference books. The list contains 86,741 dif-
ferent words (types). The book gives the frequency for
each word type by grade levels 3 through 9 plus an ungraded
category. (In the analyses in this study, the ungraded
category is labeled "x.") Grade levels for each book from
which text was sampled were determined by the answers to
questionnaires submitted by those school districts supply-
ing books and texts for the frequency analyses. The read-
ing levels were, therefore, subjectively, not objectively
determined. This lack of objective determination of the
reading levels of the books analyzed is a serious limita-
tion of Carroll, Davies, and Richman's research. The fre-
quency for each word type is also given for 17 different
subject categories determined in a similar manner to the

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[5]Edgar Dale, "Evaluating Thorndike's Word List,"
Educational Research Bulletin, X (November 25, 1931), 451-
457.

grade levels for each word type.

The statistical analysis of the AHI corpus includes a lognormal model of word-frequency distribution called Standard Frequency Index (SFI). This SFI was developed by John B. Carroll to attempt to measure the true relative frequency of the word types in an infinite corpus. A variation of this index, suggested by Carroll, was used in this study to compare the Dale-Eichholz comprehension data with the frequencies in the AHI corpus.

In the AHI corpus, the first 1,000 word types, arranged in descending order of frequency, account for 74% of the whole corpus. The first 5,000 word types account for 89.4% of the whole corpus.[6] The value of a lognormal model of word frequency such as Carroll's SFI is in the compression of a large quantity of data into more manageable figures which are more easily manipulated. "The usefulness and probable validity of the lognormal model are supported by the highly satisfactory agreement that can be obtained between empirical data and data predicted from the model."[7] The simplified formula suggested for use in this study is as follows:[8]

$$SFI = 10 \log_{10}p + 10$$

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[6]Ibid., p. xxviii.

[7]Ibid., p. xxvii.

[8]John B. Carroll and Margaret N. White, "Age of Acquisition Norms for 220 Picturable Nouns," Research Bulletin (Princeton, N. J.: Educational Testing Service, December, 1972), p. 7.

where p = true probability of the occurrence of a word type.

The computer analyses of the Carroll, Davies, and Richman corpus gave separate frequencies for the singular, plural, and possessive form of each word type. Computer analyses also gave separate frequencies for varying forms of capitalization for each word type: one frequency for the number of times the word type had no capital letters, an additional frequency for the number of times the same word type had the initial letter capitalized, and yet another frequency for the number of times all letters in the same word were capitalized. The analyses in this study followed the Carroll, Davies, and Richman separate analysis of singular, plural, and possessive forms of the same word type. However, the separate analysis of the same word type on the basis of capitalization of letters was not considered relevant to comprehension. Therefore, the total frequency of the word type analyzed was the frequency of the word type with all its variant capitalizations.

Dale-Eichholz Measure of Word Comprehension

Complementing the Carroll, Davies, and Richman measure of word frequency is the Dale-Eichholz measure of word comprehension. This measure, the result of years of national testing by Edgar Dale and Gerhard Eichholz at The Ohio State University, gives the grade levels of about 45,000 words and phrases known by children in grades 4, 6, 8, 10, 12, 13, and 16. Words were tested so that the

scores would range from 67% to 85% comprehension by the children at the grade level at which the word is considered to be known. If a word tested as comprehensible to only 60% of sixth-grade students, the word would be retested at the fourth-grade level. Similarly, if a word tested as comprehensible to 92% of the sixth-grade students, the word would be retested at the eighth-grade level. The grade level of word comprehension is that grade level at which a word is understood by a range of 67% to 85% of the children. The validity of this measure lies in the extensive testing of actual comprehension on a national scale. With a few exceptions, the Dale-Eichholz data does not include proper nouns or geographical place names.[9]

The Dale-Eichholz measure looks at vocabulary out-of-context in the same manner as a child approaching the subject catalog looks at subject headings. Subject headings can be considered to be vocabulary out-of-context. Children's comprehension of this vocabulary out-of-context can be, within specified limits, predicted for particular grade levels. The limitations of any vocabulary measure yet devised are the inability of such measures to account for variations in a person's conceptual framework, in educational and economic background, in intelligence, etc. These factors, in addition to vocabulary comprehension, also influence the child's choice of a possible subject

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[9] Edgar Dale, "The Future Tense," Theory into Practice, IX (April, 1970), 140-142.

heading in the library catalog.

The Dale-Eichholz comprehension measure was applied against the four lists of subject headings (LC, LC Jr., Sears, and MARC) at The Ohio State University. However, there were several inconsistencies in application of the measure to subject headings which resulted in inconsistent data. For example, geographic place names and proper nouns were, in general, not analyzed. In Dale's thinking, both are assumed to be familiar terms. Occasionally, plural forms were analyzed using scores for the singular term. In some cases where the subject term was not in the Dale-Eichholz data base, the comprehension level of a variant form of the word was given. In cases where two words were really a single concept, the Dale-Eichholz measure often gave a comprehension level for the concept instead of analyzing the individual words. Such a term was FIRE ENGINES. Some of the terms needing analysis were homographs for which Dale gave one or more meanings. Dale-Eichholz's measure considers semantics. Frequency counts do not. In some cases a word type in a subject heading had differing Dale scores because of the variation in its meaning from noun to adjective and/or adverb. For example, the word "world" has one comprehension level as an adjective and another when it is used as a noun. Finally, some of the data seemed inconsistent when a parenthetical expression, basically irrelevant to the meaning of a subject heading, had a higher vocabulary level than any word in the subject

heading itself. In the cases where the parenthetical expression was not completely germane to understanding the subject heading, the vocabulary level of the subject heading was considered to be the highest level word in the heading. For example, in BIGAMY (Canon law), "BIGAMY" (eighth grade) has a lower vocabulary level than "Canon law" (sixteenth grade). Because of the parenthetical expression, however, the vocabulary level of the heading is the eighth-grade word "bigamy."

The grade level assigned to a subject heading was determined by the term in the heading with the highest vocabulary level. The only exception to this was the parenthetical expressions described in the previous paragraph.

The subject headings containing inconsistent data were tagged. The vocabulary levels of subject headings were analyzed with and without the inconsistent (tagged) data to determine if the inclusion of the inconsistent (tagged) data would significantly affect the results of further analysis and comparison of the four subject heading lists (LC, LC Jr., Sears, and MARC). Table 2 shows the analysis of the subject heading samples using consistent and inconsistent (tagged) data. Table 3 shows the grade-level differences in relative frequencies between the consistent and the inconsistent (tagged) data. While differences within grade-level categories are significant, these differences vary so widely from one list to another

TABLE 2.--Four Subject Heading Lists Analyzed for Comprehension--Number of Cases of Consistent and Inconsistent Data

	LC	LC Jr.	Sears	MARC
Consistent data	228	238	261	246
Inconsistent data	73	46	39	50
Total number of cases	301	284	300	296
Variation of sample from number of LC cases	.000	.056	.003	.016

TABLE 3.--Grade Level Differences in Relative Frequency between Consistent and Inconsistent Data in Four Subject Heading Lists by Vocabulary Level of Subject Headings

Grade levels	LC	LC Jr.	Sears	MARC
Grade 4	-1.9	-2.1	-9.6	-7.3
Grade 6	-3.2	-0.7	+3.0	-9.8
Grade 8	-5.9	+2.6	+3.1	+1.7
Grade 10	+0.1	+4.5	+1.7	+5.5
Grades 12-16	+10.8	-4.2	+1.8	+5.0
Average grade level difference	+0.2	+0.2	0.0	-0.2

within the same grade level as to indicate only the random-
ness of the vocabulary analyzed. In addition, when these
differences are averaged out across a subject heading list,
they are consistently insignificant. Because the incon-
sistent data did not contaminate the samples, and because,
by using all the data, a statistically superior sample size
is available for making inferences and for generalizing
about the relationships between the four subject heading
lists, the samples were tested and analyzed in their
original form.

Comparisons of Vocabulary Measure of Word Comprehension and Word Frequency

Because the comprehension measure corresponds to
the child approaching the catalog and the word frequency
corresponds to the adult author/cataloger attempting to
communicate with the child, the relationship of these two
measures should be an indication of the effectiveness of
the library's subject catalog as a communication system
providing access to information.

Three comparisons were made between the comprehen-
sion measure and the frequency measure:

1. Comparison of the total sample for each subject
heading list, grades 3 through 9, plus an ungraded category
"x."

2. Comparison of the portion of each subject head-
ing list analyzed by comprehension as grades 3 through 6.

3. Comparison of the portion of each subject

.heading list analyzed by comprehension as grades 7 through
9.

Pearson correlation coefficients ranging from -.13
to -.52 (Table 4) indicate an inverse relationship between
word frequency and word comprehension. This finding con-
tradicts the correlation of .47 determined by Kirkpatrick
and Cureton when they compared the results of a multiple-
choice test with the Thorndike-Lorge frequency.[10] Chi-
square tests for independence of word frequency and word
comprehension (Table 5) also indicate a relationship
between frequency and comprehension. These findings indi-
cate that there is some form of communication between the
adult cataloger and the child user of a subject catalog.
The nature of this communication is statistically signifi-
cant. However, the quality of the catalog as a medium of
communication is open to question from an educational as
well as from a pragmatic point of view. In any case, the
amount of communication is weak and in need of more pre-
cise definition. The research in this study was not
designed to investigate or to construct intervals in the
frequency measure which would correspond to the grade-level
intervals built into the comprehension measure. In light
of the additional objectives of this study and the exten-
sive further research needed to determine grade-level

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[10]James J. Kirkpatrick and Edward E. Cureton,
"Vocabulary Item Difficulty and Word Frequency," Journal
of Applied Psychology, XXXIII (August, 1949), 347-351.

TABLE 4.--Correlations between Word Comprehension and Word Frequency Using Pearson Correlation Coefficients

	LC	LC Jr.	Sears	MARC
Total file	-0.52	-0.36	-0.43	-0.43
Level of significance	.001	.001	.001	.001
Grades 3-6	-0.37	-0.19	-0.31	-0.49
Level of significance	.001	.003	.001	.001
Grades 7-x	-0.31	-0.17	-0.30	-0.13
Level of significance	.001	.096	.001	.140

Number of Cases Correlated[a]	LC	LC Jr.	Sears	MARC
Total file	260	266	280	285
Grades 3-6	138	194	170	212
Grades 7-x	106	60	101	70

[a]Discrepancies between the total file and the divided subfiles are caused by Boolean programming logic.

TABLE 5.--Chi-square Tests for Independence between Word
Comprehension and Word Frequency

Dale-Eichholz grade levels	CDR frequencies			
	30	40	50	60

LC Subject Headings

4	4 (14)	21 (34)	47 (31)	11 (6)
6	3 (10)	25 (23)	29 (22)	2 (4)
8	4 (6)	20 (16)	15 (15)	1 (3)
10 up	32 (13)	37 (30)	4 (28)	3 (5)

Chi-square = 90.61 (p = .05) with 9 df

LC Jr. Subject Headings

4	9 (16)	38 (49)	67 (55)	27 (21)
6	3 (7)	25 (21)	26 (23)	6 (9)
8	7 (4)	15 (11)	7 (13)	4 (5)
10 up	11 (4)	14 (11)	4 (12)	3 (5)

Chi-square = 40.17 (p = .05) with 9 df

Sears Subject Headings

4	8 (13)	26 (37)	45 (39)	20 (10)
6	3 (11)	32 (28)	40 (30)	1 (7)
8	11 (7)	17 (20)	22 (21)	3 (5)
10 up	16 (7)	2 (19)	4 (21)	3 (5)

Chi-square = 65.95 (p = .05) with 9 df

MARC Subject Headings

4	2 (8)	13 (28)	53 (51)	36 (17)
6	4 (9)	37 (29)	63 (54)	6 (18)
8	6 (3)	11 (9)	15 (17)	2 (5)
3	11 (3)	15 (10)	9 (18)	2 (6)

Chi-square = 84.83 (p = .05) with 9 df

Critical value for chi-square = 16.19.

CDR frequencies = Carroll, Davies, and Richman frequencies.

intervals within disciplines for a frequency list, the con-
tinued use of the Carroll, Davies, and Richman frequency
list as a measure of vocabulary was abandoned.

The Dale-Eichholz comprehension measure with its
grade-level intervals built in and validated was selected
to analyze the vocabulary levels of the LC, LC Jr., Sears,
and MARC subject heading lists. The Dale-Eichholz measure
has the additional advantage of being conceptually related
to the measure of readability. Therefore, the use of the
Dale-Eichholz measure also made comparison of the vocabu-
lary level of the subject headings with the reading levels
of the books they described a valid comparison.

Analysis of Vocabulary Levels
of Four Subject Heading Lists

Of the four subject heading lists, the Library of
Congress list, as expected, had the highest vocabulary
level as well as the largest standard deviation from the
mean of this level (Table 6). The vocabulary levels are
measured in grade-level intervals. Although the lowest
combination of mean and standard deviation appears to be
that of the LC Jr. list, this list is never used indepen-
dently. Terms from this list plus terms from the Library
of Congress list combine to form the MARC list. The MARC
list is, therefore, not a listing of possible subject head-
ings but of subject headings actually applied to juvenile
books in two specified years (1970 and 1972). The mean
difference between the MARC terms and the terms from the

TABLE 6.--Mean and Standard Deviation of the Vocabulary
Levels of the Subject Heading Lists

Dale-Eichholz comprehension ,data	Grade level			
	LC	LC Jr.	Sears	MARC
Mean	7.7	6.0	6.9	6.4
Standard deviation[a]	3.5	2.6	2.9	2.6
Standard error[b]	0.2	0.2	0.2	0.2
Number of cases	260	266	280	285

American Heritage frequency data	Frequency index			
	LC	LC Jr.	Sears	MARC
Mean	45.8	48.5	47.1	49.5
Standard deviation	8.3	8.9	8.1	7.7
Standard error	0.5	0.5	0.5	0.5
Number of cases	260	266	280	285

[a]A measure of the spread in a set of observations
(Hamburg, 1973, p. 64).

[b]Standard deviation of the sampling distribution
(Siegel, 1956, p. 13).

Sears list is 7% with an 11% difference between the standard deviations. The MARC subject headings, therefore, have a vocabulary level which is, statistically, significantly lower than the headings in the other two lists. Educationally, however, the difference is less. Statistical measurement considers a difference to be significant if it is greater than or less than .05 or .01.[11] Educationally, a difference is considered to be significant if it is greater than or less than one grade level. This difference in vocabulary level, however significant, has implication for the cataloger of juvenile books in that he must consider not only the user for whom he is cataloging materials but also the vocabulary level of the subject heading list he is using. For example, for intermediate grade-level students, use of the adult Library of Congress subject heading list would provide less access to information than MARC cataloging.

The first hypothesis to be tested by the study was that LC, LC Jr., Sears, and MARC subject heading lists are all equally readable. This hypothesis is not supported. The four subject heading lists are not equally readable as a whole or at any grade level.

Looking at the relative and cumulative frequency of terms in the subject heading lists at each grade level,

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[11]Sidney Siegel, Nonparametric Statistics for the Behavioral Sciences (New York: McGraw-Hill Book Company, 1956), p. 168.

one-third of the terms are at the lowest reading level
(grade 4). The Library of Congress list has 32.7% of its
subject headings in the lowest (fourth) grade-level cate-
gory and 21.6% in the highest (twelfth-sixteenth) grade-
level category. At a sixth-grade level only 55% of the
terms in the LC list are understandable to a user. The
user can understand 62% of the Sears list at the sixth-
grade level and 75% of the MARC terms. Table 7 gives com-
parative figures by grade levels for the number of cases,
the relative frequencies, and the cumulative frequencies of
the four subject heading lists. Figure 2 shows graphically
the comparisons between the vocabulary levels of the four
subject heading lists. The graph shows far more clearly
than words or numbers the increased access to information
which is possible when lower vocabulary levels are used
for subject headings.

At the fourth-grade level where library instruction
formally begins in most schools, approximately one-third
of the subject headings in each list can be understood by
children. This assumes that all fourth-graders are actu-
ally reading at the levels considered as norms for the
grade. The fact that so many students do not read at grade
level norms[12] means that the comprehension scores at any

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[12]National Assessment of Educational Progress: A
Project of the Education Commission of the States, Report
02-R-09 Reading Rate and Comprehension (Denver: Educa-
tion Commission of the States, December, 1972); New Jersey
Educational Assessment Program, 1972-1973 Test Specifica-
tions and Questions, Grades 4 and 12 (Trenton: Office of

TABLE 7.--Grade Level Analysis of Subject Heading Lists by Number of Cases, Relative Frequency, and Cumulative Frequency

Grade level	LC			LC Jr.			Sears			MARC		
	No. cases	% RF	% CF	No. cases	% RF	% CF	No. cases	% RF	% CF	No. cases	% RF	% CF
4	85	32.7	32.7	141	53.0	53.0	99	35.4	35.4	104	36.5	36.5
6	59	22.7	55.4	60	22.6	75.6	76	27.1	62.5	110	38.6	75.1
8	40	15.4	70.8	33	12.4	88.0	53	18.9	81.4	34	11.9	87.0
10	20	7.7	78.5	16	6.0	94.0	26	9.3	90.7	18	6.3	93.3
12 up	56	21.6	100.0	16	6.0	100.0	26	9.2	99.9	19	6.7	100.0
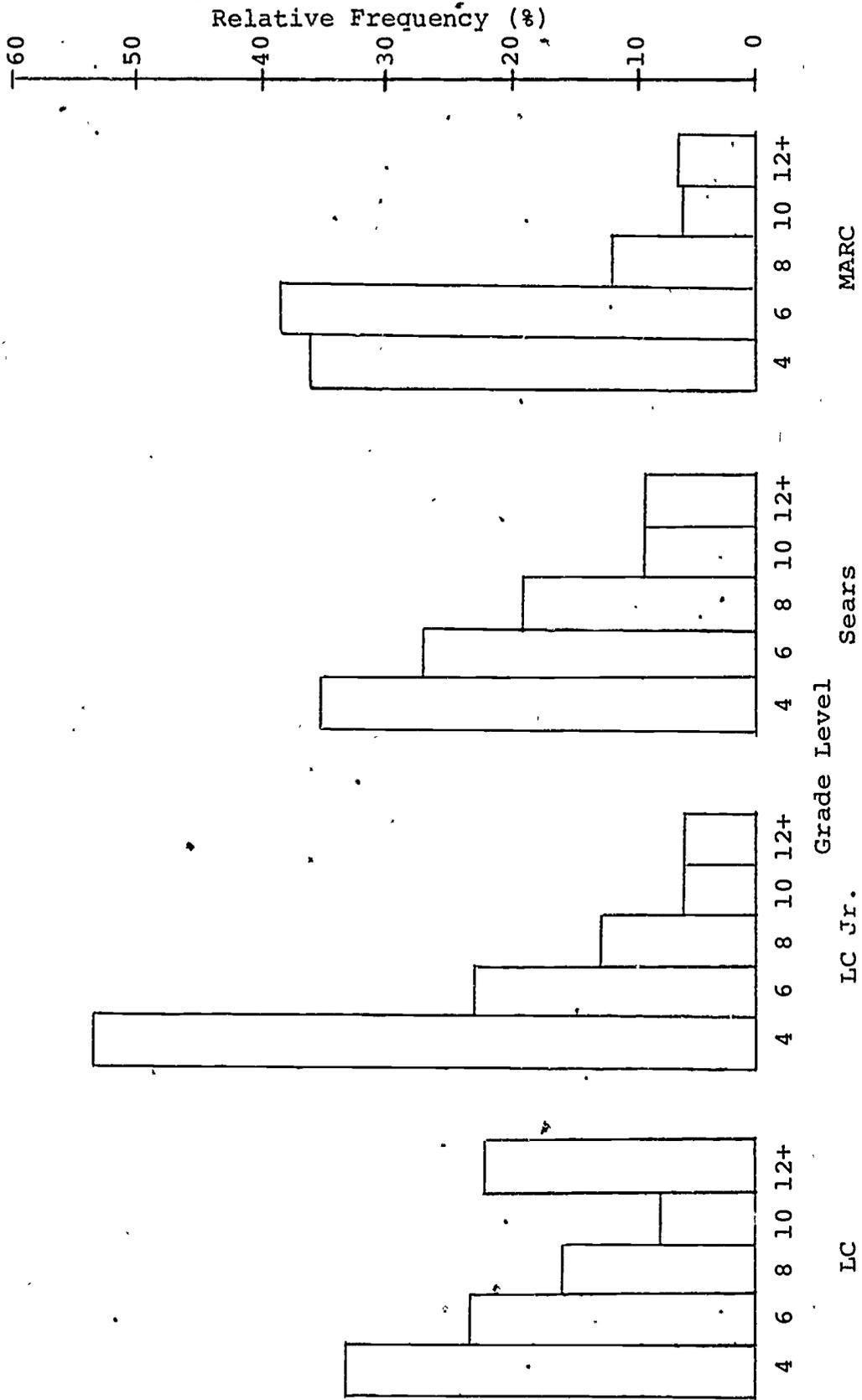
Figure 2. Grade level analysis of subject heading lists.

grade levels are an optimistic estimate of actual comprehension. Assuming that comprehension is essential to learning, then the amount of learning possible through use of the library's subject catalog is dubious.

A child frustrated in his attempts to learn to use the library's subject catalog to find information is not likely as an adult to turn naturally to the library as his first source of needed information.

Educational Assessment, Divisions of Research, Planning, Evaluation and Field Services, New Jersey State Department of Education, 1972). Also, letter giving test results from Gordon Ascher, Director, Bureau of Assessment and Evaluation, New Jersey Department of Education, June 19, 1974.

CHAPTER V

ANALYSIS OF RELATIONSHIP OF SUBJECT

HEADINGS TO READING LEVEL OF

BOOKS THEY DESCRIBE

The importance of reading level of subject headings
in the library's subject catalog is only one aspect of
access to library information. A second aspect of access
is the relationship of the subject headings to the books
or other materials they describe. For instance, FOLKLORE
is a subject heading with a high sixth-grade reading level.
The heading will provide access to information about folk-
lore to most people reading at this level or higher. How-
ever, many children's picture books and some early "easy
readers" are also books of folklore. The young readers for
whom these books are intended are, by virtue of not knowing
the access terminology, effectively denied the use of these
books through the subject catalog.

For the purposes of this study, the determination
of children's access to information in print is, therefore,
a determination of the relationship of the vocabulary level
of a subject heading to the reading level of the books
which the heading describes. If there is a negative dif-
ference or no difference between the vocabulary level of

the subject heading and the reading level of the book, the subject heading can be said to provide access to the book. In terms of accessibility, the fact that the reading level of the book may be far above the vocabulary level of the subject heading is a secondary consideration. The important consideration is that access to the book is provided and the user given the option of deciding whether or not he can read the book or it is useful for his purposes.

The second part of the study investigated the relationship of the vocabulary level of MARC subject headings to the reading levels of juvenile books published in 1970 and 1972 which the subject headings described. To determine the relationship between the reading levels of subject headings and books, the measure of vocabulary level of subject headings had to be conceptually related to the measure used to determine the readability of the books.

Description of Dale-Chall
Formula for Readability

The conceptual premises of the Dale-Eichholz comprehension measure are essentially similar to those in the Dale-Chall readability formula.[1] In addition to relating conceptually to the vocabulary measure, the Dale-Chall formula has the added advantage of precision and validity as a research tool to predict grade level of words-in-

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[1]Edgar Dale and Jeanne S. Chall, "A Formula for Predicting Readability: Instructions," Educational Research Bulletin, XXVII (January 21 and February 18, 1948), 11-20 and 37-54.

context.[2]

Formulae for predicting readability are generally based on two factors: sentence length of a sample of text, and vocabulary. The Dale-Chall formula uses a sample of 100 words selected from every tenth page of text. The average sentence length is computed. The number of words are computed which are not found on the list of basic words developed by Dale for use in the formula. This list does not contain the proper names of persons and places. Dale considers these to be familiar words. The Dale-Chall formula may be summarized as follows:

Select 100+ word samples from every tenth page of the material to be analyzed;

Compute the average sentence length in words (X);

Compute the percentage of words outside the Dale list of 3,000 familiar words (Y, or Dale score);

Apply in the formula:

FRS = .1579X + .0496Y + 3.6365.

FRS is the "formula raw score." This FRS must be converted into a grade-level score using a table developed by Dale and Chall.[3]

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[2]George R. Klare, The Measurement of Readability (Ames: Iowa State University Press, 1963), pp. 116-120; Wayne Lee Dale, "Readability of General Psychological Textbook Material: A Cross Validation Study of the Dale-Chall Formula" (unpublished doctoral dissertation, Oklahoma State University, 1963), pp. 5-29.

[3]Dale and Chall, "A Formula for Predicting Readability: Instructions," p. 42.

Readability formulae have limitations as do tests of comprehension and word frequency lists. The formulae measure only one aspect of writing: difficulty of vocabulary. They do not consider format, reader appeal, or clarity of writing. However imperfect, readability formulae have been proven to be related to reading speed, acceptability, understanding, and learning. In addition, as predictors of difficulty, they are usually more accurate than individual writers.[4]

Pretest to Simplify Dale-Chall Formula

The large quantity of books with 1970 and 1972 copyrights from the MARC subject heading sample to be analyzed for readability (405 books) and the time-consuming complexity of the Dale-Chall readability formula led to a decision to pretest sampling patterns in hopes of simplifying the process of readability analysis.

The books selected for the pretest were the 32 books of DOGS-STORIES and FOLKLORE previously chosen for in-depth subject-heading/readability analysis (see p. 24).

A pagination analysis was run for the entire universe of juvenile books on MARC tapes for 1970 and 1972. The size of this universe corresponded to the total 1970 and 1972 American book title outbook of 5,166 as indicated in the Bowker Annual.[5] Additional titles are the results

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[4]Klare, Measurement of Readability, pp. 18-25.

[5]The Bowker Annual of Library and Book Trade Information, Vol. XVII (New York: R. R. Bowker and Co., 1972), p. 176; ibid., XVIII (1973), 322.

of the Library of Congress' efforts to catalog additional
juvenile titles from other years after institution of their
children's cataloging program. The original universe of
5,186 books was cut 5% to 4,927 books by excluding the 259
books listed as having either more than 999 pages or less
than one page (Table 8).

The sampling basis for the Dale-Chall formula is
100 words about every tenth page for books. This sample,
according to the instructions, should never begin or end
in the middle of a sentence. The sampling instructions are
based on research by Bertha Leifeste who in 1944 tested 11
types of sampling in geographies, histories, and readers
for fourth, sixth, and eighth grades.[6]

The sample of books related to the MARC subject
headings includes many picture books. These picture books
are characterized by large type face, generous (often full-
page) use of illustrations, and, in general, pagination of
less than 50 pages. A sampling basis was needed that could
be used equally effectively with picture books as well as
with books having a larger quantity of text.

Taking the square root of the number of paging
units (a sequence of pages considered as one page) contain-
ing 100+ words instead of selecting 100 words on every
tenth page fulfilled the requirements of sampling theory.

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[6]Bertha V. Leifeste, "An Investigation of the
Reliability of the Sampling of Reading Material," Journal
of Educational Research, XXXVII (February, 1944), 441-450.

TABLE 8.--Pagination Analysis of Juvenile Books from MARC
Tapes--1970 and 1972

Observations	Mean	Median	Mode
	Total Observations		
5186	119.086	71.984	32.000
	Observations < 999 pp. and > 1 p.		
4927	104.103	79.830	32.000

That is, half of a book having only four pages of text would be sampled, one-third of a book having only nine pages would be sampled, while one-tenth of a book with 100 pages would be sampled. Taking the square root of the paging units containing 100+ words saves time (thereby increasing efficiency) by reducing the number of samples necessary for books having many pages and a large quantity of text. Because the mean and the median of the books ranged around 100 pages and the mode was constant at 32 pages (see Table 8), sampling by using the paging units of text containing 100+ words proved as accurate for picture books and easy readers as for books for older readers having a greater quantity of text and smaller type face. The revised sampling procedure, therefore, proved more accurate, more efficient, and is applicable to any textual material having at least 100 words.

There are at least two valid simplifications of the Dale-Chall readability formula. One by George R. Klare[7] involves considerable computation. The Klare simplification requires computation of (1) the Dale score (the percentage of words outside the Dale list), and (2) the average sentence length of each sample of text. For a book requiring ten samples of text, Klare's simplification requires 20 computations. Reading this data into Klare's

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[7]George R. Klare, "A Table for Rapid Determination of Dale-Chall Readability Scores," _Educational Research Bulletin_, XXXI (February 13, 1952), 43-47.

table of raw scores for readability, a final computation is
necessary to convert the raw scores to grade-level scores
using the Dale-Chall correction table.[8] Any samples having
an average sentence length of less than six words or more
than 38 words have to be computed for grade level of read-
ability using the original Dale formula.

The second simplification has been developed by
Charles R. Goltz.[9] Goltz's simplification requires compu-
tation only of the Dale score. Direct grade-level equiva-
lents are read from a table after determination of the
number of sentences in a 100-word sample and the Dale
score. Use of Goltz's table saves additional time since
the Dale-Chall correction table is not necessary for con-
version of raw scores to grade levels of readability.

The pretest examined 14 types of sampling in 32
books, and checked both the Klare and the Goltz simplifi-
cation for validity. Nested samples of one sentence, 25
words, 50 words, 100 words, and 100+ words (to the end of
the sentence) taken from every tenth page and also from
the square root of the number of pages and/or paging units
containing 100+ words were analyzed using Dale's, Klare's,
and Goltz's computations. The most accurate method was

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[8]Dale and Chall, "A Formula for Predicting Read-
ability: Instructions," p. 42.

[9]Charles R. Goltz, "A Table for the Quick Compu-
tation of Readability Scores Using the Dale-Chall Formula,"
Journal of Developmental Reading (Spring, 1964), pp. 175-
187.

assumed to be Dale's original method computed for an aug-
mented sample size. This size is every tenth page for
books over 100 pages and every nth page for books under 100
pages where n equals the square root of the number of pages
and/or paging units containing 100+ words. The other meth-
ods and sample sizes were compared with this standard by
using root-means-squared. The results closest to those
obtained by using the original Dale-Chall formula with the
largest possible sample size came from (1) using the square
root of the number of pages of text containing 100+ words,
(2) using the full Dale sample of 100+ words, and (3) com-
puting grade level using Goltz's table (Table 9).

The three most accurate results varied from the
standard by only one-third of a grade level. Accepted
error in readability prediction is plus or minus one grade
level. The three most accurate results, therefore, also
validated both Klare's and Goltz's simplifcations.

Goltz's simplification (100-word sample) was easy
to use and resulted in a considerable saving of time over
Klare's and Dale's methods. Determining the number of
samples necessary for each book using the square root of
the number of paging units of text containing 100+ words
resulted in increased predictive accuracy for books of few
pages. This method of sampling was also more efficient
with no significant loss of accuracy for books over 100
pages. Combining both these features did not impair the
predictive accuracy of the original Dale-Chall formula.

TABLE 9.--Results of Pretest for Simplification of Read-
ability Analysis. Grade-Level Differences from Dale Method
with Augmented Sample Size

	Full Dale (100 words +)	100 words	50 words	25 words	One sentence
Sample: Every Tenth Page					
Goltz	.51	.51	.72	.87	–
Klare	.34	–	–	–	1.03
Dale	.34	–	–	–	1.03
Sample: Square Root of Number of Pages					
Goltz	.33	.34	.60	.74	–
Klare	.00	–	–	–	.86
Dale	.00	–	–	–	.86

The method selected for readability analysis for books for this study may be summarized as follows:

1. Take the square root of the number of paging units in the book having 100+ words. If the book is a picture book having 50 pages of text each averaging 50 words, take the square root of 25 (to achieve 100+ words per page). A paging unit in this book would consist of two pages.

2. Take a 100-word sample every nth page where n equals the square root of the number of pages.

3. Determine the number of sentences in the sample. When the last sentence is not complete at 100 words, count the number of words in the last sentence. If the fragment of a last sentence has half or more than half of the words in the whole sentence, count the fragment as a complete sentence.

4. Determine the number of words in the sample not on Dale's list of 3,000 words.

5. Apply Goltz's chart for direct grade equivalents.

6. Average the reading levels of the samples to determine the readability level of the book.

Reading Levels of Books Described by MARC Subject Headings in 1970 and 1972

The reading levels of the 437 books analyzed by the modified Dale-Chall formula are listed in Table 10. The books described by DOGS-STORIES and FOLKLORE were each analyzed as a separate group as part of the pretest to simplify

TABLE 10.--Number of 1970 and 1972 Juvenile Books by Grade Readability Levels

Grade level	Combined 1970-1972	1970	1972	DOGS-STORIES	FOLKLORE
4	46	34	12	4	3
5	--	--	--	2	11
6	159	103	56	4	4
7	--	--	--	1	1
8	97	61	36	--	1
9	--	--	--	--	1
10	71	48	23	--	--
12	25	16	9	--	--
14	7	5	2	--	--
Total	405	267	138	11	21

the Dale-Chall formula for readability.

The pretest had an additional purpose of providing
an in-depth examination of books described by one low-
vocabulary subject heading (DOGS-STORIES) as well as books
described by a high-vocabulary-level subject heading (FOLK-
LORE). DOGS-STORIES has a low fourth-grade vocabulary
level and FOLKLORE has a high sixth-grade vocabulary level.
These books as well as the others analyzed were published
in 1970 and 1972. Because the sample sizes were relatively
small (11 DOGS-STORIES and 21 FOLKLORE) and because analy-
sis of the larger sample showed no significant differences
when broken down into separate years, the analyses for
these subject headings were not broken down into separate
years.

Comparisons of Subject Heading Vocabulary Levels with Reading Levels of the Books They Describe

Comparison of Mean Levels of Readability. Table 11
compares the percentages of books in each grade level
(determined by the MARC subject headings) over the two-year
time period 1970 to 1972. The statistically significant
increase (.15) in fourth-grade books might be accounted for
by the increasing demand for lower-grade "easy readers."
The contradiction in this possibility, however, is the high
reading levels for books in this category. The seventh-
grade mean readability level of the books in this category
would not seem to support the possibility of more "easy
readers" having low-vocabulary-level subject headings.

TABLE 11—Percentage of Books, Mean and Standard Deviation of Book-Grade-Readability-Level for Combined 1970-1972, 1970, and 1972 by Vocabulary Level of Corresponding Subject Headings

Subject heading grade level	Combined 1970-1972			1970			1972		
	% books	Mean	Standard deviation	% books	Mean	Standard deviation	% books	Mean	Standard deviation
4	37.8	7.176	2.084	35.6	7.137	2.176	42.0	7.241	1.940
6	35.1	7.254	2.267	37.1	7.051	2.145	31.2	7.721	2.491
8	13.1	7.925	2.480	13.5	8.278	2.625	12.3	7.176	2.007
10	6.2	8.000	2.449	6.4	8.000	2.449	5.8	8.000	2.619
12	5.7	8.522	2.778	6.0	8.500	2.875	5.1	8.571	2.760
13	1.0	9.000	2.582	0.4	6.000	0.0	2.2	10.000	2.000
16	1.2	8.400	4.336	1.1	10.667	4.163	1.4	5.000	1.414
Total	100.0	7.462	2.329	100.0	7.431	2.373	100.0	7.552	2.248

To compare the relationships between the vocabulary
levels of the subject headings and the readability levels
of the specific books the subject headings describe, three
tests were used: DIFF, Chi-Square, and Pearson Correlation
Coefficients.

Comparison by DIFF (Subject Heading Vocabulary
Level Minus Book Reading Level). The first comparison was
called DIFF. DIFF is the difference between the vocabulary
level of the subject heading and the readability level of
the book the heading describes. A zero DIFF or a negative
DIFF indicates that the reading level of the book was equal
to or higher than the reading level of the subject heading.
Under these conditions, access to the book is provided to
the user searching this term. A positive DIFF indicates
that the reading level of the subject heading is higher
than the reading level of the book it describes. In this
case, access to the book is effectively denied to the user
searching the subject catalog. Table 12 shows the number
of cases, the relative frequencies, and the cumulative fre-
quencies for DIFF calculated plus and minus six grade
levels.

Using DIFF as an indicator of accessibility, 70%
of the children's books published in 1970 and 1972 were
assigned subject headings equal to or lower than the read-
ability levels of the books they described. Thirty percent
of the books published in those years were, in effect,
hidden from children searching for them in a subject

TABLE 12.--DIFF (Subject Heading Vocabulary Level Minus
Book Reading Level): Number of Cases, Relative and
Cumulative Frequencies in Yearly Increments·

DIFF	Combined 1970-1972			1970			1972		
	No. cases	% RF	% CF	No. cases	% RF	% CF	No. cases	% RF	% CF
-6.0	26	6.4	6.4	13	4.9	4.9	13	9.4	9.4
-5.0	19	4.7	11.1	13	4.9	9.7	6	4.3	13.8
-4.0	40	9.9	21.0	25	9.4	19.1	15	10.9	24.6
-3.0	43	10.6	31.6	29	10.9	30.0	14	10.1	34.8
-2.0	57	14.1	45.7	38	14.2	44.2	19	13.8	48.6
-1.0	55	13.6	59.3	37	13.9	58.1	18	13.0	61.6
0.0	41	10.1	69.4	31	11.6	69.7	10	7.2	68.8
1.0	40	9.9	79.3	28	10.5	80.1	12	8.7	77.5
2.0	36	8.9	88.1	21	7.9	88.0	15	10.9	88.4
3.0	15	3.7	91.9	11	4.1	92.1	4	2.9	91.3
4.0	12	3.0	94.8	6	2.2	94.4	6	4.3	95.7
5.0	9	2.0	97.0	8	3.0	97.4	1	0.7	96.4
6.0	12	3.0	100.0	7	2.6	100.0	5	3.6	100.0

catalog by virtue of the child's lack of comprehension of the subject headings used to describe the books.

DIFF analyses of the relationships between vocabulary level of subject headings and readability level of books for DOGS-STORIES and FOLKLORE illustrate the accessibility problem. Because of the low vocabulary level of the subject heading, all 11 books about DOGS-STORIES are accessible (Table 13). With the high sixth-grade level of FOLKLORE, 61.9% of the books analyzed were not accessible to children. Because many of these books are designed in picture-book format for the younger child, the lack of accessibility is particularly unfortunate.

Table 14 shows the mean of DIFF between the grade levels of the subject headings and the book-readability levels. According to these tables, approximately 73% of the books are accessible when relating the subject heading level to the readability level of the books they describe. Looking at the data in Table 14, 37.8% of the books analyzed for readability had subject headings at the fourth-grade level. The subject headings of 72.9% of the books were at the sixth-grade level or below; 85.5% of the books had subject headings at the eighth-grade level or below. The mean reading level of the books analyzed was not less than seventh grade, even when subject headings were at the fourth-grade level. These figures look discouraging for the elementary school child (sixth grade and below) who wishes to learn from the library books he finds. Comparing

TABLE 13.--DIFF (Subject Heading Vocabulary Level Minus
Book Reading Level) in Yearly Increments: Number of Cases,
Relative and Cumulative Frequencies: DOGS-STORIES,
FOLKLORE

DIFF	No. of cases	% relative frequency	% cumulative frequency
DOGS-STORIES: Combined 1970-1972 Subject Heading Vocabulary Level = 4.0			
-3	1	9.1	9.1
-2	4	36.4	45.5
-1	3	27.3	72.7
0	3	27.3	100.0
FOLKLORE: Combined 1970-1972 Subject Heading Vocabulary Level = 6.0			
-3	1	4.8	4.8
-2	1	4.8	9.5
-1	1	4.8	14.3
0	5	23.8	38.1
1	11	47.6	85.7
2	2	14.3	100.0

TABLE 14.--Percentage of Books, Mean of Book Readability Levels and DIFF (Subject Heading Vocabulary Level Minus Book Reading Level) for Combined 1970-1972, 1970, and 1972 by Subject Heading Grade Level

Subject heading grade level	Combined 1970-1972			1970			1972		
	% books	Mean: books	Mean: DIFF	% books	Mean: books	Mean: DIFF	% books	Mean: books	Mean: DIFF
4	37.8	7.176	-2.908	35.6	7.137	-2.811	42.0	7.241	-3.069
6	35.1	7.254	-1.070	37.1	7.051	-0.929	31.2	7.721	-1.395
8	13.1	7.925	0.434	13.5	8.278	0.111	12.3	7.176	1.118
10	6.2	8.000	2.440	6.4	8.000	2.529	5.8	8.000	2.250
12	5.7	8.522	3.609	6.0	8.500	3.652	5.1	8.571	3.571
13	1.0	9.000	4.250	0.4	5.000	6.000	2.2	10.000	3.667
16	1.2	8.400	5.200	1.1	10.667	4.667	1.4	5.000	6.000

the figures in Table 11 with those in Table 14, the mean of
the reading levels of those 1970 and 1972 books having
fourth-grade vocabulary level subject headings is over
seventh grade. If all fourth-graders read at a seventh-
grade level or higher there would be no problem. However,
data from the National Assessment of Educational Progress
studies indicate that on a passage graded for readability
at the mid-fifth-grade level, only 40% of the population
of 13-year-olds (eighth graders) comprehended the
passage.[10]

In terms of library instruction in the use of the
subject catalog to gain access to information, the reading
level of the students becomes vital to the success of such
instruction. If comprehension level is falling so much
behind the reading level norms, then for most students
library instruction at the elementary level in the use of
the subject catalog is a waste of time. Expectations of
independent use of the subject catalog by all but the most
superior students are unreasonable as well.

Chi-Square Test for Independence between Subject
Heading Vocabulary Levels and Book Readability Levels.
Another test of the relationship of the vocabulary levels
of the subject headings to the readability levels of the
books they describe was the chi-square test. This

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[10]National Assessment of Educational Progress: A
Project of the Education Commission of the States, Report
02-R-09 Reading Rate and Comprehension (Denver: Education
Commission of the States, December, 1972), p. 23.

statistical test was computed for the mean readability

levels of (1) the 405 books published in 1970 and 1972, (2)

the 267 books published in 1970, and (3) the 138 books pub-

lished in 1972 (Table 15). With 9 degrees of freedom, the

probability that chi-square is equal to or greater than

10.062 is 0.34547 for the combined 1970 and 1972 samples

of books. For the 1970 books the probability that chi-

square is equal to or greater than 10.854 is 0.28587. For

the 1972 books the probability that chi-square is equal

to or greater than 3.799 is 0.92413. These figures tend

to support the idea of independence (lack of relationship)

between the vocabulary level of the subject headings and

the readability level of the books they describe.

Test for Correlation of Subject Heading Vocabulary

Levels and Readability Levels of Books They Described. Pear-

son correlation coefficients were calculated as a third

statistical test to determine the relationships between the

vocabulary level of the subject headings and the reading

level of the books they describe (Table 16). The low cor-

relation coefficients indicate a lack of relationship

between the subject headings and their corresponding books.

Comparing the relationships between the vocabulary

level of the subject headings and the readability levels of

the books they describe, three different tests indicate

that vocabulary levels of the MARC subject headings do not

correspond to the readability levels of the books they

describe. Therefore, for the second hypothesis of this

TABLE 15.--Chi-square Test for Independence between Subject
Heading Vocabulary Levels and Book Readability Levels

Subject heading grade level	Average reading level of books			
	Grade 4	Grade 6	Grade 8	Grades 10-16
Combined 1970-1972				
4	20 (17.4)	61 (60.1)	40 (36.6)	32 (38.9)
6	20 (16.1)	56 (55.5)	32 (34.0)	34 (36.1)
8	3 (6.0)	22 (20.8)	11 (12.7)	17 (13.5)
10 up	3 (6.5)	20 (22.4)	14 (13.7)	20 (14.5)

Chi-square = 10.062 (p = .03) with 9 df

		1970		
4	14 (12.1)	38 (36.7)	23 (21.7)	20 (24.6)
6	16 (12.6)	39 (38.2)	23 (22.6)	21 (25.6)
8	2 (4.6)	13 (13.9)	7 (8.2)	14 (9.3)
10 up	2 (4.7)	13 (14.3)	8 (8.5)	14 (9.6)

Chi-square = 10.854 (p = .29) with 9 df

		1972		
4	6 (5.0)	23 (23.5)	17 (15.1)	12 (14.3)
6	4 (3.7)	17 (17.5)	9 (11.2)	13 (10.6)
8	1 (1.5)	9 (6.9)	4 (4.4)	3 (4.2)
10 up	1 (1.7)	7 (8.1)	6 (5.2)	6 (4.9)

Chi-square = 3.799 (p = .92) with 9 df[a]

Critical value for chi-square = 16.19.

[a]More than one-fifth of the expected frequencies are
± 5.0.

TABLE 16.--Pearson Correlation Coefficients between
Vocabulary Level of Subject Headings and Readability Level
of Books

Year	No. of cases	Correlation coefficient	Level of significance
1970-1972	405	0.17	.001
1970	267	0.21	.001
1972	138	0.09	.001

study (that the vocabulary and readability levels are inde-
pendent) there is insufficient evidence to reject the null
hypothesis of independence.   This implies that there is no
apparent relationship between the vocabulary level of a
subject heading and the readability level of the book it
describes.

CHAPTER VI

FINDINGS AND CONCLUSIONS

The objective of the first part of the study was to analyze the vocabulary levels of the four most commonly used subject heading lists: LC, LC Jr., Sears, and MARC. The special headings for children were compiled to facilitate children's use of the subject catalog. Sears is an abridgment of the LC list. MARC headings are headings taken from LC and LC Jr. lists which are actually applied to juvenile books.

Using statistical calculations to determine the means and standard deviations of the subject heading lists, the relative and cumulative frequencies of grade levels within the lists, the subject heading lists were not found to be equally readable. The LC list had the highest level of vocabulary (grade 7.7, s.d. 3.5) followed, in descending order, by Sears (grade 6.9, s.d. 2.9), MARC (grade 6.4, s.d. 2.6), and LC Jr. (grade 6.0, s.d. 2.6). The standard error was the same for all four lists: 0.2 (see Table 6). Statistically, the level of the MARC headings is significantly (.07) lower than Sears. However, this statistical significance is secondary to the educational significance which allows for an error of plus or minus one grade level

instead of an error of plus or minus .05. Educationally,
therefore, the four lists are almost equally readable.
While the null hypothesis of equal readability is statis-
tically rejected because the differences in vocabulary
level are greater than .05, the hypothesis is less easily
rejected using the broader, educationally accepted ranges
of error.

In terms of access to information, the average
vocabulary level of subject headings (found to range from
sixth- to seventh-grade levels) poses several problems.
These problems affect the child user of the subject cata-
log, the student attempting to learn to use the subject
catalog, and the average person attempting to obtain access
to information in the library's collections through the
subject catalog. The sixth- and seventh-grade-level aver-
age vocabulary level of subject headings represent measure-
ments using national norms of reading levels. Most chil-
dren do not read at the established national norms.

The National Assessment of Educational Progress
study found that only 40% of eighth-grade students can
answer comprehension questions about a passage of text at
the fifth-grade level.[1] In the light of these findings,
expectations that any but the most superior students can
read the library's subject catalog seem unreasonable. The

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[1]National Assessment of Educational Progress: A
Project of the Education Commission of the States, Report
02-R-09 Reading Rate and Comprehension (Denver: Education
Commission of the States, December, 1972), p. 53.

National Assessment of Educational Progress study as well
as a recent study by the New Jersey Educational Assessment
program[2] indicate that a significant number of students do
not possess either the vocabulary to read or the study
skills to use the library's subject catalog with any degree
of success.

The curriculum in many United States schools today
provides for library instruction. Part of this instruction
includes the use of the subject catalog. This instruction
is traditionally concentrated in grades 4, 5, and 6 with
less concentrated instruction at the higher grade levels.
As previously stated, the findings of this study indicate
that the mean vocabulary levels of the subject catalog
range from grade 6 to grade 7 with a standard deviation
of plus or minus two grade levels. The elementary child
is, therefore, being instructed to use a tool he cannot
read.

A consistent lack of success in attempting to learn
to use the subject catalog coupled with a teacher's unreal-
istic expectations of how much the student is able to com-
prehend may dissuade the student from using the library long
after the period of unsuccessful instruction has passed.

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[2]New Jersey Educational Assessment Program, 1972-
1973 Test Specifications and Questions, Grades 4 and 12
(Trenton: Office of Educational Assessment, Divisions of
Research, Planning, Evaluation and Field Services, New
Jersey State Department of Education, 1972). Also, letter
giving test results from Gordon Ascher, Director, Bureau
of Assessment and Evaluation, New Jersey Department of
Education, June 19, 1974.

The implications of the child's inability to com-
prehend the vocabulary in the subject catalog extend beyond
the school library situation to affect the average adult
patron of the public library. According to a recent
research project, a substantial portion of the United
States population does not read well enough to function
in society:

> Some 12 million people 14 years of age and older can-
> not read as well as the average fourth-grader, yet
> seventh-grade reading ability is required to perform
> such skilled or semi-skilled jobs as machinist or
> cook.
>   Approximately 60% of the Nation's 13-year-olds
> cannot follow directions in a relatively simple cook-
> book.
>   An estimated 18 million adults cannot read well
> enough to file applications for Medicaid, Social
> Security, bank loans, or drivers' licenses.[3]

The National Assessment of Educational Progress Study indi-
cates that only 34% of 17-year-olds could comprehend cor-
rectly a passage of text rated at a tenth-grade level by
three different readability formulae (including Dale-
Chall).[4] This reading rate varies from community to com-
munity and from region to region. The rate drops in poor
communities with a low educational level and rises in more
affluent suburbs with a higher educational level. In gen-
eral, however, the results of the National Assessment of
Educational Progress study applied to the findings of this

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[3]"NIE Attacks the Reading and Language Skills
Problem," American Education, X (May, 1974), 35.

[4]National Assessment of Educational Progress,
p. 119.

study indicate that the average person is unable to read the library's subject catalog on his own, much less to use it to locate information in the library.

If vocabulary level were the only problem the child or average adult encountered in using the subject catalog, the difficulty of gaining access to information would be discouragingly serious. However, in addition to a high vocabulary level of subject headings, the user encounters two other difficult problems: (1) unsystematic and inconsistent form of subject headings, and (2) a mismatch of the conceptual patterns of the user and the conceptual patterns of the cataloger. The first problem was the subject of a dissertation by Jessica Harris.[5] The second problem was examined in a dissertation by John M. Christ.[6] Put together: the findings of this dissertation, the Harris dissertation, and the Christ dissertation lead to the conclusion that the subject catalog cannot be understood by the child and the average adult because of the combined problems of high vocabulary level, inconsistent form of headings, and the mismatch of conceptual patterns. An additional conclusion of the present study is that, because of these problems, library instruction in the

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[5]Jessica Lee Harris, Subject Analysis: Computer Implications of Rigorous Definition (Metuchen, N. J.: The Scarecrow Press, Inc., 1970).

[6]John M. Christ, Concepts and Subject Headings: Their Relation in Information Retrieval and Library Science (Metuchen, N. J.: The Scarecrow Press, Inc., 1972).

subject catalog should be discontinued at the elementary
grade levels.

A second aspect of the analysis of vocabulary level
of the subject headings investigated by this study was an
attempt to determine the relationship between word compre-
hension and word frequency in the measurement of vocabulary
levels. The data (p. 38) shows that comprehension and fre-
quency are statistically related using correlation coeffi-
cients and the chi-square test. However, the correlations
are inverse and do not indicate any interval interrelation-
ships between grade levels of comprehension and lognormal
intervals of frequency. Determination of such interrela-
tionships is necessary to convert from one approach to
vocabulary level measurement to the other. While the
determination of such conversion intervals was beyond the
scope of this study, investigation of this relationship
has been suggested as a topic for future research.

The attempt to measure the relationship of word
comprehension to word frequency was also an attempt to
determine the effectiveness of the subject catalog as a
medium of communication. Word comprehension indicated the
concepts understood by the child who would use them to
address the subject catalog in a search for information.
Word frequency indicated the vocabulary and concepts of
the adult authors and catalogers attempting to communicate
with the child by the headings they selected to include
in the catalog. The statistical tests indicated a weak,

inverse relationship between the two ways of measuring
vocabulary level. The relationship is sufficiently weak
(p = -.036 to -0.52) as to be pragmatically meaningless.
Therefore, this finding of the study indicates that the
catalog is not useful as a medium of communication. The
fact that the subject catalog is such a weak medium of
communication strengthens and adds weight to the previous
conclusion that the subject catalog does not provide access
to information.

The objective of the second part of the study was
to investigate the subject catalog as a means of access to
information by determining the relationship between the
vocabulary levels of subject headings and the readability
levels of the books these headings described. The data was
analyzed using three tests: DIFF (see p. 61), chi-square,
and Pearson correlation coefficients. Each test indicated
no apparent relationship between the vocabulary level of a
subject heading and the readability of the book it
describes.

The original premise of the study had been that a
positive relationship should exist between vocabulary level
of a subject heading and the reading level of the book the
heading described. This premise was stated as a null
hypothesis that the vocabulary level of a subject heading
and the readability level of a book with that heading would
be independent of each other. The use of a null hypothesis
of independence was dictated by the statistical analysis of

the chi-square test. There was no evidence to reject the null hypothesis using chi-square, correlation coefficients, or the DIFF (p. 61) statistic.

The fact that three different statistical tests found no apparent relationship between the vocabulary level of a subject heading and the readability level of the book it describes once again leads to the conclusion that the subject catalog is not effective as a means of access to information for the child or the average adult. The statistical correlations (0.09 to 0.21) show an almost completely independent relationship between subject heading vocabulary level and book readability level.

The 405 books in the sample were cross tabulated using the DIFF accessibility statistic and the grade level of the subject heading assigned to the book. The subject heading vocabulary level at the first point where DIFF indicated accessibility was grade 8. At this point, 70% of the books published in 1970 and 1972 were accessible. However, the mean grade level of readability of these books was 7.9. The National Assessment of Educational Progress finding was that only 40% of eighth-grade students could comprehend a passage graded for readability at the mid-fifth-grade level. If only 70% of the books are accessible at a subject heading vocabulary level of eighth grade and these books themselves have a mean grade level of readability of 7.9 (more than two grade levels higher than the passage tested by the NAEP study), then, optimistically,

only 28% of books are accessible to the eighth-grade child using the subject catalog.

Looking at DIFF in relation to a subject heading having a low fourth-grade vocabulary level, all books tested were accessible. Using DIFF with a subject heading having a high sixth-grade vocabulary level, only 32.1% of the books analyzed with that heading were accessible if the child's reading level equaled or was greater than national norms.

An additional finding of the second part of the study was the grade-level mean of readability for 405 children's books published in 1970 and 1972. This grade-level mean was found to be 7.4 with a standard deviation of 2.3 grade levels and a standard error of 0.1. The mean of the readability levels of books published in 1970 and of books published in 1972 did not vary significantly (< .02). The data, therefore, did not vary over time.

The fact that the mean grade level of readability of juvenile books is mid-seventh grade indicates that the publishers do not produce much material for the very young reader, the handicapped reader, the reader with learning disabilities, or the reader who is not capable of reading at grade-level norms. One unanswered question is whether publishers produce for a market of librarians who purchase books or for a market of ultimate users who have considerably lower reading levels than those indicated by the grade levels of books published.

Prior to determining readability levels for the 405
juvenile books, a simplified method for using the Dale-
Chall readability test was developed and validated. In the
process of validating the modification used in the study,
the Goltz and the Klare simplifications of the Dale-Chall
formula were validated as well. A more accurate, less
time-consuming, and more widely applicable text-sampling
procedure was also developed. This simple, accurate read-
ability test might be used by publishers to determine objec-
tively the grade levels of readability of the manuscripts
they consider for publication.

Not long after the institution of the Library of
Congress' program for cataloging children's materials, Miss
Treva Turner (Head, Children's Cataloging Section, Subject
Cataloging Division) of the Library of Congress asked for
information from the field about the effectiveness of the
program.[7] The findings of this study answer two of her
questions and partially answer a third.

Miss Turner's questions were (1) how effective have
the new LC juvenile headings proven in children's librar-
ies; (2) how do they compare, from the user point of view,
with other existing schemes; and (3) would a user study
indicate a serious problem due to lack of standardization?
This study would conclude that LC juvenile headings taken

[7]Treva Turner, "Cataloging Children's Materials at
the Library of Congress," The Quarterly Journal of the
Library of Congress, XXX, No. 2 (April, 1973), 152-157.

from MARC tapes are no more effective than headings from
any other subject heading list.

A user study might indicate that the problem of
lack of comprehension of the headings is as great, if not
greater, than the problem of standardization of form of
the headings. A user study might look at the interactions
of the problems of comprehension, form of headings, mis-
match of concepts, and complexity of filing rules in terms
of frustration levels for children and adults.

Several alternatives might be considered to provide
the patron with easier access to the information in the
library's collections than that presently provided by the
subject catalog.

One alternative would be to lower the reading
levels of the subject headings and to simplify and stan-
dardize their form. The difficulties inherent in lowering
the reading level of subject headings are many. Rankings
of words in English by frequency of use indicates that
words of high frequency are often general, somewhat generic
terms lacking the specificity necessary for the file struc-
ture of any but the smallest library. Lowering the reading
level would not solve the problem of the patron who must,
in addition to understanding the subject heading, linguis-
tically match his concept of the information he seeks with
the concepts of the cataloger who selected the subject
heading. John Christ's study[8] of concepts and subject

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[8]Christ, Concepts and Subject Headings.

headings suggests that such conceptual matching is not suc-
cessfully managed by library catalogers. An additional
problem relating to both reading level and conceptual
matching is the difficulty library patrons frequently
have with the variant forms of subject headings. For
these reasons, lowering the reading level of the library's
subject headings does not seem to be a viable alternative.

A second alternative would be to avoid the subject
catalog altogether. Avoidance of the subject catalog might
be accomplished in at least two ways. One simple approach
used by libraries large and small is to divide the library
catalog to separate the subject entries from the title and
author ones. Another approach might be the use of a sym-
bolic guide directly to broad subject areas on the shelves.
This approach might be workable for small collections with
easily accessible materials, but would be difficult in
larger collections or in collections where the patron can-
not go directly to the library's materials.

Another alternative in small collections might be
to use KWIC or KWOC indexing for non-fiction titles. This
alternative was investigated and found feasible in a study
by Marilyn Crane and Joy Moll.[9]

A fourth alternative would be to consider the

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[9] Marilyn W. Crane and Joy K. Moll, "KWIC Indexing:
A More Readable Alternative to the Subject Catalog for
Children Using Libraries" (unpublished manuscript, Gradu-
ate School of Library Service, Rutgers University,
1971).

subject catalog a tool for the librarian and to provide
personnel to interface between the catalog and the patron
seeking information. Depending on the person serving as
the "interface," access might be improved. Access might
also be further impeded. Left to his own devices, the
library user might hope to combine luck and serendipity
by using his own detective skills. Even when provided with
the reference services of a professional librarian, the
patron has no guarantee that the librarian will understand
his query. Forced to use a librarian as an interface with
the collection, the user no longer possesses the freedom to
browse and discover unexpected but useful materials.

The possibility exists that, depending on the type
of library and the user population, a combination or one or
more of these alternatives might be a viable alternative to
the problem of access to information through the subject
catalog.

The findings and conclusions of this study show
that when readability is used as an indicator of access
to information, the subject catalog provides minimal access
to information irregardless of grade or age level. This
minimal access to information provided by the subject cata-
log holds whether the subject headings in the catalog are
analyzed by themselves or in relation to the readability
levels of the books they describe.

CHAPTER VII

TOPICS FOR FUTURE RESEARCH AND STUDY

In the course of the study many additional questions were raised which would, when answered, shed more light on children's access to information, provide more accurate measures of reading comprehension, and, perhaps, lessen the complexities of library subject headings.

The relationship between vocabulary comprehension and word frequency needs further investigation to determine the intervals in word frequency that might correspond to grade levels of comprehension. One approach to this might be a study of general and specific vocabulary terms by subject or discipline area. A second approach might be the study of the frequency of root or stem words and the comprehension levels of their variant forms. A third approach might be to study levels of concept formation as they relate to vocabulary comprehension. According to a study by Clinton I. Chase, "the measurement of concepts associated with verbal symbols has potential utility as a means of evaluating students' vocabularies."[1]

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[1] Clinton I. Chase, "An Application of Levels of Concept Formulation to Measurement of Vocabulary," Journal of Educational Research, LV (October, 1961), 75-78.

Dale's list of 3,000 words needs updating as it is
now over 25 years old.

More light on children's access to information
might be shed after studying the subject headings assigned
to picture books and "easy readers." A study of actual
book reading levels and how these have changed over time
would also be interesting. A similar study might be made
of audiovisual or non-print materials for children with an
analysis of the NICEM (National Information Center for Edu-
cational Media) subject headings. A study of book reading
levels in elementary and intermediate school libraries
might also prove fruitful.

An optimal file structure of the universe of juve-
nile materials might be developed for library catalogs.
Using this optimal structure, standardized subject heading
forms might be developed for juvenile materials.

Utilizing current practice and the data from this
study, a determination could be made of the proportions of
subject headings where the standard subdivision of the head-
ing or the adjectival entry word in the heading determines
its vocabulary level. Identification of these headings and
subsequent adjustment of LC cataloging practice for juvenile
materials might improve children's access to information.

In teaching reading, the concept of frustration
level[2] is often used to identify the reading levels at

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[2]Emmett Albert Betts, _Foundations of Reading
Instruction_ (New York: American Book Company, 1975.

which a child functions independently, at which he can be taught, and at which he is frustrated by not being able to comprehend the material he is trying to read. Empirical testing of the results of this study in terms of frustration level would add validity to its conclusions.

Future research might also monitor change in both reading levels of juvenile books published as well as in the subject headings assigned to them. Such monitoring could determine if reading levels are indeed meeting the needs of all juvenile seekers of information. The monitoring could also determine if access to information were being achieved by attempting to match the level of a subject heading to the level of the material which the heading is providing access to.

Finally, in investigating subject headings and their application to children's books, the rules, conventions, structure, and application of subject headings suggest that subject headings may be a "language" of their own: the librarian's professional dialect. The varying forms of subject headings suggest a grammar. The subject headings are a self-contained group of concepts which embody a series of exper.ences (cataloging courses?) which are similar in one or more respects.[3] The librarian's training may indeed be teaching him a unique professional language not easily understood by others.

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[3]John B. Carroll, "Words, Meanings and Concepts," Harvard Educational Review, XXXIV (Spring, 1964), 178-202.

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APPENDIX A.

SUBJECT HEADINGS ANALYZED

FOR VOCABULARY LEVEL

LC SAMPLE

AARDVARK
ABBREVIATIONS
ABSTRACTS
ABUSE OF ADMINISTRATIVE POWER (ROMAN LAW)
ACETAL RESINS
ADVERTISING LAWS
AEROPLANES
AEROPLANES ELECTRIC WIRING
ALE PUMP
ANEMOMETER
ANKLE
ARABESQUES
ARCHERS
ARMADA 1588
ART EXPERTISING
ART NOVEAU
ART PRIMITIVE
ASBESTOS FIBERS
AUDITORS
AUTHORITARIANISM
AUTOMOBILE ENGINEERING
BACTERIOLOGY AGRICULTURAL
BAIT CASTING
BANDSMEN
BASALT
BETROTHAL
BIBLE
BIBLIOGRAPHY INTERNATIONAL
BIGAMY (CANON LAW)
BINS
BIOGEN (ANTISEPTICS)
BIRDS ORNAMENTAL
BIRTH (PHILOSOPHY)
BOILERS
BOLOMETER
BORDER PATROLS
BREEDING
CARROTS AS FEED
CATHOLIC CHURCH
CATHOLICS IN ENGLAND
CHANNEL CATFISH
CHEMISTRY PHYSICAL AND THEORETICAL
CHILD WELFARE
CHILDREN
CHILDREN IN AFRICA
CHLOROPHYLLIN
CHORUSES SECULAR (MENS VOICES 8 PTS) W/ORCHESTRA
CHORUSES SECULAR (MIXED VOICES 6 PTS) W/BAND
CHURCH HISTORY
CHURCH MUSIC
CIGARETTE TAX

CIRCUMCISION
CITIES AND TOWNS
CIVIL DEATH
CLAIMS AGAINST DECEDENTS ESTATES (CANON LAW)
CLEMATIS
CLOSED CIRCUIT TELEVISION
COAL RESEARCH
COALING
COBALT ORGANIC COMPOUNDS
COCONUT OIL
COD FISHERIES
COLLEGE COSTS
COLLEGE SPORTS
COMMANDMENTS OF THE CHURCH
COMMERCIAL LAW (ASAT LAW)
COMMUNICATION (THEOLOGY)
CONCERTO (VIOLINCELLO)
CONCERTOS (HORN WITH BAND)
CONCERTOS (VIOLA)
CONCERTOS (VIOLA DA GAMBA)
CONCRETE HOUSES
CONFEDERATE STATES OF AMERICA
DECEDENTS ESTATES
DEFECATION
DEPARTMENT STORES
DIAMOND CUTTING
DIETARIES
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PELICANS STORIES
PHYSICAL RESEARCH
PHYSICALLY HANDICAPPED FICTION
PHYSICS EXPERIMENTS
PICNICKING FICTION
PIGS STORIES
PLANETS
PLANT PROPAGATION
PLAY FICTION
POETRY
POLICE
POND FLORA
POPULATION
PREJUDICES FICTION
PRESIDENTS
PRIMATES

PRISONS FICTION
QUESTIONS AND ANSWERS
RACE PROBLEM
RADIATION
RAILROADS POPULAR WORKS
RELIGION
REPRODUCTION
REPTILES
RIVERS
ROBINS
ROCKETS (AERONAUTICS)
SCIENCE
SCIENCE FICTION
SCULPTURE
SEALS ANIMALS STORIES
SENSES AND SENSATION
SET THEORY
SEVEN WONDERS OF THE WORLD
SEXUAL ETHICS
SHEEP NEW SOUTH WALES
SHELLS
SHETLAND PONY STORIES
SHOEMAKERS FICTION
SIGNS AND SYMBOLS
SLAVERY FICTION
SLEEP FICTION
SMOKING AND YOUTH ADDRESSES ESSAYS LECTURES
SMUGGLING GT BRIT HISTORY
SOCIAL WORK AS A PROFESSION US
SOUTH AMERICA DESCRIPTION AND TRAVEL
SOUTHERN STATES FICTION
SOUTHWEST OLD FICTION
SPORTS
SQUIRRELS STORIES
STEEL INDUSTRY AND TRADE
STOCK EXCHANGE US
SUN
TALES AFRICAN AFRICA WEST
TALES BANTU
TALES JEWISH
TALES PORTUGUESE
TALES VIETNAMESE
TECHNOLOGY
TELEVISION BROADCASTING
THEATER AS A PROFESSION
TOADS STORIES
TRADE UNIONS
TRANSPORTATION
TRAP DOOR SPIDERS
TREES STORIES
US AIR DEFENSES MILITARY
US ECONOMIC CONDITIONS
US EMIGRATION AND IMMIGRATION

US FOREIGN RELATIONS JAPAN
US HISTORY CIVIL WAR BIOGRAPHY
US HISTORY CIVIL WAR NEGRO TROOPS
US HISTORY COLONIAL PERIOD BIOGRAPHY
US HISTORY COLONIAL PERIOD FICTION
US HISTORY CONSTITUTIONAL PERIOD 1789 1809
UNDERDEVELOPED AREAS
UNDERGROUND-RAILROAD FICTION
UNMARRIED MOTHERS FICTION
VENEREAL DISEASES
VOYAGES AND TRAVEL
WAR FICTION
WEATHER
WHEAT
WHEELS
WITCHCRAFT
WITCHES FICTION
WOLVES
WOMAN RIGHTS OF FICTION
WOMAN SUFFRAGE
WOMEN IN THE BIBLE
WORLD POLITICS 1900 1945
WORLD SERIES BASEBALL
YOUTH FICTION
ZOO ANIMALS
ZOOLOGY AUSTRALIA

APPENDIX B

BOOKS ANALYZED FOR READABILITY LEVEL

ACCIDENTS, PREVENTION
Bolian, Polly, and Hinds, Shirley. Safety. Watts, 1970.

ADOLESCENT GIRLS--FICTION
Blume, Judy. Are You There, God? It's Me, Margaret. Bradbury Press, 1970.

AEROPLANES--JET PROPULSION
Ahnstrom, D. N. The Complete Book of Jets and Rockets, rev. and enl. new ed. World Publishing Co., 1970.

AIR TRAFFIC CONTROL
Peet, Creighton. Eye on the Sky: How Aircraft Controllers Work. Macrae Smith, 1970.

Olney, Ross, Robert. Air Traffic Control. T. Nelson, 1972.

AIR TRAFFIC CONTROL--VOCATIONAL GUIDANCE
Yokley, Joseph, with Michael Reuben and Emmett Smith. Meigs Tower. Children's Press, 1970.

AIRPLANES--HISTORY--FICTION
Loening, Grover Cleveland. The Conquering Wing. Chilton Book Co., 1970.

ALPHABET
Duggan, William. How Our Alphabet Grew, the History of the Alphabet. Golden Press, 1972.

ALPHABET BOOKS
Beers, Dorothy Sands. ABC Alphabet Cookbook. Schmitt, Hall & McCreary Co., 1972.

AMATEUR THEATRICALS
Nolan, Paul T. Around-the-World Plays for Young People: A Collection of Royalty-free, One-Act Plays About Lands Far and Near. Plays, Inc., 1970.

Murray, John. Comedies and Mysteries for Young Actors: A Collection of One-Act, Royalty-free Plays for Teen-agers. Plays, Inc., 1972.

AMERICA--DISCOVERY AND EXPLORATION
Hirsch, S. Carl. Mapmakers of America: From the Age of Discovery to the Space Era. Viking Press, 1970.

Keating, Bern. Famous American Explorers. Rand McNally, 1972.

AMERICA--DISCOVERY AND EXPLORATION--FRENCH
Toye, William. Cartier Discovers the St. Lawrence. H. Z. Walck, 1970.

AMERICA--DISCOVERY AND EXPLORATION--SPANISH
     Shepherd, Elizabeth. The Discoveries of Esteban the
     Black. Dodd, Mead, 1970.

AMERICAN NEWSPAPERS
     Fleming, Thomas J. Behind the Headlines; Great Moments
     in American Newspaper History. Doubleday, 1970.

ANIMAL DEALERS
     Johnson, Eleanor Noyes. Mrs. Perley's People. West-
     minster Press, 1970.

ANIMAL MIGRATION
     Gibson, Darlyne. How Far Can It Go? Reilly & Lee,
     1970.

ANIMALS, FOOD HABITS OF
     Wong, Herbert H., and Vessel, Matthew F. Pond Life:
     Watching Animals Find Food. Addison-Wesley, 1970.

     Johnson, James Ralph. Animals and Their Food. McKay,
     1972.

ANIMALS, MYTHICAL--STORIES
     Freeman, Barbara C. Timi, the Tale of a Griffin.
     Grosset and Dunlap, 1970.

ANIMALS--POETRY
     Brown, John Alan. Brown John's Beasts. Scribner,
     1970.

     Laird, Jean E. The Alphabet Zoo. Oddo Publishing,
     1972.

AQUATIC ANIMALS
     Andrews, Martin. Water Life. Platt & Munk, 1970.

ARCHEOLOGY AS A PROFESSION
     LaRue, Gerald A. Your Future in Archeology. Richards
     Rosen Press, 1970.

ARCTIC REGIONS
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     Voyages for the Discovery of a North-West Passage, with
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     May, Julian. The Arctic . . . Top of the World. Cre-
     ative Educational Society, 1972.

ART, AMERICAN--HISTORY
     Glubok, Shirley. The Art of the American Nation.
     Macmillan, 1972.

ATHLETES, AMERICAN--BIOGRAPHY
    Katz, Frederic. American Sports Heroes of Today.
    Random House, 1970.

    Hollander, Zander. Great American Athletes of the 20th
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ATOMIC POWER PLANTS
    Fuchs, Erich. What Makes a Nuclear Power Plant Work?
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AUTHORS, ENGLISH
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    graphical Fragment. Macmillan, 1970.

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AUTOMOBILE INDUSTRY AND TRADE--FICTION
    Butterworth, William E. Fast and Smart. Norton, 1970.

BALLET--FICTION
    Allan, Mabel Esther. We Danced in Bloomsbury Square.
    Follett Publishing Co., 1970.

BASEBALL MANAGING
    Hoopes, Roy and Spencer. What a Baseball Manager Does.
    John Day Co., 1970.

BASKETBALL
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    Mead, 1970.

    Knosher, Harley. Basic Basketball Strategy. Doubleday,
    1972.

BASKETBALL--STORIES
    Christopher, Matthew F. Johnny Long Legs. Little
    Brown, 1970.

    Cox, William Robert. Gunner on the Court. Dodd, Mead,
    1972.

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    Kuratomi, Chizuko. Mr. Bear in the Air. Judson Press,
    1970.

    Bond, Michael. Paddington Abroad. Houghton Mifflin,
    1972.

    Benton, Robert. Don't Ever Wish for a 7-Foot Bear.
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1970.

BEHAVIOR--FICTION
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tions, 1970.

BOTANY--EXPERIMENTS
    Budlong, Ware, and Fleitzer, Mark H. Experimenting
    with Seeds and Plants. Putnam, 1970.

    Rahn, Joan Elma. Seeing What Plants Do. Atheneum,
    1972.

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    Diaz, Paul. Up from ElPaso. Children's Press, 1970.

BUILDING TRADES--VOCATIONAL GUIDANCE
    McKibben, Galen. Building Trades. Dillon Press, 1970.

BUSHMEN
    Bateman, Walter L. The Kung of the Kalahari. Beacon
    Press, 1970.

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    Ducornet, Erica and Guy. Shazira, Shazam and the Devil.
    Prentice-Hall, 1970.

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    Rand, Edward Augustus. The Tent in the Notch. Books
    for Libraries Press, 1972.

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    Rivers and Waterways that Aided Transportation. T. S.
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    1972.

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    the Great Experimenter. Prentice-Hall, 1970.

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CHILDREN IN PORTUGAL
    Gidal, Sonia. My Village in Portugal. Pantheon Books,
    1972.

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Wortman, Arthur, comp. Father, We Thank Thee: Simple
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A Collection of Thirty Royalty-free One-act Plays for
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tions, 1972.

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dren. Holt, Rinehart and Winston, 1970.

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Bland, Edith (Nesbit). The Conscience Pudding. Coward
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CINEMATOGRAPHY
Bendick, Joanne, and Bendick, Robert. Filming Works Like This. McGraw-Hill Book Co., 1970.

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Peterson, John Lawrence. How to Write Codes and Secret Messages. Four Winds Press, 1970.

Gardner, Martin. Codes, Ciphers and Secret Writing.
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CIRCUS STORIES
Reuther, Ruth E. Gray C. Circus Horse. Houghton Mifflin, 1970.

Hoff, Sydney. Ida, the Bareback Rider. Putnam, 1972.

CIRCUS--RUSSIA
Harris, Leon A. The Moscow Circus School. Atheneum, 1970.

COAL MINES AND MINING--FICTION
Cookson, Catherine. The Nipper. Bobbs-Merrill, 1970.

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Beaney, Jan. Adventures with Collage. Warne, 1970.

Borja, Corinne and Robert. Making Collages. Whitman, 1972.

COLLECTORS AND COLLECTING--FICTION
Krieger, David. Too Many Stones. Young Scott Books, 1970.

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Summers, James L. Don't Come Back a Stranger. Westminster Press, 1970.

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Dietz, Elisabeth Hoffman (Warner). You Can Work in the Communications Industry. John Day Co., 1970.

COMPOSERS
Gass, Irene. Mozart: Child Worder, Great Composer.
Lothrop, Lee & Shepard Co., 1970.

Salsini, Barbara. Irving Berlin, Master Composer of Twentieth Century Songs. SamHar Press, 1972.

COOKERY
>   Paul, Aileen, and Hawkins, Arthur. <u>Kids Cooking: The</u>
>   <u>Aileen Paul Cooking School Cookbook</u>. Doubleday, 1970.
>
>   Meadows, Hank. <u>Cooking with Hank</u>. No publisher, 1970.
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>   Beers, Dorothy Sands. <u>ABC Alphabet Cookbook</u>. Schmitt,
>   Hall & McCreary Co., 1972.

COWBOYS
>   Honig, Donald. <u>In the Days of the Cowboy</u>. Random
>   House, 1970.
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>   Rounds, Glen. <u>The Cowboy Trade</u>. Holiday House, 1972.

CREATION
>   Bible. O.T. Genesis I-II (English, Jerusalem Bible).
>   <u>The Creation</u>. Doubleday, 1970.

CRIME AND CRIMINALS--THE WEST
>   Johnson, Dorothy M. <u>Western Badmen</u>. Dodd, Mead, 1970.

CRUSADES--FICTION
>   Collidge, Olivia E. <u>Tales of the Crusades</u>. Houghton
>   Mifflin, 1970.

DEPRESSION--1929--U.S.
>   Rublowsky, John. <u>After the Crash: America in the</u>
>   <u>Great Depression</u>. Crowell-Collier Press, 1970.

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>   Bronin, Andrew. <u>The Desert: What Lives There</u>. Coward,
>   McCann & Geoghegan, 1972.
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>   Henriod, Lorraine. <u>Peter and the Desert</u>. Putnam,
>   1970.

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>   Tyler, Margaret. <u>Deserts</u>. John Day Co., 1970.
>
>   May, Julian. <u>Deserts, Hot and Cold</u>. Creative Educa-
>   tional Society, 1972.

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>   Gibbs, Jessie O'Connell. <u>The Bishop's Basset</u>. Essan-
>   dess Special Eds., 1970.

DOGS--STORIES
>   Asch, Frank. <u>Rebecka</u>. Harper and Row, 1972.
>
>   Baker, Charlotte. <u>Cockleburr Quarters</u>. Prentice-Hall,
>   1972.

Brown, Judith Gwyn. Muffin. Abelard-Schuman, 1972.

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Merrill, 1972.

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Heide, Florence Parry. Giants Are Very Brave People.
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LeShan, Eda. What Makes Me Feel This Way? Growing Up
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Ziner, Feenie. <u>Bluenose, Queen of the Grand Banks</u>. Chilton Book Co., 1970.

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Noel, Bernard. <u>Sinbad the Sailor</u>. Doubleday, 1972.

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Wier, Ester. _The Straggler: Adventures of a Sea Bird_. McKay, 1970.

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Alderman, Clifford Lindsey. _The Royal Opposition: The Story of the British Generals in the American Revolution_. Crowell-Collier, 1970.

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