

BIBLIOMETRIC ANALYSIS OF READING
RESEARCH JOURNAL LITERATURE

by

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We accept this thesis as conforming to the required
standard.

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ABSTRACT

The results from a bibliometric analysis of reading research journal literature are reported in this investigation. The major purposes of the study were to: establish a sample of reading research literature; determine the core journal structure of the sample; describe developmental characteristics of the reading research journal literature; and illustrate disciplinary connections among journals reporting reading research.

Summaries from the Annual Summary of Research on Reading (ASRR) for the years 1959, 1964, 1968 and 1972 -- representing the years 1959 to 1972 -- provided the literature for analysis. 768 (84 percent of the total) of the journal articles appearing in the four summaries were collected and provided the referencing and cited sets of journal titles. Three major analyses were performed. In the first, the referencing collection of journal articles was described and sets of core journals listed. Developmental characteristics of reading research were described in the second using a number of bibliometric measures including average number of references per article, age of cited materials, type of publication cited, frequency of author self-cites, and patterns of multiple authorship both in the referencing and cited set of journals. In the third analysis, two clustering programs (UBC C-Group and Osiris Hiclust) were used to statistically group the core cited journal titles.

Core Journal Structure

Core journals were identified using three criteria: number

of articles appearing in the ASRR, quantity of references produced by the articles, and volume of citation in the referencing set of journals. For all three lists, the most productive journals accounting for 50 and 80 percent of the total articles, references and citations in the two sets of journal titles are identified. The journals isolated as the cores for the three lists follow the general Pareto distribution, confirming earlier work by Price (1965), Garfield (1972) and others, thus demonstrating the predominance of small cores of highly productive journals in the reading research information network. Comparison revealed the three core lists represent subject areas such as reading, growth and development, curriculum, educational research, general education, educational psychology and several areas of psychology. The discipline diversity of the journal titles increased markedly with the selection criterion based on volume of citation in the referencing set of journals.

Developmental Characteristics

Based on the results of the study, and comparison with research using other literatures, the following developmental characteristics for reading emerged. Reading research is becoming a more scholarly field using quantity of citations per article as a criterion. There is a slight movement toward a more immediate research front, indicated by age of cited materials, but this is not strong and the field still relies heavily on archival and near archival resources in its research. A movement toward generation of science-like paradigms may be developing, based on proportion of serial and monographic usage, but this is

tentative at best and not yet a pronounced trend. Reading research may be becoming more cumulative as indicated by increasing author self-citation. Finally, based on multiple authorship data, reading research is definitely becoming more collaborative.

Clustering of Journal Titles

Two statistical algorithms, one using correlational techniques and the other Euclidian distances in n-dimensional space, were applied to the 36 core cited journal titles. Intuitively acceptable journal groupings were produced in the cluster analysis with the two programs generally confirming each other. Ten journal groupings emerged. Three were somewhat ambiguous with the remaining seven illustrating strong interrelationships suggesting the existence of clusters of ideationally related content among subjects in journals reporting reading research.

Recommendations for further research include: statistical analysis of the dispersion of the identified core journal listings; comparison of the core cited journals with recent issues of the ASRR and ERIC's CJJE ; further study of author productivity in reading research; development of a Journal of Really Important Papers , analysis of conceptual research fronts in reading research; broader analysis of the extent to which archival sources are used in reading research; analysis of cited journal titles which emerged as clusters to delineate conceptual maps related to reading research; and development of a Reading Research Literature Citation Index based on the annual summary of research.

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CHAPTER I

STATEMENT OF THE PROBLEM

The published literature in a discipline provides the vehicle for communication and information transfer among the members of the discipline. A literature is a body of thought expressed in published writings and represents an archival record that can be carefully analyzed and studied. Many sources make up the print information system of a discipline, but the journal article constitutes one of the more important archival links. The major purpose of this study is to examine a collection of journal articles and use the data contained in their bibliographic references to describe some of the emerging characteristics of the field of reading research. The research was conducted in the tradition of unobtrusive measurement as described in the well-known work of Webb et al. (1965). In introducing their unobtrusive measures study of bibliographic citations in behavioral science journals, Parker, Paisley, and Garrett (1967:1) state:

The common element in this quite varied, highly pragmatic and usually imaginative research strategy is the observation and analysis of natural artifacts or traces of the phenomenon being studied, rather than measurement or observation that might influence behavior. There is little danger that the behavior being studied is atypical (as in some experiments); no danger that the responses are distorted to fit the predispositions of the questioner or the ideals of the

Note: This dissertation was formatted by computer using the UBC FMT documentation program available through the Computing Centre, University of British Columbia.

respondent (as in some observational techniques). There are obvious disadvantages in unobtrusive measurement: natural traces don't always provide direct answers about the behavior the researchers would like to observe, or ask about, or directly manipulate, and the imagination of the researcher is often taxed in the more complicated analysis and inference processes that the strategy often requires.

There are good reasons for examining the collection of research literature in the field of reading. In any discipline, the unobtrusive written record can be used to identify patterns of growth and development. For example, Kochen (1969) suggests that the primary concern of a new discipline should be with the conditions under which the growth of knowledge becomes stable. He notes that while knowledge grows in individuals by "natural learning processes", knowledge grows in communities by other natural processes, one of which is scientific growth and advancement. Patterns in the growth of knowledge, and in scientific change, can be revealed by analysis of the literature output of a discipline. Price (1963), in what has become a classic work, presented a series of unique information measures, based on counts of scientists and publications, that are useful in establishing the growth characteristics of any discipline. Kuhn (1962) suggests that linkages among bibliographic citations in a collection of journal literature can reveal the communication network which in turn defines subgroups of scientists who share similar paradigms. Such paradigms are still emerging in most disciplines, and patterns in their information bases, particularly in the cutting edge journal literature, reveal these changes.

The journal thus plays an important role in the communication network of any discipline. Analysis of journal

articles, which constitute the primary literature, can provide insight into growth patterns in reading research and the interrelationship of reading with other disciplines. The general goals of the present study include:

(1) specifying a time period and selecting a set of articles representing that time period to provide a collection of referencing reading research journal literature for analysis,

(2) describing the referencing collection of reading research journal literature,

(3) analyzing the bibliographic references contained in the referencing collection to:

-describe selected characteristics of the growth and development of the field of reading research,

-determine the patterns of interconnections among journals representing disciplines as cited in the referencing collection.

BACKGROUND AND SIGNIFICANCE OF THE PROBLEM

Most of the previously reported research involving bibliometric analysis of the reading research journal literature has consisted of tabulating frequency data on selected variables. These data have then been used to identify sets of important journals or to describe changes in the quantity of literature being published for specified time periods.

This study adds to such research, but another important dimension is included. Intensive analysis is made, for the first time, of the bibliographic references in the journal articles reporting reading research. The bibliographic reference, whether it is found in a footnote or in a bibliography, has been used in a number of ways in research on use of information and information sources. The value of such analysis is increasingly

recognized by other disciplines and falls under the general label of "citation analysis" in the literature of information science. Analysis of bibliographic citations provides data that can be used to pinpoint trends in the growth and development of the field of reading research. Through use of clustering algorithms, citation analysis can also reveal patterns of interdisciplinary relationships among the journals which are cited by the journals which report research in reading.

The research methodology of citation analysis is based on several underlying assumptions. First, it is assumed that it is possible to identify a source or set of sources for the references which are representative of the discipline being studied with respect to distribution and type of citation. Second, it is assumed that there is a positive relationship between an author's use of a piece of material and the citation of that material as a reference item in an article. That is, the author is citing all documents and sources used that are directly related to the work and that citations are not being made only for the purpose of increasing the number of sources or for the prestige value they contribute to the work. Third, it is assumed that the cited materials in an article are conceptually and substantively related to the topic under consideration and that materials from other disciplines indicate legitimate interdisciplinary connections with the field of the referencing article and reflect the transfer of ideas from discipline to discipline. Finally, it is assumed that frequency of citation does have a direct relationship to the value of the cited material. That is, a substantial correlation exists between

frequency of citation and the value of the work or journal being cited.

This is an appropriate time in the emergence of reading as a discipline for conducting a broadly based bibliometric study of the primary research-journal literature related to the field. There are several criteria which can be applied in judging whether a field of study is a discipline including growth in the number of people involved in the discipline, the role of the discipline in the academic structure, the existence of a national learned society, and the strength of the publication program and presence of journals to publish scholarly activity in the field.

The last twenty years have seen steady growth in the number of people involved in the field of reading. The International Reading Association has developed into one of the largest and fastest growing learned societies in the world, and provides a broad base for activities in reading. The Association also includes membership and chapters on an international basis. In terms of the role of reading within the academic structure, a recent IRA study (Guthrie, 1976) lists over 300 colleges and universities in Canada and the United States which offer programs leading to advanced graduate degrees in the field of reading. The IRA conducts extensive local, regional and international professional conferences, in addition to its yearly massive national conference on reading, and special symposia and institutes of various kinds. Another visible indicator of the status of reading as a discipline is the presence of an extensive publishing program including journals

such as the Reading Teacher, the Journal of Reading, and the Reading Research Quarterly.

Reading also falls within the category of an emerging research discipline. Donohue and Karioth (1966), basing their analysis on work by Berry (1965) and Hoselitz (1961), suggest that three conditions typify a new emerging discipline: (1) a set of problems exist which have attracted the attention of several investigators; (2) sufficient data has been collected to promulgate broad generalizations which focus on common features of the problems under investigation, and (3) the discipline has attained official or institutional recognition. In reading research, the problems, although as yet ill defined, are certainly recognized by the field. Data is widely available but has yet to be cumulated within a conceptual/theoretical framework adequate for broad scale generalization. Reading has attained official recognition, both institutionally and internationally, and thus qualifies as an emerging research discipline.

Increases in the volume of research journal literature, in particular, are strong indicators of the growth and development of reading as a discipline. There has been sustained and steadily expanding interest in research on reading for the past 50 years. Gray in 1925 noted the increasing volume of published reading research and organized the first comprehensive review of literature in the field. This landmark review covered 436 research articles published prior to 1924. Since publication of that first review, a summary of research related to reading has appeared on an annual basis for the past fifty years.

Summers (1968) reported a study which analyzed the yearly summaries and tabulated and compared their growth from their inception through the 1965-66 edition. A set of important core journals was specified based on a decade by decade analysis of the volume of articles produced across journals reporting reading research. Summers concluded that the 1965-66 summary listed better than four times as many journals carrying seven times as many articles as the first annual summary appearing four decades earlier. This represents a 400 percent increase in journals reporting reading research and a 700 percent increase in the number of actual articles reported. This approximates an exponential increase and approaches the information "flood" stage as described by Licklider in 1966. Along with this increase in productivity, Summers also noted an increased discipline diversity among the titles of the core journals producing the greatest volume of research articles. His analysis did not extend to the references in the articles in the summaries.

Kling (1971) later underscored the same discipline diversity noted by Summers based on his own evaluation of substantial quantities of reading research in the preparation of five comprehensive reviews for the U.S. Office of Education's Targeted Research and Development Program on Reading. Reading research appears to be shifting from a practically oriented, educationally based literature to a broader interdisciplinary focus. Examination of the contents of more recent annual summaries of research also reveals this changing pattern in the type of literature reported, and suggests that the disciplinary

base in reading research is broadening.

With the growth of reading as a discipline, the increase in volume of reading research reported, and the frequently offered hypothesis that such research is also broadening in its interdisciplinary content, the time seemed suitable for conducting a study which examines the archival record and adds to the description of the primary research journal literature in the field, pinpoints some of its developmental and growth characteristics, sheds light on the disciplinary interconnections among the journals cited in the reading research journal literature, and compares reading as a research area with other disciplines for which bibliometric data are available.

OBJECTIVES AND FOCUS OF THE STUDY

The initial task in the study was to establish a reasonable time period and specify a set of journal articles for analysis. Journals are preferred to monographs or other citation sources because they most adequately reflect current priorities and research fronts and interests in the field. They are the chief medium for the diffusion of emerging and developing areas of concern in a discipline. In addition, journals are refereed and thus have undergone professional screening and possess some measure of quality control.

The source of references being analyzed is the most critical factor in any citation study. To adequately reflect the characteristics of a subject literature, the references must be typical of the materials being used for research in that particular area. A standard approach in citation analysis is to

first subjectively generate a list of journals which are thought to be most relevant to the goals of the research. A variation is to spread this decision across a broader group by using a jury approach in selecting journals. Once the journals are selected, an appropriate time period is designated, and the articles produced by the selected set of journals during that period become the data base for the study. Many variations of this approach have also been reported, including selection and use of a single representative journal source.

In this study, the decision was made to sample the annual summary of research on reading (ASRR) in developing the data base of journal articles. This provides a sampling from the leading journals of the area being studied and accurately reflects the field of reading research. The time period was established as approximately 1959 to 1972 and the summaries for the years 1959, 1964, 1968, and 1972 were selected for processing. The rationale for these decisions is presented more fully in Chapter II. Basically, it was felt that use of the summaries maximized professional input in establishing the journal data base and in generating a reasonably representative set of heterogeneous journal articles for analysis.

Three major analyses comprise the study. In the first, information is generated that is used in describing the referencing journals from the ASRR which constitute the data base for the study. This involves determining the total number of journal articles listed in the summaries and specifying the actual number of articles obtained for analysis. The journals producing these articles are then tabulated. This data is also

used to define two sets of core journals for the ASRR based on rank ordered frequency counts of articles and the references contained in those articles.

The second analysis focuses on providing data which can be useful in indicating developmental trends in reading research as reflected by the journal literature. The data are analyzed to illustrate characteristics on the following variables: average number of references per journal article, age of cited materials, types of publications cited, frequency of author self-cites, patterns of multiple authorship in both the referencing and cited materials, and core journals based on the cited materials. All the above variables have been found to be of value in previously reported citation studies for illustrating developmental characteristics of a body of literature.

In the third analysis, the major objective is to group the cited journal titles contained in the journal articles which appeared in the ASRR using a statistical approach. Cluster analysis is used for this grouping with the total body of cited materials for the four time periods conflated into one set of data. In cluster analysis, the journals are grouped based on the way they were used by the authors who wrote the articles rather than ad hoc groupings based on the subjective analysis of referencing journal titles. Clustering provides a technique for automatically dividing a data set into natural groups without previously specifying the groups in any way.

The technique is applied to journals in the following fashion. The contributors to a journal will refer to or cite

articles in other journals. When the referencing behaviors of the contributors to one journal are pooled and treated collectively, it becomes possible to examine the "preference" that the journal has for other journals in terms of the frequencies with which it cites them. It is also possible to examine the varied preference that a journal obtains from a set of journals by examining the varied frequencies with which it is cited by them. The frequencies obtained by two or more journals may be compared by examining the similarities in their frequency patterns (examining for co-variance across the referencing set). Journals with similar patterns could be grouped or "clustered". Thus, similarities in referencing patterns provide a means of objectively organizing cited journals.

The actual mechanics of journal title grouping by cluster analysis have been accomplished using a variety of methods and algorithms. A general procedure in clustering studies has been to utilize more than one method to check reliability and compare results. This is particularly appropriate in studies with smaller samples of data. Therefore, two methods of clustering are applied in this study. For both methods, the input data is an $m \times n$ matrix, the rows (m) and columns (n) are labelled with the titles of cited and referencing journals respectively. The number of columns is the number of source journals (variables) and the number of rows is the number of cited journal titles (data points). The cells contain the number of citations from each referencing journal to each cited journal. Since the clustering programs group data points based on similarity of treatment across a number of variables, the cited journal titles

will be clustered based on similarity of treatment from the source journals. The matrix is first reduced to accomodate the program limitations and to increase the cell density of the matrix, and hence to accomplish the clustering on the more highly cited journals.

In one method (Osiris), Pearson Product-Moment correlations are calculated for each pair of cited journals based on their citation patterns across the referencing journals. The correlations are used as similarity measures on which the clustering is accomplished. In the second method (C-Group), cited journals are considered as pcints in n-dimensional space, and the clusters are based on the Euclidean distances between the points. Both programs begin with each cited journal considered as a separate cluster and then group the most similar two journals into one larger cluster which takes a pooled score from its composite journals. Both programs proceed stepwise until all cited journals are placed in one final cluster. Since the initial and final steps of the algorithms yield no information, and since what is of interest is the way in which the journal titles cluster, the results are illustrated in a dendogram (or branching tree diagram) which displays the clustering results from the first step to the last. An error term plotted beside each step indicates the relative jump that the program must make in order to accomplish the next clustering. This term may be used as a point of entry into the dendogram if natural clusters do exist in the data.

The results of such statistical grouping of journal titles can be examined and obvious similarities determined. The

descriptive words in journal titles contained in a cluster, as in, for example, The British Journal of Educational Psychology, suggest the disciplinary focus of the cluster. Since all the referencing journal articles contributing references were from an annual summary of research on reading, the resulting clusters can be examined for their interdisciplinary relationship to the field of reading.

LIMITATIONS

The following are seen as boundaries and limitations to the scope of this study:

1. The selection of the set of source journals will affect any analysis of citation data. However, it has been found that random selection of source journals does not provide particularly appropriate collections. Subjective selection is still the best approach. Citation studies are usually based on a set of journals designated by professionals in the field as being representative of the information network. In this study, the ASRR journal articles were designated as comprising the information base. The journal articles in the summary, covering the four time periods, were tabulated and the journals publishing those articles became the set of source journals. This approach seems more than adequate in light of discussions of source journal selection techniques described in other recent citation clustering studies.

2. The conclusions based on this study relate only to the reading research journal literature base defined as those journals which appeared in the ASRR for the four time periods. It should be also borne in mind that the four summaries were

selected to represent the broader time span from approximately 1959 to 1972. The ASRR does in fact contain only a partial (although considerable) sample of the total universe of journal literature reporting reading research for the time span covered. However, it is felt that, in the opinion of most professionals in the field, the ASRR would constitute an appropriate representative information base for use in a citation study of reading research journal literature.

3. A total of 918 journal articles appeared in the ASRR across the four time periods. Because of library limitations, and excessive costs, it was possible to locate only 768 of the originally cited articles. It is felt that the excluded articles constitute essentially a random deletion of material and their contents do not adversely affect the results of the study. The non-locatable material did not concentrate in any one journal or time period. In fact, a good many of the articles appeared in journals with only one citation and would, as a matter of course, have been eliminated from at least the cluster portion of the study. A total of 84 percent of the original articles were located and it can be reasonably argued that these in effect constitute a reliable representation of the journal literature information network for reading research.

4. The study is limited by the assumption that the results obtained reflect the referencing behaviors of researchers rather than the reviewing patterns of those assembling the ASRR. Because of the consistent production of the ASRR for a considerable time period, it is felt that some confidence can be placed in the procedures used to identify and obtain journals

articles that are truly representative of the field as a whole.

5. The study is also limited by the wide variety of referencing habits of various researchers. All references are treated here as if they are given equal weight by researchers, which is obviously not the case. Further, as noted by Ziman (1970), the citation is a carefully selected bit of evidence that a researcher uses after the fact to justify the place of his or her study in a legitimate and reputable context. As such it should not be construed as representing the researcher's total information gathering and usage behavior.

6. For the cluster analysis, the journal articles were conflated into one source set spanning the four time periods. It was not economically feasible to conduct a cluster study for each time period and compare the results over time. However, such an approach would make an interesting future analysis. Other studies have indicated considerable stability for clusters over time although the death of old journals and the birth of new ones does have an effect on the data. The descriptive portion of the study does examine trends over time while the cluster analysis discusses characteristics of the journal literature in terms of the reading research reported for approximately a decade time span.

7. The conclusions drawn from the study are dependent on the assumptions underlying the clustering techniques used and the adjustments to the data made to accommodate their models. The clustering techniques were selected after careful analysis of the problem to be attacked, and the clustering models available, in an attempt to generate the best "goodness of fit"

between the objectives of the study and the clustering techniques available. In addition, two techniques were used in examining the data to negate any adverse effects due to use of a single approach. This practice is becoming common in the field where the state of the art in clustering for various purposes is still emerging.

DEFINITION OF TERMS

For the purposes of the study the following definitions obtain:

1. Cluster Analysis : A method of grouping data points based on their similarity of performance across a set of variables without recourse to a preset classification system.

2. Citation : An acknowledgement received from another document.

3. Reference : An endnote or footnote which acknowledges another document. (This distinction between "reference" and "citation" is made to make it easier to distinguish between such descriptions as "core referencing journals", "core cited journals", "referencing authors", "cited authors", and so on.)

4. Cited Journal : The journal referred to in the bibliography of another document.

5. Referencing Journal : The journal acknowledging another document.

6. Reading Research Literature : Both a collection of journal articles defined by the compilers of the ASRR as related to the field or discipline of reading, and the literature cited by the articles in the ASRR.

7. Bibliometrics : The use of formal, quantitative methods

for analysis and management of literatures and their contents.

SUMMARY AND OVERVIEW

Citation analysis is an established research methodology using information from the archival primary literature of a discipline in order to comment on the structure and development in the discipline. Citation analyses are also well-known and much-used in bibliometrics--the use of formal quantitative methods for analysis and management of literatures and their contents.

The present study is a citation analysis of the primary journal research literature in the field of reading. The purpose of the study is to generate quantitative data from the primary literature which serves as a data base for comments on the structure and growth and development of reading as a research discipline.

The study has three major aspects: (1) the definition, collection, and computer storage of a representative body of journal references from reading research literature, (2) the analysis of those references to provide demographic data and tables, and (3) the measurement of the interconnectedness of the cited journals by the use of cluster analysis.

Chapter II presents the review of literature and the conceptual framework for the study. The design and methodology of the investigation are outlined in Chapter III. Chapter IV presents the analysis of the data and the findings of the study. Finally, Chapter V presents the summary and conclusions for the investigation, and suggests further research.

CHAPTER II

REVIEW OF THE LITERATURE

AND CONCEPTUAL FRAMEWORK

INTRODUCTION

The conceptual base for this study derives from a variety of fields which have been concerned either with describing the activities of science as a discipline or with description and control of the multifold increase of published literature. These often overlapping interests reside in such fields as the sociology of science (Merton, 1957), the history of science (Price, 1970; Goffman, 1966), the philosophy of science (Kuhn, 1962), and in a relatively new field which includes most of the above: information science (Kessler, 1963; Garfield, 1972; Margolis, 1967; and many others). Change and growth in science have been measured across a wide variety of variables. A good deal of attention has been paid to scientific communication in general and that contained in scientific papers in particular. A number of characteristics of scientific literature have been studied, including, for example, dispersion of literature, multiple authorship, amount of tabature, number of citations, and age of cited material [see the excellent reviews by Parker, Paisley, and Garrett (1967) and Donohue (1973)]. As Ziman (1970:77) noted in his article on the growth of information science and the study of information, scientific communication depends almost entirely on its fragmentary and derivative

primary literature. Scientific papers are fragmentary because, according to Ziman, "they are not meant to be final statements of indisputable truths, but as tiny tentative steps forward, as elements in a larger scheme." The papers are derivative because they lean heavily on previous research. The study of references in such papers is particularly important because it is the function of the reference to embed the referencing document within the conceptual structure of the field. The citations relate the paper to the state of the art in the discipline. Price (1970:6) makes the important suggestion that a document must be viewed as only a part of the embedding framework.

A scholarly publication is not a piece of information but an expression of the state of a scholar or group of scholars at a particular time. We do not, contrary to superstition, publish a fact, a theory, or a finding, but some complex of these. A scientific paper is at the same time more and less than a concept or a datum or an hypothesis. If the paper is an expression of a person or several persons working at the research front, we can tell something about the relations among the people from the papers themselves.

Citation studies have focused on the analysis of a number of different variables contained in the references in selected collections of scientific articles. The results have been used to delineate research fronts, identify invisible colleges, distinguish between "hard" and "soft" science, (Price, 1970); identify growth patterns of emergent disciplines (Goffman, 1966); identify key documents and establish such secondary bibliographic services as the Science Citation Index and the Social Science Citation Index (Garfield, 1975); and to reveal what may be general trends in the literature of the discipline, such as the growth of multiple authorship, the number of

citations per articles, and the proportion of citation to journals as opposed to books or monographs. A number of mathematical models have been borrowed, or developed, in attempts to identify and explain mathematical regularities inherent in scientific literatures. For example, Goffman (1966) made use of epidemic theory to explain the spread and growth of the literature in mast cell research. He found that the mathematical properties of the growth of research on a topic were similar to the growth curves observed in the spread of epidemics, such that there was a period of initial rapid growth, a peak, and then a rapid dropping off of frequency of published articles.

Other citation studies have made use of Pareto distributions (Pareto, 1897), Zipf curves (Zipf, 1935, 1949), Lotka's law (Lotka, 1926), and Bradford's law (Bradford, 1934), among many others, to create bibliographic models related to distribution of literary productivity, dispersion of articles on specific topics, and identification of core journals within fields and subfields. Recent studies, such as that reported by Donohue (1972, 1973), emphasize combining several bibliometric measures in analyzing collections of literature. Computer technology has extended the power of citation analysis by making it possible to examine the interconnectedness of journals as reflected in large collections of citations, as in those contained in a specific journal over a period of time (Broadus, 1952), or those contained in bibliometric tools such as the Science Citation Index (Arms and Arms, 1973). The Science Citation Index is probably the most significant application of

the bibliographic citation to information retrieval. The Index itself has generated a new group of studies which are beginning to verify some of the earliest assumptions of citation analysis.

Citation studies, and bibliometric studies in general, were originally concentrated in the hard sciences, but with the success of the methods, the techniques have been increasingly applied in the social sciences as well. Educational literature, with its sheer volume and dispersion, has long presented problems to those who would study or control it. Citation studies using educational literature have been reported (Broadus, 1953, 1965; Narin and Garside, 1972), but in the area of reading the closest work has focused only on counts of articles and journal titles published in reviews of research. This study extends previous work and broadens the base of analysis using citation data to indicate growth and development trends in reading research literature, locate interdisciplinary relationships, and describe the core journal literature related to reading research. The following sections present a selective review of research on the growth of science and scientific communication, and on citation analysis, to provide the conceptual framework for the bibliometric analysis of reading research journal literature which follows.

GROWTH OF SCIENCE AND SCIENTIFIC LITERATURES

This section examines information studies on science as a discipline and on scientific communication. The rationale for such studies is succinctly put by Nelson and Pollack (1970) in the preface to Communication Among Scientists and Engineers.

The assimilation and dissemination of information by scientists and engineers is an integral part of their research and development activities. With the realization on the part of scientists that they are confronted with an information crisis, much money and effort has gone into research on scientific communication and the development of information retrieval systems.

In fact, Kochen (1970:44) noted that the study of scientific communication has led to the development of a new science.

A new intellectual discipline seems to be in the making. It is the study of processes by which knowledge grows. It seeks conditions under which such growth is stable. Knowledge grows in individuals by natural learning processes. Knowledge grows in communities by other natural processes, such as scientific advance and revolution.

Kuhn (1962), in his well known work on the structure of scientific revolutions, suggested the possibility that fields (or schools) which have a shared consensus of theoretical opinion, which he labelled a "paradigm," differ from fields that do not, in that the former have a community of specialists (not necessarily concentrated in one institution) who share professional communication. He suggested a research technique whereby a shift in the distribution of technical literature cited in the footnotes to research reports ought to be studied as a possible index to the occurrence of revolutions.

In a recent application of Kuhn's suggestion, Small (1975:34) examined citation patterns in scientific literature and hypothesized that the actual set and configuration of highly-cited documents in a specialty provides a concrete representation of a paradigm for that specialty in Kuhn's sense of that term. Small developed maps of specialties over four year periods using the co-citation of highly-cited documents (from

five successive Science Citation Indexes , 1970-1974) as a basis for clustering and multidimensional scaling as inter-cluster similarity measures. The results markedly illustrated the shifts in the distribution of literature that Kuhn predicted.

Fully one-third of the specialties over the four year period underwent sudden major shifts in the set of cited documents. Based on these cases, we anticipate that specialties undergo, on the average, one revolution every 12 years.

Similar attempts to describe professional communication and the other methods that scientists use to gain access to information have inspired a wide variety of research. Parker and Paisley (1966) reviewed the literature on the study of information use in science. They noted seven frequent methods of investigation: questionnaire, interview, and diary studies; participant-observer studies; sociometric analyses; experiments and quasi-experiments in field settings; laboratory experiments involving motivation for information seeking and cognitive organization of information; document analyses; and computer-based research.

Document analyses have been particularly attractive to researchers for a number of reasons. Compared to, for example, questionnaire data, document data is relatively easy to obtain, is organized in various handy and revealing collections across all sciences and applied fields, and exists in a dated and tabulated archival form. Further, document analyses are attractive because they may reveal a much more accurate picture of science than can be obtained in such sources as textbooks and other such secondary derivative literature. Carpenter and Narin (1973:425) commented, "There is an inherent challenge to

structuring the [journal] literature, since it may well reflect the mosaic of scientific knowledge." The idea that the literature can be used to reflect the mosaic of scientific knowledge is also expressed in slightly different form by Price (1965:515).

It seems clear that in any classification into research-front subjects and taxonomic subjects there will remain a large body of literature which is not completely one or the other. The present discussion suggests that most papers, through citations, are knit together rather tightly. The total research front of science has never, however, been a single row of knitting. It is, instead, divided by dropped stitches into quite small segments and strips. From a study of the citations of journals by journals I come to the conclusion that most of these strips correspond to the work of, at most, a few hundred men at any one time. Such strips represent objectively defined subjects whose description may vary materially from year to year but which remain otherwise an intellectual whole. If one would work out the nature of such strips, it might lead to a method for delineating the topography of current scientific literature. With such a topography established, one could perhaps indicate the overlap and relative importance of journals and, indeed, of countries, authors, or individual papers by the place they occupied within the map, and by their degree of strategic centralness within a given strip.

Journal citations provide the most readily available data for a test of such methods.

Price is suggesting a number of concepts which are central to information science in general and to citation studies in particular. First, because of its social role, there is a good deal revealed in scientific literature beyond its substantive content. Second, scientific literature can be used to map and define the topography of science, and therefore, mathematical regularities can be observed in the growth of science and its literature. Third, such studies can be useful in the identification and retrieval of key documents and the identification of core journals.

Before turning to a review of citation studies, it is worth noting that there is wide consensus of opinion among information scientists about the existence of consistent patterns in many aspects of scientific communication. Lotka (1926) reported on the frequency distribution of scientific productivity in chemistry and physics. Goffman (1966) and Goffman and Newill (1967) attributed epidemiological properties to the spread of ideas through a population of scientists. Goffman and Warren (1969) found support for Bradford's Law of Dispersion in literatures relating to research in schistosomiasis and mast cell literatures. Rapoport (1953) comments on the mathematical theory of information that was born among communication engineers such as Shannon and Weaver (1949), and which relates the behavior of information (or order) to the law of entropy. According to this theory, "the process of obtaining information is quantitatively equated to the process of ordering portions of the world."

Thus, many information studies have sought to identify and apply the mathematical regularities to be found in collections of citation data. This study extends such research and examines a variety of growth characteristics revealed in the citations in a body of reading research journal literature.

CITATION ANALYSES

Citation analysis has a long and interesting history in bibliometric research and information science. Carpenter and Narin (1973), in their review of the history of research on scientific literature, noted that early works by Coles and Eales (1917), and Hulme (1923) attempted to relate publication and

author counts to external economic and political events. Gross and Gross (1927) were the first to relate frequency of citation with importance and made recommendations about journal purchase based on citation counts in the Journal of the Chemical Society. A burst of papers by science librarians followed these early works, but with the exception of Bradford's 1934 analysis (which will be discussed later in this section), the late 30's and 40's were not productive in terms of literature analyses. Carpenter and Narin (1973:425) commented on the more recent growth.

In the 1950's there was a gradual re-emergence of analysis of the literature and, as science becomes large in the 1960's, more and more attention was focused on managing the large and rapidly growing scientific enterprise. Price made use of a number of literature counts in devising his macroscopic outlines of the scientific enterprise. Citation counting began to attract more and more attention as a potential means of structuring the scientific literature.

As noted in the introduction to this chapter, citation data have been used for a wide variety of analyses, including: the evaluation of researchers (Cole and Cole, 1967) and the quality of research (Cole and Cole, 1971); the evaluation of articles (Margolis, 1967) (Garfield, 1975); of journals (Garfield, 1972); the design of information systems (Arms and Arms, 1973); and in understanding collections of literature (Donohue, 1973). Within this broad variety of citation literature, this review focuses on research which relates most specifically to the goals of the study, and includes representative studies which used citation analysis to examine (1) core journals, (2) citations per article, (3) age of cited documents, (4) types of cited documents, (5) self-citation, (6) multiple authorship, and (7) cluster analysis of journal titles.

Core Journals

Studies of document dissemination have made use of distributions related to the dispersion, utilization, and scatter of recorded knowledge. The exploration of various empirical distribution laws is based on the desire to provide practical information systems built on the basis of some formally observed properties of communication. Bradford (1934) published a study of the dispersion of articles on specific topics. He found that when he ranked periodicals containing articles to a specific topic, then divided the collection into three parts such that each part contained the same number of articles on the topic, the number of journals in each part increased geometrically. This led to the concept that there was a nucleus or core of journals in a topic, field, or discipline. Fairthorne (1970:523), in a very complete review of the empirical distributions used in bibliometric description and prediction, suggested that there may be a number of names for essentially the same function.

Different manifestations of the hyperbolic distribution for both discrete and continuous variables are found in many fields and named variously after Fechner, Zipf, Pareto, Bradford, Willis, Berger-Mandelbrot, and others. But these are names associated with particular manifestations of this type of behavior, not names for the type of behavior itself.

Pareto (1897), for example, was an economist studying the distribution of wealth, while Zipf (1949) was studying the distribution of words based on the frequency of their occurrence in text. These various manifestations of hyperbolic distributions are referred to by Fairthorne as "Stable Paretian Laws" (after Pareto).

Price (1963) used the Pareto distribution in examining a variety of indicators of scientific literature growth and distribution. Of particular interest here is his adaptation of the Paretian distribution in a simple square root calculation to conclude that although 30,000 journals were estimated to exist, half the reading that was done used only the 170 most popular items. That is, according to the data then available from the Science Citation Index, if the citation of a journal is taken as a measure of its use, and if the journals are rank-ordered in terms of frequency cited (or used), then 170 journals out of the total of 30,000 will receive 50% of the total number of citations.

Garfield (1972:476), using the massive amount of citation data available in the Science Citation Index, did a similar analysis. He ranked journals by frequency of citation, and found that a small group of 250 journals were named in almost half of the 3.85 million references processed for the SCI in 1969. He concluded that "the predominance of cores of journals is ubiquitous," and such data provide conclusive support for Bradford's bibliographic law.

The data reported here demonstrate the predominance of a small group of journals in the citation network. Indeed the evidence seems so conclusive that I can with confidence generalize Bradford's bibliographic law concerning the concentration and dispersion of the literature of individual disciplines and specialties. Going beyond Bradford's studies, I can say that a combination of the literature of individual disciplines and specialties produces a multidisciplinary core for all of science comprising no more than 1000 journals. The essential multidisciplinary core could, indeed, be made up of as few as 500 journals if, for example, one is attempting to satisfy the needs of libraries in developing countries.

Citations Per Article

Citation habits differ widely from author to author, but averages across collections of literature may yield reliable data. Parker, Paisley, and Garrett (1967:62) suggested that as a field becomes more mature, it will exhibit an increased number of citations per article. They found increased average citation rates in eight social science journals across the fifteen year span studied, from 8.4 citations per article in 1950 to 15.2 in 1965. Tremendous variance in the citation habits between journals was also noted. For example, Psychological Bulletin had an unusual median of 36.5 citations per article, American Sociological Review and Journal of Abnormal and Social Psychology had 18.0 and 12.0 citations per article respectively, and American Documentation had 3.7 citations per article. They related increases in average citations per article to emergence of a field as a research discipline.

It is a reasonable inference that a small number of citations indicates an emerging field, because the number of citations is increasing with time across the set of journals, all of which represent fields in early or intermediate stages of evolution as disciplines.

Price (1970:7-8), in his study of citation measures of hard science, soft science, technology, and nonscience, using Science Citation Index data, reported that there seems to be a slow but steady increase in referencing in all fields. While notable exceptional documents exist, the amount of referencing in a paper can be related to the "scholarliness" of that document.

The etymology of "scholarship" indicates that it derives from the scholia, the added explanatory footnotes put into school texts, so perhaps it is reasonable to identify the amount of such footnoteage and referencing with our intuitive idea of

"scholarliness."

Price noted that the general norm of scholarliness is a paper listing about ten to twenty-two references. The amount of citation varies greatly within fields because of the existence of review papers, research papers, and ex cathedra pronouncements by experienced scientists in unreferenced papers. Also technologists, scientific scholars, and unscientific scholars all tend to have different citation habits. Price warned that amount of referencing by itself is not totally valid for discriminating science and nonscience, hard and soft. Nevertheless, citation counts across collection of articles provide a useful tool for analysis of developmental trends and the general level of scholarship within a discipline. Price suggests:

Scholarliness as I have defined it may be taken not just as a diagnostic but also as prescriptive for a cumulating knowledge system.

Age of Cited Material

The age of material cited at the time of citation has been used as an indicator of the relative importance a field assigns to its archival literature. That is, median age of citations can reveal to what extent a field (or publication, or researcher) favors a recent body of publications over older literature. Broadus (1965), in an analysis of the references used in the 1950 and 1960 Encyclopedias of Educational Research, found that the median age of cited materials changed from 12 to 7 years over the ten year span of the two books. He suggested that such information should be considered seriously when building library collections of educational materials and attempting to develop a

decision structure for information subscriptions in research libraries.

The extreme contemporaneity of some scientific citation fits the intuitive model that views research as a cumulative process by which new knowledge grows from relatively recent findings, in pyramid fashion. Cole and Cole (1967) found that papers in physics have a "half-life" of no more than five years; that is, at least half the citations in any year are to work published within the five preceding years.

Price (1970:9-10) reviewed a number of measures which could be used to distinguish between science, hard and soft, and technology and nonscience. His experimentation and experience with the vast number of references available in the Science Citation Index, led him to conclude that age of cited material could serve as the basis for such discriminations. The measure he developed takes the proportion of references dated within the last five years as an indicator of whether a field (or author, or journal) relied upon a research front, a general archive, or some combination of the two. Price's index is a deceptively simple measure. Price felt his earlier work had conclusively shown that there was not a single population of references, but two overlapping ones.

On the one hand there was a fairly uniform raiding of the archive of all the available literature, past and present, with only a slow secular decrease in the usefulness of literature as a function of its age. Secondly, there was something which I called an "Immediacy Effect," a special hyperactivity of the rather recent literature which was still, so to speak, at the research front.

Thus, the index gives a proportion between the research front immediacy and the normal archival use of the literature,

while measures such as "half-life" simply give a profile of the fall-off in immediacy effect. More significantly, Price pointed out that his index is a tool for distinguishing between modes of scholarship which are "cumulative" versus "noncumulative," or "scientific" versus "nonscientific."

...it would seem that this index provides a good diagnostic for the extent to which a subject is attempting, so to speak, to grow from the skin rather than the body. With a low index one has a humanistic type of metabolism in which the scholar has to digest all that has gone before, let it mature gently in the cellar of his wisdom, and then distill forth new words of wisdom about the same sorts of questions. In hard science the positiveness of the knowledge and its short term permanence enable one to move through the packed down past while still a student and then to emerge at the research front where interaction with one's peers is as important as the storehouse of conventional wisdom. The thinner the skin of science the more orderly and crystalline the growth and the more rapid the process.

Price was able to give an estimate of the range of values of his index but noted that the growth rate of the literature also affected the measure.

...we may note that a literature growing at a rate of 5 percent per annum doubles in size in 13.9 years and contains about 22 percent of all that has been published in its last five years of publication. A field growing at the most rapid rate experienced of 10 percent per annum, with a doubling time of 6.9 years, has within the last five years about 39 percent of all its archive. Price's Index (as I might call it) will vary from 22 percent for normal growth to 39 percent for most rapid growth for a field that is purely archival, raiding all the literature that has gone before equally, with only a gradual secular decline with aging, and without this special immediacy of an active research front.

In work reported since that of Price, Garfield (1972:476) analyzed the overall chronological distribution in each edition of the Science Citation Index and concluded:

An analysis of this distribution has shown that the typical cited article is most heavily cited during the 2 years after its year of publication. (In any given year, 21 to 25 percent of all references cite articles that are 3 or fewer years old.)

Parker, Paisley, and Garrett (1967) found that in 17 social science journals in four time periods across the 15 years from 1950 to 1965, the percentage of citations dated 0 to 4 years before the referencing publication was relatively stable at close to 40 percent and those dated 5 to 9 years were also stable at about 26 percent. In other words, from 1950 to 1965, the mean percentage of citations in this sample of social science which were less than 10 years old was slightly over 65 percent for all four time periods recorded. Broadus (1971) reported that the median age of cited material in education had dropped from 12 to 7 years from 1950 to 1960.

Type of Publication

Type of publication simply analyzes whether the reference being cited is a book, article or other kind of medium. The types of publications referred to in references vary greatly from discipline to discipline. Price (1970) noted that in the average journal article, 80% of the citations are to other serial publications rather than to books, theses, reports, and unpublished work. Parker, Paisley, and Garrett (1967) found 43% of the citations from 17 selected behavioral science journals were to journals and 31% were to books. Lin and Nelson (1969:49) found striking differences between the types of publications in three major sociological journals when compared to those in a major optical journal. They presented a variety of hypotheses to explain the greater proportion of reference to books in the

sociological journals (about 50%) when compared with that in the optical journal (about 15%). Of particular interest here is their reference to paradigms.

Assuming that optics is an old, well-established science with a history of paradigms, and sociology is a younger and less established science without rigorous paradigms, then the results seem to lend support to Kuhn's hypothesis, drawn from a study of the history of science, that disciplines with paradigms tend to publish their work in journals, while disciplines without paradigms tend to publish in books.

Broadus (1971) reviewed a number of citation studies which referred to the form of the publications cited: Martin (1952), in political science, found 51.3% of references to "monographs," while in economics, Livesay (1953) and Mark (1956) reported finding 51.3% and 47.6% to "monographs." Quinn (1951), Meier (1951), Broadus himself in 1952 and again in 1967, showed that in sociology 45.2% and 55.6% referred to "monographs" and 53.7% and 61.5% to "non-serials." Sarle (1958) reported that in business administration 32.6% of the references were to "monographs." In education, Broadus (1953, 1965) discovered 30.9% and 32.7% of references were to books. Guttman (1966) found in general social sciences that 43.9% of references were to "treatises" and "monographs," while, in the same area, Earle and Vickery (1969), found 46.2% of references to books.

Broadus (1971:241) noted the difficulties inherent in comparing the studies due to the slightly different meanings assigned to terms like "book," "monograph," and "serial." Nevertheless, he felt that some comparison was possible.

The proportions take on a meaning when compared with data obtained from citation studies in other disciplines. Vaughan, in music, found that 69.5 per cent of the references were to "monographs"; Tucker, in philology, classified 60.4 per cent as "monographs." Simonton, in his study of fine arts literature as a whole, discovered that 71.4 per cent of the citations referred to "books." Fussler's analysis for 1939 showed chemists using 5.21 per cent "monographs," while physicists were using 7.75 per cent. Craig found that "books" used in geology made up 17.5 per cent of the total references in 1960; 21.5 per cent in 1965.

With one exception each of the studies dealing with the literature of the humanities showed a higher percentage of citations referring to "books" or "monographs" than did any of those in the social sciences. Apparently, however, physical scientists use many more serials than monographs, and the contrast with the social sciences is notable.

Self-Citation

Comparatively little work has been done in relation to the number of times an author refers to his or her own work. Parker, Paisley, and Garrett (1967:29) found trends toward increased frequency of citing own work in eighteen behavioral science journals across four time periods. The percentages increased steadily from 33% in 1950 to 38% in 1955, to 44% in 1960 and to 46% in 1965.

These figures might reasonably be interpreted as indicating an increased commitment to cumulative research by those working and publishing in this interdisciplinary behavioral science area. If that is so, then the percentage of citations to own previous work might be taken as indicators of the stage of development of a subfield of science, with higher frequencies interpreted as more cumulative (and, presumably, more theoretical) research.

Multiple Authorship

Co-authorship is increasing generally in science, and most rapidly in fields which receive proportionally more economic support. Price (1963) noted the movement toward increased

collaboration in data from Chemical Abstracts . Clarke (1964) could find no marked trend toward multiple authorship in biomedical writers. The average number of authors per paper in this group remained steady (from 1946 on) at about 2.3. Clarke speculated that there may be considerable collaboration variance between different groups of scientists due to conditions other than the growth of "Big Science" as suggested by Price. Parker, Paisley, and Garrett (1967) observed that number of authors per article had been shown to correlate with whether or not financial support for research was reported. In their research on behavioral science journals, they reported that the average number of authors per article was 1.34 with a range of 1.1 to 1.8 across journals. Lin and Nelson (1969) examined the mean number of authors per article in three core sociological journals and found it to be approximately 1.4. Price (1970) felt his research demonstrated that collaboration arises more from economic than intellectual dependence. He concluded that the amount of collaborative authorship measures no more than the economic value accorded to each field by society.

These studies contained authorship data based on collections of documents, not on citation data. The only article located which examined joint authorship in citation data was by Xhignesse and Osgood (1967). They found that 59% of the articles cited were by single authors, and 41% by two or more. Apparently, historical analyses of multiple authorship trends in citation data are not very common, even though the archival nature of the citations can permit extensive historical research.

Clusters of Journal Titles

Clustering provides a method of identifying groups within collections of objects without recourse to preset classification. This statistical method can be used to group together sets of journals with similar patterns of citation. The application of clustering techniques to citation data is relatively new. Kessler (1963a, 1963b, 1965) used the method of bibliographic coupling to link both articles and journal titles. He created two step maps which defined the unit of coupling as "one item of reference used by two papers."

Xhignesse and Osgood (1967) used the multidimensional scaling of the reciprocal citation among 21 psychology journals to produce clusters of interesting journals. Their methods produced, in their words, "several identifiable clusters of journals."

Price and Schiminovich (1968) created a clustering program based upon the extension of bibliographic coupling through the use of the computer. They applied their technique to a collection of 240 theoretical high energy physics papers. They felt their classification scheme had validity for use in literature dissemination systems.

A key study by Carpenter and Narin (1973) made use of two similarity measures between journals as the basis of title clustering. The first is a Euclidean distance measure based on a cross-citing matrix and the other is a rank correlation measure also based on citations received from other journals to the compared journals. They used their procedure to cluster 288 highly cited journals in molecular biology, physics, and

chemistry. The resulting clusters could be identified by national, subject, and subdisciplinary divisions.

A research project (DISISS) based at the University of Bath, in England, attempted to carry out the research necessary for the effective design of information systems in the social sciences. An excellent working paper by Arms and Arms (1973:10) describes in detail their work on the clustering of journal titles by citation data. They developed a technique referred to as the Scicon method and compared it to other approaches and algorithms. Since their concern was with the development of a technique, their conclusions are basically guidelines to be considered in future journal-title clustering attempts. Arms and Arms main objective in applying cluster analysis to bibliographic data was to provide criteria for structuring bibliographic files. They acknowledged that the data obtained could be used in a number of ways, and of particular interest here is their comment about structure in relation to emergent disciplines.

Journal title clusters provide data on the structure of the primary literature in a discipline. From this general picture new fields can be identified, either by comparison with earlier results or because unexpected patterns are displayed.

BIBLIOMETRIC ANALYSIS OF READING RESEARCH JOURNAL LITERATURE

The studies reviewed in the previous sections provide methodology and a useful conceptual base for organizing a bibliometric analysis of the journal literature related to reading research. Such an analysis is predicated on the assumption that the field (area of knowledge or learning) of reading can be viewed as a discipline, in the broad sense of

that term, and that it is reasonable to analyze and speculate about the written behavior of people working in the discipline. The citations contained within a body of reading research literature represent a sample of the written behavior of reading researchers. As such, they constitute a relatively unobtrusive measure of citation habits and information sources.

A time trend sample of reading research journal literature, then, in light of concepts and methodologies from this review, could be examined in terms of several bibliometric characteristics including: (1) core journal structure, (2) number of citations per article, (3) ages of cited documents, (4) types of cited documents, (5) proportions of self-citations, (6) frequencies of multiple authorships, and (7) inter-journal structure as revealed by cluster analysis of journal titles. The following section discusses the rationale for the application of each measure in the analysis of reading research journal literature conducted in this study.

Time Sampling

Samples of journal articles reporting reading research should be selected over time because the study focuses on patterns of growth and change, as exhibited through various bibliometric indices, rather than a single point in time. In his study of the Annual Summary of Research on Reading (ASRR), Summers (1968) found a steady increase in journals reporting reading research, and in the number of articles reported, until approximately 1958-1959. From that point onward there was an almost geometric spurt in growth and a sharp increase in the amount of reading research reported. Thus, the time period

sampled should begin with the 1958-1959 spurt in reported research. In addition, following Small's recent 1975 analysis, it also seems reasonable to examine growth characteristics in the specialty of reading covering approximately a twelve year span. Thus, the upper limit of the period sampled should be set at 1972. Because of the volume of data involved, it would not be feasible to analyze each of the annual research summaries (13 in all) for the total time period. Therefore, four spaced summaries (1958, 1964, 1968, 1972) should be selected to provide a sample to represent gross trends for the total time period.

Small (1975), Arms and Arms (1973), Narin and Carpenter (1972), and Xhignesse and Osgood (1967) all found considerable stability in citation structures over time. Therefore, while the developmental measures for the study should be selected and compared using the four separate annual summaries, the journal title clustering can be accomplished by combining the data across the four individual yearly summaries.

Core Journals

Summers (1968) identified a core journal structure in reading research based on ranked frequency of number of articles reported annually in the ASRR. That is, in the year 1936/37, the Elementary School Journal was the highest ranking journal because it contributed 12 of the 79 journal articles reported for that year. In this study, computer coding and storage of the data can facilitate obtaining three types of core journal lists. The first list specifies the core of journals which produce the bulk of the articles listed in the ASRR for the four selected time periods and for the separate periods combined. The second

list specifies the core of journals whose articles produced the greatest number of references for each of the four selected periods and for the four separate periods combined. The third list specifies the core of journals most often referenced (or alternatively, which received the greatest number of citations) for the four selected periods and for the four separate periods combined.

Tabulating core journals by three methods can offer a basis for confirmation of Garfield's (1972) statement that the predominance of cores of journals is indeed "ubiquitous." The results can serve to substantiate findings across many disciplines, and across the Science Citation Index in general, which suggest that a small core of journal titles account for the preponderance of the citations (and articles and references) in the reported research in the discipline. The three lists can also be extremely useful in developing a decision structure for monitoring the most frequent journals producing reading research based on number of times cited in the ASRR, number of references produced, or citations received.

Citations Per Article

As noted previously, it is reasonable to identify the number of references in a paper with our intuitive idea of scholarliness. Therefore, a rough index of the scholarliness of reading research can be obtained by calculating the norm of referencing in reading research papers. Further, since there seems to be a steady increase in the average number of references per article in all fields, the data can be analyzed using this measure to determine if trends toward more scholarly

research are evident in the literature of reading research over the time period covered by the study.

Age of Cited Material

Reading research is certainly not a new field in the same sense as mast cell and laser research. Considerable research has been reported since the early 1900's. The first summary in the 1925 ASRR included 436 research articles relating to reading reported during the late 1800's to June 30, 1925. From then to 1966 alone, the ASRR reported more than 5000 research documents. Thus, an archival literature exists spanning approximately a century of reported reading research.

Determining the distribution of the ages of cited material in a recent sample from that collection, and calculating Price's Index, can indicate if a research front exists in reading similar to other disciplines and whether or not that research front is changing its fundamental nature across time.

Type of Publication

Broadus (1971) noted that researchers found that the literature of the humanities showed a higher percentage of citations to books or monographs than did the social sciences, and that physical scientists use many more serials than monographs, in striking contrast to the social sciences.

Determining the relative proportions by which reading research literature cites books, journals, and other types of publications can permit a comparison of reading with other social sciences. Again, through time sampling, comparison and trends over time can be indicated.

Self-Citations

Self-citation can indicate a commitment to cumulative research. Determining the proportion of reading research documents which contain at least one self-cite to those which do not can permit comparison with results from other social science disciplines, such as those reported by Parker, Paisley, and Garrett (1967).

Multiple Authorship

Significant conclusion oriented educational research, particularly in North America, is usually heavily funded by foundations and governmental agencies. Such research is program or project oriented, involving investigative teams, rather than being pursued by the individual researcher operating in isolation. If Price's (1970) conclusions on increases in multiple authorship are valid, reading research should demonstrate an increase over time in the average number of authors per paper. This should be particularly true of research conducted in the United States. In addition, growth in multiple authorship over time can be determined using the authorship of the references as opposed to the authorship of the articles in the ASRR. Since references are dated, the sample can permit analysis on this particular variable on 30 years of prior published reading research literature.

Cluster Analysis

Cluster analysis, as a tool for structuring bibliographic data, is still in an exploratory stage, as was demonstrated by the 1973 Bath University study. Journal title clustering,

though, can provide a useful method of roughly structuring the primary research literature in the discipline of reading. At worst, a cluster analysis would present amorphous clusters of journal titles which would not follow any intuitive sense of discipline and subdiscipline patterning. At best, the method would reveal intuitively related sets of journals (i.e. general education, educational psychology, psychology, sociology, etc.) which could be used to identify the inter-disciplinary contributions to the information base in reading research.

SUMMARY

The desire to understand, often identified as the goal of pure science, and the desire to produce products and to control, often identified with technology, are not easily distinguished in information science. For example, one of its methods, bibliometric analysis, appears to have grown co-jointly from the desire to understand the growth of knowledge and from the need to control an exponentially-growing published literature.

Over time, philosophers, historians, and sociologists of science, and science librarians have come to share similar methods--in particular, the technique of citation analysis. The former were concerned with citations because they contained a written history of the relationships among scientists, disciplines, and institutions. Rarely had researchers been presented with such a well-dated and well-tabulated archival record of their subject matter. Science librarians, of course, perceived that citations represented a record of the information usage of scientists, and could, therefore, be reliably used to make evaluations and recommendations in structuring and ordering

information delivery systems.

This twofold interest in citation analysis is illustrated in the ways in which the Science Citation Index and the Social Science Citation Index are used. The SCI organizes 4 million sources of citations which have appeared in 2,600 of the most important scientific journals since 1961. A similar technique is used in the SSCI with social science journals. Primarily, the SCI is an information retrieval system, but much of the work of such major scientific historians as Derek DeSolla Price and others is based upon SCI data.

Citation research, as with information science in general, is a relatively new phenomenon, but ample quality work has been done in the last decade and a half to establish its methodology and test its reliability and validity.

Reading research can be viewed as an emerging discipline and is a field in which bibliometric methods can be productively applied. Five factors support this contention. First, an extensive primary journal system exists and has been under good yearly archival control for some time. A number of active professional associations, such as the International Reading Association and the National Reading Conference, exist and knit researchers and research efforts together through various information efforts. They also generate an extensive secondary information system which produces major reviews, research summaries and other state-of-the-art products. In addition, reading literature is included in an extensive information system developed for education as a whole (ERIC).

Second, previous bibliometric research such as that

conducted by Summers (1968), Mayes (1973), Kling (1971), Raygor et al. (1974), and by Weintraub et al. (1976), have brought the state of the art in the field of reading to a point just short of extended descriptive analysis and citation analysis.

Third, an ample number of citation studies have been conducted in the sciences and the social sciences in general, and in education in particular, to provide legitimate comparisons based on an array of bibliometric variables.

Fourth, the major reviews in the field of reading have reached the stage where difficulties are being encountered in selecting and covering the most relevant journal literature. Research could provide a better basis for the reviews of the future.

Fifth, perhaps common to educational research as a whole are questions about the type and quality of research in a field which is heavily practitioner oriented. The fundamental question asks, "Just how scientific and interdisciplinary is reading research?" Reading has been one of the most heavily research-oriented of the education disciplines, and a number of indicators, such as the relatively recent development of a new research-oriented journal (Reading Research Quarterly), and the dramatic membership growth of the International Reading Association, may suggest a trend toward increased scientific awareness in reading research in particular, and in educational research in general.

In summary, the focus of this study is on the description of selected developmental characteristics and patterns of growth and structure within a collection of reading research journal

literature. The conceptual base, design and methodology derive from the review and analysis of selected, related literature in the areas of information science, citation studies, and reading research. The study makes use of a number of measures which satisfy the requirements of effective citation analysis in answering questions germane to the study of reading research journal literature.

CHAPTER III

DESIGN, METHODOLOGY, AND STATISTICAL ANALYSIS

The purposes of the study required that a set of articles be specified to represent the reading research journal literature for the approximate time period 1959 to 1972. The ASRR for the periods 1959, 1964, 1968, and 1972 were designated as the journal literature collections. (At this point it is worth re-emphasizing that according to the definitions of this study the terms "reference" and "citation" are differentiated in the following fashion: a reference is given and a citation is received.) The articles contained in these summaries were tabulated and the journals producing them became the referencing set of journals. The references contained in the articles were tabulated and the journals producing them became the cited set of journals. The sections which follow present the design, methodology and statistical procedures used in developing the collection of journal articles which served as the data base, determining the developmental characteristics of the reading research journal literature, organizing and applying the clustering methodology, and describing the interdisciplinary nature of the reading research literature.

DEVELOPMENT OF THE JOURNAL LITERATURE COLLECTION

This section describes the development of the referencing reading research journal literature collection. Copies of the ASRR were obtained for the four time periods and photocopies made of the referenced materials for each summary. Since the study was concerned with the journal literature, only journal articles in each of the four summaries were identified and prepared for analysis. Each specific reference was glued to a 3 x 5 card. An attempt was made to locate a complete copy of each article and to photocopy the references listed throughout and at the end of the article. These copies were then stapled to the appropriate journal article card. Some journal articles were not located because the UBC library did not subscribe to some journals and because some journals were either lost or on extended loan and could not be retrieved. It was also not possible to include some specialist and foreign journals.

The next step was to prepare the journal articles and their associated references for computer input and processing using a special coding system (see example in Appendix). The following data, when available, were keypunched:

- (1) the source journal (journal in which the reference appeared),
- (2) the date of appearance (date of appearance in the annual summary, e.g. 1959, 1964, 1968, 1972),
- (3) the cited journal or type of publication if non-journal (code letters were used for journal titles or identification of books, monographs, newspapers, etc.),

(4) the date of publication (date contained in the citation),

(5) the number of authors,

(6) the identification of author self-citations.

Selected data from each reference within the set of citing articles was then keypunched onto computer cards using the IBM 29 Card Punch. A single card contained data from one reference. A typical card contained a code which identified the 'source' journal in which the reference appeared as a reference (that is, the journal referred to in the ASRR), the date of the summary in which the source journal appeared (1959, 1964, 1968, 1972), a number which coded the reference to a specific article in the source journal (because a source journal might have 22 or so articles from it during one year), a code which identified the cited journal (journal title contained in the reference in the source journal), the date of the reference, the number of authors, and finally an indication as to whether the author was 'self-citing' (referring to one of own works).

DESCRIPTION OF THE JOURNAL LITERATURE COLLECTION

The referencing set of materials was analyzed and described. Volume of articles and references produced for the four time periods and the number of references actually obtained for analysis were calculated and tabulated. Data were generated to specify a set of core referencing journals rank ordered on the volume of articles in the ASRR and on the volume of references produced. A third set of core journal data was generated based on the volume of citations received. The core

journals were compared to each other and with the Pareto characteristic described by Price (1963).

DETERMINATION OF THE DEVELOPMENTAL CHARACTERISTICS OF THE COLLECTION

Data were developed, based on the referencing and cited materials, to illustrate the characteristics of the literature using the following variables: average number of citations per article, age of cited material, types of publications in the cited materials, author self-cites, and patterns of multiple authorship.

Citations Per Article

The average number of citations per article was computed for the journals listed in the referencing set for the four time periods and tabled for comparison.

Age of Cited Material

The age of cited material was measured by subtracting the date of publication of the cited article from the date of appearance in the ASRR in order to reveal the age of the material at the time it was referred to by the author of the referencing article. This is possible because the large majority of documents referred to in the ASRR are works which are published in that year. The results were scaled into the following intervals: 0 to 4 years, 5 to 9 years, 10 to 14 years, 15 to 19 years, 20 or more years, and undated. Results were displayed by number in each category and by the percent that number represented of the total year's citations.

Type of Publication

The yearly percentage for the following types of publications occurring in each of the four time periods were calculated and displayed in tables: books, conference reports--published, conference reports--unpublished, abstracts, theses, personal communications, unpublished materials, newspapers and magazines, miscellaneous documents, tests and test manuals, and journals (by journal name).

Self-Citations

The percentage of times an author cited his or her own work was calculated and displayed for each time period. This was computed by comparing the number of articles which contained at least one self cite to the total number of articles. These were recorded and displayed as raw numbers and percents by time period.

Multiple Authorship

The ASRR contained two groups of authors--those responsible for the referencing documents and those responsible for the cited documents. Multiple authorship for the former group was calculated by recording the number of documents which had one, two, three, four, or five plus authors across the four time periods of the sample. Multiple authorship in the cited set was calculated by recording the number of documents which had one, two, three, four, and five plus authors across five year intervals between 1940 and 1970 measured by date of publication of the cited document. Documents prior to 1940 were ignored. The results of the two methods were compared.

CLUSTER ANALYSIS OF THE CITED JOURNALS

This section describes the clustering rationale and the selection of the two programs used; the preparation of the data for statistical analysis, including the reduction of the matrix and adjustment for self-citation; and the analysis of the data using the two clustering techniques. The data from the four time periods of the ASRR were conflated into one set of cited and citing journals for the cluster analysis.

The Clustering Rationale and Selection of the Two Programs

The clustering technique has been defined as a method of grouping a set of data points without recourse to a pre-set classification. Cluster analysis differs from other statistical techniques, such as regression or the analysis of variance, in that it is still going through a process of definition. Presently, the term is applied to a wide variety of approaches which share the common objective of identifying groups of points within a given set of data points.

In this study, clustering techniques were applied in order to determine if the journal titles cited in the articles of the referencing set could somehow be organized into approximate groupings to illustrate the disciplines being cited in reading research literature. The cluster analysis was not expected to assign hard and fast disciplinary groupings among cited journal titles but to suggest the general disciplinary structure. As mentioned previously, it is assumed that when an author cites a reference, the content of that reference has some substantive

relationship to the topic in the paper being reported. Another citation to a different journal in the same article can be taken as a measure of similarity between the two cited journals. As large numbers of citations are taken into account, journals instead of articles become a more practical source of similarity measures among the cited journals. That is, if journal A contains a large number of articles which cite journal B, then it can be said that A cites B heavily. If A also cites journal C heavily then the assumption is that B is related to C. The relationship between C and B can be measured across a variety of referencing journals, and the results can be used to define groups of related journals based on similarity measures obtained from the referencing set of journals. Thus, cited journals are formed into groups based on the citation habits of the authors of the articles in the referencing journals. A hierarchical clustering program begins by grouping the most highly related journals together, then the next highly related, and so on until all the journals are joined into one large group. Since the end points of the program are meaningless, the program must be interrupted at some point in order to examine the groups formed at that point. A variety of rationale exist for determining the optimal point of interruption and will be discussed later. The journal titles in a group can be examined to see if they embrace a similar substantive content or exhibit a single disciplinary focus.

Recent increased interest in the use of clustering techniques for the organization of bibliographic material has arisen both from the desire to plan patterns of journal coverage

for secondary services and from the desire to explore and map the structure of the primary literature in a discipline.

A review of the literature in both these areas produced numerous clustering studies but failed to reveal any firm guidelines for selecting "the" technique among the wide variety of existing clustering techniques and programs. In fact, in an excellent review of the field by Arms and Arms (1973), a number of studies were faulted for their failure to describe in detail the methods used in clustering. The clustering technique is still being developed, and the existing methods tend to be idiosyncratic to the particular study in which they are used.

The reader desiring a broader elaboration of the rationale and methodology related to the clustering of journal titles, plus an extensive review of the related literature to date, is referred to the Arms and Arms (1973) study just mentioned.

The most widely used approach to journal clustering makes use of the frequency of citation to a particular journal across a set of referencing journals. Clustering groups data points which consist of measurements on each of a fixed set of variables. In journal title clustering, the data points are cited journal titles, the variables are referencing journal titles, and the measurements consist of frequencies of citation. Although researchers are aware of the dangers of equating value, use, and frequency of citation, there is, as Arms and Arms (1973) and others have pointed out, a positive relationship between use and citation. That is, one can assume that when an author cites an article, the article was germane to the study, and further, that material is not generally cited haphazardly or

following some devious rationale.

Two of the more commonly used and comprehensive clustering methods which followed this pattern were selected for use and comparison in this study. These are labelled the UBC--C Group method and the Osiris Hiclust method. (descriptions of both programs are given in the Appendix.) In the C Group method, the algorithm places the objects to be clustered into n-dimensional space and forms clusters based on the Euclidean distances between the points. In the Osiris Hiclust method, the algorithm calculates correlations between the objects and treats the scores as similarity measures on which the clustering is accomplished. Arms and Arms (1973) provide elaboration on the rationale and methodology underlying each method.

If perfect clustering could be obtained, both programs would provide the same results. This is seldom the case. If the two methods produced quite different hierarchies, this would demonstrate that the concept is not a clusterable one and that the data are too "noisy" for precise analysis. For purposes of this study, it was decided to use the UBC C Group program to produce one cluster hierarchy, the Osiris Hiclust program to produce another, and then to compare the two as a reliability check on the "cluster-ability" of such a limited sample as the one being used in this study. (Often, clustering of journal titles is accomplished using masses of data such as that contained in a large collection of citations like the SCI.)

Preparation of the Cluster Data

The citation data from the four time periods were arranged into an $m \times n$ matrix where m is the number of cited journals and n is the number of referencing journals. A particular entry (E_{ij}) represents the number of times journal J referred to journal I .

The UBC C Group clustering program will accept an $m \times n$ multivariate array and plot the m points in n -dimensional space. The clustering is based on the Euclidean distance between the ends of the vectors.

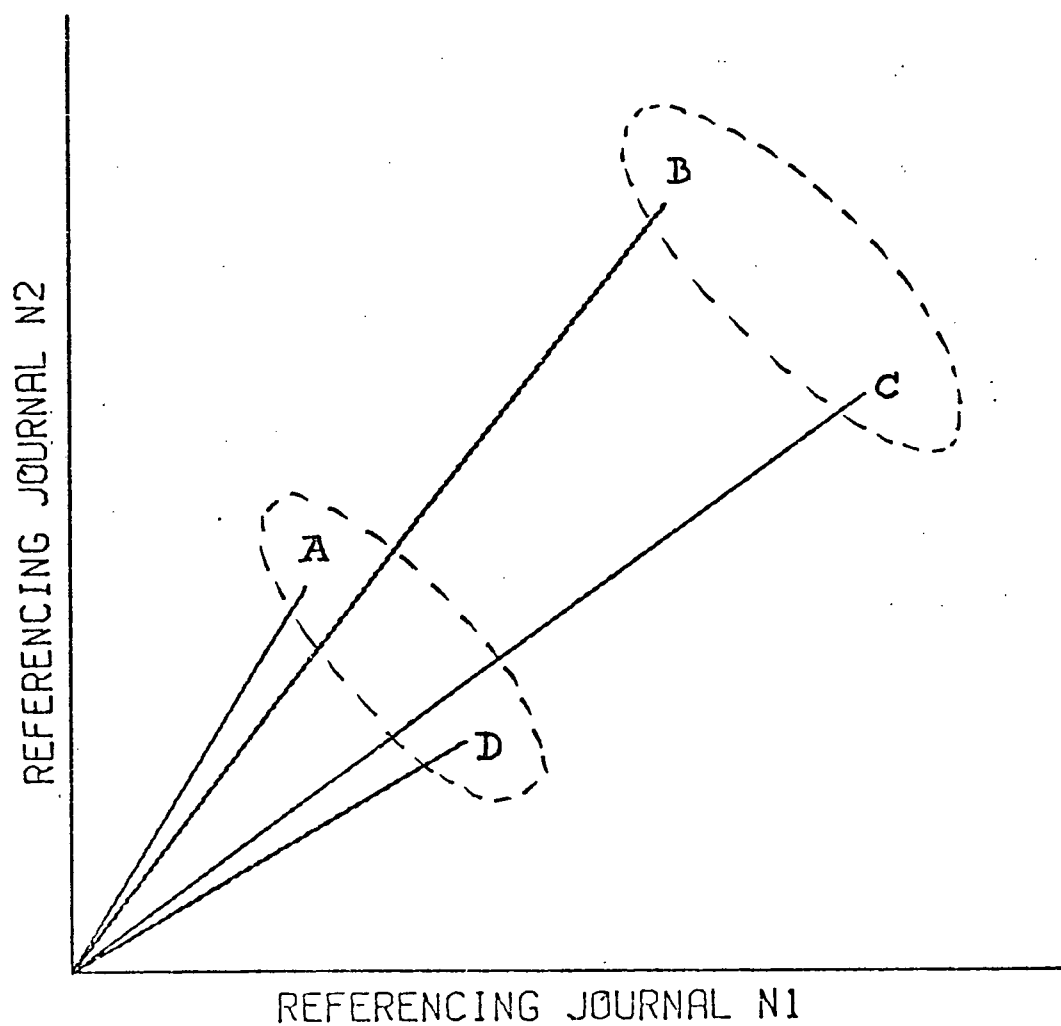
The volume that a journal is cited will affect the clustering in the following fashion: imagine the n -dimensional space reduced to the two dimensions n_1 and n_2 as in Figure 1.

INSERT FIGURE 1 ABOUT HERE

Points A, B, C, and D represent the location in space of various cited journals. The length of the vector is determined by the volume of citation, but the direction of the vector is determined by the relative proportion of the citations received from journals n_1 and n_2 . Clustering by Euclidean distance will group journals A and B together and journals C and D together. If the matrix is normalized so that the vectors are reduced to unit dimension space, as in Figure 2, the program will cluster A with C and B with D. This clustering more accurately reflects

Note: The figures in this dissertation were produced on the UBC PLOT program available through the Computing Center, University of British Columbia.

Figure 1



Cited Journals in Simplified
Two-Dimensional Space
Before Normalization

the citation patterns of journals n_1 and n_2 .

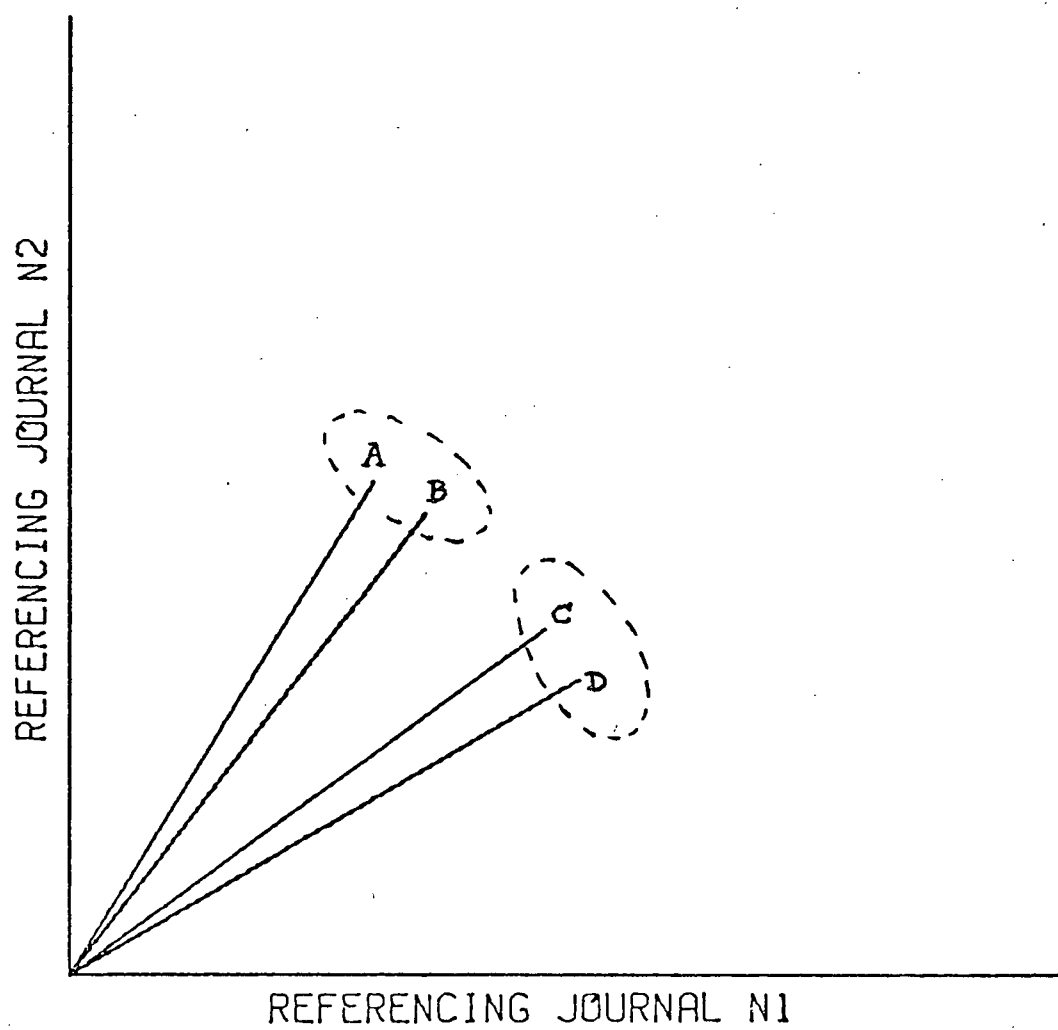
INSERT FIGURE 2 ABOUT HERE

The normalization of the multivariate array was not necessary with the Osiris Hiclust clustering program because this program reduces the multivariate array to an $m \times m$ similarity matrix in which each entry E_{ij} is the correlation between cited journals I and J . The correlations (Pearson product-moment) were determined by comparing the performance of journals I and J across the referencing set of journals. Correlations are not affected by citation magnitudes.

Reduction of the Matrix

Clustering programs involve physical limitations in terms of the amount of material that can be handled in computer manipulation. Also, the time taken by the algorithm increases rapidly with the number of data points. Finally, clustering is more reliable when the data is as dense as possible--that is, when many of the cells of the matrix contain some value. It is common practice in citation clustering to eliminate those journals with very low citing or cited frequencies. Therefore, the $m \times n$ matrix was reduced in size (a) to accommodate the input limits of the clustering programs, (b) to increase the cell density of the matrix, and (c) to deal only with the most productive journals in terms of frequency of citation in both the referencing and the cited sets.

Figure 2



Cited Journals After Normalization

A preliminary calculation indicated that reducing the number of citations by one third would satisfy the above conditions. An optimal reduction in the size of the citation matrix would result in the subset of rows and columns of journals for which the average number of citations per cell, or cell density, reached a maximum with a pre-determined number of citations, such as two-thirds of the total. This represents a complex combinatorial problem because the set of citations eliminated by the deletion of rows overlaps the set eliminated by the deletion of columns. An optimal solution would locate the pattern of deletion, from all possible patterns, in which the overlap was the largest. For a large matrix this solution would require an immense amount of computing time. To make the matrix reduction feasible, a cruder approach was employed. The core referencing journals responsible for 80 percent of the citations were retained as columns and the core cited journals receiving 80 percent of the citations were retained as rows. This should retain approximately two-thirds the total number of citations (80 percent of 80 percent equals 64 percent). At this point the average cell density was calculated by dividing number of citations by number of cells, and the results were reported.

Adjustment for Self-citation

Journals tend to cite themselves frequently and self-citations tend to distort the citation patterns of the journals. Various methods of adjustment for self citation have been applied in previous research. Rather than reduce the number of self-citations by a fixed amount, say 25%, it was decided to reduce them by a proportion relative to the popularity of the

journal across the total set of cited journals. The assumption made was that journal A should prefer itself over other journals in the same proportion that the total referencing set prefers A over the total set of cited journals. The formula that was applied for cell adjustment was:

$$\frac{[\text{NEW SELF-CITES OF A}]}{\text{TOTAL CITES OF A}} = \frac{\text{TOTAL CITATION OF A}}{\text{TOTAL CITATIONS}}$$

Clustering Statistical Analysis

The prepared data was run using the respective clustering programs. Both the C Group and the Hiclust programs cluster the journals in the step-wise fashion described in the Appendix. The results in each case are conveniently displayed in branching tree forms known as dendograms. The dendograms illustrate the hierarchy of the clustering process from the first step where each journal is considered to be a separate cluster to the final step where all clusters are finally joined into one large cluster comprised of the entire set of cited journals. The resulting dendograms can be displayed and compared. The dendograms are entered at the appropriate point and interpreted. The appropriate point is determined by following the error values at each step of the program and entering at the point where there is a large jump in this figure. Clusters formed beyond that jump are joined with less confidence than the ones before it. It is assumed that the clusters already formed are relatively strong, and that if the programs are revealing similar clusters, their similarity should be apparent at this stage. The results from the C Group and the Hiclust method can

be compared by a pairwise matching of similar clusters.

SUMMARY

This chapter has presented the design, methodology and statistical procedures used in developing the collection of journal articles which served as the data base, in determining the developmental characteristics of the reading research literature, and in organizing and applying the clustering methodology in order to obtain an outline of the interdisciplinary nature of the base for reading research journal literature.

CHAPTER IV

RESULTS OF THE STUDY

This chapter presents the results of the study and is organized into three main divisions including: description of the referencing reading research journal literature collection; developmental characteristics of the reading research journal literature collection; and cluster analysis results.

DESCRIPTION OF THE REFERENCING

JOURNAL LITERATURE COLLECTION

The first prerequisite in any journal citation study is to develop a set of referencing journal articles for analysis. The bibliographic information from four time periods of the ASRR was used for this purpose. The ASRR has been produced by a number of different authors, at several different locations, and has been published in a number of journals throughout its history. A complete history and analysis of the ASRR from its inception through 1966 can be found in Summers (1968). Subsequent yearly summaries can be analyzed for the period 1967 through 1976.

The annual summaries for the periods 1959, 1964, 1968, and 1972 were used as the data base for this study. The annual summary for any one year spans the academic rather than the calendar year and is usually referred to using two dates, i.e., 1958-59. For purposes of this study, the summaries are referred to by the last date of the period covered. Table I presents

general publication information on the four summaries included in the study. Table II provides data on the number of references contained in each summary with the proportion of journal articles.

INSERT TABLE I ABOUT HERE

INSERT TABLE II ABOUT HERE

As in any bibliographic study, difficulties were encountered in obtaining a complete set of materials. Time, library availability, and economics did not allow for collection of all 918 journal articles listed for the four time periods. For example, of the 113 journal articles listed for the 1959 summary, 91 were obtained. In all 768 out of 918 articles were included. Table III summarizes the results for all four time periods.

INSERT TABLE III ABOUT HERE

It was felt that for purposes of this study, 84 percent provided a sufficient data base. The unobtainable journal articles, in essence, approximated a random deletion and their absence would not unduly influence the results. Analysis of the unobtainable materials indicated that they were largely from

TABLE I
ASRR for four time periods

Date of ASRR	Author(s)	Journal	Location	Number of articles
1959	W.S. Gray	<u>Journal of Educational Research</u>	University of Chicago	120
1964	H.M. Robinson, S. Weintraub, C.A. Hostetter	<u>The Reading Teacher</u>	University of Chicago	264
1968	H.M. Robinson, S. Weintraub, H.K. Smith	<u>Reading Research Quarterly</u>	Indiana University	376
1972	S. Weintraub, H.M. Robinson, H.K. Smith, G.S. Plessas	<u>Reading Research Quarterly</u>	Indiana University	302

TABLE II

Total Articles and Percent of Journal Articles, ASRR

Year of ASRR	Number of Articles	Number of Journal Articles	Percent
1959	120	113	94
1964	264	222	84
1968	376	330	88
1972	302	253	84
Total	1062	918	86

TABLE III

Total Journal Articles and Percent of Articles Located, ASRR

Year of Summary	Number of Articles Cited	Number of Articles Obtained	Percent
1959	113	91	81
1964	222	186	84
1968	330	278	84
1972	253	213	84
Total	918	768	84

journals which would have dropped out of the matrix reduction stage. In addition, the materials did not focus in any one of the four time periods. The three occurrences of 84 percent were coincidental and did not represent a conscious cut-off point. An article was considered obtained even if it contained no references. The bibliographic data from 768 reading research articles, dispersed over 108 journals, were available for keypunching, computer storage and analysis. The 108 journals became the referencing set of materials.

Identification of Core Journals

One purpose of the study was to provide descriptive data on the reading research journal literature collection. Part of the description included the delineation of the core journals for the time period 1959 through 1972. In previous research, core literature had been designated largely on the basis of the number of articles published in the ASRR. In this study, core literature was designated on the basis of the number of articles published in the ASRR, the number of references appearing in the articles published in the ASRR, and the frequency of journal citation in the referencing materials. Note that the last set are journals identified by the referencing habits of the researchers whose articles appeared in the ASRR.

Data were tabulated separately for each of the four time periods and then conflated in designating the three core listings. Price (1963) suggested that the number of large contributing journals will equal the square root of the total population and can be expected to account for approximately 50 percent of the total articles produced. Price's Pareto

characteristic is well known and has been used widely in information studies and provides a general rule of thumb in indicating the core journal demarcation in a set of literature. The Pareto findings of Price obtain in the collection analyzed here.

Table IV presents the data for the 108 referencing journals ranked by quantity of articles produced for the total period. The first 9 journals account for approximately 50 percent of the total number of articles.

INSERT TABLE IV ABOUT HERE

Using the Pareto rule of thumb, we would expect 10 journals (square root of 108) to account for approximately 50 percent of the articles. The results are very similar--a small number of journals predominate in the reading research literature reported in the ASRR and can be designated as core publications on the basis of their carrying a large percentage of the articles published. The nine journals in this core listing include 4 reading journals, 2 educational research journals, 1 English journal, 1 journalism journal and one general elementary journal, suggesting that the 50 percent of articles produced by the core appear in a broad variety of journals.

Adding the next 25 most productive journals would produce a highly useful set of approximately three dozen core journals accounting for over 80 percent of the articles published in the 108 journals. Table IV presents the ranked listing for the journals producing 80 percent of the articles. The data for all

TABLE IV

Journals by Number of Articles in ASRR in Four Time Periods.
(Ranked by Total.)

JOURNAL	TIME PERIOD				CUM. %	
	1959	1964	1968	1972	TOTAL	
Journalism Quarterly	9	26	29	22	86	11.20
The Reading Teacher	3	22	36	6	67	19.92
Journal of Educational Research	18	8	14	12	52	26.69
Elementary English	9	11	8	11	39	31.77
Journal of Educational Psychology	5	6	13	9	33	36.07
Journal of Reading	0	0	25	7	32	40.23
Elementary School Journal	5	9	10	3	27	43.75
Journal of Developmental Reading	9	18	0	0	27	47.27
Journal of Reading Behavior	0	0	0	21	21	50.00
Jrnl of Verbal Learning and Verbal Behavior	0	5	7	4	16	52.08
Journal of Experimental Education	2	7	2	4	15	54.04
American Educational Research Journal	0	2	6	6	14	55.86
Perceptual and Motor Skills	0	4	8	0	12	57.42
Psychological Reports	0	2	3	7	12	58.98

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
British Journal of Educational Psychology	5	2	3	1	11	60.42
Reading Research Quarterly	0	0	6	5	11	61.85
Alberta Journal of Educational Research	2	3	2	3	10	63.15
Journal of Personality and Social Psychology	0	0	10	0	10	64.45
Public Opinion Quarterly	0	6	2	2	10	65.76
Psychology In The Schools	0	0	3	7	10	67.06
Exceptional Children	0	1	5	3	9	68.23
Educational Research	0	2	4	3	9	69.40
Journal of The Reading Specialist	0	0	9	0	9	70.57
Child Development	0	4	2	2	8	71.61
Educational Leadership	1	0	3	4	8	72.66
Journal of General Psychology	2	5	0	1	8	73.70
Education of Visually Handicapped	0	0	0	7	7	74.61
Journal of Applied Psychology	1	3	2	1	7	75.52
Journal of Advertising Research	0	7	0	0	7	76.43
Columbia Journalism Review	0	6	0	0	6	77.21

JOURNAL	TIME PERIOD				CUM. %
	1959	1964	1968	1972 TOTAL	

Educational and Psychological Measurement	1	0	4	1 6	77.99
Illinois School Research	0	0	6	0 6	78.78
Journal of Abnormal and Social Psychology	0	6	0	0 6	79.56
Journal of Communication	0	2	3	1 6	80.34

108 journals appears in the Appendix. The relative decrease in article productivity as the lesser producing journals in the referencing set are added, and the demarcation lines for the 50 and 80 percent points, are also illustrated graphically in Figure 3.

INSERT FIGURE 3 ABOUT HERE

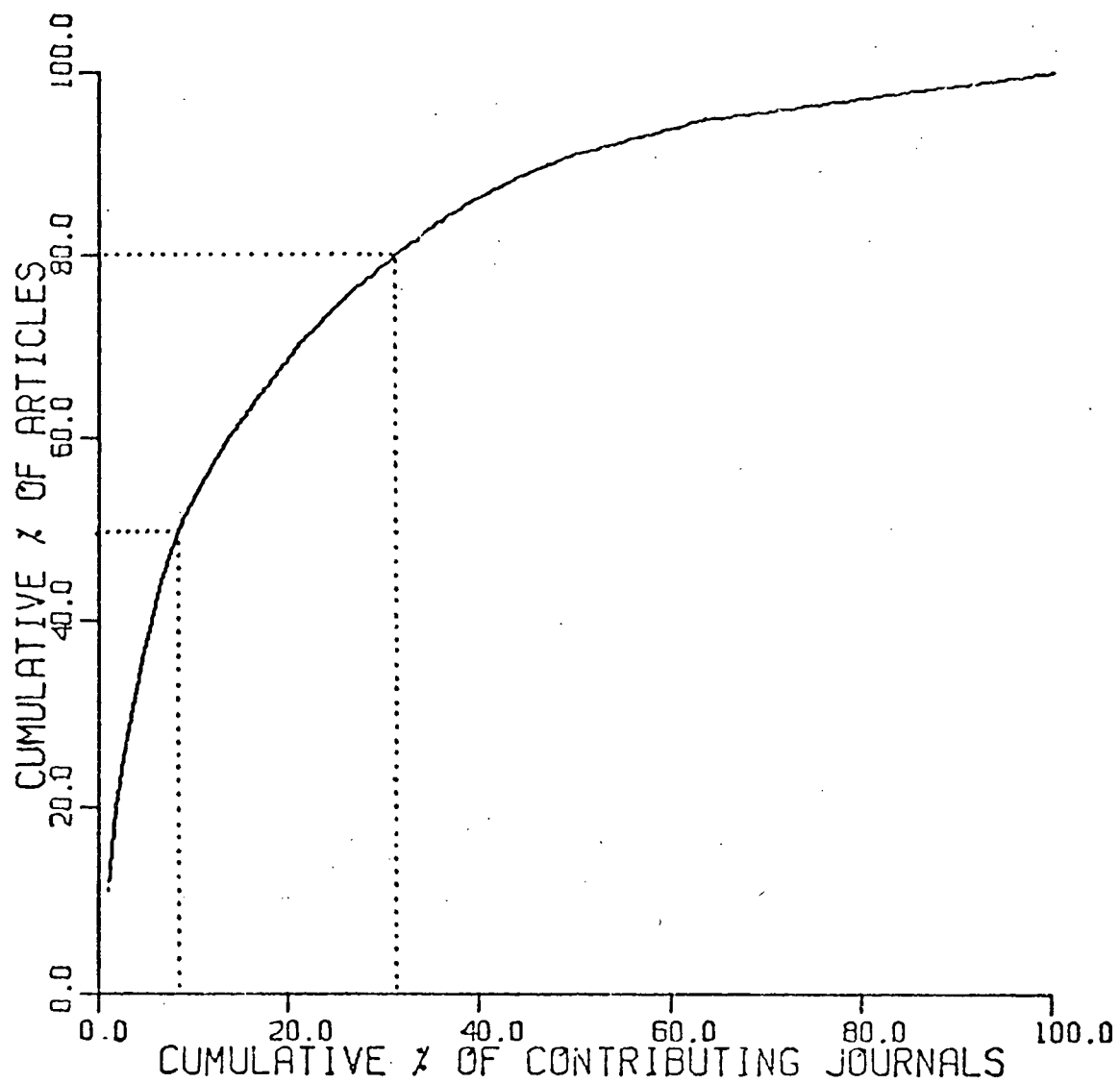
The 768 articles dispersed across the 108 journals of the referencing set in turn listed 7,642 references. Reference productivity can also be used to designate useful core journals in the ASRR. The references in each journal article were tabulated and summed. Journals were then rank ordered on the basis of reference frequency. The results appear in Table V in order of decreasing references per journal across the total period.

INSERT TABLE V ABOUT HERE

It should be noted that the number of references contributed for each journal is related to but not totally dependent on the number of articles a particular journal contributes. Some journals produce a small number of articles but these articles have quite high reference counts.

The top 12 referencing journals contributed approximately 50 percent (3,941) of the 7,642 references. The 12 journals in this core include the 9 from the previous list based on quantity

Figure 3



Journals Contributing Articles to ASRR

TABLE V

Journals by Number of References Produced in ASRR in Four Time Periods. (Ranked by Total.)

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
Journalism Quarterly	34	170	192	310	706	9.24
The Reading Teacher	4	149	291	44	488	15.62
Elementary English	118	86	92	129	425	21.19
Journal of Educational Research	118	51	100	99	368	26.00
Reading Research Quarterly	0	0	234	134	368	30.82
Journal of Educational Psychology	21	47	142	102	312	34.90
Journal of Reading	0	0	224	50	274	38.48
Journal of Experimental Education	69	99	14	49	231	41.51
Elementary School Journal	11	52	111	34	208	44.23
American Educational Research Journal	0	26	93	81	200	46.85
Journal of Reading Behavior	0	0	0	197	197	49.42
Educational Research	0	27	96	41	164	51.57
Journal of Developmental Reading	35	129	0	0	164	53.72
Perceptual and Motor Skills	0	65	93	0	158	55.78

TABLE V (CONTINUED)

JOURNAL	TIME PERIOD				CUM. %
	1959	1964	1968	1972 TOTAL	
Jrnl of Verbal Learning and Verbal Behavior	0	47	43	67	157 57.84
Journal of Personality and Social Psychology	0	0	134	0	134 59.59
Psychology In The Schools	0	0	46	85	131 61.31
Public Opinion Quarterly	0	44	25	41	110 62.75
British Journal of Educational Psychology	55	26	16	10	107 64.15
Reading World	0	0	0	105	105 65.52
Exceptional Children	0	8	38	57	103 66.87
Journal of Abnormal and Social Psychology	0	88	0	0	88 68.02
Psychological Reports	0	12	14	59	85 69.13
Education	0	74	9	0	83 70.22
Journal of Special Education	0	0	26	56	82 71.29
Journal of General Psychology	16	54	0	10	80 72.34
AV Communication Review	0	12	38	29	79 73.37
Journal of Genetic Psychology	79	0	0	0	79 74.40
Alberta Journal of Educational Research	11	16	16	35	78 75.43
Child Development	0	30	8	39	77 76.43
Young Children	0	0	0	77	77 77.44

JOURNAL	TIME PERIOD				CUM.	
	1959	1964	1968	1972	TOTAL	%
<hr/>						
Journal of Social Psychology	0	17	55	0	72	78.38
Interchange	0	0	0	68	68	79.27
Journal of Communication	0	15	37	13	65	80.12
American Journal of Sociology	0	0	0	61	61	80.92

of articles and adds 1 reading research journal and 3 educational research journals suggesting that, when references produced becomes the criterion, the 50 percent of references produced by the core appear in an even broader array of journals, particularly educational research journals.

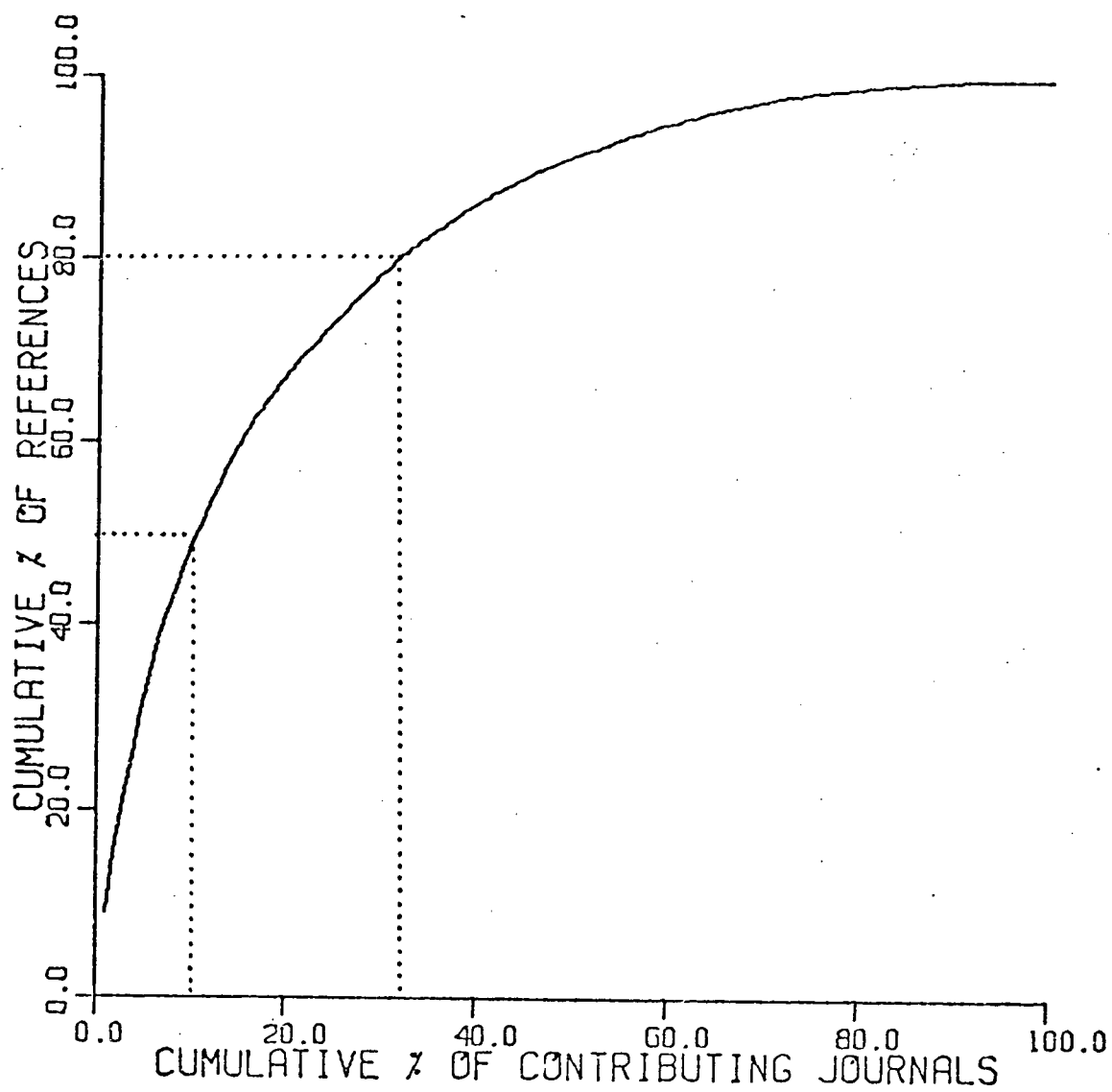
Table V presents the data for the 34 journals which listed approximately 80 percent of the total number of references. Complete data for all 108 journals are listed in the Appendix. The data for production of references by referencing journal also approximate Price's Pareto characteristic. The most frequently cited 10 journals produced approximately 47 percent of the total number of references. Again, a small number of journals predominate and can be designated as core publications on the basis of the number of references produced in the ASRR. The relative decrease in reference productivity as lesser producing referencing journals are added is illustrated in Figure 4, as are the 50 and 80 percent demarcation lines.



INSERT FIGURE 4 ABOUT HERE

Core journals can also be designated on the basis of the number of citations received. To develop this data, the frequency of occurrence of journal titles appearing in the 7,642 references of the 108 referencing journals were tabulated. The resulting journals were then rank ordered on the basis of volume of citations received. This set represents the core journals that the authors of reading articles are referring to most often in their writing. The articles in the referencing set of

Figure 4



Journals Producing References in ASRR

journals produced 3,777 citations to journals. These were dispersed across 448 separate journal titles. Table VI presents the results and lists the 19 journals responsible for approximately 50 percent (1,895) of the total citations, and the 74 journals responsible for 80 percent of the citations. The complete listing for all 448 journals appears in the Appendix. The 19 journals in this core add a number of journals to the two previous cores in psychology, social psychology, developmental psychology, verbal learning, and perceptual and motor skills, suggesting that, when citations received becomes the criterion, the 50 percent of citations produced by the core appear in a very interdisciplinary and diverse group of journals. It is interesting to note that 3 of the reading journals are not included in the 50 percent citations received core although they would appear in the 80 percent core.

INSERT TABLE VI ABOUT HERE

Interestingly enough, the Pareto distribution also holds for this set of journals. The most frequently cited 20 journals (square root of 448) produced 50 percent of the total citations. The relative decrease in production of citations as the lesser cited journals are added is illustrated in Figure 5 as are the 50 percent and 80 percent demarcation lines.

TABLE VI

Journals by Number of Citations Received from ASRR in Four Time Periods. (Ranked by Total.)

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
Journal of Educational Psychology	39	48	75	81	243	6.43
Journal of Educational Research	25	31	77	45	178	11.15
Elementary School Journal	16	49	70	26	161	15.41
Journalism Quarterly	2	32	45	67	146	19.27
Elementary English	19	19	52	40	130	22.72
Journal of Experimental Psychology	4	57	28	40	129	26.13
The Reading Teacher	8	15	43	55	121	29.34
Journal of Abnormal and Social Psychology	8	33	66	10	117	32.43
Perceptual and Motor Skills	0	5	26	55	86	34.71
Child Development	0	13	21	46	80	36.83
Journal of Applied Psychology	10	18	36	9	73	38.76
Jrnl of Verbal Learning and Verbal Behavior	0	3	24	42	69	40.59
Journal of Experimental Education	9	16	24	13	62	42.23
Public Opinion Quarterly	5	22	16	13	56	43.71

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
American Journal of Psychology	3	24	14	14	55	45.17
Psychological Bulletin	5	5	28	16	54	46.60
British Journal of Educational Psychology	9	7	25	9	50	47.92
Psychological Review	6	10	10	18	44	49.09
Journal of Genetic Psychology	7	14	10	10	41	50.17
Journal of Personality and Social Psychology	0	0	35	6	41	51.26
Journal of Consulting Psychology	12	8	12	8	40	52.32
Journal of Developmental Reading	0	6	21	11	38	53.32
Journal of Psychology	6	9	18	5	38	54.33
Education	6	9	15	7	37	55.31
Reading Research Quarterly	0	0	8	29	37	56.29
Exceptional Children	0	2	10	22	34	57.19
School and Society	10	7	10	7	34	58.09
Journal of Reading	0	0	12	21	33	58.96
Psychological Reports	2	5	10	15	32	59.81
American Journal of Orthopsychiatry	2	1	12	16	31	60.63

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
Educational Research Bulletin	12	5	6	7	30	61.42
American Educational Research Journal	0	0	14	15	29	62.19
English Journal	1	5	6	17	29	62.96
Journal of Social Psychology	7	6	13	3	29	63.73
American Psychologist	5	7	15	2	29	64.50
American Journal of Mental Deficiency	0	3	13	11	27	65.21
Educational and Psychological Measurement	3	1	18	2	24	65.85
Journal of Personality	3	7	10	4	24	66.48
Canadian Journal of Psychology	0	9	5	8	22	67.06
British Journal of Psychology	4	4	6	7	21	67.62
Science	0	5	7	9	21	68.18
School Review	3	6	10	2	21	68.73
American Sociological Review	1	5	9	4	19	69.23
Speech Monographs	3	2	12	2	19	69.74
Teachers College Record	3	4	7	5	19	70.24
Review of Educational Research	0	0	9	8	17	70.69
California Journal of Educational Research	1	5	3	7	16	71.11

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
Harvard Educational Review	0	4	4	8	16	71.54
Educational Admin and Supervision	1	6	7	1	15	71.94
Jrnl of the Experimental Analysis of Behavior	0	9	2	4	15	72.33
Journal of General Psychology	0	2	5	8	15	72.73
Journal of Reading Behavior	0	0	0	15	15	73.13
Psychometrika	3	1	9	2	15	73.52
Psychonomic Science	0	0	6	9	15	73.92
Genetic Psychology Monographs	0	4	4	6	14	74.29
Journal of Speech and Hearing Disorders	7	0	4	3	14	74.66
Psychology In The Schools	0	0	7	7	14	75.03
Journal of Education	1	3	4	5	13	75.38
Journal of Learning Disabilities	0	0	0	13	13	75.72
Acta Psychologica	3	1	2	7	13	76.07
Journal of Communication	1	0	8	3	12	76.38
Phi Delta Kappan	0	2	8	2	12	76.70
Elementary English Review	4	3	2	3	12	77.02
Editor and Publisher	0	4	6	2	12	77.34

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
Social Forces	0	4	5	3	12	77.65
Educational Research	0	4	4	3	11	77.95
Archives of Psychology	1	0	5	5	11	78.24
Jrnl of Comparative and Physiological Psychology	0	4	2	5	11	78.53
Quarterly Journal of Experimental Psychology	0	1	2	8	11	78.82
Journal of Clinical Psychology	0	0	6	4	10	79.08
Personnel and Guidance Journal	0	3	6	1	10	79.35
NEA Journal	0	2	5	3	10	79.61
Peabody Journal of Education	3	4	2	1	10	79.88
Perception and Psychophysics	0	0	0	10	10	80.14

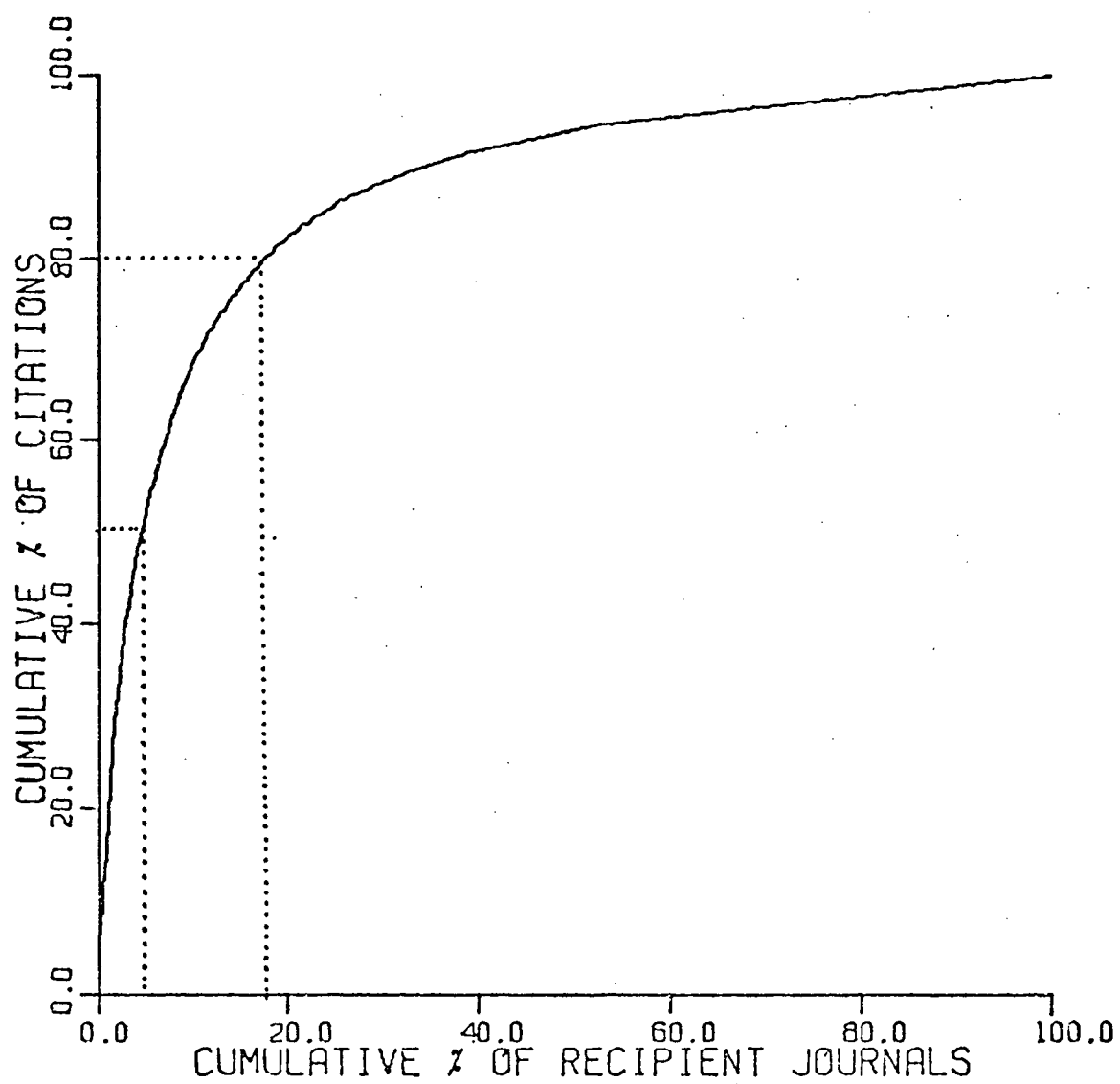
INSERT FIGURE 5 ABOUT HERE

Comparison of the Core Literature Results

The results of the previous section confirm that it is possible to establish a minimal nucleus of core journals which are highly productive in terms of the total number of articles or references produced in a collection. The core concept is also useful in establishing the key cited journal titles in the references of a collection. Core titles can be based on various zones or levels or productivity. A tight set of journals is produced when a 50 percent factor is set whereas a broader set of titles is generated when the criterion is set at 80 percent. For purposes of establishing good titles for reviews of reading research, it is felt the 80 percent criterion would produce an optimal listing. It is important to keep in mind that although the bulk of the important papers in a specialty will tend to congregate in the key publications, other good papers will be scattered throughout the more general literature. This is particularly true of an emerging discipline with a diffuse literature. Therefore, a liberal 80 percent criterion has the potential of casting a broad enough net while at the same time still reducing the labor that would be involved in adopting a total 100 percent criterion.

Table VII compares the journal titles producing 50 percent of the total materials based on the number of articles, number of references listed, and citation volume.

Figure 5



Journals Receiving Citations from ASRR

INSERT TABLE VII ABOUT HERE

The two listings based on articles and references have many common journals, but the journal base is broadened when reference productivity is added as a criterion for inclusion. Both should be considered in establishing key journal lists for various purposes, particularly in working with collections that are research-oriented. There is usually considerable correlation between article and reference productivity but this is not always the case. For example, on the basis of number of articles produced, the Reading Research Quarterly would not have been designated a key journal, whereas, on the basis of references produced, it becomes an important journal. Important titles can be omitted using article productivity as the sole criterion in designating key journals.

The interaction between reading and journals in other disciplines is clearly indicated in examining the citations received column. Journal citedness would seem to offer an important tool in gaining insight into the manner in which reading establishes substantive connections with other fields, particularly in the core literature. The cluster analysis, described later, provides a means of statistically grouping the most cited journal titles into discipline arrays.

TABLE VII

Core Journals Producing 50 Percent of Articles, References, and Citations

JOURNAL TITLE	ART.	REF.	CIT.
Journalism Quarterly	X	X	X
Reading Teacher	X	X	X
Journal of Educational Research	X	X	x
Elementary English	X	X	X
Journal of Educational Psychology	X	X	X
*Journal of Reading	X	X	
Elementary School Journal	X	X	X
*Journal of Developmental Reading	X	X	
Journal of Reading Behavior	X	X	
Reading Research Quarterly		X	
Journal of Experimental Education		X	X
American Educational Research Journal		X	
Educational Research		X	
Journal of Experimental Psychology			X
Journal of Abnormal and Social Psychology			X
Perceptual and Motor Skills			X
Child Development			X
Journal of Applied Psychology			x
Journal of Verbal Learning and Verb. Beh.			X
Public Opinion Quarterly			X
American Journal of Psychology			X
Psychological Bulletin			X
British Journal of Educational Psychology			X
Psychological Review			X
Journal of Genetic Psychology			X

*The same journal.

DEVELOPMENTAL CHARACTERISTICS OF THE READING RESEARCH
JOURNAL LITERATURE COLLECTION

Citations Per Article

Another statistic of interest in relation to measuring the scholarly attributes in a collection of literature, is the average number of citations per article. Table VIII presents the data for each of the four time periods. It is important to note that review articles which pull together large bibliographies were not included in the original listing of articles produced in the four issues of the ASRR.

INSERT TABLE VIII ABOUT HERE

The steady increase in citations from an average of 6.89 per article in 1959 to 12.61 per article in 1972 should be noted.

Age of Cited Material

Price (1970) suggested that age of cited materials provides some clue as to the existence and recency of the research front in a field. Table IX presents the results for age of cited materials across the four time periods.

TABLE VIII

Average Number of References per Article

	YEARS			
	1959	1964	1968	1972
TOTAL REFERENCES	627	1562	2768	2685
TOTAL ARTICLES	91	186	278	213
AVERAGE REFERENCES PER ARTICLE	6.89	8.40	9.96	12.61

INSERT TABLE IX ABOUT HERE

After the initial jump from 12 percent in 1959, the percentage of documents cited less than five years old stays constant at approximately 22 percent of the total. This figure is Price's Index (percentage of references to last five years), and indicates that reading research does not make use of a research front, but examination of the other categories indicates a trend toward such a front. There is a steady decline in the 15-19 year old category (from 12.6 percent to 6.9 percent) and a similar decline in the 20 year or older category (from 26.2 percent to 13.6 percent). Those cited documents which were relatively young (5-9 years) showed a steady increase in importance, growing from 21.1 percent to 40.1 percent of the total number of citations. This reflects a strong trend toward the citation of a more recent body of literature at the expense of an older body represented by those documents which were 15 years or older at the time of citation.

Type of Publication

Book and journal citations usually predominate in most literature collections while other materials receive less frequent emphasis. The breakdown of the citations into the type of publication in which they appeared is presented in percentage form in Table X.

TABLE IX
Age of Cited Materials

YEAR	AGE IN YEARS					
	0-4	5-9	10-14	15-19	20 or more	
1959	n (%)	81 (12.9)	137 (21.8)	158 (25.2)	82 (13.1)	170 (27.1)
1964		345 (22.1)	508 (32.5)	261 (16.7)	154 (9.9)	294 (18.8)
1968		606 (21.9)	1037 (37.5)	467 (16.9)	262 (9.5)	396 (14.3)
1972		581 (21.6)	1081 (40.3)	470 (17.5)	186 (6.9)	366 (13.6)

INSERT TABLE X ABOUT HERE

While journals account for a relatively steady 50 percent of the citations, and books contribute another 35 percent, some growth has taken place in the contributions from conference reports (both published and unpublished), abstracts, unpublished literature, newspapers and magazines, and tests and test manuals.

Self-Citation

An author may self-cite if previous work is related to present work. In fields where scholarship is cumulative, the incidence of related work may, by definition, be higher than in fields where there are a broad range of topics with which a scholar is expected to be conversant. Table XI presents the number and percent of articles in the ASRR which contained at least one self-cite. It was decided that if an author self-cited one or twenty times in one article that it was still only one self-citing document (as opposed to a document which contained no self-cites).

INSERT TABLE XI ABOUT HERE

Table XI shows obvious growth in this practice from 30.8 percent in 1959 to 42.7 percent in 1972.

TABLE X

Percentage of Citation by Type of Publication

PUBLICATION TYPE	TIME PERIOD				TOTAL
	1959	1964	1968	1972	
BOOKS	34.8	39.0	34.9	33.0	35.0
JOURNAL	52.6	47.7	49.2	49.3	49.0
OTHERS*	12.6	13.3	15.9	17.7	16.0

* OTHERS includes Conference Reports -- Published, Conference Reports -- Unpublished, Abstracts, Theses, Personal Communications, Unpublished Documents, Newspapers/Magazines, Miscellaneous Documents, and Tests/Test Manuals.

TABLE XI
Frequency of Author Self-Cites

	YEARS			
	1959	1964	1968	1972
NUMBER OF ARTICLES	91	186	278	213
NUMBER WITH A SELF-CITE	28	63	114	91
PERCENT	30.8	33.9	41.0	42.7

Multiple Authorship

Changes in multiple authorship have also been found to have some relationship with the nature of the research collection in a discipline. Tables XII and XIII present the number of authors (or multiple authorship) per document for the journals in the referencing set and for the documents in the cited set. It should be borne in mind that the time span is greater for cited than referenced multiple authorship because the referenced multiple authors are based on appearance in the ASRR for an approximate one year range.

INSERT TABLE XII ABOUT HERE

INSERT TABLE XIII ABOUT HERE

The single-authored documents in the referencing set show a marked and relatively dramatic drop from 65.93 percent in 1959 to 50.70 percent in 1972, while all categories representing multiple authorship indicate progressive growth. The growth trends in multiple authorship in the cited set of documents are even more pronounced as illustrated in categories 2, 3 and 4 in Table XIII. Single-authored documents account for only 56.9 percent of the documents from 1966 to 1970, whereas they accounted for about 75 percent in the period from 1941 to 1945. The results in Table XII and XIII are comparable when they are matched at points in time.

TABLE XII

Frequencies (Percentages) of Referencing Journal Articles with One, Two, Three, and Four or More Authors for Four Time Periods.

YEAR		NUMBER OF AUTHORS			
		1	2	3	4 or more
<hr/>					
1959	n	60	26	4	1
	(%)	(65.9)	(28.6)	(4.4)	(1.1)
1964		109	57	11	9
		(58.6)	(30.6)	(5.9)	(4.8)
1968		167	81	23	7
		(60.0)	(29.1)	(8.3)	(2.5)
1972		108	75	23	7
		(50.7)	(35.2)	(10.8)	(3.3)

TABLE XIII

Frequencies (Percentages) of Cited Documents with One, Two, Three, and Four or More Authors for Six Time Periods.

TIME PERIOD	NUMBER OF AUTHORS			
	1	2	3	4 or more

1941-45	n 95 (%) (74.8)	26 (20.4)	6 (4.7)	
1946-50	176 (71.2)	63 (25.5)	5 (2.0)	
1951-55	301 (67.9)	113 (25.5)	21 (4.4)	8 (1.6)
1956-60	420 (62.9)	167 (25.0)	57 (8.5)	23 (3.3)
1961-65	641 (60.5)	297 (28.1)	64 (6.0)	56 (5.1)
1966-70	434 (56.9)	229 (30.0)	71 (9.3)	28 (3.5)

CLUSTER ANALYSIS RESULTS

The overall purpose of the cluster analysis study was to take the highest ranked journal titles (See Table VI in the Appendix) cited in the references of the materials published in the ASRR for the four time periods and determine if they could be grouped by cluster analysis to illustrate disciplinary connections in the reading research reported.

As described in Chapter III, clustering allows one to take the combined citations for a journal in the cited set and determine how those citations are distributed across the referencing set of journals. Clustering the set of cited journals is simply a partitioning of the set into mutually exclusive, or exhaustive, groups or clusters. The basis for the partitioning is the degree of similarity with which two cited journals are treated by the referencing set.

The UBC C Group programs forms clusters based on measures of Euclidean distances in n-dimensional space while the Osiris Hiclust method produces clusters based on correlation coefficients. The original matrix listing all cited and referencing journals was 448 by 108. Applying the matrix reduction procedure described in Chapter III eliminated low-cited and low-referencing materials and resulted in a matrix of 75 cited and 32 referencing journals. At this point the average cell density for the matrix was one. The data from this matrix were run using the UBC C Group program. A dendogram was produced and provided a visual display of the clustering hierarchy.

The dendogram was analyzed but proved somewhat difficult to

interpret. Entering the hierarchy at that point where the error changed from a steady rise to a marked degree produced a total of 17 clusters of journal titles. Although some interesting and expected combinations of journal titles emerged within these clusters, many anomalies existed and it was decided that too much noise in the matrix was producing implausible clusters. Running the data using the Osiris Hiclust program corroborated this impression with both hierarchies exhibiting similar patterns.

In examining some of the ambiguous clusters, it was noted that journals with fairly low citation counts were often clustered, particularly at the later less reliable steps in the program, with journals having very high citation counts. Some journals in the cited set had less than 10 citations over the four time periods of the ASRR. In most instances, these groupings appeared to account for the largest ambiguities in the results. Obviously, the general matrix reduction procedures (described in Chapter III) had not produced a "tight" enough matrix to allow for reasonable interpretation of the results.

It was decided to reduce the matrix further by requiring that no cited journal title enter the analysis with less than 20 citations over the four time periods of the ASRR. This decision also seemed reasonable in light of the fact that the cited materials appeared in four annual summaries selected to broadly represent the 13 year period 1959 to 1972. Thus, journals with less than 20 citations seemed inappropriate as representatives of the most cited research literature. Cut-off points of 30 and 45 citations were also considered but rejected. A limitation of

20 citations seemed not too high or too low and assured that the important most representative titles would enter the analysis. Useful interpretable data would have been lost using a higher citation criterion.

C Group Results

The new clustering results obtained with the UBC C Group program are presented in dendogram form in Figure 6.

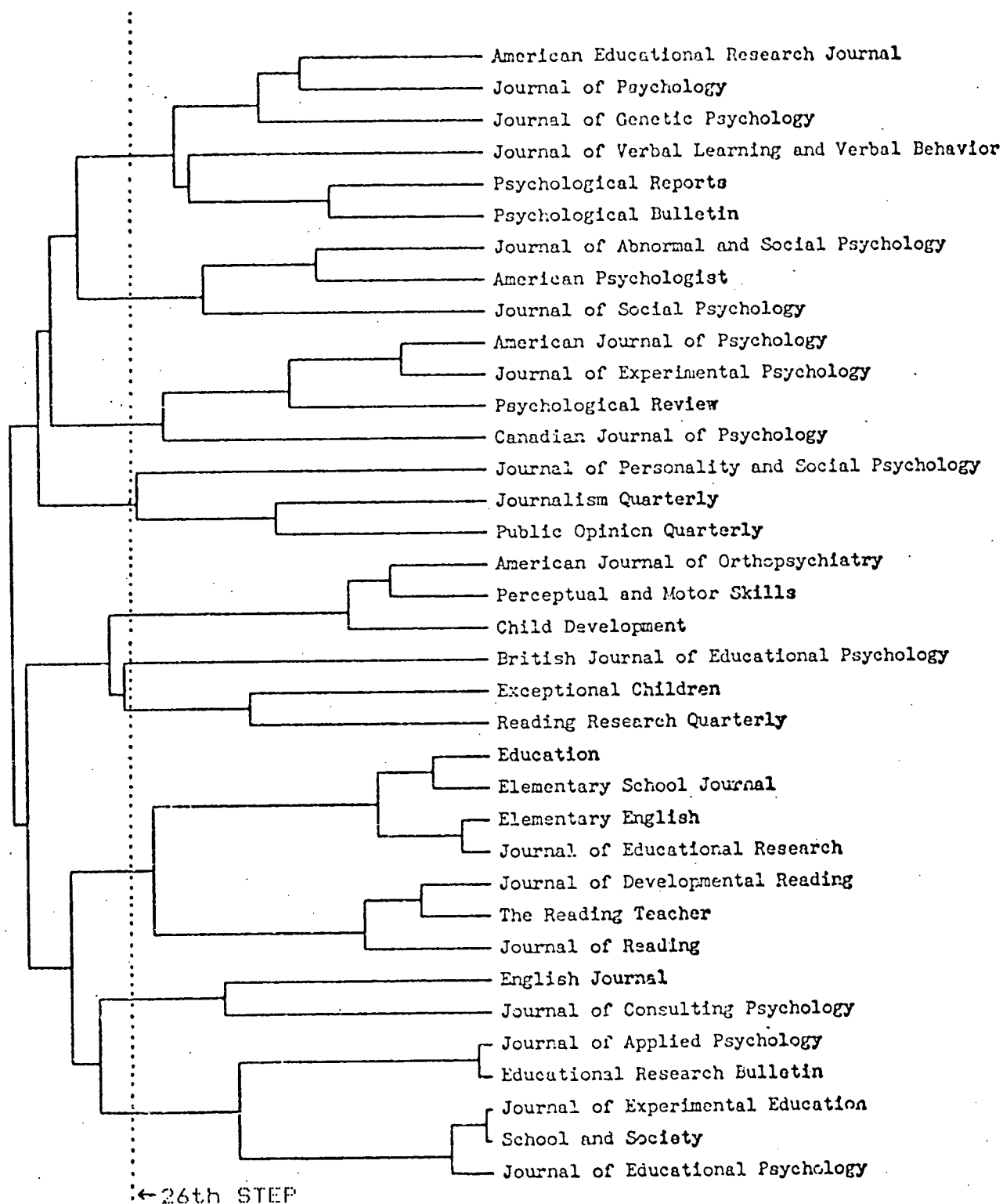
INSERT FIGURE 6 ABOUT HERE

For purposes of interpretation, the hierarchy is entered just prior to the point where a substantial change in the error term associated with each level occurs. (See Figure 7.)

INSERT FIGURE 7 ABOUT HERE

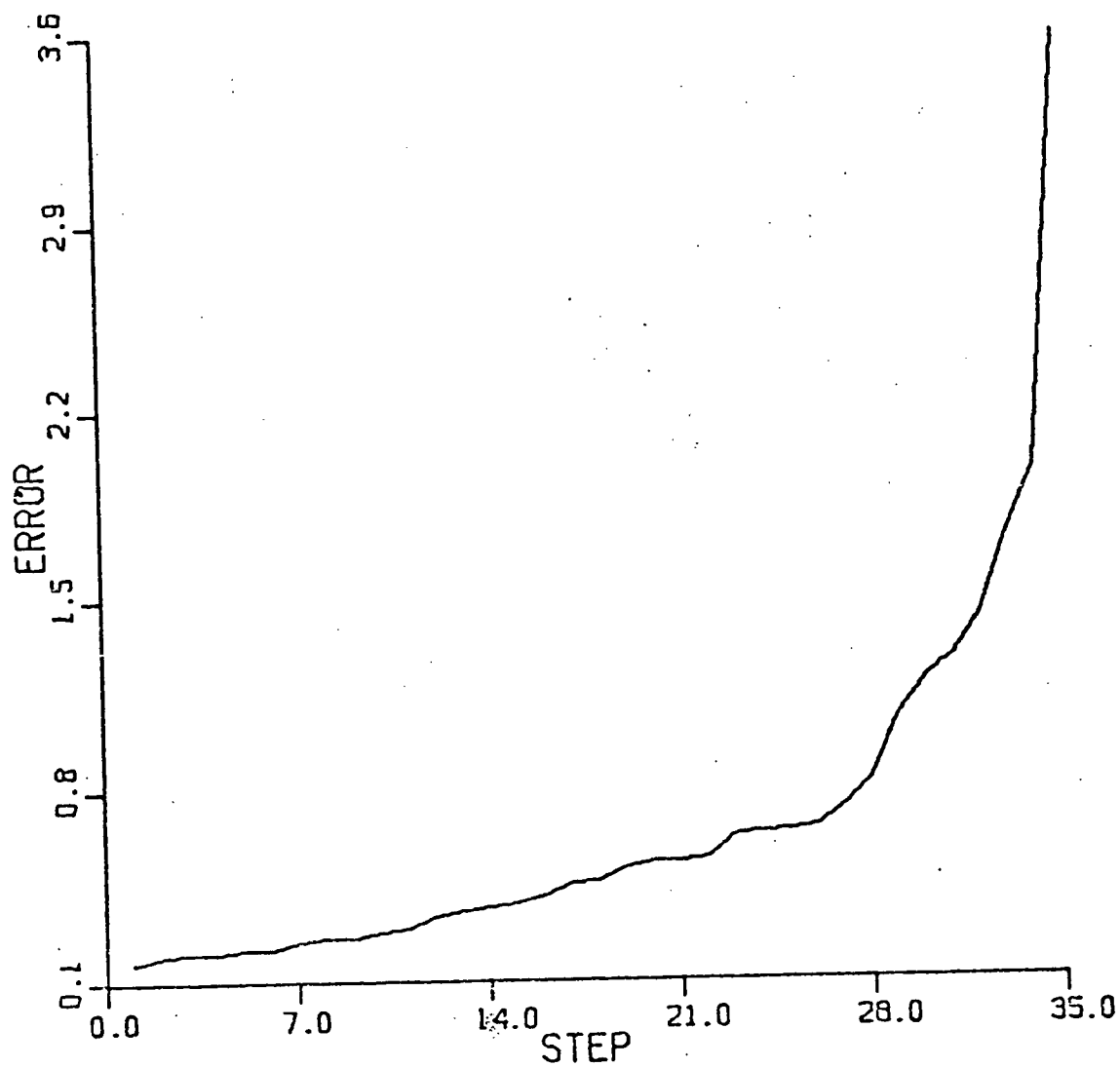
Since the program continues to cluster until all clusters eventually unite to form one, there are several jumps in the error term. The jump closest to the approximate number of groups desired for examination is taken as the entry point. For purposes of this study, a number of groups between 4 and 10 was deemed desirable, so the data were examined for an error jump in the range between 4 and 10 groups. The error jump indicates that reduction to the next stage of grouping would involve a substantially larger error than was associated with the previous reduction. The Selection Index is also helpful in entering the hierarchy. This indicates the relative error increase associated

Figure 6



Cluster Analysis of Journals Related by Citation
 to the Field of Reading Research
 (C-Group method)

Figure 7



Relative Error at Each Step of
C-Group Cluster Analysis

with decreasing the number of groupings by one. The plot of the logarithm of error terms versus the number of groups provides a useful visual display of the error increase and can also be helpful in entering the dendrogram. Using all three indices, level 26, or that point where 10 groups had been formed, seemed the appropriate point for interpretation of the hierarchy. At that point the error jumped markedly in the reduction to 9 groups (see Figure 7 presenting the logarithm of error terms versus the number of groups).

Three points should be noted about the obtained clusterings. The first, is that the clustering is performed on the journal titles cited with the greatest volume in the articles for the four time periods of the ASRR. Thus, in a sense, the clustering represents only a division of the high frequency core cited materials into general discipline classes. The second point is that the earliest formed clusters are relatively stronger than those formed at later stages in the program. Finally, it is of course impossible to completely separate journal titles into totally discrete groups but it is possible to divide the set into relatively meaningful general groupings. No optimal solution is obtained.

As illustrated in Figure 6, the overall hierarchy in the dendrogram at the 26th step (indicated by dotted line) shows 10 clusters containing 36 journal titles. These 36 core journals account for approximately 65 percent of the total citations (See Table VI in the Appendix). The balance of 35 percent are accounted for by the remaining 412 journal titles in the cited set. The journals that are found in each of the ten groups tend

to have similar patterns of citation across the journals in the referencing set. The 6 journals listed in Group 1 can be used to illustrate the clustering concept. These journals were cited with the following frequencies in the referencing set of journals:

<u>American Educational Research Journal</u>	cited 29 times
<u>Journal of Psychology</u>	cited 38 times
<u>Journal of Genetic Psychology</u>	cited 41 times
<u>Journal of Verbal Learning and Verbal Behavior</u>	cited 69 times
<u>Psychological Reports</u>	cited 32 times
<u>Psychological Bulletin</u>	cited 54 times

The clustering program grouped these six journals together on the basis of the fact that the citations for each journal exhibited a similar pattern across the journals in the referencing set. In other words, the referencing journals tended to refer to these journals in similar proportions and when they tended to refer to one they tended to refer to the others. This suggests that the 6 journals possess substantive ideational content that is in some way similar or closely related. This hypothesis is based on the assumption that authors do not cite references haphazardly; they cite articles from other journals because those articles somehow relate to or support the conceptual thrust of their research. Journals exhibiting similar statistical patterns of citation are thus also ideationally related. Examining the nature of the journals clustered together

on the basis of pattern of citation, and making comparisons with other journal clusters, can illustrate general disciplinary emphases in the research cited in reading research articles.

The journals in Group 2 also exhibit similar patterns of citation across the referencing set. However, this pattern is different than that established by Group 1 or by any of the remaining 8 groups of journals. This uniqueness holds, in turn, for all 10 groups. A description of each cluster obtained with the C-Group method follows.

Group 1 Journals

American Educational Research Journal
Journal of Psychology
Journal of Genetic Psychology
Journal of Verbal Learning and Verbal Behavior
Psychological Reports
Psychological Bulletin

Two main trees emerged in this group. Psychological Reports and Psychological Bulletin clustered relatively early and later joined with the Journal of Verbal Learning and Verbal Behavior to form one tree. The American Educational Research Journal and the Journal of Psychology clustered at a somewhat later point and eventually joined with the Journal of Genetic Psychology to form the second tree. These two trees then merged to form Group 1.

Group 2 Journals

Journal of Abnormal and Social Psychology
American Psychologist
Journal of Social Psychology

The Journal of Abnormal and Social Psychology joined relatively early with the American Psychologist and eventually clustered with the Journal of Social Psychology to form Group 2.

Group 3 Journals

American Journal of Psychology
 Journal of Experimental Psychology
 Psychological Review
 Canadian Journal of Psychology

The American Journal of Psychology joined very early with the Journal of Experimental Psychology to form a cluster. This cluster later joined with Psychological Review. This three journal cluster eventually joined with the Canadian Journal of Psychology to complete Group 3.

Group 4 Journals

Journal of Personality and Social Psychology
 Journalism Quarterly
 Public Opinion Quarterly

The Journalism Quarterly joined the Public Opinion Quarterly relatively late and then merged with the Journal of Personality and Social Psychology to complete Group 4.

Group 5 Journals

American Journal of Orthopsychiatry
 Perceptual and Motor Skills
 Child Development

The American Journal of Orthopsychiatry and Perceptual and Motor Skills clustered early and joined with Child Development relatively early to form this group.

Group 6 Journals

British Journal of Educational Psychology

The British Journal of Educational Psychology had not joined any other journals by the 26th step and was therefore considered in a cluster by itself.

Group 7 Journals

Exceptional Children
Reading Research Quarterly

Exceptional Children and the Reading Research Quarterly merged at the 18th step of the program and formed cluster 7.

Group 8 Journals

Education
Elementary School Journal
Elementary English
Journal of Educational Research
Journal of Developmental Reading
The Reading Teacher
Journal of Reading

Two main trees, with two sub-clusters, emerged in this group. Education and Elementary School Journal clustered very early. Elementary English and the Journal of Educational Research also clustered early. These two sub-trees then joined to form one main tree. The Journal of Developmental Reading clustered early with the Reading Teacher. This cluster later joined with the Journal of Reading to form the second main tree. (It should be noted that the Journal of Developmental Reading and the Journal of Reading are the same publication. The fact that the program clustered the two together is considerable support for the stability and reliability of the clusters.) the two main trees then joined to complete Group 8.

Group 9 Journals

English Journal
Journal of Consulting Psychology

These two journals cluster at a late stage to form Group 9.

Group 10 Journals

Journal of Applied Psychology
 Educational Research Bulletin
 Journal of Experimental Education
 School and Society
 Journal of Educational Psychology

Two main trees form Group 10. The Journal of Applied Psychology and the Educational Research Bulletin clustered very early to form one tree. A three journal tree consisting of the Journal of Experimental Education , School and Society and the Journal of Educational Psychology also cluster very early to form the second tree. These later merge to form Group 10.

Group 1 appears to take into account features of general experimental psychology with that literature cited in relation with facets of educational research and verbal learning and verbal behavior. Group 2 exhibits a strong flavor of abnormal and social psychology. Group 3 appears to take a more general psychology focus with two national psychology journals of a general nature cited in relation with a review and general experimental publication in psychology. Group 4 assumes a social psychology flavor with journal titles in these areas cited in relation with personality and social psychology. Group 5 has journal titles representing child development and behavior problems giving the cluster a strong growth/development flavor. In Group 6 the British journal stands alone. Group 7 is a rather unique cluster with a journal related to exceptionality and a research-oriented reading journal. Group 8 contains a strong reading and language focus cited in relation with general education, curriculum development, methodology, and educational research. Group 9 is difficult to interpret. The two journals

joined late in the program but combine eventually with the general education and applied psychology groups. The journal titles in Group 10 have a strong applied psychology and educational psychology and research focus.

Some subjective interpretation of the 10 journal clusters is possible. It should be borne in mind that cluster analyses do not lend themselves to specific conclusions even though hard data are analyzed. The cited journal titles represent a wide variety of disciplinary activity related to reading research, and the problem is to provide labels to represent the focus of each cluster. One possibility was to classify the journal titles according to the subject scheme found in Ulrich's International Periodical Directory (1974). This method would place titles in very broad categories such as Education, Children and Youth, Journalism, Political Science, Psychology and the like. These categories are too broad and allow for little differentiation. An alternative method is followed which consists of subjectively discussing clusters based on statements from journal editorial policy, familiarity with the journal, and examination of copies of the journals themselves.

The C-Group clustering results suggest that the disciplinary profile of the most frequently cited journals appearing in the reading research articles referenced in the ASRR includes one cluster of journals representing reading, general education, elementary school curriculum, elementary language development, and educational research. This could be labelled the reading and education cluster. These journals tend to cluster early, and thus rather strongly, in Group 8. The

Group 10 journals represent a strong educational flavor and were among the earliest journals to cluster. The Group 5 journals represent a strong growth and development flavor clustering relatively early in the program. Groups 6, 7, and 9 are somewhat ambiguous and their co-occurrence and citation patterns across the referencing set are difficult to interpret. However, if Groups 6 and 7 are considered later in the clustering program (after the 26th step) in relation to Group 5, a reasonable grouping of journals results -- although this is not a particularly strong grouping. The remaining four groups (Groups 1, 2, 3, and 4) are heavily psychological in their orientation and include groupings of journals related to general psychology, verbal learning, abnormal and social psychology, and experimental psychology.

Some journals may appear to be in unusual relationships within groups. For example, the American Educational Research Journal's position with the psychological journals in Group 1 may appear to be odd. However, the arrangement of journals in each cluster is based on aggregate articles cited, and is content as well as statistically oriented. Previous clustering studies have confirmed that some apparently odd journal title placings can exist without altering the general "flavor" of the cluster as a whole. In fact, if the articles cited within a cluster were actually examined (a rather awesome task), it would most likely be revealed that they hold together quite well in terms of ideational content. It must be borne in mind that the title of a journal may also be a poor reflection of the actual contents of the articles therein. The fact that the journal was

cited in similar fashion with the other journals is a stronger rationale for its location in a cluster than location based purely on journal title. As Garfield (1973) points out, the paper itself, and not the location in a journal, determines the impact of its citation.

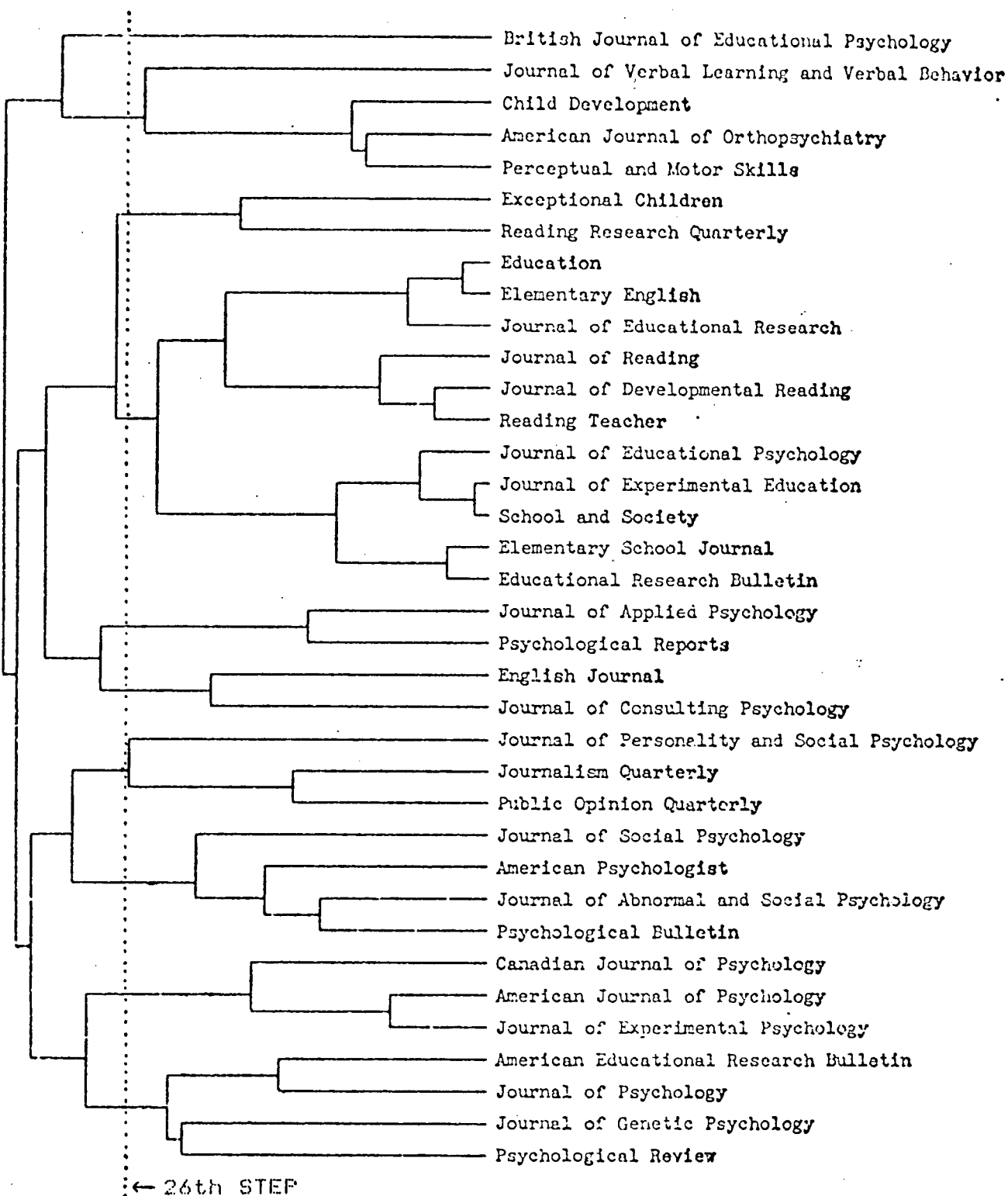
Hiclust Results

The reduced matrix data for the core journals was also run using the Osiris Hiclust program. The Hiclust program uses the Pearson Product-Moment correlation as a similarity measure between cited journals, but produces a step-wise clustering similar to the C-Group method. The dendrogram which graphs the left to right progress of the clustering is shown in Figure 8.

INSERT FIGURE 8 ABOUT HERE

A correlation term plotted for each step indicates where the program could be interrupted and the results to that point examined. The rationale for the use of the correlation term is the same as that for the use of the error term in the C-Group method. A large correlation drop occurred after the 26th step where 10 clusters had already formed. This drop can be seen graphically displayed in Figure 9. The results of both the C-Group and the Hiclust programs indicated that the relative "strength" of the clustering diminished markedly after the 26th step. This can be seen by comparing Figures 7 and 9.

Figure 8



Cluster Analysis of Journals Related by Citation
 to the Field of Reading Research
 (Miclust method)

INSERT FIGURE 9 ABOUT HERE

A description of each of the groupings formed at the 26th step of the Hiclust program follows.

Group 1 Journals

British Journal of Educational Psychology

This journal had not joined any of the other journals at the 26th step so is considered to be in a cluster by itself.

Group 2 Journals

Journal of Verbal Learning and Verbal Behavior
Child Development
American Journal of Orthopsychiatry
Perceptual and Motor Skills

Child Development , the American Journal of Orthopsychiatry , and Perceptual and Motor Skills clustered relatively early and were joined later by the Journal of Verbal Learning and Verbal Behavior .

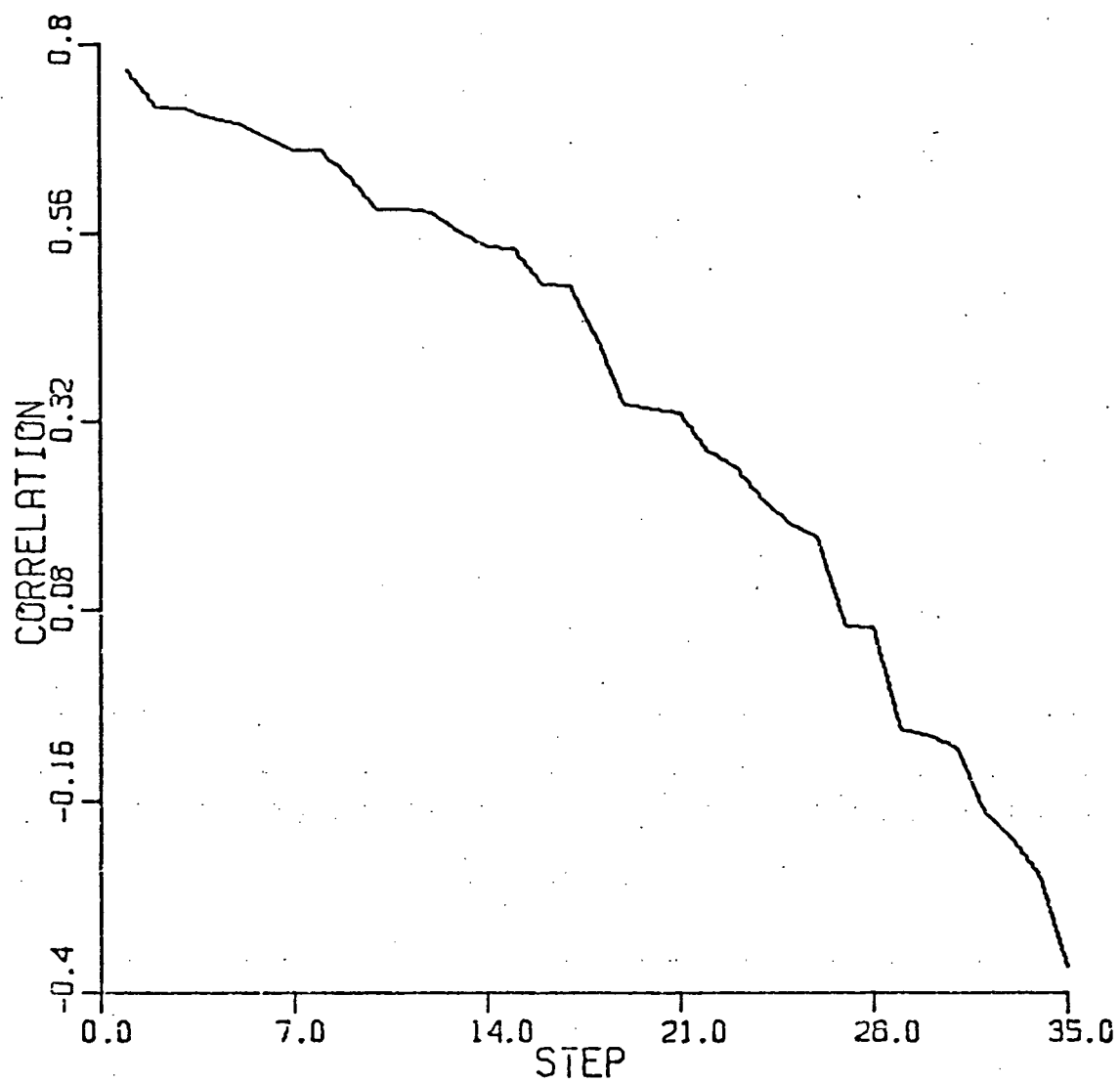
Group 3 Journals

Exceptional Children
Reading Research Quarterly

These journals clustered together at the 18th step in the program, just as they had in the C-Group program.

Group 4 Journals

Figure 9



Correlation Coefficient at Each Step of
Hierarchical Cluster Analysis

Education
 Elementary English
 Journal of Educational Research
 Journal of Reading
 Journal of Developmental Reading
 The Reading Teacher
 Journal of Educational Psychology
 Journal of Experimental Education
 School and Society
 Elementary School Journal
 Educational Research Bulletin

Four distinct subgroups clustered early within this collection of obviously education-related journals. Education joined Elementary English and the Journal of Educational Research to form the first. The second contained three reading journals: the Journal of Reading , the Journal of Developmental Reading , and the Reading Teacher . (Again note that the Journal of Developmental Reading and the Journal of Reading are the same publication.) The third subgroup contained the Journal of Educational Psychology , the Journal of Experimental Education , and School and Society . Elementary School Journal and Educational Research Bulletin made up the final subgroup. The large cluster itself contains only journals which refer to education or educational subjects such as reading, exceptionality, and elementary English. Of the total 36 journals clustered only four distinctly education-related journals do not appear in this cluster: the Reading Research Quarterly , the British Journal of Educational Psychology , the English Journal , and the American Educational Research Journal .

In the following clusters there are 18 journals, 14 of which relate directly to psychology.

Group 5 Journals

Journal of Applied Psychology
Psychological Reports

These journals clustered relatively early at the 13th step, indicating a relatively strong similarity of treatment by the referencing set, but were placed in completely different clusters in the C-Group method.

Group 6 Journals

English Journal
Journal of Consulting Psychology

This unique clustering together of the English Journal and the Journal of Consulting Psychology also took place at the same step (20th) as in the C-Group method.

Group 7 Journals

Journal of Personality and Social Psychology
Journalism Quarterly
Public Opinion Quarterly

The two quarterlies clustered first and were joined later by the Journal of Personality and Social Psychology.

Group 8 Journals

Journal of Social Psychology
American Psychologist
Journal of Abnormal and Social Psychology
Psychological Bulletin

Two of the journals here refer to social psychology, and three, the American Psychologist, the Journal of Abnormal and Social Psychology, and the Psychological Bulletin are all American Psychological Association publications.

Group 9 Journals

Canadian Journal of Psychology
 American Journal of Psychology
 Journal of Experimental Psychology

Group 10 Journals

American Educational Research Journal
 Journal of Psychology
 Journal of Genetic Psychology
 Psychological Review

The results of the Hiclust program generally confirm those of the C-Group program. 10 clusters were formed by each program. It is interesting to note that the C-Group clusters which were judged to be somewhat ambiguous (Groups 7, 8 and 9) were exactly replicated in the Hiclust program as groups 1, 3 and 6.

Group 4 in the C-Group program contains the same journals as Group 7 in the Hiclust program. Except for the shifting of some journals, and the combining of two groups, the results obtained by the two programs are quite similar. Group 1 in the C-Group program is quite similar to group 10 in the Hiclust program with the exception that the Journal of Verbal Learning and Verbal Behavior and Psychological Bulletin have shifted to other groups. Group 2 in the C-Group method is the same as Group 9 in the Hiclust program with the exception that Psychological Review has been omitted from the Hiclust Group 9. Group 5 in the C-Group program is the same as Group 2 in the Hiclust program with the exception that the Journal of Verbal Learning and Verbal Behavior is added to the Hiclust Group 2.

Group 8 and Group 10 in the C-Group program are essentially combined into one group, Group 4, in the Hiclust program with the exception that the Journal of Applied Psychology from the C-

Group program Group 10 is omitted.

The fact that similar distinguishable groups were produced by both programs, and the fact that the groups can be identified with subject fields such as, for example reading and social psychology, suggests that there is a clusterable structure within the cited journal set and that journal citation data are amenable to analysis and interpretation using clustering techniques.

The clustering hierarchies represent what could be termed a "network of cross-disciplinary journals related to reading research." Authors tend to cite other reading publications but their citations also flow to a number of core publications which represent general disciplinary groupings. The strongest flavor of the groupings is education and psychology with other areas, such as social psychology and exceptionality, included as noted previously. The authors also cite a broad array of journal titles which are strongly related to the core literature in substantive terms, but whose volume of citation does not qualify for inclusion in that group. These 414 titles did not meet the minimum 20 citation criteria established for inclusion in the core matrix. Thus, some even more diffuse discipline areas are also represented in reading research. The reading research literature appears to focus across a range of disciplines, both within the general educational literature and outside. The cluster analysis technique reveals the general disciplinary profile in somewhat but not totally systematic patterns. The cited literature analysis confirms the broad nature of reading research literature. The literature is representative of the

pattern that could be expected in an emerging field where a central tight core is beginning to emerge but the overall pattern is still cross disciplinary citation to a wide variety of literature.

SUMMARY

This chapter has presented the analysis of the data and the findings of the study. Of the 1062 documents reviewed in the ASRR across the four time periods selected for this study, 918 were journal articles. Of the 918 journal articles, 768 (84 percent) were obtained and deemed a sufficient data base for the purposes

Core journal titles were identified in three ways: by rank ordering journal titles by articles in the ASRR, by total references produced by those articles, and by citations received from the referencing articles. In each case, results followed a Pareto-like distribution such that of the 108 referencing journals, nine journals accounted for 50 percent of the articles in the ASRR, and 34 journals accounted for 80 percent. In the production of references, 12 journals accounted for 50 percent of the 7,642 references produced by the 768 articles in the 108 journals, and, again, 34 journals accounted for 80 percent. The third measure of core journals, by citations received, indicated 19 of the 448 journal titles were recipient of 50 percent of the 1,895 citations to journals, and 74 journal titles were recipient of 80 percent.

Citations Per Article

The average number of citations per article was found to

grow steadily from 6.89 to 12.61 across the 13 year interval of the study. This indicates that scholarliness (as defined by Price, 1970) in the field of reading has been moving closer to the norm for science in general, which is a paper with from 10 to 22 references. These results parallel the findings of Parker, Paisley, and Garrett (1967). In eight social science journals (psychology and sociology) they found an average of 8.4 citations per article in 1950, 9.4 in 1955, 15.2 in 1960, and 15.2, again, in 1965.

Age of Cited Material

The use of Price's Index provides a criterion for assessing the relative recency of journal literature citation in reading research. Price suggested that the larger the Index, the more probable the existence of a research front in a field. The results of this study suggest steady growth in the number of cited documents which are less than 10 years old across the decade studied with the percentage increase moving from 34.7 percent in 1959 to 61.9 percent in 1972. This provides support for the notion that reading is moving rapidly toward less reliance on archival sources and more on the citation of recent research literature and may indicate the existence of a reading research front that has recency characteristics similar to other more "scientific" disciplines. However, Parker, Paisley, and Garrett (1967) found that while 70 percent of the cited material in 17 science journals in 1965 was less than 10 years old, the 0 to 4 time period accounts for the bulk (41 percent) of the material. In reading, the 0 to 4 period accounts for only 21 percent of the cited material. In addition, Price (1970)

estimated that in a normally growing field, if 22 percent of cited documents were less than 5 years old, the field was purely archival and without an active research front. Comparisons with these data suggest an emergent possible research front in reading which is still more archival than social science data in general and certainly more archival than hard science.

Type of Publication

The journal literature in reading cited other journal literature approximately 50 percent of the time, books 35 percent of the time, and other types of documents about 16 percent. These results are comparable with the findings of Broadus (1971) that in education in general, 30.9 percent of the citations were to books in 1953, and 32.7 percent in 1965. Parker, Paisley, and Garrett (1967) found 43 percent of the citations from 17 selected behavioral science journals were to journals and 31 percent were to books. However, Price (1970) reported that, in the SCI, the average journal article referred to other serial publications 80 percent of the time. Lin and Nelson (1969), in comparing the 50 percent reference to books in sociological journals with the 15 percent rate in an optical journal, concluded that disciplines with paradigms tend to publish their work in journals while disciplines without tend to publish in books. When compared with these results, apparently reading researchers rely upon journal and book literature to somewhat the same extent as most social scientists, but considerably less than do physical scientists.

Self-Citation

Taking the proportion of author self-citation as an indicator of the existence of cumulative scholarship within a field, the finding that self-citation has grown markedly in reading research from 30.8 percent in 1959 to 42.7 percent in 1972 suggests that research in reading may be becoming more cumulative. These findings are very similar to what Parker, Paisley, and Garrett (1967) found in 17 behavioral science journals where percentages of self-citation increased from 33 percent in 1950 to 46 percent in 1965.

Multiple Authorship

According to Price (1970) and others, multiple authorship may be related to the amount of financial support available within a field. Parker, Paisley, and Garrett, (1967) reported that the average number of authors per article in the social sciences was 1.34. Lin and Nelson (1969) reported a very similar 1.4 average in sociological journals. The results here suggest, that in reading, there was a steady decline in the single-authored document from approximately 75 percent of the total in the early forties to about 55 percent in the late sixties. The averages for reading based on the referencing articles were found to be 1.40 authors per document in 1959, 1.59 in 1964, 1.53 in 1968, and 1.66 in 1972. Similarly, the multiple-authorship in the cited documents increased steadily as the number of authors per article grew from 1.29 during the Second World War to 1.59 in the period from 1966 to 1970. This suggests a trend in reading to more collaborative work, and may indicate that financial support of project-type activity in reading

research is becoming more characteristic of the field.

Cluster Analysis

The cluster analyses by the UBC C-Group and the Osiris Hiclust methods yielded similar though not identical groupings of journal titles. The general profile revealed a group of education related journal which clustered early and contained within itself a tight subcluster of reading journals. The other clusters relate largely to exceptionality, growth and development, educational psychology and psychology.

CHAPTER V

SUMMARY, CONCLUSIONS AND IMPLICATIONS, FURTHER RESEARCH

SUMMARY

The literature of reading research can be defined as a body of thought expressed in published writings and represents an archival record that can be measured and analyzed. This investigation is based on the concept that studying the research journal literature can reveal much about reading as a discipline in addition to its substantive content. The major purposes of the study were to: establish a sample of reading research literature; determine the core structure of the sample of reading research journals; describe developmental trends in the reading research literature; and illustrate disciplinary connections among journals reporting reading research. The conceptual base for the study, and the bibliometric measures used, derive from research in the field of information science. The Annual Summary of Research on Reading, published yearly since 1925, was selected to represent the reading research journal literature. That publication is an annual summary of research, produced by the International Reading Association, and appears in the IRA journal, the Reading Research Quarterly. The ASRR provided two sets of journal titles for analysis, those titles which constitute the referencing set of journals and those titles which are cited in the articles of the referencing set of journals.

The ASRR is the result of an integrated program devoted to identifying and summarizing reading research on an annual basis. It represents a preselected set of materials chosen by professionals in reading. The summaries for the years 1959, 1964, 1968 and 1972 -- representing the years 1959 to 1972 -- provided the literature for analysis. 768 of the journal articles published (84 percent of the total) in the four summaries were collected and analyzed.

Three major analyses were performed using the journal literature. In the first, the referencing collection of journal articles was described and sets of core journals generated. Developmental trends in reading research were determined in the second analysis using a number of bibliometric measures applied in the study of other literatures including average number of references per journal article, age of cited materials, type of publication cited, frequency of author self-cites, and patterns of multiple authorship both in the referencing and cited set of journals. In the third analysis, two clustering programs were used to statistically group the core cited journal titles and illustrate the disciplinary profile of reading research based on literature use habits of authors.

CONCLUSIONS AND IMPLICATIONS

The conclusions and implications for the study are discussed under the headings of core journal structure, developmental characteristics, and clustering of journal titles.

Core Journal Structure

The results of the study demonstrate that it is possible to

view reading research production using the core journal concept. Core journal lists were identified using three familiar indices: number of articles appearing in the ASRR, quantity of references produced by those articles, and volume of citation in the referencing set of journals. For all three lists, the most productive journals accounting for 50 and 80 percent of the total articles, references and citations were identified. These results confirm those reported by Garfield (1972) in working with the literature from the large data base of the SCI. The journals isolated as the cores for the three lists follow the expected general Pareto distribution, reported in core journal research using other literatures, demonstrating the predominance of a small number of journals as primary nodes in the reading information network in terms of article, reference, and citation production. The predominance of cores of journals is indeed ubiquitous.

The journals in the three core lists represent diverse subject areas such as reading, general education, educational research, growth and development, curriculum, educational psychology and various areas of psychology. The subject diversity is even more pronounced when the total journal lists based on the three criterion are examined. The 768 articles in the referencing materials from the four years of the ASRR produced a total of 108 journals and the articles in those journals in turn generated 7,642 references. The 108 journal titles markedly expand the subject diversity represented by the core listings. This diversity is expanded even more when the emphasis shifts to counting the journals cited in the

references. The increase is fourfold producing a list of 448 cited journal titles. These are the titles referred to by the authors who wrote the 768 articles in the ASRR for the four time periods. It appears that literally every subject area in education, and a considerable number of subject areas outside education, is in some way related to and speculating about research in reading. However, the total significance of the wide disciplinary spread of titles cited by reading researchers has yet to be determined. In the context of this study, it is taken as a strong indicator of multidisciplinary activity.

Decisions with respect to core journal identification have considerable relevance in developing an annual summary of reading research. Most core lists have been developed using article productivity as the criterion for monitoring journals, or, as is the case in some limited journal collections, reference counts. Using cited journal titles as the criterion adds an important dimension to core identification. Theoretically, a hypothetical number of reading research articles exist "out there" for any one year. Leaving aside the fact that most summaries now have to be selective and limit their size because of economics, the good summary is the one which comes closest to identifying and presenting all the relevant literature for a particular year. Considering those journals cited by authors of reading research articles as candidate journals for monitoring would add considerable power to the surveillance network for an annual summary. Power would be added because, in using cited journals as a criterion, the network relationships become conceptual in nature and not just

quantitative as is the case when the criterion is either article or reference productivity. In addition, such procedures would also enhance the power because the network of cited journal titles, as demonstrated by the results of this study, will considerably broaden the disciplinary base of journal titles which then become candidates for systematic article monitoring.

Developmental Characteristics

Price (1970) suggested that a subject grows from the body and the skin; the body, or archival record, consisting of monographic sources, and the skin, or cutting edge record, consisting largely of the research journal literature. Analysis of the citations appearing in the 768 journal articles published in the four annual summaries suggest several important growth characteristics in the field of reading research.

Studies of various literatures suggest that there is a slow but steady increase in referencing in all fields and that a general norm of scholarliness can be taken as 10 to 22 references per document. It is recognized that even with a long list of references some articles lack the scholarliness that might be bestowed by bibliographic citations. Quantity should not be directly equated with quality and the notion that the distinction between scholarly and non-scholarly work hinges on presence or absence of references is a controversial one. However, bibliographic backscratching and excessive self-citation can be considered as limiting assumptions in such counts. Such practices have been shown to have minimal effects when macro conclusions across literatures are being made rather than limited conclusions based on small collections or

individual works.

The increased frequency of referencing in reading research articles is obvious from the data on average number of citations per document. The average has grown steadily from 6.89 in 1959 to 12.61 in 1972. The 10 to 22 citations per document norm figure may be somewhat influenced by inclusion of review articles and unreferenced papers. None of the former and few of the latter were included in this study making the data for reading research a harder estimate of actual recent citation volume and placing the subject well within the scholarly range.

It has been suggested that citation data serve both a prescriptive and a diagnostic function; prescriptive in that a discipline must exhibit citation data to be scholarly and diagnostic in that the presence of such data indicates general scholarliness. Reading research is definitely moving to the generalized scholarly norm for science and is very close to data for other social sciences, sociology and psychology in particular. These findings suggest reading research emerged as a more mature discipline over the period 1959 to 1972. It can be argued that reading research is now in an intermediate rather than an early stage of scholarliness using average number of references per paper as the criterion.

Another characteristic by which materials used in reading research were analyzed, is their age at the time of citation. New knowledge usually grows from recent findings and age of cited materials reflects the extent to which a subject favors a recent over an older body of literature. It has been suggested that if 22 percent of cited documents are less than 5 years old

the subject tends to be archival and lacks an active research front in the sense of the hard sciences. A 39 percent figure indicates a subject is in a period of rapid growth.

Although the reading results show a steady increase in the number of documents 10 years of age or less (moving from 34.7 percent in 1959 to 61.9 percent in 1972), the evidence does not suggest a science-like research front or immediacy effect in its research literature.

For other social science data, 40 percent of the material was dated 4 years prior to the referencing publication and 26 percent dated within 5 to 9 years. For reading research, 21 percent of the materials were dated 0 to 4 years. There was a steady increase in materials dated 5 to 9 years with a subsequent decrease in older materials. It can be concluded that there may be a beginning research front in reading, based on recency of cited materials, but it still tends to be more archival than social science data in general and far more archival than research in the hard sciences. It is also interesting to view this data in relation to that discussed previously for citations per document. While the average number of citations per article is rising in reported reading research, the age of cited material has also been decreasing although the age range is still not within that of science articles in general. Reading research is broadening in the discipline literature it relates to, with the total picture also suggesting citation of more recent materials.

Publication type simply indicates whether the reference being cited is a book, journal or other type of medium.

Variability in publication type depends on the discipline examined, with the humanities and social sciences using more monographic materials, while in hard science, serials dominate over monographic usage. For the social sciences in general, monographic citation varies from 40 to 55 percent, while in the sciences, some studies report 80 percent of the references in the average journal article to be to other journals. For reading research, references to books and serial literature held steady across the four time periods at 35 and 50 percent with some growth taking place in citation of other source. The results suggest that, in terms of form of publication, reading research tends to rely less on book and more on serial publications than some of the other social sciences.

It has been noted in the sciences that disciplines with established paradigms tend to publish in journals while those with less established paradigms rely more on books. The data indicate that there may be some beginning movement toward established paradigms in reading research, based on the somewhat higher use of serial over monographic citations. This must be offered as a tentative conclusion and would have to be supplemented by content analysis of reading research literature to determine the existence of legitimate research paradigms.

Although there has been little work previously reported in this area, degree of self citation may provide some indication of commitment to cumulative research and individual author productivity. (It is recognized that self citation could also measure mediocrity or parochialism.) Data based on social science journals suggest a trend toward increasing self

citation. The figures are roughly paralleled by the reading data. Self cites of 30.8 and 42.7 percent were reported in 1959 and 1972 suggesting some increase in commitment to cumulative work. The area of individual productivity in reading research should be followed up as a possible measure of the research emphasis in the field. Clemente (1973) suggests that one of the few areas of consensus in productivity studies has been that of publication output. Price (1963) also emphasizes this point.

Co-authorship is reported to be increasing in most fields and is an indicator of collaborative effort and the extent to which financial support is available for broader project type research. Sociological research provides the only comparison based on citation data and indicates 59 percent of articles with single authors and 41 percent with two or more authors. In reading research, single authorship dropped from 65.93 percent in 1959 to 50.70 percent in 1972 in the referencing set of journals. In the cited set, the increase in multiple authorship is even more dramatic with single authors dropping from 74.8 percent in 1941-45 to 56.9 percent in 1966-70. In both sets of data, the drop in single authorship articles is accompanied by rises in multiple authorship, particularly in two-authored papers. The data from this study lend strong support to the conclusion that collaborative work in reading research increased in the period 1959 to 1972 and in the wider time range 1941 to 1970. It is likely the increase resulted from broader funding which enabled researchers to mount more comprehensive projects. This could be checked by examining the co-authored reports in the ASRR for information on source of funding.

In summary, several conclusions can be offered, with respect to developmental characteristics of reading research, based on the sample of journal literature derived from the four time periods of the ASRR. Reading research is emerging as a more scholarly field, using quantity of citations as a criterion. There is a slight movement toward a more immediate research front, indicated by age of cited materials, but this is not strong and the field still relies heavily on archival and near archival resources in its research. A movement toward generation of science-like paradigms may be developing in reading research, based on proportion of serial and monographic usage, but this is tentative at best and not yet a pronounced trend. Some limited data suggest reading research may be becoming more cumulative, as indicated by increasing author self citation in journal articles. Finally, reading research is definitely becoming more collaborative based on the increasing proportions of multiple authorship, across a wide time range, in both the referencing and cited sets of journals.

Clustering of Journal Titles

Two statistical algorithms, one using correlational techniques and the other Euclidean distance, were applied to the cited set of journal titles. Matrix reduction techniques produced a listing of 36 core titles for analysis. The titles accounted for 65 percent of the total citations to journals in the referencing set of 108 journals. It should be borne in mind that in clustering, cited articles are pooled to represent their respective journals and the program assigns journals to groups on the basis of similarity in the manner in which their citation

are distributed across the referencing set of journals. Thus, journals in the final groupings exhibit conceptual as well as statistical relationships.

Intuitively acceptable journal groupings were produced in the cluster analysis with the two programs generally confirming each other. It can be concluded that cluster analysis is a viable technique for illustrating relationships in the primary literature using citation data from the reading research journal literature. Ten journal groups emerged. Three were deemed somewhat ambiguous, consisting of single journals or pairs emerging late in the clustering programs. Seven groups illustrated strong interrelationships among journal titles suggesting the existence of similar ideational content among the journals.

The journals cited by reading researchers reported in the ASRR can be described as belonging to several disciplines or subjects. One group, which can be categorized as the literature most directly devoted to the subject of reading, incorporates journals from reading, general education, curriculum, elementary English, and educational research. The remaining six groupings can be categorized as those which, while devoted more specifically to other subjects, also publish research related to reading. These six grouping embrace areas such as growth and development, exceptionality, educational psychology, and several branches of psychology.

As indicated previously, the most frequently cited journals, and the balance making up the cited set, provide useful input in developing summaries of research. If one

intended to keep abreast of the most productive journals in reading, a good multidisciplinary journal collection could probably be built on about four dozen titles. The cluster groups of journal titles also provide useful differentiation for searching the reading literature. Those interested in topics closely related to the subject of reading and its educational implications would monitor some groupings while those interested in reading as it might be related to other subjects or disciplines would monitor other groupings. The most useful reading-related journals are usually well known in the field but it is difficult to decide which journals from the vast array available in other subjects relate to reading in a more direct way. A times-cited list, based on research articles reported in an acceptable summary like the ASRR, can be very helpful in making such decisions.

FURTHER RESEARCH

Several areas for further research are suggested in the bibliometric analysis of reading research journal literature.

The study of the three core lists generated nuclei of core journals. Following the Pareto concept, these core journals represented 50 percent of the total articles, references and citations produced. It would be interesting to utilize Bradford's (1934, 1948, 1953) bibliographical law concerning concentration and dispersion of individual literatures and further analyze the lists in terms of the statistical dispersion of the journals beyond the cores. Succeeding sub-cores of important journals would most likely be revealed. Partitioning studies of other literatures, by Goffman and Warren (1969) and

Leimkuhler (1967), provide a statistical methodology for such an analysis. It has been suggested in these and other more recent sources (Donohue, 1973; Murphy, 1973; Pope, 1975), that dispersion analysis should be applied in many areas to generate cross-discipline comparison data.

It would also be useful to generate a study to compare the 448 journal titles in the cited set with several recent editions of the ASRR to determine the degree to which such titles are now being included on a yearly basis. The cited titles should also be compared with those appearing in ERIC's Current Index to Journals in Education (now indexing approximately 700 journals) to determine the overlap between the general education journal literature and that being cited by reading researchers.

Study of author productivity in reading research could be profitably extended by conducting research along the lines suggested by Voos (1974). He points out that Lotka (1926) made the initial examination of author productivity and suggested the factor for predicting the number of papers in a field to be $1/(n \text{ to the power of } 2)$ of the number of authors writing only one paper (If 100 authors wrote only one paper, 25 would write two, 11 three, etc.). Price (1965) also suggests the harder the science the greater the probability that authors will publish multiple papers. This factor provides another method for ranking research productivity in various disciplines along the continuum from hard to soft sciences. Voos found the author factor for information science to be $1/(n \text{ to the power of } 3.5)$. His work provides a good model for such an analysis in that previous methods are modified to utilize Chi square as the computational

method allowing one to theorize what the author publication volume would have to be to move a discipline along the science non-science continuum. Extent of citation of one's work by others should also be examined, using reading research, to provide another indicator of research productivity.

Analysis of cited journal articles could also yield a listing of the articles which have had the most impact in reading research. These could be compiled into what Price (1965) termed a Journal of Really Important Papers. Analyses of reading research articles that have made a difference have been reported in the past. However, the articles have been subjectively selected and citation data have not entered such decisions. Identification of nodal papers in the citation network could also aid in determining if Price's (1965) tightly knit groups of papers representing research fronts have been prevalent in reading research. Cawkell's (1974) research provides a good methodological base here. Analysis of citation data could also shed light on the actual proportions of archival and immediate papers which are cited in reading research to supplement the more gross age of cited papers data.

The cluster portion of the study grouped journals together on the basis of similarities in their patterns of citation by reading researchers. Analysis should shift to the individual articles which are represented in the various strong cluster groups. It would be interesting to see if viable conceptual maps would emerge which illustrate the most important topics and issues in reading research.

Finally, one very useful project could be developed using

citation data. On an annual basis, the citations in all the research articles making up the ASRR could be organized in a Reading Research Literature Citation Index. The value of such indexes have been proven in other subjects. Through computer technology, a large yearly data base of such citation material could be developed in a cost effective fashion.

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APPENDICES

APPENDIX A

THE CLUSTERING PROGRAMS

THE CLUSTERING PROGRAMS

Two hierarchical clustering programs were used in this study. Arms and Arms (1973:21) describe the step-wise procedure which produces the results shown in the dendograms (see Figures 6 and 8, Chapter IV).

The most common family of hierarchical methods can be described as follows.

- (a) Input the $n(n-1)/2$ similarities between the n points to be clustered.
- (b) Consider each point as a separate cluster.
- (c) Choose the two closest clusters p and q and merge them into a new cluster k which replaces p and q .
- (d) Compute the distance of cluster k from any cluster s , as a function of the distance of p and q from s .
- (e) Return to step (c).

The UBC C-Group method makes use of a similarity profile as the basis for determining inter-cluster distance. Patterson and Whitaker (1971:3), who wrote the program, describe the process in UBC statistical package manual.

The criterion to determine which pair is to be combined is established on the basis of profile similarity where the total within-group variation is the (value-reflecting) function minimally increased at each step in the process.

The algorithm used in the program is that of J. H. Ward as described in "Hierarchical Grouping to Optimize an Objective Function," Journal of the American Statistical Association, 1963, 58, 236-244.

The Osiris Hiclust program is described by an un-named author or authors in the Osiris II manual.

The method is designed to produce successive partitions of a set of points, called clusterings, by combining clusters at one level to yield a smaller number of clusters at the next level. The input data in this program consists of a correlation matrix which gives the degree of proximity of pairs of points where the points are variables.

The algorithm used in the Hiclust program is that proposed by R. Johnson in Psychometrika , 1967, 32, 241-254.

APPENDIX B

TABLE IV Journals by Number of Articles in ASRR in Four Time Periods. (Ranked by Total.)

TABLE V Journals by Number of References Produced in ASRR in Four Time Periods. (Ranked by Total.)

TABLE VI Journals by Number of Citations Received from ASRR in Four Time Periods. (Ranked by Total.)

TABLE IV

Journals by Number of Articles in ASRR in Four Time Periods.
(Ranked by Total.)

JOURNAL	TIME PERIOD				CUM. %	
	1959	1964	1968	1972	TOTAL	
Journalism Quarterly	9	26	29	22	86	11.20
The Reading Teacher	3	22	36	6	67	19.92
Journal of Educational Research	18	8	14	12	52	26.69
Elementary English	9	11	8	11	39	31.77
Journal of Educational Psychology	5	6	13	9	33	36.07
Journal of Reading	0	0	25	7	32	40.23
Elementary School Journal	5	9	10	3	27	43.75
Journal of Developmental Reading	9	18	0	0	27	47.27
Journal of Reading Behavior	0	0	0	21	21	50.00
Jrnl of Verbal Learning and Verbal Behavior	0	5	7	4	16	52.08
Journal of Experimental Education	2	7	2	4	15	54.04
American Educational Research Journal	0	2	6	6	14	55.86
Perceptual and Motor Skills	0	4	8	0	12	57.42
Psychological Reports	0	2	3	7	12	58.98

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
British Journal of Educational Psychology	5	2	3	1	11	60.42
Reading Research Quarterly	0	0	6	5	11	61.85
Alberta Journal of Educational Research	2	3	2	3	10	63.15
Journal of Personality and Social Psychology	0	0	10	0	10	64.45
Public Opinion Quarterly	0	6	2	2	10	65.76
Psychology In The Schools	0	0	3	7	10	67.06
Exceptional Children	0	1	5	3	9	68.23
Educational Research	0	2	4	3	9	69.40
Journal of The Reading Specialist	0	0	9	0	9	70.57
Child Development	0	4	2	2	8	71.61
Educational Leadership	1	0	3	4	8	72.66
Journal of General Psychology	2	5	0	1	8	73.70
Education of Visually Handicapped	0	0	0	7	7	74.61
Journal of Applied Psychology	1	3	2	1	7	75.52
Journal of Advertising Research	0	7	0	0	7	76.43
Columbia Journalism Review	0	6	0	0	6	77.21

JOURNAL	TIME PERIOD				CUM. %
	1959	1964	1968	1972 TOTAL	
Educational and Psychological Measurement	1	0	4	1 6	77.99
Illinois School Research	0	0	6	0 6	78.78
Journal of Abnormal and Social Psychology	0	6	0	0 6	79.56
Journal of Communication	0	2	3	1 6	80.34
Journal of Genetic Psychology	6	0	0	0 6	81.12
Journal of Psychology	1	0	5	0 6	81.90
Journal of Social Psychology	0	2	4	0 6	82.68
Journal of Experimental Psychology	0	0	2	3 5	83.33
Journal of Negro Education	0	0	1	4 5	83.98
Journal of Special Education	0	0	2	3 5	84.64
Reading World	0	0	0	5 5	85.29
AV Communication Review	0	1	2	1 4	85.81
American Journal of Mental Deficiency	0	0	2	2 4	86.33
British Journal of Psychology	0	0	0	4 4	86.85
California Journal of Educational Research	0	0	3	1 4	87.37
Developmental Psychology	0	0	0	4 4	87.89
Education	0	3	1	0 4	88.41

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
Australian Journal of Education	2	0	0	1	3	88.80
American Journal of Psychology	0	2	0	1	3	89.19
Childhood Education	0	0	1	2	3	89.58
English Journal	1	0	1	1	3	89.97
Journal of Speech and Hearing Research	0	1	2	0	3	90.36
Optometric Weekly	0	0	3	0	3	90.76
Research In The Teaching of English	0	0	0	3	3	91.15
American Journal of Orthopsychiatry	0	1	0	1	2	91.41
American Journal of Sociology	0	0	0	2	2	91.67
Academic Therapy	0	0	0	2	2	91.93
Cognitive Psychology	0	0	0	2	2	92.19
Journal of Abnormal Psychology	0	1	1	0	2	92.45
Journal of Speech and Hearing Disorders	2	0	0	0	2	92.71
Kansas Studies In Education	0	1	1	0	2	92.97
Library Quarterly	0	1	1	0	2	93.23
Phi Delta Kappan	0	0	0	2	2	93.49
Science	0	1	0	1	2	93.75

JOURNAL	TIME PERIOD				CUM. %
	1959	1964	1968	1972 TOTAL	
Sociometry	0	0	2	0	2 94.01
School Review	0	0	1	1	2 94.27
Training School Bulletin	0	0	2	0	2 94.53
Young Children	0	0	0	2	2 94.79
Adult Education Journal	0	0	0	1	1 94.92
American Journal of Ophthalmology	0	1	0	0	1 95.05
American Sociological Review	0	0	1	0	1 95.18
Bulletin of The Orton Society	0	0	1	0	1 95.31
College Composition and Communication	1	0	0	0	1 95.44
California English Journal	0	0	1	0	1 95.57
Canadian Journal of Psychology	0	0	0	1	1 95.70
Educational Admin and Supervision	1	0	0	0	1 95.83
Educational Broadcasting Review	0	0	1	0	1 95.96
Educational Review	0	0	1	0	1 96.09
Gifted Child Quarterly	0	1	0	0	1 96.22
Genetic Psychology Monographs	0	1	0	0	1 96.35

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
Harvard Educational Review	0	0	0	1	1	96.48
Interchange	0	0	0	1	1	96.61
Illinois English Bulletin	0	0	1	0	1	96.74
Journal of The American Medical Association	0	0	1	0	1	96.88
Journal of Applied Social Psychology	0	0	0	1	1	97.01
Journal of Clinical Psychology	1	0	0	0	1	97.14
Journal of Education	0	1	0	0	1	97.27
Jrnl of the Experimental Analysis of Behavior	0	1	0	0	1	97.40
Journal of Experimental Social Psychology	0	0	1	0	1	97.53
Journal of Learning Disabilities	0	0	0	1	1	97.66
Journal of Reading Disabilities	0	0	1	0	1	97.79
Journal of Typographical Research	0	0	1	0	1	97.92
NEA Research Bulletin	0	0	0	1	1	98.05
New Zealand Journal of Educational Studies	0	0	1	0	1	98.18
Ontario Journal of Educational Research	0	0	1	0	1	98.31
Personnel and Guidance Journal	0	0	1	0	1	98.44
Programmed Learning	0	0	0	1	1	98.57

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	

Reading	0	0	1	0	1	98.70
School and Community	1	0	0	0	1	98.83
Science Education	1	0	0	0	1	98.96
School Libraries	0	0	0	1	1	99.09
Speech Monographs	0	0	1	0	1	99.22
School and Society	1	0	0	0	1	99.35
School Science and Mathematics	0	0	0	1	1	99.48
University of Kansas Bulletin of Education	1	0	0	0	1	99.61
University of Queensland Papers	0	0	1	0	1	99.74
Vocational Guidance Quarterly	0	0	0	1	1	99.87
Wilson Library Bulletin	0	0	0	1	1	100.00

TABLE V

Journals by Number of References Produced in ASRR in Four Time Periods. (Ranked by Total.)

JOURNAL	TIME PERIOD				TOTAL	CUM. %
	1959	1964	1968	1972		
Journalism Quarterly	34	170	192	310	706	9.24
The Reading Teacher	4	149	291	44	488	15.62
Elementary English	118	86	92	129	425	21.19
Journal of Educational Research	118	51	100	99	368	26.00
Reading Research Quarterly	0	0	234	134	368	30.82
Journal of Educational Psychology	21	47	142	102	312	34.90
Journal of Reading	0	0	224	50	274	38.48
Journal of Experimental Education	69	99	14	49	231	41.51
Elementary School Journal	11	52	111	34	208	44.23
American Educational Research Journal	0	26	93	81	200	46.85
Journal of Reading Behavior	0	0	0	197	197	49.42
Educational Research	0	27	96	41	164	51.57
Journal of Developmental Reading	35	129	0	0	164	53.72
Perceptual and Motor Skills	0	65	93	0	158	55.78

TABLE V (CONTINUED)

JOURNAL	TIME PERIOD				TOTAL	CUM. %
	1959	1964	1968	1972		
Jrnl of Verbal Learning and Verbal Behavior	0	47	43	67	157	57.84
Journal of Personality and Social Psychology	0	0	134	0	134	59.59
Psychology In The Schools	0	0	46	85	131	61.31
Public Opinion Quarterly	0	44	25	41	110	62.75
British Journal of Educational Psychology	55	26	16	10	107	64.15
Reading World	0	0	0	105	105	65.52
Exceptional Children	0	8	38	57	103	66.87
Journal of Abnormal and Social Psychology	0	88	0	0	88	68.02
Psychological Reports	0	12	14	59	85	69.13
Education	0	74	9	0	83	70.22
Journal of Special Education	0	0	26	56	82	71.29
Journal of General Psychology	16	54	0	10	80	72.34
AV Communication Review	0	12	38	29	79	73.37
Journal of Genetic Psychology	79	0	0	0	79	74.40
Alberta Journal of Educational Research	11	16	16	35	78	75.43
Child Development	0	30	8	39	77	76.43
Young Children	0	0	0	77	77	77.44

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
Journal of Social Psychology	0	17	55	0	72	78.38
Interchange	0	0	0	68	68	79.27
Journal of Communication	0	15	37	13	65	80.12
American Journal of Sociology	0	0	0	61	61	80.92
Journal of Experimental Psychology	0	0	29	32	61	81.72
Developmental Psychology	0	0	0	55	55	82.44
British Journal of Psychology	0	0	0	54	54	83.15
Illinois School Research	0	0	53	0	53	83.84
Journal of Applied Psychology	3	23	14	10	50	84.49
Journal of Speech and Hearing Research	0	14	34	0	48	85.12
American Journal of Mental Deficiency	0	0	13	33	46	85.72
English Journal	3	0	2	41	46	86.33
Journal of Psychology	0	0	46	0	46	86.93
Education of Visually Handicapped	0	0	0	44	44	87.50
American Journal of Orthopsychiatry	0	22	0	19	41	88.04
Educational Leadership	0	0	15	24	39	88.55

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
Journal of The Reading Specialist	0	0	38	0	38	89.05
American Journal of Psychology	0	25	0	11	36	89.52
Genetic Psychology Monographs	0	34	0	0	34	89.96
California Journal of Educational Research	0	0	30	1	31	90.37
Educational and Psychological Measurement	0	0	23	7	30	90.76
Journal of Negro Education	0	0	2	28	30	91.15
Science	0	22	0	7	29	91.53
Training School Bulletin	0	0	29	0	29	91.91
Australian Journal of Education	18	0	0	10	28	92.28
Journal of Advertising Research	0	28	0	0	28	92.65
Wilson Library Bulletin	0	0	0	28	28	93.01
Cognitive Psychology	0	0	0	27	27	93.37
Educational Review	0	0	27	0	27	93.72
Sociometry	0	0	26	0	26	94.06
Adult Education Journal	0	0	0	25	25	94.39
Childhood Education	0	0	3	22	25	94.71
Journal of Learning Disabilities	0	0	0	23	23	95.01

JOURNAL	TIME PERIOD				CUM. %
	1959	1964	1968	1972 TOTAL	
American Sociological Review	0	0	21	0 21	95.29
Academic Therapy	0	0	0	20 20	95.55
New Zealand Journal of Educational Studies	0	0	20	0 20	95.81
Optometric Weekly	0	0	20	0 20	96.07
Research In The Teaching of English	0	0	0	20 20	96.34
Journal of Abnormal Psychology	0	9	9	0 18	96.57
University of Queensland Papers	0	0	18	0 18	96.81
Gifted Child Quarterly	0	17	0	0 17	97.03
Journal of Speech and Hearing Disorders	17	0	0	0 17	97.25
Canadian Journal of Psychology	0	0	0	15 15	97.45
Journal of The American Medical Association	0	0	15	0 15	97.64
Ontario Journal of Educational Research	0	0	15	0 15	97.84
Bulletin of The Orton Society	0	0	12	0 12	98.00
Journal of Applied Social Psychology	0	0	0	11 11	98.14
Jrnl of the Experimental Analysis of Behavior	0	11	0	0 11	98.29
Programmed Learning	0	0	0	11 11	98.43
Speech Monographs	0	0	10	0 10	98.56

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
California English Journal	0	0	8	0	8	98.67
Journal of Clinical Psychology	8	0	0	0	8	98.77
Journal of Education	0	8	0	0	8	98.87
Journal of Experimental Social Psychology	0	0	8	0	8	98.98
School Review	0	0	6	2	8	99.08
Library Quarterly	0	1	6	0	7	99.18
NEA Research Bulletin	0	0	0	7	7	99.27
Reading	0	0	7	0	7	99.36
Vocational Guidance Quarterly	0	0	0	6	6	99.44
College Composition and Communication	5	0	0	0	5	99.50
Journal of Reading Disabilities	0	0	5	0	5	99.57
Journal of Typographical Research	0	0	5	0	5	99.63
Kansas Studies In Education	0	3	2	0	5	99.70
Personnel and Guidance Journal	0	0	5	0	5	99.76
School Science and Mathematics	0	0	0	5	5	99.83
Harvard Educational Review	0	0	0	4	4	99.88

JOURNAL	TIME PERIOD				CUM. %
	1959	1964	1968	1972 TOTAL	

Illinois English Bulletin	0	0	4	0	4	99.93
University of Kansas Bulletin of Education	2	0	0	0	2	99.96
American Journal of Ophthalmology	0	1	0	0	1	99.97
Educational Broadcasting Review	0	0	1	0	1	99.99
Phi Delta Kappan	0	0	0	1	1	100.00
Columbia Journalism Review	0	0	0	0	0	100.00
Educational Admin and Supervision	0	0	0	0	0	100.00
School and Community	0	0	0	0	0	100.00
Science Education	0	0	0	0	0	100.00
School Libraries	0	0	0	0	0	100.00
School and Society	0	0	0	0	0	100.00

TABLE VI

Journals by Number of Citations Received from ASRR in Four Time Periods. (Ranked by Total.)

JOURNAL	TIME PERIOD				TOTAL	CUM. %
	1959	1964	1968	1972		
Journal of Educational Psychology	39	48	75	81	243	6.43
Journal of Educational Research	25	31	77	45	178	11.15
Elementary School Journal	16	49	70	26	161	15.41
Journalism Quarterly	2	32	45	67	146	19.27
Elementary English	19	19	52	40	130	22.72
Journal of Experimental Psychology	4	57	28	40	129	26.13
The Reading Teacher	8	15	43	55	121	29.34
Journal of Abnormal and Social Psychology	8	33	66	10	117	32.43
Perceptual and Motor Skills	0	5	26	55	86	34.71
Child Development	0	13	21	46	80	36.83
Journal of Applied Psychology	10	18	36	9	73	38.76
Jrnl of Verbal Learning and Verbal Behavior	0	3	24	42	69	40.59
Journal of Experimental Education	9	16	24	13	62	42.23
Public Opinion Quarterly	5	22	16	13	56	43.71

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
American Journal of Psychology	3	24	14	14	55	45.17
Psychological Bulletin	5	5	28	16	54	46.60
British Journal of Educational Psychology	9	7	25	9	50	47.92
Psychological Review	6	10	10	18	44	49.09
Journal of Genetic Psychology	7	14	10	10	41	50.17
Journal of Personality and Social Psychology	0	0	35	6	41	51.26
Journal of Consulting Psychology	12	8	12	8	40	52.32
Journal of Developmental Reading	0	6	21	11	38	53.32
Journal of Psychology	6	9	18	5	38	54.33
Education	6	9	15	7	37	55.31
Reading Research Quarterly	0	0	8	29	37	56.29
Exceptional Children	0	2	10	22	34	57.19
School and Society	10	7	10	7	34	58.09
Journal of Reading	0	0	12	21	33	58.96
Psychological Reports	2	5	10	15	32	59.81
American Journal of Orthopsychiatry	2	1	12	16	31	60.63

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
Educational Research Bulletin	12	5	6	7	30	61.42
American Educational Research Journal	0	0	14	15	29	62.19
English Journal	1	5	6	17	29	62.96
Journal of Social Psychology	7	6	13	3	29	63.73
American Psychologist	5	7	15	2	29	64.50
American Journal of Mental Deficiency	0	3	13	11	27	65.21
Educational and Psychological Measurement	3	1	18	2	24	65.85
Journal of Personality	3	7	10	4	24	66.48
Canadian Journal of Psychology	0	9	5	8	22	67.06
British Journal of Psychology	4	4	6	7	21	67.62
Science	0	5	7	9	21	68.18
School Review	3	6	10	2	21	68.73
American Sociological Review	1	5	9	4	19	69.23
Speech Monographs	3	2	12	2	19	69.74
Teachers College Record	3	4	7	5	19	70.24
Review of Educational Research	0	0	9	8	17	70.69
California Journal of Educational Research	1	5	3	7	16	71.11

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
Harvard Educational Review	0	4	4	8	16	71.54
Educational Admin and Supervision	1	6	7	1	15	71.94
Jrnl of the Experimental Analysis of Behavior	0	9	2	4	15	72.33
Journal of General Psychology	0	2	5	8	15	72.73
Journal of Reading Behavior	0	0	0	15	15	73.13
Psychometrika	3	1	9	2	15	73.52
Psychonomic Science	0	0	6	9	15	73.92
Genetic Psychology Monographs	0	4	4	6	14	74.29
Journal of Speech and Hearing Disorders	7	0	4	3	14	74.66
Psychology In The Schools	0	0	7	7	14	75.03
Journal of Education	1	3	4	5	13	75.38
Journal of Learning Disabilities	0	0	0	13	13	75.72
Acta Psychologica	3	1	2	7	13	76.07
Journal of Communication	1	0	8	3	12	76.38
Phi Delta Kappan	0	2	8	2	12	76.70
Elementary English Review	4	3	2	3	12	77.02
Editor and Publisher	0	4	6	2	12	77.34

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
Social Forces	0	4	5	3	12	77.65
Educational Research	0	4	4	3	11	77.95
Archives of Psychology	1	0	5	5	11	78.24
Jrnl of Comparative and Physiological Psychology	0	4	2	5	11	78.53
Quarterly Journal of Experimental Psychology	0	1	2	8	11	78.82
Journal of Clinical Psychology	0	0	6	4	10	79.08
Personnel and Guidance Journal	0	3	6	1	10	79.35
NEA Journal	0	2	5	3	10	79.61
Peabody Journal of Education	3	4	2	1	10	79.88
Perception and Psychophysics	0	0	0	10	10	80.14
AV Communication Review	0	3	6	0	9	80.38
American Journal of Sociology	0	2	3	4	9	80.62
Educational Leadership	0	2	0	7	9	80.86
Journal of Speech and Hearing Research	0	1	7	1	9	81.10
Sociometry	0	2	7	0	9	81.33
Research In The Teaching of English	0	0	0	8	8	81.55

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
American Political Science Review	0	1	2	5	8	81.76
Arithmetic Teacher	0	3	1	4	8	81.97
Bell System Technical Journal	0	3	4	1	8	82.18
Journal of Experimental Child Psychology	0	0	2	6	8	82.39
National Elementary Principal	2	4	0	2	8	82.61
Childhood Education	1	0	0	6	7	82.79
Journal of Special Education	0	0	3	4	7	82.98
Australian Journal of Psychology	1	0	4	2	7	83.16
Biometrika	0	1	4	2	7	83.35
Brain	0	3	1	3	7	83.53
Journal of Programmed Instruction	0	1	3	3	7	83.72
Journal of Teacher Education	0	0	5	2	7	83.90
Merrill-Palmer Quarterly of Behavior and Devel	0	0	2	5	7	84.09
Psychological Record	1	0	1	5	7	84.27
Alberta Journal of Educational Research	2	1	2	1	6	84.43
Journal of Advertising Research	0	6	0	0	6	84.59
Journal of Experimental Social Psychology	0	0	6	0	6	84.75

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
Journal of Negro Education	0	1	1	4	6	84.91
Ontario Journal of Educational Research	0	0	4	2	6	85.07
College English	0	1	1	4	6	85.23
Chicago Schools Journal	1	2	3	0	6	85.39
Human Relations	0	1	2	3	6	85.54
Journal of Broadcasting	0	3	2	1	6	85.70
Journal of School Psychology	0	0	0	6	6	85.86
Journal of Social Issues	0	1	2	3	6	86.02
Language and Speech	0	0	2	4	6	86.18
American Journal of Ophthalmology	1	1	2	1	5	86.31
Developmental Psychology	0	0	0	5	5	86.44
Behavior Research and Therapy	0	0	0	5	5	86.58
Education Digest	1	0	3	1	5	86.71
The High School Journal	1	3	1	0	5	86.84
Information and Control	0	3	2	0	5	86.97
Journal of American Statistical Association	0	4	0	1	5	87.11
Language	0	2	1	2	5	87.24

JOURNAL	TIME PERIOD				CUM. %
	1959	1964	1968	1972 TOTAL	
Rural Sociology	0	0	5	0	5 87.37
Educational Review	0	0	3	1	4 87.48
Journal of Abnormal Psychology	0	0	3	1	4 87.58
Journal of The Reading Specialist	0	0	2	2	4 87.69
Library Quarterly	1	3	0	0	4 87.79
NEA Research Bulletin	0	0	3	1	4 87.90
School Science and Mathematics	2	1	1	0	4 88.01
Vocational Guidance Quarterly	0	0	0	4	4 88.11
American Journal of Optometry	0	0	4	0	4 88.22
American Journal of Psychiatry	3	0	0	1	4 88.32
Archives Otolaryng.	4	0	0	0	4 88.43
Clearing House	0	0	1	3	4 88.54
Journal of Consulting and Clinical Psychology	0	0	0	4	4 88.64
Journal of Experimental Pedagogy	1	1	2	0	4 88.75
Journal of Experimental Research In Personality	0	0	2	2	4 88.85
Mental Retardation	0	0	3	1	4 88.96

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
Psychological Clinic	0	4	0	0	4	89.07
Pediatric Seminary	1	2	1	0	4	89.17
Quill	0	2	0	2	4	89.28
University of Iowa Studies	2	2	0	0	4	89.38
Women: A Journal of Liberation	0	0	0	4	4	89.49
Word	0	0	2	2	4	89.59
Academic Therapy	0	0	0	3	3	89.67
Columbia Journalism Review	0	0	0	3	3	89.75
Journal of The American Medical Association	1	0	2	0	3	89.83
Wilson Library Bulletin	0	3	0	0	3	89.91
Annals of the Amercn Acad of Poli and Soci Science	0	0	0	3	3	89.99
American Documentation	0	3	0	0	3	90.07
Annals of Mathematical Statistics	0	1	1	1	3	90.15
Archives of Neurology	0	2	0	1	3	90.23
American Scientist	0	0	0	3	3	90.31
Academic Therapy Quarterly	0	0	0	3	3	90.39
Behavioral Science	0	1	1	1	3	90.47

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
Catholic Education Review	0	1	2	0	3	90.55
Comprehensive Psychiatry	0	1	1	1	3	90.63
Gazette	0	1	0	2	3	90.71
IPI Report	0	1	0	2	3	90.79
Journal of Higher Education	1	0	2	0	3	90.87
Journal of Nervous and Mental Diseases	0	2	1	0	3	90.95
Journal of Pediatrics	1	1	1	0	3	91.02
Journal of Research and Development In Education	0	0	0	3	3	91.10
Lancet	2	0	1	0	3	91.18
Media/Scope	0	3	0	0	3	91.26
Monthly Labour Review	0	0	3	0	3	91.34
Nature	0	0	1	2	3	91.42
The Nations Schools	0	2	0	1	3	91.50
Pediatrics	0	0	2	1	3	91.58
Psychologische Forschung	0	1	2	0	3	91.66
Reading Horizons	0	2	0	1	3	91.74

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
Bulletin of The Orton Society	0	1	1	0	2	91.79
Cognitive Psychology	0	0	0	2	2	91.85
Gifted Child Quarterly	0	0	2	0	2	91.90
New Zealand Journal of Educational Studies	0	0	0	2	2	91.95
Optometric Weekly	0	0	2	0	2	92.00
Young Children	0	0	1	1	2	92.06
Archive Fur Die Gesamti Psychologie	0	0	0	2	2	92.11
AMA Archives of Ophthalmology	0	2	0	0	2	92.16
American Teacher	1	0	1	0	2	92.22
Archives of Neurological Psychiatry	0	0	2	0	2	92.27
American Journal of Physics	0	2	0	0	2	92.32
Barnards Journal of Education	0	0	1	1	2	92.37
Behavior Therapy	0	0	0	2	2	92.43
Cerebral Palsy Bulletin	0	1	1	0	2	92.48
Contemporary Psychology	0	0	1	1	2	92.53
Child Studies	2	0	0	0	2	92.59
Central States Speech Journal	0	0	2	0	2	92.64

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
Ergonomics	0	0	2	0	2	92.69
Foundations of Language	0	0	0	2	2	92.75
Grassroots Editor	0	0	0	2	2	92.80
Group Psychotherapy	0	1	1	0	2	92.85
Grade Teacher	0	0	0	2	2	92.90
Human Factors	0	1	0	1	2	92.96
Ideas Educational	0	1	1	0	2	93.01
International Journal of American Linguistics	0	2	0	0	2	93.06
Instructor	0	0	1	1	2	93.12
Journal of Applied Behavior Analysis	0	0	0	2	2	93.17
Journal of Counseling Psychology	0	0	1	1	2	93.22
Journal of Mental Science	0	1	1	0	2	93.28
Journal of Optometric Society of America	0	0	0	2	2	93.33
Journal of Physiology	0	0	0	2	2	93.38
Journal of Research In Crime and Delinquency	0	0	1	1	2	93.43
The Journalism Educator	0	0	0	2	2	93.49
Journal of Research In Statistical Sociology	0	0	0	2	2	93.54

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
Journal of Speech Disorders	1	0	1	0	2	93.59
Kybernetic	0	0	2	0	2	93.65
Mental Hygiene	1	0	0	1	2	93.70
Midwest Journal	0	0	0	2	2	93.75
Modern Language Journal	1	0	1	0	2	93.80
Neurology	0	1	1	0	2	93.86
Neuropsychologia	0	0	0	2	2	93.91
New York State Education	0	0	2	0	2	93.96
The Packet	1	1	0	0	2	94.02
Proceed of the American Philosophical Society	1	0	1	0	2	94.07
Personality	0	1	1	0	2	94.12
Personnel	0	1	1	0	2	94.18
Psycholinguistic Monographs	0	0	1	1	2	94.23
Psychiatric Neurology	0	0	1	1	2	94.28
Pedagogical Seminary and Jrnl of Genetic Psych	0	2	0	0	2	94.33
Sociology of Education	0	0	0	2	2	94.39
School Library Journal	0	0	0	2	2	94.44

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
Social Work	0	0	0	2	2	94.49
Teachers Forum	0	0	0	2	2	94.55
University of Michigan Schl and Educ Bulletin	0	2	0	0	2	94.60
US News and World Report	0	2	0	0	2	94.65
Volta Review	0	1	1	0	2	94.70
Australian Journal of Education	0	0	1	0	1	94.73
College Composition and Communication	0	0	1	0	1	94.76
Education of Visually Handicapped	0	0	0	1	1	94.78
Illinois School Research	0	0	1	0	1	94.81
Kansas Studies In Education	0	1	0	0	1	94.84
Programmed Learning	0	0	0	1	1	94.86
Reading	0	0	1	0	1	94.89
Science Education	0	0	1	0	1	94.92
University of Kansas Bulletin of Education	0	1	0	0	1	94.94
American Anthropology	1	0	0	0	1	94.97
American Annals of The Deaf	0	1	0	0	1	95.00

JOURNAL	TIME PERIOD				CUM. %
	1959	1964	1968	1972 TOTAL	
Advertising and Selling	1	0	0	0	1 95.02
Amercn Assoc of University Professors Bulletin	1	0	0	0	1 95.05
Acta Sociologica	0	1	0	0	1 95.08
Adult Education	0	0	0	1	1 95.10
Archives of General Psychiatry	0	0	0	1	1 95.13
American Journal of Diseases of Children	0	0	0	1	1 95.15
American Journal of Human Genetics	0	0	0	1	1 95.18
American Journal of Public Health	0	0	1	0	1 95.21
American Journal of Physiological Medicine	0	0	0	1	1 95.23
American Speech	0	1	0	0	1 95.26
Annal of Otology, Rhinology, and Larynology	0	1	0	0	1 95.29
Arch. Psychol. Geneva	1	0	0	0	1 95.31
Acta Psychiatrica Neurologica Supplementum	0	0	0	1	1 95.34
Acta Psychiatry and Neurology Scandanavia	0	0	1	0	1 95.37
Annee Psychologique	0	0	1	0	1 95.39
Assoc for Research in Nerv and Ment Disorders	0	0	1	0	1 95.42
American Statistics Association Journal	0	0	1	0	1 95.45

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
American School Board Journal	0	0	0	1	1	95.47
Asha	0	0	0	1	1	95.50
Administrative Science Quarterly	0	1	0	0	1	95.53
Atlantic	0	1	0	0	1	95.55
Bulletin Academic De Medicine	1	0	0	0	1	95.58
Baltimore Bulletin of Education	0	1	0	0	1	95.60
Business Education Forum	0	0	0	1	1	95.63
Business Education World	0	0	0	1	1	95.66
Berkeley Journal of Sociology	0	1	0	0	1	95.68
British Journal of Statistical Psychology	1	0	0	0	1	95.71
British Medical Journal	0	1	0	0	1	95.74
Bulletin of The School of Education	0	1	0	0	1	95.76
California Education	0	0	1	0	1	95.79
The Canadian Psychologist	0	0	0	1	1	95.82
Catholic Educator	1	0	0	0	1	95.84
Catholic Schools Journal	0	1	0	0	1	95.87
Council For Basic Education Bulletin	0	0	0	1	1	95.90

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
Catholic Counsellor	0	0	0	1	1	95.92
California Journal of Elementary Education	1	0	0	0	1	95.95
Canadian Jrnl of Econo and Political Science	0	0	1	0	1	95.98
The Commonweal	0	0	0	1	1	96.00
Canadian Medical Association Journal	0	1	0	0	1	96.03
Community Mental Health Journal	0	0	1	0	1	96.06
Computer Journal	0	0	1	0	1	96.08
Cortex	0	0	0	1	1	96.11
College Press Review	0	0	0	1	1	96.13
Child Psychology	0	0	0	1	1	96.16
California Quarterly of Secondary Education	1	0	0	0	1	96.19
Crisis	0	0	0	1	1	96.21
Civil Rights Digest	0	0	0	1	1	96.24
The Chronicle of Higher Education	0	0	0	1	1	96.27
Comparative Studies In Society and History	0	0	0	1	1	96.29
Columbia Univ Contrib to Philos and Psychol	0	0	1	0	1	96.32
Credit World	0	1	0	0	1	96.35

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
Daedalus	0	0	0	1	1	96.37
Developmental Medicine and Child Neurology	0	0	0	1	1	96.40
Durham Research Review	0	0	1	0	1	96.43
Early Education	0	0	0	1	1	96.45
Ebony	0	0	0	1	1	96.48
EEG In Clinical Neurophysiology	0	0	1	0	1	96.51
Educational Forum	0	0	0	1	1	96.53
Educational Horizons	0	0	0	1	1	96.56
Educational Method	0	0	1	0	1	96.58
Educational Screen	1	0	0	0	1	96.61
Elementary School Guidance and Counseling	0	0	0	1	1	96.64
Elementary School Teacher	0	0	0	1	1	96.66
English Teacher	0	0	0	1	1	96.69
Education and Urban Society	0	0	0	1	1	96.72
Experimental Education	0	1	0	0	1	96.74
The Florida Fl Reporter	0	0	0	1	1	96.77

JOURNAL	TIME PERIOD				CUM. %
	1959	1964	1968	1972 TOTAL	
Folia Phoniatrica	0	0	1	0	1 96.80
Florida Reading Quarterly	0	0	1	0	1 96.82
Guild Reporter	0	0	1	0	1 96.85
Human Development	0	0	0	1	1 96.88
Health Education Journal	0	0	1	0	1 96.90
Human Forces	0	0	0	1	1 96.93
Improving College and University Teaching	0	0	0	1	1 96.96
Illinois Education	0	0	0	1	1 96.98
International Journal for the Eductn of the Blind	0	0	0	1	1 97.01
Industrial Medicine	0	1	0	0	1 97.03
Industrial Management Review	0	1	0	0	1 97.06
International Review of Education	0	0	1	0	1 97.09
ITA Foundation Report	0	0	0	1	1 97.11
Journal of ACM	0	1	0	0	1 97.14
Journal of The Acoustical Society of America	0	0	1	0	1 97.17
Journal of The American Optometric Association	0	0	1	0	1 97.19
Journal of Chronic Disabilities	0	1	0	0	1 97.22

JOURNAL	TIME PERIOD				CUM. %
	1959	1964	1968	1972 TOTAL	
Journal of Child Psychiatry	0	1	0	0	1 97.25
Journal of Child Psychology and Psychiatry	0	0	0	1	1 97.27
Junior College Journal	0	0	1	0	1 97.30
Journal of Conflict Resolution	0	0	0	1	1 97.33
Journal of Exceptional Children	0	0	0	1	1 97.35
Journal of Educational Measurement	0	0	0	1	1 97.38
Journal of Educational Sociology	0	0	1	0	1 97.41
Journal of Farm Economics	0	0	0	1	1 97.43
Journal of Gerontian	0	0	0	1	1 97.46
Journal of Geography	0	1	0	0	1 97.48
Journal of Health Physical Education and	0	0	1	0	1 97.51
Journal of Individual Psychology	0	0	0	1	1 97.54
Journal of Juvenile Research	1	0	0	0	1 97.56
Journal of Linguistics	0	0	1	0	1 97.59
Journal of Mathematics	0	0	0	1	1 97.62
Journal of Marketing	0	1	0	0	1 97.64
Journal of Motor Behavior	0	0	0	1	1 97.67

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
Journal of Neurophysiology	0	0	0	1	1	97.70
Jrnl of Neurological and Neurosurgical Psychiatry	0	0	1	0	1	97.72
Journal of Psycholinguistic Research	0	0	0	1	1	97.75
Jrnl of Proj Techniques and Personality Assessmt	0	0	1	0	1	97.78
Journal of Rehabilitation	0	0	1	0	1	97.80
Journal of The Royal Society of The Arts	0	0	1	0	1	97.83
Journal of Research In Science Teaching	0	0	0	1	1	97.86
Journal of The Royal Statistical Society	0	0	1	0	1	97.88
Journal of Sociology	0	1	0	0	1	97.91
Journal of Secondary Education	0	0	1	0	1	97.93
Journal of Social Research	0	1	0	0	1	97.96
Los Angeles Educational Research Bulletin	0	1	0	0	1	97.99
Land Economics	0	0	0	1	1	98.01
Library Trends	0	1	0	0	1	98.04
The Library Journal	0	0	0	1	1	98.07
Language Learning	0	0	1	0	1	98.09

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
Multivariate Behavior Research	0	0	0	1	1	98.12
Mind	0	0	0	1	1	98.15
Minnesota Reading Quarterly	0	0	0	1	1	98.17
National Association of Secondary Sch Principals	0	0	0	1	1	98.20
Negro Digest	0	0	0	1	1	98.23
New Education	0	0	1	0	1	98.25
National Education Journal	0	0	1	0	1	98.28
Negro Educational Review	0	0	0	1	1	98.31
Nervenarzt	0	1	0	0	1	98.33
New Outlook	0	0	1	0	1	98.36
The New Outlook For The Blind	0	0	0	1	1	98.38
New Republic	0	1	0	0	1	98.41
New Research In Education	0	0	0	1	1	98.44
National Review	0	1	0	0	1	98.46
Overview	0	1	0	0	1	98.49
Oceanic Linguistics	0	0	1	0	1	98.52
Occassional Papers	0	0	0	1	1	98.54

JOURNAL	TIME PERIOD				CUM. %
	1959	1964	1968	1972 TOTAL	
Ohio State University Edctnl Research Bulletin	0	1	0	0 1	98.57
Progressive Education	1	0	0	0 1	98.60
Personnel Journal	0	1	0	0 1	98.62
Philosophie Studien	0	0	0	1 1	98.65
Programmed Instruction	0	0	1	0 1	98.68
Pittsburgh School	0	0	1	0 1	98.70
Psychological Optics	1	0	0	0 1	98.73
Philosophy of Science	0	0	0	1 1	98.76
Psycholopharmacologia	0	0	0	1 1	98.78
Pedagogical Seminary	0	0	1	0 1	98.81
Psychoanalytic Studies of The Child	1	0	0	0 1	98.84
Psychiatry Et Neurologie	0	0	1	0 1	98.86
Psychologia Wychowawcza	0	0	0	1 1	98.89
Psychiatry	0	0	0	1 1	98.91
The Reporter	0	0	1	0 1	98.94
Review of Economics and Statistics	0	1	0	0 1	98.97
Reading Improvement	0	0	1	0 1	98.99

JOURNAL	TIME PERIOD					CUM. %
	1959	1964	1968	1972	TOTAL	
Review Philosophique	0	0	0	1	1	99.02
Research Quarterly	0	0	1	0	1	99.05
Scientific American	0	1	0	0	1	99.07
School Management	0	0	0	1	1	99.10
Search	0	0	1	0	1	99.13
Sociologische Gids	0	0	0	1	1	99.15
The Syracuse Journalist	0	0	1	0	1	99.18
School Life	0	0	1	0	1	99.21
Social Science	0	0	0	1	1	99.23
Social Science and Medicine	0	0	0	1	1	99.26
Sociology and Social Research	1	0	0	0	1	99.29
Social Psychology and Psychiatry	0	0	0	1	1	99.31
Spelling Progress Bulletin	0	0	0	1	1	99.34
Studies In Public Communication	0	1	0	0	1	99.36
Special Education	0	0	0	1	1	99.39
Speech Pathology and Therapy	0	0	1	0	1	99.42

JOURNAL	TIME PERIOD				CUM. %
	1959	1964	1968	1972 TOTAL	
School and Safety	0	0	0	1	1 99.44
Sight Saving Review	0	0	1	0	1 99.47
Speech Teacher	0	0	1	0	1 99.50
Studies In Reading	0	0	0	1	1 99.52
Supra	0	0	0	1	1 99.55
Survey	0	0	0	1	1 99.58
Synthese	0	0	0	1	1 99.60
Teachers College Contrib to Education	0	0	1	0	1 99.63
Todays Education	0	0	0	1	1 99.66
Teaching Exceptional Children	0	0	0	1	1 99.68
Teachers World	0	0	0	1	1 99.71
University of California Public Education	1	0	0	0	1 99.74
Urban Education	0	0	0	1	1 99.76
Unischool	0	0	0	1	1 99.79
Vanderbilt Law Review	0	0	0	1	1 99.81
WEA Journal	0	0	1	0	1 99.84
Wisconsin English Journal	0	0	1	0	1 99.87

JOURNAL	TIME PERIOD				CUM. %
	1959	1964	1968	1972 TOTAL	
Wiener Klinische Wochenschrift	0	0	0	1	1 99.89
Western Political Quarterly	0	0	0	1	1 99.92
Yale Psychological Studies	0	0	0	1	1 99.95
Zeitschrift Fur Padagogike Psychologie	0	1	0	0	1 99.97
Zeitschrift Fur Klinische Medizin	0	0	0	1	1 100.00