Literature Searching in Science, Technology, and Agriculture

EILEEN PRITCHARD
and
PAULA R. SCOTT

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Preface

This introduction to library research in science, technology, and agriculture provides an overview of the most basic library tools in these areas for college students, library personnel unfamiliar with scientific materials, and persons interested in beginning scientific investigation. It stresses the interdisciplinary nature of investigation in a general approach to the major abstracting and indexing services and the most representative reference books, style manuals, and guides.

The material in this work is arranged to correspond to the order of procedures in which a person would undertake a literature search. The contents are both a guide to doing a literature search and a reference to listings of basic sources and databases.

Most guides to scientific literature are arranged by subject and/or by types of literature, and provide lists of many reference works and detailed descriptions of the types of literature. Their intent is to be as comprehensive as possible. The authors found that these guides contained excessive information for library users seeking a briefer discussion of important library tools and research techniques. Other guides had a format corresponding to the sequence of a literature search, but added material on library operations which seemed suitable only for librarians, and lacked otner important features (adequate material on database searching and style manuals). The approach taken here evolved from classes in scientific literature searching conducted by the authors at a major academic library. One of the authors needed material to simplify interpretation of the abstracts and indexes for her students. Additional information was added to explain other directions for research as these arose in class discussions.

The initial chapters orient the reader to types of literature, search preparation, and finding books in libraries. The search strategy chapter outlines basic steps of the literature search process, utilizing a number of charts. These

charts lead the searcher from the basic sources to the specialized; delineate which types of sources to use according to one's need; and recommend procedures according to the experience of the user.

The abstract and index chapters present the major publications in a subject sequence, procedures for using them, and access points or indexes available in each. Additional sections are devoted to abstracting and indexing services for special types of literature; i.e., reviews, conference proceedings, dissertations, and government publications.

Basic logic of computer searching is explained and searches from different vendors are compared in Chapter 8. Computer systems and databases included are BRS, SDC, DIALOG, MEDLINE, and SCISEARCH. Other features of the chapter are lists of the advantages and disadvantages of doing computer searches and recommendations for computer search preparation.

No attempt is made to cover all of the important reference books, since that task has been accomplished in many guides to scientific literature. Chapter 9 outlines the types of reference books and lists the appropriate guides to scientific literature which provide information on reference books.

The chapter "Citing the Literature in a Bibliography" illustrates four basic styles of citation and lists 10 style manuals used in the scientific disciplines.

Appendices list abstracts and indexes, selected journals, databases, and sources for review articles.

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Contents

1
Surveying the Types of Literature

There are many different kinds of materials available to the researcher. In this chapter we will explore briefly the nature of these resources and their varied formats. The remaining chapters of this guide will explain how to find and utilize them. The forms of information may be divided into primary and secondary sources. Primary sources are those in which the records of events are first reported or disseminated. Secondary sources result from analysis, description, and synthesis of primary sources.

Primary Sources

The Scientific Journal. Modern primary journals contain articles which are reports of original research or original observations. The journal article may have evolved from the paper prepared for oral delivery at meetings of scholarly societies, or perhaps from prize essays which early societies developed to stimulate scientific research.[1]

The modern scientific journal article often has a set format. There may or may not be a summary, or abstract, at the beginning of the article. There is usually an introduction which states the problem examined in the article, the importance of the study, and how it relates to other work in the field. The introduction is followed by the material and methods section which outlines the researchers' methodology: description of the objects of study, test conditions, and procedures. Next are the results, or observations, which are the main data of the study and may take the form of diagrams, photographs, tables, and graphs, in addition to the narrative. Often this is the longest section. The discussion brings the results together, evaluates them, and interprets them in the light of other research. There is

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[1] "Information processing," Encyclopaedia Britannica, (15th ed.) IX, 568.

usually a reference section at the end of the article listing the literature cited in the work.

Trade Journals. Practical information related to persons in industry is conveyed in the trade journal. The content includes business news, product information, advertising, and trade articles. The journals can provide a great deal of information on current trends in technology, and are useful to persons seeking orientation to a vocation. Some examples of trade journals are Aviation Week and Space Technology, Livestock, Chemical Marketing Reporter, and Professional Engineer.

The Technical Report. Technical reports are accounts of work done on research projects; they are written to provide information to employees and other research workers. A report may emanate from completed research or on-going research projects. Private companies and associations use reports internally for communication within the organization, and occasionally for public distribution. Governments support many technical reports by means of grants and government contracts. Government reports are usually published as separates and may be kept with government documents. Sometimes the reports appear in series with identifying report numbers, and the number may be crucial in being able to locate the desired document. Reports may be confidential and accessible only to select individuals with security clearances. National Aeronautics and Space Administration (NASA) is one of the main producers of technical report literature. Many technical reports are distributed by the National Technical Information Service (NTIS). NTIS strives to make available all unclassified results of federal research. Its index is the Government Reports Announcements & Index.

Proceedings. Scientists present original research findings and review articles at professional meetings. Often these are published and distributed in various forms. The meetings may be referred to as symposia, conferences, institutes, workshops, or colloquia. They provide an important channel of communication for scientists and an important source of information for researchers.

Abstracts of Research in Progress. Abstracts may be primary sources when they are used to report research in progress presented at a meeting before the journal research article appears. Many biological meetings are reported on in this way. For example, the Genetics Society of America issues abstracts of this kind for their meetings. These abstracts are often published in the society's journal; note sections of them in the journal Genetics. Often the initial talk and

associated abstracts are used to test a new interpretation of results of research.

Dissertations. Doctoral dissertations are another primary source of scientific publication. In the sciences, the awarding of a Ph.D. degree usually requires completion of a major monograph including extensive experimentation, reporting on the results, and suggesting future implications. The dissertations are kept in libraries at the home schools of the doctoral candidates and are indexed in Dissertation Abstracts International. They can be purchased from University Microfilms International.

Patents. Patents are rights granted by law for the protection of inventions or discoveries. Patent specifications describe designs, methods and processes of the invention, and are, therefore, an important source of information for the engineer, physicist, chemist, and other researchers. To locate patents there are commercial indexing services such as Chemical Abstracts which include patents, and government patent indexes. The main one for the United States is the Official Gazette of the United States Patent and Trademark Office. Recently, database searching has become useful in examination of patent literature.

Standards. Standards are requirements for the quality or size or shape of industrial products. They also comprise recommendations for methods and processes in manufacturing. Standards are prepared by a variety of trade associations, national and international bodies. Some types of standards include quality and measure recommendations, testing materials, and definitions of trade terms. Some important groups working on standards in the United States are the American National Standards Institute (which serves as a clearinghouse for many types of standards), the American Society for Testing Materials (which establishes many standards and develops test methods), and the National Bureau of Standards (which concerns itself mainly with physical measurement). The Visual Search Micro Film (VSMF) service is a good source for retrieval of different standards.

Secondary Sources

Abstracts. There are many services which abstract and index technical publications so that researchers can select important papers quickly in their field of interest. The most important abstracting services are described in later chapters of this book. Traditionally, abstracts appear in two forms: the descriptive abstract, which indicates what is discussed in the original documents, and the informative abstract, which attempts to present all the significant data and conclusions of the original document.

In the United States, for example, Chemical Abstracts and Biological Abstracts provide major abstracting services.

Reviews. Review articles "distill the existing knowledge relevant to a particular subject into a compact, accessible form. A typical review article focuses on important advances which have been made in a specialty, evaluates research, indicates where gaps in knowledge exist, and provides a comprehensive bibliography on the subject."[2] The review article can be the most efficient starting point for a search of the literature on a particular topic. There are collections of reviews which are published on an annual basis by a company called "Annual Reviews, Inc." Many other publishers are also collecting reviews to cover the state of the art in specific fields. Titles of review serials are typically "advances in," "annual review of," "progress in," and "yearbook of."

Specialized Books. There are many important books that contain authoritative information and are considered to be basic in the field. Students need to make note of these works, which are sometimes mentioned by instructors or noted in guides to the literature. Some examples of basic biology books are--

Mayr, Ernest. Animal Species and Evolution. Cambridge: Belknap Press of Harvard University Press, 1963.

Stebbins, George Ledyard. Variation and Evolution In Plants. New York: Columbia University Press, 1950.

Reference Books. In many cases, specific facts or a summary of a topic are all that is required. Handbooks, manuals, encyclopedias, and dictionaries perform this function. There are also reference materials which refer the inquirer to other works which will provide the desired information. A multitude of different reference aids can aid the researcher (See Chapter 12 on reference sources).

Some Important Sources of Information Which May Publish Primary or Secondary Source Material

Government Publications. There are many government agencies publishing works of interest to scientists and technicians. The United States Department of Agriculture, Smithsonian Institution, and the United States Department of the Interior are examples of important agencies which publish many valuable

[2] Institute for Scientific Information, The First Place to Look is the Index to Scientific Reviews. (Philadelphia: Institute for Scientific Information, [n.d.]), p. 1.

documents. The format of government publications varies widely; there are periodicals, monographs, reports, microforms, and others.

Agricultural Experiment Station and Extension Service Publications. The state agricultural experiment stations conduct agricultural research to find answers to problems common to farmers (and consumers). There is usually one station in each state. The stations publish periodicals, bulletins, reports, circulars, and miscellaneous publications. The documents contain valuable research material which is closely related to the problems of agricultural and food production. Related to the experiment stations is the Cooperative Extension Service, which communicates the research findings of the stations and the United States Department of Agriculture to citizens, especially farmers, through the county and state extension offices.

2
Formulating a Basic Search Strategy

Introduction

In implementing a research project, one must successfully analyze a question appropriate to the topic and the method to solve the question. In this chapter, the authors will discuss (1) how to decide on a research topic, (2) how to limit a topic, and (3) how to form a search strategy for obtaining the desired information.

Because of the complexity of information resources, library research is not easy. It may be frustrating because of the time required to obtain needed sources. Searching indexes and abstracts usually takes more time than expected. The library may have to request materials from other libraries on interlibrary loan. The information may not correspond to expectation. These are a few reasons why it is important to plan a library search carefully, allowing ample time to complete a project.

Choosing a Topic

Many sources from printed material, radio, and television may suggest topics for term papers and seminars. Often, newspaper articles can provide ideas. Papers such as the New York Times, Wall Street Journal, Christian Science Monitor, or a local paper may have a report worth pursuing. One must be careful about choosing articles from newspapers in which the events are so new that little is available on the topic elsewhere. Sometimes a newspaper article will reflect such a simplification of complex research that it is too difficult to pursue the topic further. Periodicals such as Newsweek and Time also report scientific discoveries. The same considerations for newspapers also apply to these publications. Television may be a good source; Nova and other public television programs often present subjects suitable for further investigation.

There are several general science magazines for the public and the general academic audience such as Science 8-, Discover, Omni, Science Digest, and Science News. They have eye-catching titles and articles on the latest discoveries. Science News, a weekly, has articles which are often only two or three paragraphs of highly condensed explanation. The other four journals appear monthly and include news and longer feature articles. The British magazine, New Scientist, is another general magazine which usually consists of short articles written by authorities or the New Scientist staff. This journal is decidedly more political than the above American counterparts.

Yearbooks to encyclopedias, such as Science Year, have reports of current happenings and articles of current interest. These can be helpful in selecting a topic.

Scientific American and American Scientist are two excellent journals for topics. Articles from Scientific American often inspire seminar topics, and Scientific American attracts readers from the general public as well as scientists. This journal, available on newsstands as well as by subscription, has contributors who are authorities in their fields and who are often well known scientists. Scientific American has noteworthy illustrations which are often reproduced elsewhere in books and lectures. For each article, Scientific American has a short list of references which can be helpful in pursuing the topic further.

The American Scientist discusses topics similar to those in Scientific American. Although not a newsstand magazine, its articles are often a little easier to read. The authors, who are authorities, document their articles well, so it is easy to find earlier articles on the topics. The references are sometimes extensive. Sigma Xi, the Scientific Research Society of North America, publishes this journal for its members, but it is available in libraries.

The American Association for the Advancement of Science publishes the weekly journal Science. It covers the broad spectrum of science and consists primarily of short research reports. It also includes a few longer articles which review the literature. Both types of articles have valuable references to other publications.

Nature, a British journal, serves the same function as Science. Both Science and Nature can serve as sources of ideas for the more scientific and specialized papers and for seminars.

Limiting a Topic

Individual circumstances determine the extent of literature searching. The library user will consider the following:

1. The size of the library's collection on one's chosen subject, and
2. Time limitations for deadlines, interlibrary loans, and library accessibility.

The type of assignment will influence student decisions. To write a short paper, one may wish to limit searching to fewer indexes and use fewer articles. For a seminar, one will search more thoroughly, and a more extensive library collection may be necessary.

In order to get an idea of whether a topic is well covered, it is a good idea to do a preliminary search in an index service. This will reveal whether the topic is:

1. manageable--is there too much or too little on the topic?
2. relevant--does the topic appear in the literature?
3. in a foreign language--is it understandable to the user?

A preliminary search should also include looking at the library's journal holdings to determine the availability of articles.

In determining whether a topic is manageable, the following clues may be of assistance:

1. See if there are more than five citations in a five-year period (usually the last five years) of a Wilson Company index (for titles see page 34); if so, think about narrowing the topic.
2. Probably 15 to 25 citations will be about the right number for the total number of citations for a paper. Much will depend on the nature of the research project.
3. It may help to use a review paper to narrow or limit a topic, because a review paper alerts the reader to what research has been done and what research could be done.
4. In the Permuterm Subject Index of Science Citation Index, a quick perusal of the number of key terms which match a chosen topic may be helpful in determining the amount of material available. Using the five-year cumulations will make the search even easier.