CHAPTER 13

WRITING THE RESEARCH REPORT

In discussing the characteristics of science (chapter 1) we alluded to its "open" nature, its self-correcting feature, and its "public" domain. It is in the reporting of research findings that these features become operational. In other words, it is through the dissimination of research findings that they become part of the public purview and science grows. The final stage in the research process consists in writing up and reporting results. Only through the communication of research can the results become significant; otherwise they would be confined to one's "private world."

Kerlinger has succinctly summarized the purpose of the research report. It tells the reader:

> the problem investigated, the methods used to solve the problem, the results of the investigation, and the conclusions inferred from the results. It is not the function of the investigator to convince the reader of the virtue of the research. Rather, it is to report, as expeditiously and clearly as possible, what was done, why it was done, the outcome of the doing, and the investigator's conclusions.[1]

Before the final report is written the researcher must answer several questions: 1)Who--what audience(s)--is the report aimed at? 2) What is the manifest purpose of the research? 3) In what forum--what medium--should the report appear? 4) What writing style should be adopted to best communicate thefindings? 5) How should the report be organized? and 6) How can the researcher fulfill all his/her professional and ethical obligations?[2]

Structure of Research Reports

While the structure of research reports vary[3], they typically include the following sections: 1) title, 2) abstract, 3) introduction 4) methods, 5) results, 6) discussion, 7) references, and 8) appendix.

Title. The title of a research report should be clear, relatively short, and descriptive. It is important that the title captures the flavor

of the study. This may not always be easy but is critical for several reasons. First, some potential readers may decide whether to read the report on the basis of the title alone. Second, reports that are prepared for some type of information retrieval system typically use key words/phrases appearing in the title. Third, titles which promise more than they deliver often meet with caustic criticism.

The medium through which the report will be dissiminated and the intended audience affect the nature of the title (and writing of the entire report). Two types of audiences are: 1) professional (often academic) and 2) non-professional (typically non-academic). For professional audiences, such as one's colleagues, it is permissible and desirable to use technical jargon. On the other hand, for lay audiences or even professionals in an unrelated field, professional terminology should be avoided in the title as well as the other sections of the paper.[4] The researcher is cautioned in using favorite academic "bon mots" such as linkages, paradigms, input, output, parameters, and impact. Similarly, one should avoid neologisms and travesties (e.g., prioritize and expertise) that Ed Newman and others have documented.[5] For example, consider the following research title: "Contributions of Pollen Morphology to the Systematics of the Family Hydrophyllaceae." Note that there are two problems with the language. First, the jargon ("biologese") is a stumbling block to effective communication for readers outside the professional arena. Second, nonacademic consumers are probably more concerned with its applicability than with the implications for theory and research in the field.

Abstract. An abstract is a brief summary (often 50-150 words) of the report. It usually appears at the beginning of the paper and acquaints the reader with the research problem, research design, hypotheses, data collection and data analysis strategies and results. Of these components, it

is generally the results that receive the most space and attention. It is desirable not to repeat the title of the report since that has already been read and it uses up valuable space and words. The abstract should typically not include any information or discussion not found in the body of the paper. Sentences should be complete but abbreviations, if clear, may be used. To conserve space numbers should be in Arabic form rather than spelled out.[6]

Introduction. The first major section of the research report is the "Introduction." It may or may not be "headed" as such. In this division the problem is described along with the research question under investigation. A review of the historical evolution of the problem (along with names and dates) often helps the reader locate the present one in proper perspective.[7] By discussing and summarizing the work of others the reader can make an informed judgment of the researcher's contribution to the existing fund of knowledge in a particular area. It is also valuable for the researcher to make explicit how the study adds to or clarifies the results of earlier studies in the same general research domain. At the end of the introduction section the specific hypotheses to be tested are stated. In doing this key variables are defined and the linkages between theory and research are made explicit.

The introduction often contains the following subsections: 1) a formal statement of the problem, 2) review of literature, and 3) conceptual framework.[8]

1) Statement of the Problem. In this section, an attempt is made to succinctly state just what is being studied. Discussion of both major and minor objectives of the study, along with the proposed sociological (or psychological, or economic, etc.) significance of the problem can be presented. The writer should attempt to immediately and clearly familiarize the reader with what is proposed and need not engage in a great deal of

editorializing about the problem.

2) Review of Literature. In this section, the writer presents theoretical and research findings related to the formulation of the problem. This section may be divided into two subsections, one dealing with relevant theoretical literature and the other with relevant research literature. The reason for discussing the research and theoretical literature is two-fold: 1) it helps to explain and clarify to the reader the theoretical underpinnings of the study, and 2) it informs the reader what is known and unknown about the research problem. The writer should strive to select only that literature which is most directly relevant to the problem. In some instances, not much literature, or none has been directed to the problem. In these instances, it may be necessary to adapt some literature from a related area and use it. The literature in this section (or two subsections) must be presented in an organized manner. Use should be made of introductory statements/paragraphs to focus the selected literature directly on the problem. A summary of the most relevant ideas/findings should be included.

3) Conceptual Framework. In this section, the major variables and hypotheses which are to be studied are stated. Frequently the variables are derived from theoretical and research literature and where appropriate, are designated as either independent or dependent variables. These variables need to be conceptually and operationally defined. Using the variables, hypotheses are constructed, where appropriate, which suggest the way(s) in which these variables are expected to be related. Hypotheses must be stated as clearly as possible and this can be accomplished by concentrating on the essential nature of the expected relationship and thus simplifying the terminology used in stating the hypotheses. Where possible, the ways in which the hypotheses are integrated with each other should be explored. A rationale can be provided indicating how and/or why each of the hypothesized

relationships between the variables was expected. In the conceptual framework section, it is also appropriate to state some of the assumptions you made as to why the variables selected and hypotheses constructed were worthy of study, or were expected to be related.

Methods. The methods section informs the reader of how the study was conducted. The writer must make an effort to tell the reader what was done so that the reader, if he/she so desired, could replicate the study. The methods section covers: 1) sources of data, 2) data collection techniques, 3) procedures of variable measurement, and 4) data analysis.

1) Sources of Data. The researcher must specify whether the data were collected from a sample or the universe. If information was collected via samples, the nature of the sampling must be mentioned, how they were selected, and why they were so selected. Very rarely are specific names mentioned since most research concerns only aggregate descriptions and usually implies confidentiality of specific subjects' responses. Guaranteeing respondents both anonymity and confidentiality is an important ethical consideration involved in the research process.

2) Data Collection Techniques. It is imperative for researchers to indicate whether the data were secured first hand through interviews, questionnaires, observation, and unobtrusive measures, or second hand through printed documents, public reports, official statistics, etc. By making the data collection techniques known the reader can develop a "feel" for the adequacy of the procedures as they relate to answering the research questions.

3) Procedures of Variable Measurement. In this subdivision the researcher makes known the specific manner in which the variables were measured (i.e., operationalized). If a scale was used (e.g., Likert, Thurstone, Guttman, etc.) it must be succinctly described in terms of construction, scoring, etc. The amount of detail will vary according to the complexity

of the research design and variable measurement.

4) Data Analysis. The manner in which the data were statistically treated (if they were) appears in this subdivision. If the analyses involves percentages, ratios, crosstabulations, measures of association, and tests of statistical significance these must be specified. When measures of association are employed it is necessary to indicate the specific measures (e.g., C, gamma, r_s, r) utilized. When tests of statistical significance are employed (e.g., chi square, t, z, analysis of variance, etc.) the observed magnitude of the statistic should be reported along with the level of significance achieved and any qualifying assumptions (e.g., degrees of freedom, small cell frequencies, etc.) upon which the statistic is based. Additionally, the reader must be informed of the direction of the effect (e.g., which group, experimental or control, produced the larger mean score). With common statistical tests there is no need to provide references; on the other hand, with more elaborate procedures (e.g., path analysis, canonical correlation, lattice structure, factor analysis) literature sources should be provided so that the readers can consult them if they so desire. By providing such sources the reader can familiarize or learn more about the technique in question.[9]

Results. The content of the results section is ordinarily what the reader is most interested in and set out to discover. In writing the results the researcher must be selective. Rather than report everything that was discovered, only those findings bearing directly or indirectly on the research question should be included. This means that some interesting observations and findings may have to be deleted because they do not bear upon the central research concerns. The main question guiding the writing of this section is: "Do the data support or not support the hypotheses?"

In order to help the reader digest the findings, the researcher may wish to use tables, graphs, maps, charts, figures, and facsimiles in reporting the results. Researchers must be cognizant of the conventions for using such devices. For example, graphs should be correctly labeled and numbered consecutively. They should also be referred to in the body of the report (e.g., "Figure 1 demonstrates..."). The independent variable should appear along the horizontal axis (i.e., the abscissa) and the dependent variable should appear along the vertical axis (i.e., the ordinate). The graph's axes must be clearly labeled and the unit of measurement specified. Constructing good graphic devices can greatly facilitate the readers understanding of the results.[10]

Tables can be used to present a large amount of information in an economical fashion. Tabular displays of data should be simple and condensed and, ideally, permit readers to make their own calculations. Futhermore, they should provide summary statistical measures (e.g., chi square, r, F, etc.) where appropriate. Like graphs, the independent variable is located on the horizontal axis and the dependent variable on the vertical axis. Also, they must be titled, numbered consecutively, and be reported in the text proper.[11]

Discussion. In the discussion section the researcher discusses the results of the investigation in relation to the stated hypotheses. Whereas the basic results of the investigation are presented in the "Results" section, here those results are discussed, qualified, and interpreted. Several specific things are done: Inferences from the data are drawn, the research outcomes are related to theoretical concerns, and conclusions are reached concerning the validity of the hypotheses. Discrepancies and unexpected findings are reported, limitations and weaknesses of the research are mentioned, and implications for future research and theory development

are considered.[12] The discussion section contains, then, three specific subdivisions: 1) contributions of the study, 2) limitations of the study, and 3) proposals for future research.

1) Contributions of the Study.[13] In this section some indication must be given to what contributions you see your study as providing. These contributions must be specific and some attempt should be made to integrate them with the body of knowledge in the field in which your study is located. When possible, document these contributions by supporting them with published literature. Discussion of contributions expected from the study allows the reader to reflect on the entire research design and draw some inferences as to implications which this study may have for both pure science and/or applied science.

2) Limitations of the Study.[14] In this section, the writer states the limitations of the study.

An attempt must be made to discuss not just what would be considered "usual" limitations (e.g., small sample, lack of available data, etc.), but also some kinds of limitations which pertain only to one's study. These limitations must also be specific in nature and should not be viewed as serious detriments to the study, except where they must be recognized as such. It is simply conventional, and more importantly, scientific, to realize that any study has limitations which must be accounted for both in terms of design and interpretation of results.

3) Proposals for Future Research.[15] In this section, an attempt is made to suggest how the study is integrated in a continuing process of building a body of knowledge in a field (e.g., sociology, psychology, anthropology, etc.). Whether your study is a descriptive study or explanatory study, it should be seen as setting the stage for future research of certain kinds. Future research may deal with a replication, on a larger

scale, or may concern itself with developing one of the dimensions of your study more fully. It is necessary to explain in some detail the kind(s) of research likely to follow from your study. Avoid making vague generalizations. The function of this section is to demonstrate some awareness on your part of the role played by the study in the overall process of scientifically gathering data and interpreting results as this relates to the interdependency between theory and empirical research.

References. All sources cited in the body of the text are listed in the reference section. If sources other than those referred to in the body of the text are important to cite, this section may be labeled "Bibliography" rather than "References." Guidelines exist for the proper organization of references. However, these tend to be somewhat variable form one medium (e.g., American Psychological Association, American Sociological Association, etc.) to another. Appropriate guidelines must be consulted so the report is prepared in the acceptable format.[16]

Appendix. The purpose of the appendix is to present supportive material that would otherwise be unnecessarily detailed in the body of the report. The kind of information often recorded in the appendix includes mathematical derivations, calculationsof various statistics, individual scores, a copy of the research instrument(s), and verbatim instructions read to interviewees. Separate materials are often given a distinct appendix number (or letter) such as "Appendix A: Mathematical Derivations"; "Appendix G: Reproduction of Research Instrument," etc.[17]

Conventions Regarding Writing Style

The hallmarks of good research reporting are accuracy and clarity. Research writing is expository in nature. In research writing the details do not unfold as in a detective story and hold the reader in suspense until the climax. Hence, a premium is placed on objective, clear, precise,

and descriptive reporting. The basic structure of the research report--see section titled "Structure of Research Reports"--provides a general outline into which researchers may locate their particular issues. Preparing a more detailed outline of what one wishes to present may also be helpful.

To write accurately and clearly sounds easy but tends to be more difficult in practice. Most researchers have to work at it and find it necessary to revise and reorganize their report by paring down, deleting circumlocutions and redundancies. Hackneyed expressions such as "with reference to," "in terms of," "with respect to" should and can usually be avoided.[18] Strunk and White's primer on writing provides guidelines for simplicity and clarity of written expressions.[19]

Sometimes report writing is written in the impersonal third person (It was found that . . ."; "The results suggest . . .") or in the first person ("I found that . . ."; "I discovered. . .".). General writing conventions appear to favor the impersonal style and the use of the active ("The data suggest . . .") rather than the passive ("It is suggested that . . .") tense. Simple declarative sentences are generally favored over more complex writing styles also.[20]

Deciding on the appropriate verb tense sometimes is problematic. Sometimes the present tense is used throughout the report, other times the past tense. It is standard procedure to opt for the use of verbs in the past tense since the report will already have been completed by the time it is written. The only exception is in the phrasing of hypotheses. Often these are stated in the present tense. When future research inquiries are considered these may also necessitate departing from the past tense verb usage.[21]

When numbers less than ten are reported they are usually spelled out (e.g., one, two, . . . nine) unless they appear in a series (e.g., 1, 2, 3,

. . .) or percentage (e.g., 5%) or precede a unit of measurement (e.g., 2 standard deviations away from the mean). Numbers of ten or greater (possessing more than one digit) are to appear in Arabic form (e.g., 11, 110, 1,111) unless they begin a sentence. The only exception to this rule of thumb is number reporting in the abstract.[22]

Frequently Latin words present a problem as to whether they are singular or plural. For example, the term "data" is plural; "datum" is singular. Similarly, "criteria" is plural; "criterion" is singular; and pheneomena is plural; "phenomenon" is singular. Misuse of the proper verb tense can be a source of irritation to readers and affect the reader's judgment of the entire study.[23]

Most writers of research reports find that there are two ways their writing can be improved.[24] First, set down the first draft for a period of time and come back to it at a later date. Such a "hand's off" approach can be a boon to one's objectivity and critical judgment of the report and writing style.

Second, have someone else (who is knowledgeable and who you respect) read and criticize the report. Often disinterested readers can call our attention to various liabilities in our report writing that we,ourselves, cannot see because of our vested interests and near-total emersion in the study.

In sum, it is probably well to remember Ogburn's statement, "Language, like clothing, varies in style according to the occasion. Scientific writing is . . . different from other styles."[25]

Summary

The final step in the research process is the writing of a research report. Scientific research is not complete until the results of the investigation are communicated. To whom the report is written plays a major

role in the style and tone of the paper. When the research is to be conveyed to the scientific community there are guidelines which operate in the effective dissemination of the results. The structure of the written research report typically includes the following sections: 1) title, 2) abstract, 3) introduction, 4) methods, 5) results, 6) discussion, 7) references, and 8) appendix.

Important Concepts Discussed in This Chapter

Research Report
Title
Abstract
Introduction
Statement of the Problem
Review of Literature
Conceptual Framework
Methods
Data Collection Techniques
Procedures of Variable Measurement
Data Analysis
Results
Discussion
Contributions of the Study
Limitations of the Study
Proposals for Future Research
References
Sources of Data
Appendix