will fill your ears. At that moment, you are current and you are ready to take part. Given the pace of work in many areas of science, that moment will be brief, but savor it! That is the sweet fruit of retrieval.

REVIEWING THE LITERATURE: WRITING THE RIGHT STUFF

By much deserved reputation, the reviews of literature in student research proposals are regarded as consisting of clumsy and turgid prose, written as *pro forma* response to a purely ceremonial obligation in the planning format. Even when carefully crafted with regard to basic mechanics, they make dull reading, and when not so prepared they are excruciating torture for most readers. Much of this problem arises from a misunderstanding of the task served by reviewing the literature, and none of it need be true.

To begin, the common designation used in proposals, "review of the literature," is a misleading if not completely inappropriate title. A research proposal is not the place to review the body of literature that bears on a problematic area, or even the place to examine all the research that relates to the specific question raised in the proposal. A variety of methods for "reviewing the literature" do exist, such as best evidence synthesis, critical reviews, and even meta-analysis, but they are rarely appropriate for proposals. Analyses of that kind may be useful documents publishable in their own right. Indeed, some journals such as the *Review of Educational Research* are exclusively devoted to such critical retrospectives on scholarship. The task to be performed in the proposal, however, is different. It is not inferior to the true review, it simply is different.

In writing a research proposal, the author is obligated to place the question or hypothesis in the context of previous work in such a way as to explain and justify the decisions made. That alone is required. Nothing more is appropriate, and nothing more should be attempted.

Although the author may wish to persuade the reader on many different kinds of points, ranging from the significance of the question to the appropriateness of a particular form of data analysis, sound proposals devote most of the literature review to explaining (a) exactly how and why the research question or hypothesis was formulated in the proposed form and (b) exactly why the proposed research strategy was selected. What is required to accomplish these tasks is a step-by-step explanation of decisions, punctuated by reference to studies that support the ongoing argument. In this, the writer uses previous work,

often some critique of previous work, and sometimes some exposition of the broad pattern of knowledge as it exists in the area to appeal for the reader's acceptance of the logic represented in the proposed study.

Whatever particular arguments must be sustained in the review of the literature, there is no place for the "Smith says this . . ." and "Jones says that . . ." paragraph-by-paragraph recital that makes novice proposals instruments for dulling the senses. This is the place to answer the reader's most immediate questions: What is it the author wants to know, and why has this plan been devised to find the answer? In a good review, the literature is made to serve the reader's query by supporting, explicating, and illuminating the logic now implicit in the proposed investigation.

It follows, then, that where there is little relevant literature, or where decisions are clear-cut and without substantial issues, the review should be brief. In some cases, the examination of supporting literature may best be appended or woven into another section of the proposal. To write a review of literature for the sake of having a review in the document is to make it a parody and not a proposal.

Remember, the writer's task is to employ the research literature artfully to support and explain the choices made *for this study*, not to educate the reader concerning the state of science in the problem area. Neither is the purpose of the section to display the energy and thoroughness with which the author has pursued a comprehensive understanding of the literature. If the author can explain and support the question, design, and procedures with a minimum demand on the reader's time and intellect, then that reader will be more than sufficiently impressed with the applicant's capabilities and serious purpose.

None of this is intended to undervalue the task that every researcher must face, that of locating and thoroughly assimilating what is already known. To do this, the student must experience what Fanger (1985) described as "immersion in the subject" by reading extensively in the areas that are either directly or indirectly related to the topic of study. This may lead at first to a sense of frustration and confusion, but perseverance usually leads out of the wilderness to the point at which what is known about the topic can be seen in the light of what is not known. The goals of the proposed study can be projected against that backdrop.

The proposal is the place to display the refined end products of that long and difficult process. It is not uncommon, for example, for the study's best support to emerge from a sophisticated understanding of gaps in the body of knowledge, limitations in previous formulations of the question, inadequate methods of data collection, or inappropriate interpretation of results. The review of the literature

section then becomes a vehicle for illustrating why and how it all can be done better. What readers need, however, is not a full tour retracing each step the author took in arriving at the better mousetrap, but a concise summary of the main arguments properly juxtaposed to the new and better plan for action.

Most students will agonize over the many studies discovered that, although fascinating and perhaps even inspiring during the immersion process, in the final stages of writing turn out to fail the test of critical relevance and therefore merit exclusion from the proposal. It is tempting to see discarded studies and unused note cards as wasted time, but that misses the long view of learning. The knowledge gained through synthesis and evaluation of research results builds a knowledge base for the future. The process of immersion in the literature provides not only the information that will support the proposal but also the intellectual framework for future expertise. What may appear in the crush of deadlines and overload stress to have been pursuit down blind alleys, ultimately may provide insights that will support new lines of thought and future proposals.

Writing the section on related literature often is no more complex than first describing the major concepts that led you to your research question or hypothesis and then describing the supporting research findings already in the literature. It may be as simple as hypothesizing that A is greater than C. Why do you hypothesize that A is greater than C? Because evidence suggests that A is greater than B, and B is greater than C; therefore, it is reasonable to hypothesize that A must be greater than C.

In the review of the related literature, you would present those conceptual relationships in an organized fashion and then document each with previously reported studies. For example, the first section would include the most important studies indicating that A is greater than B, and the second section would present similar evidence supporting the proposition that B is greater than C. The literature section would then conclude with the argument that given such information, it is reasonable to hypothesize that A is greater than C. In addition, either interwoven throughout, or in separate sections, material from the literature would be presented in support of decisions about design and measurement in the proposed study.

Look at the example in Table 4.1, which also is represented diagrammatically in Figure 4.1. In this table, the general research question is posed, followed by the specific hypothesis through which the question will be answered. They are shown here merely to establish the frame of reference for the outline. In this example of the development of the related literature, three major concepts are necessary to support the legitimacy of this hypothesis. In Table 4.1, the question suggests that the way physical fitness and cognitive function are related is

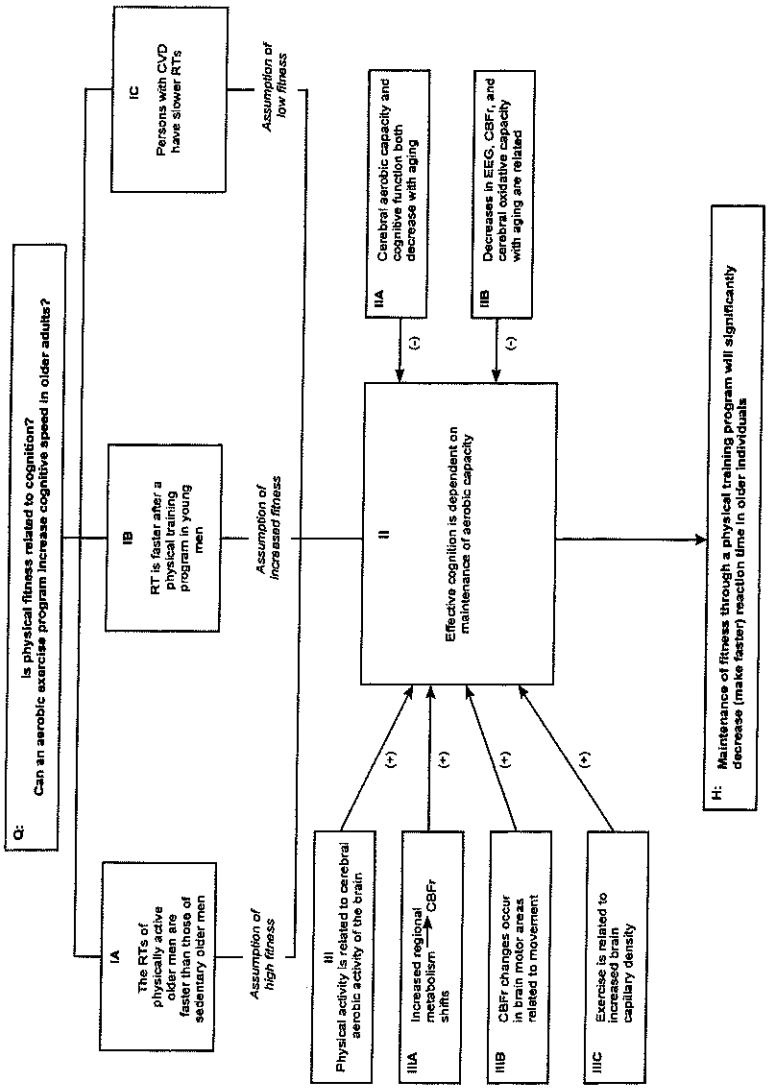

Figure 4.1. Example of a Diagrammatic Overview of the Related Literature

TABLE 4.1 Preparing the Related Literature Section

QUESTION: Is physical fitness related to cognition in older adults? More specifically, can an aerobic exercise program increase cognitive processing speed in older adults?

HYPOTHESIS: Maintenance of physical fitness through a physical training program will significantly decrease (make faster) reaction time in older individuals.

First Stage Outline: Develop the Concepts That Provide the Rationale for the Study

I. Reaction time is related to physical fitness level.
II. Maintenance of cognitive function is dependent on maintenance of aerobic capacity of the brain.
III. The aerobic capacity of brain tissue is affected by physical activity-related regional cerebrovascular changes.

Second Stage Outline: Development of Subtopics for Each Major Concept

I. Reaction time is related to physical fitness level.
   A. Comparisons of the reaction time of physically active and inactive subjects.
   B. Training effects on reaction time.
   C. Reaction time of those in poor physical condition (cardiovascular disease, hypertension).
II. Maintenance of cognitive function is dependent on maintenance of aerobic capacity of the brain.
   A. Relationship of cognitive function and brain aerobic capacity in aging individuals.
   B. Relationship of neurological measure of brain function, electroencephalography (EEG), to cerebral blood flow and cerebral oxygen uptake in older subjects.
III. The aerobic capacity of brain tissue is affected by physical activity-related regional cerebrovascular changes.
   A. Increased metabolism in specific regions leads to cerebral blood flow shifts to those regions.
   B. Regional blood flow shifts in motor areas of the brain are related to physical movement.
   C. Exercise is related to changes in brain capillarization.

Third Stage Outline: Add the Most Important References That Support Each Subtopic

I. Reaction time is related to physical fitness level.
   A. Physically active individuals have faster reaction times than do sedentary individuals (Clark & Addison, 1987; Cohen, 1993, 1995; Jones, 1998, 1999; Jones & Johnson, 1991; Lloyd, 1994).
   B. Reaction time is faster after a physical training program (Black, 1992, 1997; Dougherty, 1987; Morgan & Ramirez, 1991; Ramirez, 1994; Richards, 1995, 1997; Richards & Cohen, 1989; Roe & Williams, 1995; Walters, 1991).
   C. Cardiovascular-diseased patients have slower reaction time than normal individuals (Brown, 1991; Brown, Mathews, & Smith, 1998; Miller, 1991, 1992; Miller & Roe, 1990; Smith, Brown, & Rodgers, 1999; Smith & Rodgers, 1998).

TABLE 4.1 *Continued*

II. Maintenance of cognitive function is dependent on maintenance of aerobic capacity of the brain.
   A. Both cognitive function and aerobic capacity decrease with age (Gray, 1988; Petty, 1985).
   B. EEG, cerebral blood flow, and cerebral oxidative capacity decrease with age and are related (Doe & Smith, 1999; Doe, Smith, & Snyder, 1997; Goldberg, 1998; Smith & Doe, 1991; Waters, 1989, 1993; Waters & Crosby, 1992).
III. The aerobic capacity of brain tissue is affected by physical activity-related regional cerebrovascular changes.
   A. Increased regional metabolism leads to blood flow shifts (Green & Neil, 1966; Lewis, 1979; Thomas, 1976).
   B. Regional blood flow shifts to motor areas of the brain are related to physical movements being controlled (Caplan, Myerson, & Morris, 1991; Goldsmith, 1993, 1994; Johnson, Goldsmith, & Rodriguez, 1990).
   C. Exercise is related to changes in brain capillarization (Meyers & Templeton, 1991; Patrick, 1993; Patrick & Stone, 1995; Robinson & Spencer, 1990).

through a change in brain aerobic capacity as a result of training. If this is a reasonable question to ask, one would have to show that there have been some prior studies in which physical fitness level has been related to some measure of cognitive function (Concept I). Second, some evidence that cognitive function might be altered by aerobic functional capacity of the brain should be shown (Concept II). Finally, some evidence should exist that physical movement can alter blood flow shifts in the brain, and that blood flow shifts are related to aerobic capacity (Concept III).

Generally, the major concepts are supported by two or three subtopics, all of which lead to the formalization of the main concept. For example, the concept that reaction time and physical fitness level are related (I) can be supported in three different ways, by showing (a) that reaction time is faster in physically fit persons than in sedentary persons, (b) that physical training enhances reaction time, and (c) that reaction time in those on the lowest end of the physical fitness continuum is the slowest of all. Each of these subtopics is supported by the findings from several studies, as shown in the third stage outline section of the table.

Writing the related literature section is much easier if an outline is developed in stages of increasingly greater detail, as shown in Table 4.1, prior to the actual writing. Once the outline is developed, this section of the proposal can be written

in a straightforward manner, with little backtracking necessary. If meticulous care is taken in selecting each reference, an enormous amount of time will be saved in the long run.

Another easy way to conceptualize the organization of the related literature is to diagram it, as shown in Figure 4.1. In this figure, the question (Q) is shown in the first box, and then the major components of the rationale are shown as they relate to one another. Component I refers to the behavioral observations that have been reported in the research literature. Component II refers to the literature in which the effects of aging on cerebral aerobic capacity and cognitive function are described. Because these relationships have negative outcomes, they are shown with a negative sign. Component III refers to all literature that provides support for a relationship between physical activity and cerebral aerobic activity. In this case, these are all positive relationships, which are shown with plus signs. Finally, the last box depicts how all these relationships lead to the hypothesis (H) of the study.

Both the outline and diagram format can be very helpful in conceptualizing the related literature. The entire process can be summarized in the 15 steps in Table 4.2. Table 4.3 contains guidelines for evaluating the related literature section.

SPADEWORK: THE PROPER USE OF PILOT STUDIES

The pilot study is an especially useful form of anticipation, and one too often neglected in student proposals. When it comes to convincing the scholarly skeptic (sometimes your own advisor), no argument can be so effective as to write, "I tried it and here is how it worked."

It is difficult to imagine any proposal that could not be improved by the reporting of actual preliminary work. Whether it is to demonstrate the reliability of scores produced by the proposed instrumentation, the practicality of procedures, the availability of volunteers, the variability of observed events as a basis for power tests, subjects' capabilities, or the investigator's skills, the modest pilot study is the best possible basis for making wise decisions in designing research.

The pilot study, for example, is an excellent means by which to determine the sample size necessary to discover significant differences among experimental treatments.[1] Sample size estimation or "power analysis" recently has become commonplace in quantitative research. Although it always has been an important component of good research, it has become more frequently used because of the

availability of easy-to-use books and computer programs. A particularly useful introduction to power analysis, replete with examples and tables, is *How Many Subjects?* (Kraemer & Thiemann, 1987). In addition, a number of computer programs are available—some of which only require the user to answer a few questions before calculating sample size. Because software is being updated quickly, we suggest inquiring at your institution's statistical consulting office or computer center to find out what is available.

Pilot data and a few decisions (primarily related to the error rates you want for the study) allow researchers to estimate the sample size needed to find significance, if in fact it exists in the data. It is possible that the estimated sample size required will be so large as to be prohibitive, in which case method and measurement tools should be reexamined. In the ideal case, a power analysis will inform the researcher of an appropriate sample size based on permissible error and the data—not just from arbitrary guessing. It is better to find the appropriate sample size in advance, rather than after the fact. Both a sample size that precludes a significant finding and the use of more subjects than needed are wastes of time and effort.

The use of even a few subjects in an informal trial can reveal a fatal flaw before it can destroy months of work. The same trial may even provide a fortunate opportunity to improve the precision of the investigation or to streamline cumbersome methods. For all these reasons, students and advisors should not insist on holding stringent, formal standards for exploratory studies. A pilot study is a pilot study; its target is the practicality of proposed operations, not the creation of empirical truth.

Examples of purposes that pilot studies might serve include the following:

1. To determine the reliability of measurement in your own laboratory.
2. To ensure that differences that you expect to exist, do in fact exist—that is, if you are studying the different effects of gender on motivation, make sure the gender difference exists.
3. To "save" a sample that is difficult to obtain until the real research project is undertaken—that is, it is prudent to test available subjects until procedural bugs are worked out before testing world-class athletes.
4. To determine the best type of skills to use as an independent variable; for example, effects of different ankle braces on knee mobility—test jumping vertically, horizontally, and while running, then select one.

The presentation of pilot study results sometimes does create a troublesome problem. Readers may be led inadvertently to expect more of pilot work than it

TABLE 4.2 Steps in Writing the Related Literature Section

1. Determine the major concepts (generally no more than two or three) that are pertinent to the proposed research question. That is, what are the concepts that must be true for your question to be appropriate or hypotheses tenable?
2. List concepts either in descending order of importance or in terms of logical presentation. That is, does one concept have to be understood before another can be introduced?
3. Prepare an outline with these major concepts as the major headings (such as the one in Table 4.1, concepts I, II, and III).
4. Under each major heading, list the articles that are most directly related (authors and dates only).
5. If the articles under a major heading cluster themselves and suggest a subheading, then arrange the clusters under the major topics in logical order. For example, you might note that of the nine studies pertaining to the notion of a relationship between reaction time and physical fitness, in five of these reaction times of animals were reported, whereas in the other four studies, the reaction times were from humans. The interpretation of these studies, when clustered in terms of type of subject, might be different and have substantial bearing on the potential outcome of the proposed research.
6. Without referring to the details in the articles, summarize in one paragraph the combined findings of each cluster of studies. For example, in concept I.A of Table 4.1, the summary might be that reaction time of physically active men and women is faster than that of sedentary individuals, as long as the subjects are over 60 years old. The summary of concept I.B might be that aerobic training improves reaction time, but strength training in older individuals does not improve reaction time. At some point, you will have to discuss the interpretation to be made from different results of physical fitness on reaction time, depending on the way physical fitness as an independent variable is measured.
7. Write an introductory paragraph explaining what the two or three major areas are and in what order they will be discussed. Explain why the order used was selected, if that is important. Explain why some literature may be omitted if it might seem logical to the reader that it would be included.
8. Write a statement at the end of each section summarizing the findings within each cluster of studies. Show how this summary of findings relates to those in the cluster of studies described in the following paragraphs.
9. Write a paragraph at the end of each major topic (I, II, and III in Table 4.1), with a subheading if appropriate, that summarizes the major points, supports the cohesiveness of the subtopics, and establishes the relevance of these concepts to the proposed research question.
10. Write a paragraph or short section (with the appropriate heading) at the conclusion that draws together all the major summarizing paragraphs.
11. Read the paragraphs and subject them to Steps 1-7 in the "Guidelines for Evaluating the Related Literature Section" (Table 4.3).
12. After all these concepts and subtopics have been carefully introduced, described, and summarized, return to the beginning and insert the documentation for each of the concepts in the proper location. That is, document the statements made in each of the paragraphs by describing the studies leading to them or verifying them.

TABLE 4.2 *Continued*

13. Each time a reference is inserted, place the complete citation in a special file for eventual compilation of a reference list.
14. After a week has passed, reread the related literature section and use the complete "Guidelines for Evaluating the Related Literature Section" that are provided in Table 4.3. Make whatever revisions seem necessary and wait one more week.
15. Read the entire related literature section for coherence, continuity, and smoothness of transition from one concept to another. Check carefully for accuracy of all citations and, again, edit for mechanics.

TABLE 4.3 Guidelines for Evaluating the Related Literature Section

After you have written the first draft of the related literature section (Steps 1-11 in Table 4.2) and then again as you prepare the penultimate draft (Step 14 in Table 4.2), answer the appropriate questions below. Mark the manuscript where the answers to each of these questions are located.

1. Is there a paragraph outlining the organization of the related literature section?
2. Does the order of the headings and subheadings represent the relative importance of the topics and subtopics? Is the order of headings logical?
3. Are there summary paragraphs for each of the two or three major sections and an overall summary at the end?
4. Is the relation of the proposed study to past and current research clearly shown in the summary paragraphs?
5. What new answers (extension of the body of knowledge) will the proposed research provide?
6. What is distinctive or different about the proposed research compared with previous research? Is this clearly stated? Is this introduced in just a few paragraphs?
7. Have the results from your own pilot studies, when appropriate, been interwoven into the synthesis of the related literature?
8. What are the most relevant articles (no more than five) that bear on this research? Underline these references. Are they listed under the first topical heading?
9. Are these articles presented in a way that denotes their importance? Are some cited so many times they lose their power through repetition?
10. Has the evaluation of these key articles, as well as all other articles, been presented succinctly in terms of both procedures and interpretation of results?

PROPOSALS THAT WORK

FOURTH EDITION

A Guide for Planning
Dissertations and Grant Proposals

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