FUNCTIONS AND DEFINITIONS OF FUNCTIONS OF A RESEARCH PROPOSAL

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FUNCTIONS AND DEFINITIONS OF FUNCTIONS OF A RESEARCH PROPOSAL

Problem

1. Establishing -- to establish the existence of two or more juxtaposed factors which, by their interaction, produce an enigmatic or perplexing state, yield an undesirable consequence, or result in a conflict which renders the choice from among available alternatives moot.

2. Relating -- to relate the problem to it general antecedents (i.e., educational, scientific, social).

3. Justifying -- to justify the utility, significance, or interest inherent in the pursuit of the problem.

Logical Structure or Theoretical Framework

1. Expounding -- to expound the structure or framework within which the situation will be investigated, that is: (1) in the case of the logical structure, to provide a rationale for the perspective from which the investigator will examine the problem; or (2) in the case of the theoretical framework to conceptualize or state the theory in which terms the investigator will examine the problem.

2. Validating -- to validate the application of the particular logical structure or theoretical framework in the investigation of the problem in terms of its anticipated advantages and consequences.

Review of Related Research

1. Describing -- to describe the literature, the practical knowledge and the constraints pertinent to either the substantive or the method -- logical aspects of the research or development work,

2. Criticizing -- to critique the identified materials in terms of their strengths and weaknesses.

3. Relating -- to relate the identified materials to the research or development work by assessing their saliency and by showing how both the substance and method of the current investigation depend on them or deviate from them.

Objectives

1. Proposing -- to propose the goals or ends which the researcher or developer intends to achieve as a result of the proposed inquiry.

2. Justifying -- to justify the selection of the objectives which are chosen by explicating the criteria employed in making the choice and by showing how the objectives meet the criteria.

Hypotheses or Questions

1. Selecting -- to select and propose the specific questions to be answered or hypotheses to be tested (in the case of research) or the particular design specifications to be met (in the case of development).

2. Operationalizing -- to operationalize the definitions that will be employed for the major variables in the study.

3. Validating -- to validate the fact that the questions or hypotheses can be inferred from the theory or conceptual framework in a straightforward, deductive way; or the fact that the design specifications can be shown to have a logical relationship to the problem which is to be resolved by the development.

Procedures

1. Outlining -- to outline the overall research design within which the inquiry will be conducted or the action plan within which the development will be effected.

2. Detailing -- to detail the research design or action plan sufficiently to show how the integrity of the research findings or developments will be safeguarded (maintaining internal validity) and how their generalizability to populations of interest will be preserved (maintaining external validity).

3. Operationalizing -- to make operational the variables or conditions in the investigation or development by specifying the instrumentation or the techniques of instrument development including their selection or development.

4. Analyzing -- to posit the analytic scheme or framework which will be employed in treating the data generated by the inquiry in a method appropriate to test the hypotheses or questions of the study.

5. Organizing -- to describe the organizational plan, i.e., the work schedule or sequence of events and requisite resources that will be involved in conducting the research or effecting the development.

6. Qualifying -- to qualify the conclusions or generalizations which can be drawn from the research or development in terms of any special conditions inherent in the research design or section plan.

WORKSHEET A - THE PROBLEM

R and D proposals, whether designed for dissertation purposes, as applications to external funding agencies, or as a personal guide to the researcher, may be considered as responses to a problem. Despite this obvious and integral link between the statement of the problem and the raison d'être of the entire proposal, the nature of problems remain largely unexplicated and the processes for generating problem statements is ignored altogether or charged off as an intuitive process that will become evident to the neophyte inquirer as he gains experience and expertness in his craft. Research texts devote sections to the methodology associated with carrying out the inquiry, i.e., procedures, but will dispense with the problem with such peculiar statements as:

> "It is not always possible for a researcher to formulate his problem simply, clearly and completely. He may often have only a rather general, diffuse, even confused notion of the problem."[1]

> "A problem, then, is an interrogative sentence or statement that asks: What relation exists between two or more variables?"[2]

But it is a truism among persons who evaluate proposals that the most frequent deficiency noted by them is the lack of a clear problem statement to define and guide the inquiry. And the most frequent plaint of the doctoral student is his/her seemingly never-ending search for a problem significant enough to pursue and discrete enough to handle. The intent of this worksheet outline and the class presentations and exercises which accompany it is to de-mystify the process of generating problem statements which will be adequate to define, guide and direct systematic inquiry. Defining a Problem. A problem is a situation resulting from the interaction or juxtaposition of two or more factors (e g., givens, constraints, conditions, desires, etc.) which yields (1) a perplexing or enigmatic state, (2) an undesirable consequence, or (3) a conflict which renders the choice from among alternative courses of action moot.

Defining a Problem.

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1. F.N. Kerlinger, Foundations of Behavioral Research. New York: Holt, Rinehart and Winston, 1973, p. 16.
2. Ibid., p. 17.

A problem is a situation resulting from the interaction or juxtaposition of two or more factors (e.g., givens, constraints, conditions, desires, etc.) which yields (1) a perplexing or enigmatic state, (2) an undesirable consequence, or (3) a conflict which renders the choice from among alternative courses of action moot.

A problem solution is an action which clarifies the perplexing or enigmatic state, which alleviates or eliminates the undesirable consequence, or which resolves the conflict or delineates the course of action to be taken.

The nature or relationship between or among the factors generating the problem may take any of several forms, e.g.:

1. Provocative exception
2. Contradictory evidence
3. Moot alternatives, i.e., knowledge void
4. Action-knowledge conflict
5. Theoretical conflict

Functions of a Problem Statement

1. Establishing -- to establish the existence of two or more juxtaposed factors which, by their interaction produce an enigmatic or perplexing state, yield an undesirable consequence, or result in a conflict which renders the choice from among available alternatives moot.

2. Relating -- to relate the problem to its general antecedents (i.e., educational, scientific, social).

3. Justifying -- to justify the utility, significance, or interest inherent in the pursuit of the problem.

Common Deficiencies of Problem Statements

--- Failure to establish the existence of a problem, e.g.:
  -- "The purpose of the project is to ..."
  -- "The question(s) to be investigated is ..."
--- Statement of a condition - "The number one problem in the country today is inflation ..."
--- The boiler plate problem.
--- The problem that has no history.
--- Parochialism - personal institutional disciplinary.
--- The "lick the world" statement.

--- The solution that makes no difference.
--- The justification without a problem.

A Format for Generating Problems

Principal Proposition

Ordinarily stated in the form of a given; a generalization; a generally accepted proposition; a description of a condition; less frequently, but possibly, a desire or goal.

Interacting Proposition

Contradicts, contravenes, notes exceptions to, challenges, casts doubt upon the principal proposition; the interacting proposition frequently assumes the form of:

1. Provocative exception
2. Contradictory evidence
3. Moot alternatives
4. Action-knowledge conflict
5. Theoretical conflict

Speculative Proposition

Relates the juxtaposed propositions and makes clear the nature of the conflict, i.e., the essence of the problem. The format noted above generates the substantive dimensions of the problem but leaves open the question of how the inquirer intends to grapple with the established conflict. Figure A-l picks up with the substantive orientation o? the problem and classifies the various response modes available to the inquirer in responding to the problem.

Relating and Justifying Functions

After the problem and the primary mode of response are identified, the inquirer is responsible for relating the problem to its antecedents. Problems do not exist in vaccua, but stem from particular circumstances. The juxtaposed factors leading to the problem have histories; these may be of a scientific, social, educational, economic, etc., origin. It is not the purpose here to describe the context of the proposal, since this will be done in detail in a later section. What is necessary is a sufficient description of antecedents to put the statement in perspective so that the researcher and the reader will be able to appreciate the problem in the tradition of inquiry of which it is a part. A final function of the

problem section is to justify the utility, significance, or interest of the problem. Resources and time are always scarce. It is of great importance from the point of view of a potential funding agency or a dissertation committee and from the researcher's own point of view, that priority be given to problems of greater urgency and utility.

Obviously if problems are to be assessed for their significance some criteria must be brought to bear. These criteria include, e.g., heuristic value, programmatic sequencing, social utility, scientific interest, and the convenience and concern of the researcher or developer. These criteria will be defined later in the worksheet on objectives.

Supplementary Readings

1. William Gephart, "The Problem and Problem Delineation Techniques," Phi Delta Kappa Occasional Paper #1, Bloomington, Ind.: Phi Delta Kappa, 1968.

2. Abraham Kaplan, The Conduct of Inquiry, San Francisco: Chandler, 1964, Chap. 1.

3. Fred Kerlinger, Foundations of Behavioral Research (2d ed.), New York. Holt, Rinehart and Winston, 1973, Chap. 2.

chart

WORKSHEET B - LOGICAL STRUCTURE: THEORETICAL FRAMEWORK

Problems do not exist in "nature" but in the minds of people. This can be seen from an examination of the definition of a problem. problems stem from a juxtaposition of factors which results in a perplexing or enigmatic state of mind (a cognitive problem) an undesirable consequence (a psychological or value problem), or a conflict which obscures the appropriate course of action (a practical problem). Cognition, values, and practices are attributes of persons, not of the objective world.

Problems cannot be articulated except within a conceptual system. No inquirer can investigate a problem from all perspectives simultaneously. And that is what a logical structure or theoretical framework is all about. It establishes a vantage point, a perspective, a set of glasses through which the researcher views the problem. In this sense, the selection of a logical framework is both a clarifying and exclusionary step in the research process. While it sharpens focus and consequently increases the clarity brought to the problem area, it excludes from the view of the inquirer other perspectives which might be brought to bear on the same problem.

The framework used by the researcher is not always explicit, but the burden of the argument in this worksheet is that to the extent possible it should be explicated for several reasons:

1. Since the problem is a function of its framework, the problem can be better understood and articulated if its basic system is well understood and articulated. Additional facets of the problem may be generated as a result, and the known facets will take on greater clarity and form.

2. When the framework is well articulated it is possible to conceive and consider alternative frameworks. The explication of behaviorist theory in early psychology made it possible to see what its strengths and weaknesses were and to develop alternative theories which ultimately had high payoff. Given several possible frameworks the researcher chooses among them on the basis of criteria such as heuristic value, inclusiveness, efficiency, and the like. The power of a proposed solution to the problem may thus be considerably enhanced.

3. The explication of a theoretical framework or logical structure provides focus to all the subsequent steps in planning and carrying out the proposed inquiry. It makes it possible to generate a relatively complete set of

objectives and questions (a point which will be pursued more fully in worksheets pertaining to those activities), it provides a basis for including and excluding the literature and research that is actually related to the inquiry by identifying the variables of greatest interest and concern, and it provides focus to the inquirer's procedural planning and choices from initial design selection, through instrument development or adoption, to the organization of data, i.e., making sense of the empirical findings.

4. Perhaps most important is the impact of the explicit theoretical structure on subsequent inquiry in the same area. The investigation no longer hangs loose but becomes part of a line or tradition of inquiry which other researchers can check, replicate, or build upon. Knowledge growth in a field becomes an additive phenomenon of increasingly useful structures or concepts with which inquirers can work.

Defining a Logical Structure or Theoretical Framework

A logical structure or theoretical framework is the set of terms and relationships within which the problem is formulated and solved. Such frameworks may vary greatly in format and sophistication.

In its simplest form a conceptual framework may be no more than a set of descriptive categories. For example, one may decide to investigate teacher behavior by noting whether a teacher's verbal statements are questions/informational comments, supportive comments, or disciplinary comments. Such a set of terms would be quite useful in categorizing behavior even though there is no pretense that all behavior could be categorized this way, or that the terms were pre-selected to conform to some particular point of view.

When such a set of categories meets the additional criteria that all categories are independent of each other and are necessary and sufficient to encompass all relevant phenomena, they may be said to comprise a taxonomy, as for example, the biological taxonomy of life forms.

A theory interconnects the categories (whether or not they form a taxonomy) through a set of relationships. Both the categories and/or the relationships may be derived from a set of basic postulates Hypotheses may be derived by deduction from the theory for testing.

Functions of a Logical Structure or Theoretical Framework

1. Expounding -- to expound the structure or framework within which the situation will be investigated, that is: (1) in the case of the logical structure, to

provide a rationale for the perspective from which the investigator will examine the problem or (2) in the case of the theoretical framework to conceptualize or state the theory in which terms the investigator
will examine the problem.

2. Validating -- to validate the application of the particular logical structure or theoretical framework in the investigation of the problem in terms of its anticipated advantages and consequences.

Common Deficiencies in Proposal Structures or Frameworks

-- Failure to offer any framework - raw empiricism.
-- The inappropriate framework.
-- The overly-complex framework.
-- The framework unrelated to other competing structures.
-- The imprecise framework.

Generating a Framework or Structure

Many researchers, most neophyte inquirers, find themselves paralyzed by the notion that they are responsible for positing a theoretical structure on which their inquiry is to be based. And, consequently, many frameworks or structures end up as overly complex, sophisticated structures and statements which the researcher finds dysfunctional to the conduct of the inquiry; the framework, in effect, becomes an independent step in the inquiry process carried to a successful conclusion as an academic exercise. But it misses the central point of the activity. The theoretical grounding of a study is designed to help the inquirer - not boggle his/her mind. It is undertaken not for the advantage of a reader of the proposal but for the researcher.

As was noted, a conceptual framework is the necessary concomitant of any problem, for the problem could not be stated except within at least an implicit framework. Thus the task often is simply to make explicit what is already there at an implicit level The researcher may begin by simply noting key terms and basic assumptions underlying the inquiry. Several structures, classification systems, taxonomies, and theories may already have been
explicated precisely in the field in which the researcher is working or, in other cases, in fields which could be applied to the problem of interest to the research, e.g., the use of the social-psychological structure of interaction analysis in the observation of classroom teacher behavior.

The sources to support the inquirer in theory development are no different than those which will be turned to for support in other areas of planning in research, i.e.:

-- Extant structures of varying levels of sophistication in the literature of the field.

-- Structures from related fields that could be adopted for, or adapted to, the inquiry.

-- Previous research studies which have employed either implicit or explicit structures pertinent to the inquiry.

-- De novo explication of structures - these usually occur at simple rather than complex levels of structure building or the research itself must be geared first to a theory development project.

A special note: investigations frequently employ not one but several structures which clarify dimensions of the inquiry. For example, a "futures" study may posit one structure to support the substance of the inquiry, a second which organizes the futures view, and perhaps a third to clarify a methodological orientation toward data gathering. The critical point is that multiple structures should be truly complementary and exclusive in their orientation. If they overlap, an effort should be made to synthesize the structures and postulate a newer, more comprehensive structure

Once a framework has been proposed, it is important to ask what advantages and disadvantages may accrue as the result of using, it. In the event that there seems to be available only a single alternative framework, its use is mandated even though it may have some obvious drawbacks. In other cases where multiple frameworks may be available, as for example in learning research, the choice of the particular framework should certainly be made to maximize those advantages that are most salient for the investigation or development and to minimize those disadvantages which are most inimical to it. In general, when the proposer is able to demonstrate that (1) the proposed framework does have relevance for the study or development that is contemplated, and (2) the particular framework has more advantages and/or disadvantages than some other framework that might have been used, the validating function of this section of the proposal has been met.

Supplementary Readings

1. Harry S. Broudy, Robert H. Ennis, Leonard I. Krimerman, Philosophy of Educational Research, New York: John Wiley and Sons, 1973. Chap. 5, pp. 271-79; Chapter 8.

2. Abraham Kaplan, The Conduct of Inquiry, San Francisco: Chandler, 1964. Chaps. 7-8.

3. Fred N. Kerlinger, Foundations of Behavioral Research, (second edition), New York: Hold, Rinehart and Winston, 1973. Chaps. 2-3.

WORKSHEET C - THE CONTEXT: REVIEW OF RELATED RESEARCH, EXPERIENCE, AND CONTEXTUAL VARIABLES

Every research or development activity is conceptualized and will be carried out within some contextual framework. This contextual framework is in part conceptual, in part valuational, and in part practical, and all of these factors must typically be considered. Certain of these contextual factors may be thought of as facilitating and others as constraining.

The most obvious facilitating element is the accumulated scientific and general literature that relates to the problem. Other directly related or analogous studies are likely to have been carried out which will afford substantive or methodological insights. There is no point in rediscovering what is already known or in reinventing the tools necessary to discover it. Past and current literature and studies make it possible to assess the most sensible next point of departure in the programmatic development of an area and the most heuristic way to go ahead in that exploration.

Another useful facilitating element is the practical knowledge that has accumulated in a field. Although such practical wisdom is not likely to have been systematically codified in the literature, or to have its validity as well established as that of a research finding, it is nevertheless of great potential utility. Most individuals, in fact, are more likely to trust their experiential insights than research findings; a research datum that contravenes the experience of years is highly suspect and will need firmer establishment than will a finding which is supported by experience. The major difficulty in leaning upon experience is that codified experience is not generally available; hence special techniques may be necessary to determine just what experience indicates.

A constraint in the context of any R and D activity is precedent. A research proposal, particularly in cases where outside funding is sought, needs to be mindful of precedent in the area. For example, a research proposal in education has been more likely to have been funded if it has been cast in the psycho statistical tradition which characterizes American educational research and if the procedural elements of the inquiry have been well validated in like studies. If it has been procedurally involved with experimentation it was more likely to be judged as competent research by professional colleagues,

Another group of constraints may be summed up by the term economic and political factors. In the research area the inquirer may find that acceptance for the conduct of a certain study can not be gained if political variables in the situation are ignored. A school principal is not likely to submit to an assessment of effectiveness if he/she knows that assessment is to be made available to the district superintendent. In the development area, an innovation which is expensive to local school districts must be backed by an economic support strategy if the expectation Is held that it will be widely diffused.

Defining the Results of Related Research

As must have been obvious from the preceding section, the intent of the worksheet is to broaden the standard definition of related research in several ways, i.e.:

1. To include explicit attention to contextual factors such as precedent and economic and political factors which may constrain the conduct of the inquiry.

2. To include the general literature, practical knowledge, and on-going R and D, literary, and practical events as well as the standard review of related R and D studies.

3. To encompass analogous studies and literature as well as directly related studies.

4. To cover knowledge related to the theoretical, methodological, and managerial as well as the substantive dimensions of the inquiry.

5. To include, as will be clear in the next section, the responsibility for explicitly criticizing and relating the relevant knowledge to the current investigation, i.e., to extend well beyond narrative citations and/or an annotated bibliography. Selectivity, not comprehensiveness, is the key to effectively employing related knowledge in the inquiry process.

Functions of the Context or Related Research Section of a Proposal

1. Describing -- to describe the literature, the practical knowledge, and the constraints pertinent to either the substantive or the methodological aspects of the research or development work.

2. Criticizing -- to critique the identified materials in terms of their strengths and weaknesses.

3. Relating -- to relate the identified materials to the research or development work by assessing their saliency and by showing how both the substance and method of the current investigation depend on them or deviate from them.

Common Deficiencies in Related Research Proposal Sections

-- The missing landmark studies.
-- The outdated review - sans on-going work.
-- The parochial review - institutional, disciplinary, knowledge source.
-- Over-emphasis on substantive findings.
-- The non-discriminating review.
-- The non-critical review.
-- The specialist review.
-- The free standing study.

Generating a Review of Related Knowledge

Description is the simplest of the three function areas specified for the review of related knowledge, but nested within the term "to describe" are the terms "to find," "to compile," "to select," i.e., to conduct the basic search for related knowledge on which the more complex activities of criticizing and relating will be built.

Figure C - 1 is designed as a search tool to remind the inquirer of the components of inquiry in regard to which the review may be relevant and the range of sources which are available, with varying degrees of difficulty, to be tapped. A sufficient review will have given reasonable consideration to all the cells in this figure. Class presentations will explore search strategies and tactics appropriate to the various cells.

Mere description of the context, no matter how sufficient, will be of little value unless the components of that context are evaluated in terms of their strengths and weaknesses, i.e., unless the materials are criticized. For example, a particular study reported in the literature may have produced a finding which is potentially devastating to the conceptual framework of the proposed study. But close examination indicates that this finding is unreliable because of methodological inadequacies in the cited study. There is then no point in taking

this finding into account. Furthermore, the methodological inadequacy, having been identified, can be guarded against in the proposed work. Thus strength-weakness analysis may be most helpful in guiding the thinking of the proposer. In this example the analysis rested upon the reliability of the finding; it might also rest upon such other criteria as limitations in generalizability, validity, internal consistency, corroboration by other findings, inclusiveness, and the like.

Finally, the described and critiqued materials have to be related to the study for maximal usefulness. The saliency or importance of each item must be assessed. As noted earlier, selectivity is a more important key to the adequacy of most related knowledge presentations than comprehensiveness. Garbage collectors generate incredible quantities of material in elated knowledge searches and presentations which serve, in the final analysis, to simply confuse the reader and the researcher.

It is important to know how the proposed work will depend upon or deviate from existing and past studies, practice, etc. In most cases new research or development represents some logical extension of what is already known or available. This connection should be made as explicitly as possible. In other cases the new research may represent a sharp deviation from known approaches or practices. Such deviations are probably unwise unless there is a compelling reason for them, and when these deviations are proposed, the reasons should be spelled out in clear and convincing fashion.

Supplementary Readings

1. Arvid S. Burke and Mary A. Burke, Documentation in Education, New York: Teachers College Press, 1967.

2. Education Reading Room, "Education Reference Books: With Additional General Sources," Bloomington, Indiana: Education Reading Room, Fall 1972 with supplements.

3. ERIC Clearinghouse on Teacher Education, How to Conduct a Search Through ERIC, Washington, DC.: American Association of Colleges for Teacher Education, February, 1970.

chart

WORKSHEET D - OBJECTIVES

Once a problem is established, the strategic method of approach has been defined, i.e., research, development, implementation, evaluation, and a conceptual framework has been explicated, the inquirer is ready to grapple with the issue of which, among many possible, objectives he/she will focus upon in the study. The statement of objectives has, of course, been foreshadowed and delimited by the actions chosen for the response taxonomy (Figure A - 1) but, generally speaking, the level of choice has not been made beyond the four broad categories noted above. The researcher is now ready to choose from among action tactics, e.g., depict, relate, conceptualize, test, and from among substantive orientations defined by the logical structure for the study. And the key to understanding the material which follows and this step in the inquiry process is that every objective (correctly framed) has two aspects: action and content. So, for example, an evaluation study might pose the objective, "to determine the effect of PSSC physics materials on science achievement." The action aspect is represented by the phrase, "to determine," while the content aspect is "the effect of PSSC physics materials on science achievement."[3]

Defining the Objectives

The objectives of a proposal delineate the ends or aims which the inquirer seeks to bring about as a result of completing the research, development, or evaluation undertaken. An objective may be thought of either as a solution to the problem or as a step along the way of achieving a solution; an end state to be achieved in relation to the problem. The sentence often used as a problem statement, i.e., "The purpose of this project is to -----," is properly completed by the insertion of the objectives.

Functions of the Objectives Section of a Proposal

1. Proposing -- to propose the goals or ends which the researcher or developer intends to achieve as a result of the proposed inquiry.

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[3]. Note that the example provided does not define operationally the target of the study, i.e., effect and achievement are not defined with the precision needed to plan or understand the specific methodology of the inquiry. This is appropriate since the researcher will proceed to pose questions or hypotheses which will be operational in definition.

2. Justifying -- to justify the selection of the objectives which are chosen by explicating the criteria employed in making the choice and by showing how the objectives meet the criteria.

Common Deficiencies in Choosing and Posing Objectives

-- Letting-the-reader-down objectives.
-- The free-floating objectives.
-- The disappearing objectives.
-- The "new ball game" objectives.
-- Objectives without criteria.
-- The procedural or operational objectives.

Generating Objectives

Any given inquiry is likely to have several objectives and these objectives could, obviously, be displayed in the he form of a matrix or grid if the objective were broken into its action and content aspects. A two way table would be formed--the rows of which would be defined by the action aspects and the columns defined by the content aspects.

Where would the particular row and column headings come from? From the preceding discussion it should be clear that column headings (content aspects) would be derived from the problem and the conceptual framework. Thus, column headings will differ from study to study.

Row headings, dealing with action aspects, are not nearly so variable as noted in Figure A - 1. The number of possible actions available to a researcher or a developer is finite. If it were possible to develop a taxonomy of such research or development actions, then this taxonomy, when set against the conceptual framework in the proposal, would generate all possible objectives explicitly and make it possible to choose from among them in some systematic way.

The notion that such actions are finite was the assumption implicit in Figure A -1. The rationale underlying the particular terms chosen in that figure can be illustrated by describing the area of research. When a researcher first approaches a new area about which almost nothing is known, all that can be done is to develop phenomenological descriptions. The researcher may describe what he/she sees in terms of certain variables (the beginnings of a conceptual framework) and may make efforts to determine their amounts. Such qualitative and quantitative descriptions will be termed depicting, the first category of the research taxonomy. Once description has occurred in some detail, then it is possible to relate the various depictions qualitatively, by comparison and

contrast, or quantitatively, through correlational and related techniques. When certain relationships have been established, a next step is to account for them through the development of conceptual frameworks in terms of which the relationships may be predicted, understood, and controlled. This process will be termed conceptualization, and may be carried out either analytically or synthetically. Finally, the conceptualizations will yield certain hypotheses which can be confirmed or rejected for the phenomenological world; this process will be termed testing.

The thrust of this argument is not that the particular four terms chosen are the necessary or even the best depiction of the possible actions that might be taken, but rather that such actions are finite and, consequently, can be used conveniently to assess the full range of objectives that might hypothetically be posed for any given study. The terms are gross and may be made more operational by the following sub-classification of possible research actions:

Major Terms	**Minor Terms**	**Synonyms**
DEPICT	Describe (qual.)	Identify, define, distinguish, determine, limit.
	Estimate (quant.)	Appraise, rate, count, rank, measure, standardize, norm, extrapolate.
Relate	Compare (qual.)	Liken, contrast, collage, match.
	Correlate (quant.)	Connect, associate, regress
	Analyze	Examine, categorize, abstract, reduce, deduce

Conceptualize	Synthesize	Prepare, develop, construct, systematize, compose, assemble, induce.
	Retroduce	Model, analogize, devise metaphors.
Test	---	Confirm, resolve, substantiate, verify, disprove

To assist the inquirer in generating objectives, then, two suggestions are being made. The first is captured in Figure D - 1, i.e., to extend the decision level beyond Decision Level I through Decision Level IV. The second is to construct a two way table which portrays action aspects on the vertical dimension and content aspects on the horizontal to use as a check against the choices of objectives make from Figure D - 1. This latter step has the advantage of testing the adequacy of decisions arrived at in the choice f objectives, e.g., are key substantive terms noted on the horizontal dimension missing altogether from the objectives? Was this a matter of explicit choice? Does this indicate a weakness in the problem or framework sections? Are there new entries not noted in the previous sections? Might it be possible to compare rather than simply describe? etc.

These steps should, of course, assist substantially in justifying the objectives selected finally for the inquiry. Although there are no hard and fast criteria which can be employed to assess the relative merits of competing objectives, the following may be of assistance to the inquirer:

1. Heuristic value. The researcher should choose those objectives which, in comparison to the others, give most promise of opening the field fully and leading quickly to useful insights.

2. Programmatic value. A particular piece of research or development, while having its own starting and stopping place, may be related programmatically to other research or development already completed, currently underway, or projected. Certain objectives may therefore be chosen over others because they help to complete the mosaic of earlier research in an orderly way, because they are logical next steps in the emerging pattern, or because they lay a foundation for projected work.

3. Social utility. This criterion has differential import for research and development. In the case of development, practical utility is of paramount importance. Development, by definition, is carried on to provide solutions to operating problems; the social utility of development must therefore be high. Given two alternative objectives for development, the one with the higher social utility obviously has precedence. In the case of research, utility has a lower priority. Some of the most significant research findings have emerged from studies which had little if any apparent connection to the practical world. Nevertheless, all other things being equal, even the researcher would probably choose an objective of social significance in preference to one without such significance.

4. Scientific interest. This criterion is, in a way, the analog of the criterion of social utility. It has comparatively little import for development but a great deal of meaning for research. Research is concerned with adding to or extending knowledge, which is the scientific domain. Hence objectives which are likely to contribute most directly to the major concerns and issues of the scientific community would have precedence over other objectives. The developer is less concerned with whether his work has any impact on the scientific community but would, all other things being equal, choose that objective which is likely to have some utility for advancing science.

5. Personal interest and convenience. Lacking any more compelling basis for choosing among objectives, the researcher or developer may turn to considerations of his personal interest and convenience. Interest is likely to have already been served through the choice of the problem, but even among the objectives, some are likely to be more interesting to pursue than are others. It will certainly be the case that some will be more convenient to pursue: less costly, subjects closer by, timing more easily accomplished, and the like. These considerations, while admittedly personal, are nevertheless legitimate, although it is obvious that they must be applied in a context in which the other criteria listed above have received first consideration.

chart

WORKSHEET E - HYPOTHESES AND QUESTIONS

The statement of hypotheses or questions to be pursued in the investigation completes the four steps that collectively might be described as the inquirer's procedural guide:

1. The problem statement identified the interacting factors which gave rise to the anomaly, contradictory facts, exception, knowledge void which is being investigated and signaled the strategy for attacking the problem to be employed by the investigator.

2. The conceptual framework sharpened the focus of the study by positing a perspective or vantage point for viewing the phenomena under investigation; in the process, of course, screening out other views.

3. The objectives narrowed the investigation further by selecting the ultimate aims or purposes of the R and D activity and, concurrently, screened out other objectives which might have been chosen.

4. The statement of hypotheses and questions is actually a two-step process, i.e.:

    a. Selecting the key questions to be pursued from among several questions appropriate to the objectives.

    b. Operationalizing the definitions that will be employed for the major variables in the study in preparation for describing the design, instrumentation, and analysis appropriate to the inquiry.

<u>Defining Hypotheses and Questions</u>

In research studies, the term hypothesis implies a derivation, within a hypothetic-deductive theoretical system, of a particular assertion or prediction. The hypothesis is subject to test, i.e., to confirmation or rejection on empirical grounds. The term question implies an interrogative statement which can be answered by data, which is logically related to some conceptual framework, but which does not necessarily stem from that framework through logical deduction. Hypotheses then are developed when the degree of sophistication of the conceptual framework is high, approximating that of a hypothetico-deductive

theory. Questions are appropriate when the degree of sophistication is low and rigorous deductions are therefore not possible.

In the case of development, the hypotheses or questions are usually more appropriately called design specifications. Some problem solution is to be developed. if the development functions properly, it will alleviate or eliminate the problem, or produce some new desired outcome. The specifications of the mode of operation of the new development, and the outcomes expected from it, are in every sense design specifications, just as are, for example, statements indicating the form to be taken by a new prototype carburetor and the ways in which that carburetor should function.

Functions of the Statement of Hypotheses or Questions

1. Selecting -- to select and propose the specific questions to be answered or hypotheses to be tested (in the case of research) or the particular design specifications to be met (in the case of development).

2. Operationalizing -- to operationalize the definitions that will be employed for the major variables in the study.

3. Validating -- to validate the fact that the questions or hypotheses can be inferred from the theory or conceptual framework in a straightforward, deductive way; or the fact that the design specifications can be shown to have a logical relationship to the problem which is to be resolved by the development.

Common Deficiencies in Statements of Hypotheses or Questions

-- The independent hypotheses or question.
-- Weak hypotheses.
-- The lost question or hypothesis.
-- The incredible operational definition.
-- The non-operational hypothesis or question.

Generating Hypotheses and Questions

Questions or hypotheses flow from the conceptual framework, as noted earlier. They represent a further narrowing of the objectives, and a further step toward Operationalizing what is to be done (a preview of the procedures). Whether one asks questions or tests hypotheses depends upon which action stage of the research process is involved; thus depicting or relating are typically concerned with answering questions (although they may be involved as a step in testing) while testing is usually concerned with hypotheses. In either event, the

questions or hypotheses do not just arise by chance; they are the definite consequences of the conceptual framework which has been brought to bear on the problem.

Design specifications flow from the problem to be solved. If the carburetor is passing too much gasoline for the amount of air, the carburetor may need to be redesigned with a smaller fuel passage. it is demonstrable that there is a logical connection between reducing the size of the fuel passage and eliminating a problem caused by too much fuel being passed. By analogy, the design specifications for any educational innovation ought to have a demonstrable relationship to the problem to be resolved. If children are being blocked in their reading because of class-value or sex stereotype problems in relating to the instructional materials, the materials should be redesigned so that they reflect a value structure more nearly compatible with that of the pupils involved.

Figure E - 1 is designed to relate the questions or hypotheses directly to the statement of objectives. In column one, you should record the objectives just as they were stated in the proposal. Column two asks you to consider whether the objective suggests multiple questions which could be pursued. If the answer to that question is "yes", as is usually the case, you should record the several questions or hypotheses suggested by the objective in column three. it is from among this population of questions that you will choose those that you, in fact, intend to pursue. Column four queries whether alternative operational definitions are possible for the key terms of the question. Again, the answer is almost always "yes" and the questions need to be re-framed so that the operational definitions of the key variables to be pursued in the study are made explicit. Finally, column five suggests that the rationale for choosing a particular sub-set of questions and/or particular operational definitions may not be self-evident to either the reader or, on reflection, to the inquirer. The decisions arrived at should be tested against the criteria noted in Worksheet D for choosing objectives, i.e., heuristic value, programmatic value, social utility, scientific interest, and personal interest and feasibility.

Supplementary Readings

1. Harry S. Broudy, Robert H. Ennis, Leonard I. Krimerman, Philosophy of Educational Research, New York: Wiley, 1973. pp. 190-216, 353-365.

2. Abraham Kaplan, The Conduct of Inquiry, San Francisco: Chandler, 1964. pp. 244-45, Chap. IX.

3. Fred N. Kerlinger, Foundations of Behavioral Research (second edition), New York: Holt, Rinehart and Winston, 1973. Chapter II.

chart

WORKSHEET F - PROCEDURES

The discussion to this point has been concerned almost exclusively with ends. At some point in thinking through a proposal a researcher or developer must turn to the question of means. Just what steps will be involved in accomplishing the research or development objectives?

More attention has been given to the development of procedures than to any other aspect of the research process. At the conclusion of this worksheet you will find a set of supplementary readings which briefly sample this rather extensive literature.[4] The worksheets and class presentations will not attempt to duplicate this literature; it is already available to you in comprehensive and comprehensible form. The intent of the worksheet presentation is to provide you with a strategic feel for approaching the task of laying out the procedures to be followed in your study and to suggest some general tactics which can be followed in accomplishing this task.

Defining the Procedures

The procedures are the operational blueprint which the inquirer will follow in completing the proposed study, i.e., in accomplishing the objectives of the study. Their adequacy or inadequacy will determine the success of the project but they deal with the "how" not the "what" or "why" of the research. Procedures are a necessary but not sufficient condition for a successful inquiry. They have no power to make a silk purse from a sow's ear. They can, conversely, make cows' ears of silk purses.

The procedural description must account for (1) the variables to be considered and the conditions to be controlled or manipulated in the study; (2)

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[4]. These supplementary readings differ from those included in previous worksheets. You are not expected to read the selections but, rather, to choose those germane to your problem, e.g., Measuring Human Behavior may be a useful tool document if you are searching for an appropriate instrument in the fields covered by the volume; Futures in Education will be of significance to you if your study requires futures methodology; the several chapters of Kerlinger introduce and survey methods that may be useful to you. There are a few references that are included because they treat general topics in inquiry methodology. These may be of common interest and are asterisked to designate their general character.

the sources of data to be used in the inquiry; (3) the sample to be involved in the study; (4) the data collection procedures to be followed; (5) the analysis to which the data will be subjected; (6) the managerial, logistical, and scheduling features of the study.

Functions of the Procedural Statement

1. Outlining -- to outline the overall research design within which the inquiry will be conducted or the action plan within which the development will be effected.

2. Detailing -- to detail the research design or action plan sufficiently to show how the integrity of the research findings or developments will be safeguarded (maintaining internal validity) and how their generalizability to populations of interest will be preserved (maintaining external validity).

3. Operationalizing -- to make operational the variables or conditions in the investigation or development by specifying the instrumentation or the techniques of instrument development including their selection or development.

4. Analyzing -- to posit the analytic scheme or framework which will be employed in treating the data generated by the inquiry in a method appropriate to test the hypotheses or questions of the study.

5. Organizing -- to describe the organizational plan, i.e., the work schedule or sequence of events and requisite resources that will be involved in conducting the research or effecting the development.

6. Qualifying -- to qualify the conclusions or generalizations which can be drawn from the research or development in terms of any special conditions inherent in the research design or action plan.

Common Deficiencies of Procedural Sections

-- The missing elements.

-- The overlooked data sources.

-- The project within a project (missing instrumentation).

-- The non-qualified, externally invalid study.

-- The great disclaimer.

-- The incomplete description.

-- Inappropriate or weak control decisions.
-- The inaccessible or invalid data source.

-- The over-reach study.

Generating a Procedural Statement

As noted earlier, rich resources exist in the literature of educational R and D and the social and behavioral sciences dealing with the technical questions confronted by the inquirer, especially in the "R" portion of R and D. There is no possibility that the worksheet can cover methodological or procedural matters in any such detail or, for that matter, that it could even touch upon the wide variety of inquiry methodologies which can be employed in a study. What it will attempt to do is to touch upon some elements of the procedural planning which commonly confront inquirers regardless of their problem area or methodological orientation.

The first suggestion is to take a step ignored by many inquirers and in many proposals, i.e., outlining the overall design of the inquiry and the procedural approach to be used in the study. There are obvious advantages in such an overview to the proposal reader; what is often overlooked are the advantages to the inquirer in delineating the forest before drawing in the trees. If you can describe succinctly and clearly the major components of the procedural section before attempting to detail the actual steps to be followed in the study, you will have in hand a procedural map of your territory which can serve as a guide to you in wending your way through the myriad specific details that will surely arise in your procedural description. Imagine, if you will, that you are writing an abstract of the section; or that you are applying for a grant to an agency that requires a three to five page prospectus (one which can normally be devoted to procedures) before deciding whether or not to invite the submission of a final proposal. The necessary points to be covered in the "outlining" section; unfortunately cannot be specified for all proposals because of distinctions across methodologies. If you are fortunate enough to be using an experimental design in a field in which the methodology is well-developed, you could convey a significant amount of information by designating an "incomplete-block design" but no similar shorthand terminology would make sense in, for example, an historical inquiry, a development project, or, even, a normative survey. In general the overview should attempt to include:

1. Major variables to be covered in the study and conditions to be controlled or manipulated.

2. Major data sources to be tapped.

3. Scope of generalization sought in the study (i.e., population and sample).

4. Processes by which data is to be collected.
5. Treatments to which data will be subjected.

This list will, of course, have to be modified and in some cases supplemented to fulfill the objectives of outlining the procedures. But, it should, at least, be a starting point for your consideration in this task. The crucial question for you to ask is, "what, in the context of this study, must the reader and I know before preceding to the level of detailing procedures and methodologies?"

Assume that the outlining step has been taken. How do you "get a handle" on the problem of detailing the procedures, operationalizing the variables, and positing an appropriate analytic scheme? As a first step, consider the intent of these functions. In a generic sense, borrowing from the terminology of experimental inquiry, you are attempting to establish the internal and external validity of your research or development effort; that is, in the case of internal validity to establish the fact that the findings or products have integrity and are not artifacts of extraneous variables within the system, and in the case of external validity that they are generalizable or applicable to the population specified in the study Consequently, variables to be manipulated or controlled and the sample to be involved in the study are critical design elements. it is, of course, possible to inject sources of invalidity in the study through improper instrumentation or analysis or data sources or data gathering procedures but the questions of variables and sampling are <u>a priori</u> problems to be considered.

<u>Variables</u>. In specifying the variables to be considered in the study you obviously have an inventory with which to begin from your own problem statement, logical structure, objectives, and questions. List them out. But then turn back to your literature search. What variables have been treated in previous studies in the area and associated areas? Which have been:

1. Ignored as of no consequence in the investigation. Did this <u>a priori</u> decision turn out to be:

a. A good one, i.e., seemed to have no effect or raise no challenge to the study.

b. A bad one, i.e., resulting in a limitation or apology in the final report; or cited in critiques of the research as a limitation of the study.

2. Controlled in previous studies. It is reasonable to infer that investigators control variables that are likely to cause "noise" in their inquiry. If you have not considered such variables in your original inventory you should do so.

3. Observed or manipulated. The substantive results of previous studies should provide strong clues as to whether such variables should be considered likely, unlikely, or still ambiguous candidates for inclusion in your investigation.

The explicit generation of an inventory of variables provides the inquirer with one of the basic tools required to develop an appropriate procedural section. it does not, however, attend to the basic questions which will have to be confronted once the variables are identified, i.e.:

1. Will they be manipulated or controlled?

2. Which are feasible to manipulate and/or control?

3. What are the options for control, i.e., randomization, statistical control, assignment?

Population - Sample. The questions or hypotheses are the clue to the population and sample of the study. They have already specified, perhaps inappropriately or not feasibly, the population that will be required to achieve the stated level of generalizability of the inquiry. Begin, at least, with this population definition and ask yourself the following questions:

1. Is there any reason not to employ the entire population?

   a. cost

   b. accessibility

   c. nature of question

   d. nature of group to whom answer is addressed

e. convenience to subjects

2. If yes, do the questions suggest that the answers are or should be generalizable to this population which cannot be studied as a whole?

3. If yes, a sample is required. It will have to be specified and key questions on the nature of the sampling (randomness, efficiency, representativeness) will have to be specified.

If the variables and sample of the study are to be considered the design elements, then data sources, data collection processes, and sequencing and scheduling project events might be considered process elements.

Sources of Data. Almost all studies offer a wide range of possible data sources of varying characteristics. Begin inventorying possible data sources with an open mind for the most obvious primary data source may turn out, in fact, to be inefficient or ineffective or both. Census tracts might, at first consideration, seem to be an unattractive alternative to personal interviews until the feasibility and, in some instances, validity of the latter are considered. Criteria to employ after developing an inventory of data sources include:

Recency
Accessibility-convenience
Validity
Reliability
Efficiency
Ethical considerations
Political considerations
Complementariness
Representativeness or diversity

Data Collection and Analytic Processes. The processes to be employed in data collection and analysis will have to be sufficiently detailed to cover four areas of concern:

1. Methodology to be employed in data collection.

2. Instrumentation to be used in data collection.

3. Implementation of the methodology and instrumentation, i.e., where, how, and when of the processes.

4. Recording and treatment of data gathered.

The problems inherent in these four areas vary so much from project to project that generalizations about the problems are almost impossible. For example, in any given inquiry the instrument(s) needed to operationalize the variables of the study and gather basic study data may be commonly used and easily available, e.g., an achievement test, and the entire issue can be covered in a single sentence. Or an instrument may be available, but not commonly known or used, in which case a statement of its validity and reliability is required. Or an instrument might be adaptable to the inquiry, in which case the process of adaptation and requisite field testing of the effect of the adaptation may be necessary. Or instrumentation may have to be invented de novo, in which case the inquirer is confronted with what amounts to a project within a project.

Sequencing and Scheduling Considerations. The complexities involved in scheduling and sequencing a study's events are obviously related directly to the scope of the inquiry. Many externally funded grants and contracts require detailed budgets, personnel projections, organizational plans, and work schedules. Most dissertations, in contrast, are relatively simple to sequence and schedule but still involve the same basic components. The fact that most of the work will be accomplished by one person in no way diminishes the utility of identifying the events necessary to be scheduled and completed, assessing their interrelationship (i.e., whether they are independent work tasks or whether one constrains another), determining their cost, and estimating the time involved in their completion. One method of going about this, which has been refined for use in educational R and D is the Program Evaluation and Review Technique (PERT) and references adequate to familiarize the investigator with the technique are provided at the end of this worksheet.

Summary. Figure F - 1 is provided as a checklist which may be used by the inquirer to assess the sufficiency of the procedural section of the proposal. The vertical dimension simply repeats the major components of the procedural description of an inquiry. Along the horizontal dimension, the inquirer can insert the substance of the inquiry beginning with the major objectives, moving to the questions or hypotheses, and finally to the variables specified for the study. Each cell should, at the completion of the procedures section, be designated as either accounted for or not applicable.

Supplementary Readings

1. Theodore X. Barber, "Pitfalls in Research: Nine Investigator and Experimenter Effects," in Robert M. W. Travers (Ed.) Second Handbook of Research on Teaching, Chicago: Rand McNally, 1973. Chap. 11.

2. Charles H. Backstrom and Gerald D. Hursh, Survey Research, Evanston, Illinois: Northwestern University Press, 1963.

3. Douglas R. Berdie and John F. Anderson, Questionnaires: Design and Use, Metuchen, New Jersey: The Scarecrow Press, 1974.

*4. Donald T. Campbell and Julian C. Stanley, "Experimental and Quasi-Experimental Designs for Research in Teaching," in N. L. Gage (Ed.) Handbook of Research on Teaching, Rand McNally, 1963. Chap. 5.

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*References of general interest.

5. Desmond L. Cook, PERT Applications in Education, Washington, D. C.: Cooperative Research Monograph No. 17, U.S. Government Printing Office, 1971.

6. Jack D. Douglas, Investigative Social Research: Individual and Team Field Research, Beverly Hills: Sage Publications, 1976.

*7. William J. Gephart, "Profiling Instructional Package," Phi Delta Kappa Occasional Paper No. 7, Bloomington, Indiana: Phi Delta Kappa, 1969.

8. Stephen P. Hencley and James R. Yates, Futurism in Education, Berkeley: McCutchan Press, 1974.

9. Harold L. Hodgkinson and Stewart Edelstein, "Questionnaires: In Fact There Is Error," Educational Researcher, Vol. 1, No. 8, August, 1972, pp. 9-10.

*10. Abraham Kaplan, The Conduct of Inquiry, San Francisco: Chandler, 1964. Chapters IV, V, and VI.

*11. Fred N. Kerlinger, Foundations of Behavioral Research (Second Edition) New York: Holt, Rinehart and Winston, 1973.

12. Dale G. Lake, Matthew B. Miles, and Ralph B. Earle, Jr. (Eds.), Measuring Human Behavior, New York: Teachers College Press, 1973.

13. Gerald Nadler, "An Investigation of Design Methodology," SRIS Quarterly, Fall, 1972, pp. 12-18.

14. Daniel L. Stufflebeam, et al., Educational Evaluation and Decision-Making in Education, Itasca, Illinois: Peacock Press, 1971.

15. Eugene J. Webb, et al., Unobtrusive Measures, Chicago: Rand McNally, 1973.

16. Edwin P. Willems and Harold L. Rousch (Eds.), Naturalistic Viewpoints in Psychological Research, New York: Holt, Rinehart and Winston, 1968. pp. 1-10, 11-43, 271-286.

17. Blaine R. Worthen and James R. Sanders, Educational Evaluation: Theory and Practice, Worthington, Ohio: Charles A. Jones Publishing Company, 1973.

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