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Formulation Of Research Design

By

Chirapol Sintunawa
FORMULATION OF RESEARCH DESIGN

By Dr. Chirapol Sintunawa

Design is an essential study for both the producer and consumer of research in the social sciences. Past trends that will undoubtedly continue have been toward greater sophistication in social science research methodology and the use of complex designs. The aspiring researcher would do well to consider this paper as the beginning to a continuing study of design. Ancillary to that study should be a thorough treatment of statistical methods, which are essential in the analysis and interpretation of data generated by designs. There are far too many poorly designed studies that waste time, resources and journal spaces, but it is difficult indeed to conduct good research or fully understand it without a strong background in design.

Designed research refers to the process involved in conducting a research study.

The main purpose of research design is to answer some specific research question utilizing well-developed principles of scientific inquiry.

Any scientific investigation, either in the social or natural sciences, must begin with some structure or plan. This structure defines the number and type of variables to be studied and their relationship to one another. Furthermore, this structure or plan also defines steps and methodology to be undertaken in order to accomplish goals of the particular investigation. Such a structure is called a design, which in this paper will be limited to two different types experimental and nonexperimental.

A scientific investigation in the social sciences is undertaken to answer some specific question or hypothesis concerning the behavior of animals, humans, or social systems. Such questions may concern whether certain conditions, events, or situations cause particular behaviors or events or if certain conditions, events, situations, and behaviors occur together in

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time. For example, a social scientists might ask if poverty and social stress cause drug addiction, if traffic jams affect net income of Telephone Organization of Thailand, or if damage costs of dam construction are greater than total public compensation. These questions are to be answered by the outcomes of scientific investigation.

In many cases educated opinion intuition or commonsense beliefs about behaviors of social system are correct and sufficient to answer some specific questions. It is often shown that human judgment is only acceptable and accurate for a certain level. Scientific methods are not infallible either, but they are designed to minimize the biases that affect subjective opinion.

Experimental and Nonexperimental Studies

In general research designs can be divided into two different designs which are experimental and nonexperimental. The difference between the two concerns the degree to which the experimenter or investigator controls his or her studies.

The experimental design occurs when the subjects (people or systems) and conditions (events or situation) to be studied are manipulated by the investigator. That is the investigator does something to affect the subjects studied and then determines the effects of those manipulations. Such studies involve a comparison of subject behaviors or characteristics under the various conditions being investigated. The key to experimental design is that the investigator assigns subjects to conditions rather than deserving them in naturally occurring situations.

One might design an experimental study to determine if a chemical agent can stimulate immune response in animals. A number of animals such as mouses, cats or monkeys would be located, half being placed into one treatment group and half into another. The treatment group would be given regular inoculation of a chemical agent while the second group would be raised as usual but no inoculation. After a period of time, the progress of both groups would be assessed. By comparing immune responses of both groups, differences would be attributed to the inoculation of that chemical
agent, provided that the only difference between the groups in the treatment they received was the inoculation of a chemical reagent.

Experimental studies are considered to be more powerful than non-experimental designs in uncovering causal relationships among variables. This is due to the fact that through control and randomization, potential confounding effects can be removed from a study. A nonexperimental study merely establishes that relationships exist among variables. However, through systematic observation over time, and collection of data on several variables, it is possible to determine cause and effect. Experimental studies which involve direct manipulation are more frequently conclusive because they involve principles of control, randomization, and comparison.

In a sense, an experimental design can be viewed as a trade-off among comparison, randomization, and control. Some variables are set at different levels and compared, others are held at a constant level and controlled, and still others may be free to vary with the hope that randomization will average out confounds. In the perfect experiment the independent variables are manipulated, subjects are randomly assigned and all other variables are held constant. The researcher identifies a set of variables and makes a decision whether he wishes to manipulate, or treat as independent, or hold constant (control) each variable. By holding a variable constant, one limits generalizability to only the chosen level.

If time, subjects and resources are unlimited, one could include any number of independent variables in a study. The more independent variables included in a study, the more subjects needed to fill conditions, the more data collected on those subjects, and the more complex the analysis and interpretation. Thus, there are practical limits to the number of independent variables that can be included in a study. Hence, control by holding variables constant is essential.

The most important difference between the experimental and non-experimental study is subject assignment. In the experimental design, the researcher assigns subjects to conditions or levels of the independent variable, but in the nonexperimental study there is no assignment. When subject
assignment does not occur, the study is nonexperimental even if a treatment
is created. Although in a nonexperimental study there is no assignment of
subjects, many of the other principles of research design still apply.
Control over levels of certain variables can be exerted, but control can be
exercised in the selection of cases to include in the observational study.
Cases can be chosen to certain specific criteria, such as selecting only
houses on the right side of a road, only people below a certain annual
income, or organizations in the nonprofit sector. Control is achieved by
selecting only certain values of control variables and observing the vari­
ables of interest.

It is often taught that only experimental can establish causal rela­
tionships among variables and that observational or correlational studies can
only establish that relationships exist without specifying causal direction.
While in practice this is often true, one should be cautious in assuming that
experimental designs always establish causality and observational studies do
not. Many experimental designs are so fraught with confounding variables
that causal inferences cannot be made with reasonable confidence, and there
are nonexperimental, observational designs that can establish causal chains
of events.

Stages and Concerns

The basic ideas of design are reasonably simple and straight for­
ward, but the design of actual social science investigations is often quite
complex and difficult due to several factors including: limitations on the
degree of control an investigator can exert over human beings and social
systems, poorly formulated concepts, instruments of limited validity,
complex interrelationships among large numbers of variables and lack of
well-developed and validated theoretical models. Research questions are
often imprecise, instruments to measure variables are often unavailable, and
simple relationships among variables seem quite elusive.

To complete any investigation, both scientific and social science,
requires many stages of work. A researcher should begin at the formulation
of a researchable question. This question may be in the form of a
hypothesis that certain relationships exist among variables, or it may be a
exploratory nature, essentially asking what is the relationship among
variables. A research question may begin in a loosely formulated form, but
must eventually be stated such that a testable hypothesis or model is
generated.

Before making an investigation of a phenomenon, it is essential to
know exactly what questions the investigation should address. When it is
unclear, it is impossible to decide which variables and relationships to
include in the study and which to omit. Examples of questions to be
answered are: What determines the size of the flow of material from re-
sources to waste? What determines the composition of virgin and recycled
material in the flow? How can one increase the recycled fraction? How can
one slow down the solid waste generation rate? What advantages are there to
increasing the recycled fraction now above that dictated by purely economic
incentive?

The more precise the question, the easier it will be to answer, and
if asked precisely enough, the remaining steps will fall more easily into
place. One must certainly avoid formulating questions that are so narrow as
to be of no practical or scientific significance, but to formulate meaningful
questions requires experience and considerable knowledge of a content area.

The most important step is to plan the design of the investigation.
This step involves choice of variables, procedures, controls and randomiza-
tion plans. At this point one must decide whether the design will be
experimental or nonexperimental and whether the study will take place in a
laboratory or field setting. Decisions must also be made about where and how
to collect the data, and which variables are to be controlled at what level,
and with what methods? If subjects are assigned to levels of the independent
variable, some procedure must be chosen for assignment. Once the basic
design is laid out, careful consideration should be given to possible con-
 founding variables. If variables are indentified as possible confounds, a
strategy should be chosen to deal with them.
One good outline guide for the design of a social research problem is shown by Delbert C. Miller. This outline lists all of the essential considerations in designing a research project. It is recommended that all steps be planned before field or laboratory work is undertaken.

I. The Sociological Problem

1. Present clear, brief statement of the problem with concepts defined where necessary.
2. Show that the problem is limited to bounds amenable to treatment or test.
3. Describe the significance of the problem with reference to one or more of the following criteria:
   a. is timely.
   b. relates to a practical problem.
   c. relates to a wide population.
   d. relates to an influential or critical population.
   e. fills a research gap.
   f. permits generalization to broader principles of social interaction or general theory.
   g. sharpens the definition of an important concept or relationship.
   h. has many implications for a wide range of practical problems.
   i. way create or improve an instrument for observing and analyzing data.
   j. provides opportunity for gathering data that is restricted by the limited time available for gathering particular data.
   k. provides possibility for a fruitful exploration with known techniques.

II. The Theoretical Framework

1. Describe the relationship of the problem to a theoretical framework.
2. Demonstrate the relationship of the problem to previous research.

3. Present alternate hypotheses considered feasible within the framework of the theory.

III. The Hypothesis

1. Clearly state the hypothesis selected for test (Null and alternate hypothesis should be stated).

2. Indicate the significance of test hypotheses to the advancement of research and theory.

3. Define concepts or variables (preferably in operational terms).
   a. Independent and dependent variables should be distinguished from each other.
   b. The scale upon which variables are to be measured (quantitative, semiquantitative, or qualitative) should be specified.

4. Describe possible mistakes and their consequences.

5. Note seriousness of possible mistakes.

IV. Design of the Experiment or Inquiry

1. Describe idea design or designs with special attention to the control of interfering variables.

2. Describe selected operational design.
   a. Describe stimuli, subjects, environment, and responses with the objects, events, and properties necessary for their specification.
   b. Describe how control of interfering variables is achieved.

3. Specify statistical tests including dummy tables for each test.
   a. Specify level of confidence desired.
V. Sampling Procedures

1. describe experimental and control samples.
   a. Specify the population to which the hypotheses are relevant.
   b. Explain determination of size and type of sample.

2. Specify method of drawing or selecting sample.
   a. Specify relative importance of different types of error.
   b. Estimate relative costs of the various sizes and types of samples allowed by the theory.

VI. Method of Gathering Data

1. Describe measures of quantitative variables showing reliability and validity when these are known. Describe means of identifying qualitative variables.

2. Include the following in description of questionnaires or schedules, if these are used.
   a. Approximate number of questions to be asked of each respondent.
   b. Approximate time needed for interview.
   c. The schedule as it has been constructed to this time.
   d. Preliminary testing of interview and results.

3. Include the following in description of interview procedure, if this is used.
   a. Means of obtaining information, i.e., by direct interview, all or past by mail, telephone, or other means.
   b. Particular characteristics interviewers must have or special training that must be given them.

4. Describe use to be made of pilot study, pretest, or trial run.
   a. Importance of and means for coping with unavailabilities, refusals and response error.
VII. Working guide

1. Prepare working guide with time and budget estimates.
   a. Planning
   b. Pilot study and pretests
   c. Drawing sample
   d. Preparing observational materials
   e. Selection and training
   f. Trial plan
   g. Revising plans
   h. Collecting data
   i. Processing data
   j. Preparing final report

2. Estimate total man hours and cost

VIII. Analysis of Results

1. Specify method of analysis
   a. Use of tables, calculator, sorter, computer, etc.
   b. Use of graphic techniques
   c. Specify type of tables to be constructed

IX. Interpretation of Results.

1. Write these according to department, graduate school, and funding agents requirements

2. Select for journal publication the most significant aspects of the problem in succinct form (probably not in excess of fifteen typewritten pages double spaced). Follow style and format specified by the journal to which the article will be submitted.
Bibliography


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