Module 1: Preliminary Research Steps

Important Resources

This course is a brief overview about research design that is intended to cover the basics of designing and implementing a scientific study. Although this course will address every step of the research process, it is by no means exhaustive and is no substitute for a college-level course in research methodology, nor is it a substitute for an experienced research advisor. For further study in this area, see Trochim's "Research Methods Knowledge Base."(1) It is one of the main sources used for this guide and provides descriptions about the various parts of the process, including diagrams and examples to simplify complex concepts.

Choosing a Topic

Before a researcher chooses a topic for a project, it is important to identify a broad area of inquiry and interest. This may be as broad as "global eye health" or "personality psychology," but it should be an area that is of interest to the researcher. Within a broad topic of inquiry, each researcher must begin narrowing the field into a few subtopics that are of greater specificity and detail. For example, a researcher may be interested in "global eye health," but could focus more specifically on "proper eye care and how it affects individuals." Although this topic is still too broad for a research project, it is more focused and can be further refined into a coherent project.

Students as well as professional researchers discover their topics in both conventional and unconventional ways. Many researchers find that their personal interests and experiences help to narrow their topic. For students, previous classes and course material are often the source of research ideas. Furthermore, current events in politics as well as in academia may inspire topics for research. Academic journals such as Health Affairs, Health Economics, and the American Journal of Bioethics can provide good material for new studies, and e-resources such as PubMed, Google Scholar and Philosopher's Index are also good starting places. Lastly, many research ideas are generated through dialogue—by talking with professors, fellow students, and family.

Literature Review

One essential task when undertaking a research study is to review the existing literature on the topic and use it to inform the construction of the new study. The literature review should be conducted early in the research process, directly after the researcher chooses a topic. A literature review can bring clarity and focus to the research problem and broaden one's knowledge base while also identifying possible "knowledge gaps," or gaps in the literature, that new research may be able to address. In addition, past studies can improve methodology and help the researcher to contextualize his or her findings. The literature review is crucial because an important responsibility in research is to add to a body of knowledge and to compare one's findings with others. The procedure is simple: the researcher must search the

literature in his or her area of interest, review the selected studies, and develop a theoretical framework for his or her own study. For those pursuing research about community eye health, Unite For Sight's Journal Article Database can be used as a starting point.

What makes a good research question?

Not all research questions are good ones—in other words, not all questions can be answered through qualitative and quantitative research methodologies. A good research question needs to:

1. *Be specific:* A researcher must clearly define his or her question using known definitions outlined in the literature. For example, a poor research question would be: How do people's lives improve after surgery? Not only does this research question fail to specify the study population, it contains the vague term "improve." The researcher must specify what he or she means by this term—does it involve a physical improvement or an improvement in mental state? The more specific your research question, the better.
2. *Address an important and relevant issue:* Scientific research is done to increase knowledge, not simply for a single researcher's personal satisfaction. The question the researcher decides to pursue must have some beneficial implications. With this in mind, the researcher may continue narrowing the study focus to an area that can be addressed as a single question. For example, now that the researcher has chosen "proper eye care and how it affects individuals," the topic can be further focused to be about "basic eye care and how it affects individual work productivity." A good research question will also always have relevance to the time, place, and population of the study. For example, a study of Vitamin A deficiency in Southern India would be a poor choice as this is not a particularly significant problem in the area.
3. *Be novel:* A good research study will have some new aspect that has never previously been examined. However, this does not mean that one should avoid replicating past research. In fact, not only is replication a good way to identify an appropriate research methodology, it is also required to reinforce or negate the validity of other scientific findings. Depending on the research aims, when replicating a previous study, it is typically best to add or change one or two things to increase the novelty of the research.
4. *Be practical:* Oftentimes, beginning researchers pose questions that cannot be operationalized, or assessed methodologically with research instruments. From the example above, the idea of life improvement could be operationalized using a Quality of Life survey—a well-known and validated research tool. In general, the more abstract the idea, the harder it is to operationalize.
5. *Be within a reasonable scope:* A good research project will be manageable in depth and breadth. The scope will depend on the amount of time and the availability of resources a researcher has for his or her study. In general, the more focused the research question, the more likely it is to be a successful project. For example, a study that seeks to identify the prevalence of eye disease in a specific village is more likely to succeed than a comparable study that seeks to identify eye disease prevalence in the world population.

Qualitative and Quantitative Studies

Not all research projects require study measures. Some research simply involves observing the results of events in the field and drawing conclusions based on a theoretical framework. Others may involve analyzing data from clinics or other institutions, using statistics and reasoning to find patterns that may have important implications. However, many projects involve direct contact with participants, using an operationalized definition of a phenomenon. These projects require well-designed measures in order to be considered valid. There are two broad categories of research: quantitative and qualitative.

A study is classified as qualitative if the purpose is primarily to describe a situation, phenomenon, problem, or event. The information is usually gathered through direct interaction with individuals or groups. Qualitative studies tend to be more in-depth, focusing on a smaller population but probing deeper into a given problem than quantitative studies. Qualitative research often utilizes focus groups, interviews, or surveys and seeks to answer open-ended questions. Thematic and content analysis are two methods used to analyze qualitative data. Disciplines such as anthropology, behavioral economics, and sociology are more inclined towards a qualitative approach. Qualitative studies often produce descriptive, rich information that allow for deeper insight, including understanding why and how certain phenomenon exist.(2)

In contrast, quantitative studies tend to have larger sample sizes, use standardized measures and numerical values, and utilize statistical data analysis. A study is classified as quantitative if the researcher seeks to quantify the variation in a phenomenon and if information is gathered using quantitative variables. Quantitative studies allow for collection of large datasets from which the researcher may provide numeric estimates and identify statistically significant trends and associations.(3) Many researchers conduct hybrid studies in order to maximize the benefits of qualitative and quantitative approaches.

Measures of Comparison

When conducting an experimental study, the independent variable, dependent variable, control group, and experimental group must be clearly defined. The control group and the experimental group should be demographically similar so that differences in outcomes between the two groups can be attributed to the independent variable rather than other factors.(4)

Independent Variable: The factor that the researcher can control or manipulate.

Dependent Variable: The factor that the researcher cannot manipulate but instead varies in relation to the independent variable; this is the variable that is measured.

Control Group: The set of participants who do not receive the treatment or intervention and is used as a benchmark for comparison.

Experimental Group: The set of participants who receive the treatment or intervention; they are exposed to the independent variable in the experiment.

Hypothesis

A hypothesis is a suggested explanation for an observed phenomenon or a prediction about a relationship among several variables. Every research project is based on a hypothesis, which generally begins with a specific question. For example, “If people are provided with basic eye care services, will they be more economically productive on an individual basis?” This question is specific enough to be addressed by a research project; however, it is not yet a hypothesis. Next, the researcher must operationalize the terms being used. That is, the researcher must define otherwise abstract concepts or terms in a measurable way. For example, “economically productive” may be measured in “dollars earned per day,” “hours worked in a week,” or “number of objects successfully produced at work.” A researcher must be careful to define the terms in such a way that they reflect exactly what the researcher is trying to measure. Depending on how terms are operationalized, the results of a study can vary widely, so it is critical that a researcher carefully consider how each of the measurements are to be defined before forming a hypothesis and beginning a study.

A hypothesis uses the operationalized definition of the abstract concepts to produce a clear prediction of the relationship between the independent variable and the dependent variable in the statement; if the relationship is predicted to be causal, this must be clearly defined.

Example

A researcher might be interested to learn about the relationship between eyesight and income. A hypothesis might be, "We predict that if nearsighted participants are provided with corrective lenses that bring their vision to 20/20, they will earn more money per week on average over the course of three months than nearsighted participants who did not receive corrective lenses." This statement is a viable hypothesis because it clearly operationalizes what the researcher termed "basic eye care" and "economically productive" such that they can be measured and analyzed in an objective way.(5)(6) In this example, the independent variable is the distribution of corrective lenses, while the dependent variable is the participant's weekly income. The experimental group is the group of nearsighted individuals who are provided corrective lenses, while the control group is the group of nearsighted individuals who do not receive corrective lenses.

When formulating a hypothesis, it is important not to try to "prove" that the hypothesis is true. Instead, one should seek to find evidence that it is not true. In other words, one can never accept a hypothesis; instead, one fails to reject the null (posited) hypothesis. This is especially important when using statistics such as t-tests and p-values to determine significance.

Go To Module 2: Study Design and Sampling >>

Footnotes

(1) Trochim, W. M. K. "Structure of Research" *Research Methods Knowledge Base 2nd Edition.* Accessed 2/24/09.

(2) Ibid.

(3) Qualitative and Quantitative Research Techniques for Humanitarian Needs Assessment (May, 2012). Retrieved July 7, 2017, from Assessment Capacities Project, ACAPS.

(4) Principles of Epidemiology in Public Health Practice (May 18, 2012). Retrieved July 7, 2017, from Centers for Disease Control and Prevention.

(5) Trochim, W. M. K. "Structure of Research" Research Methods Knowledge Base 2nd Edition. Accessed 2/24/09.

(6) Pelham, B. W.; Blanton, H. Conducting Research in Psychology: Measuring the Weight of Smoke, 3rd Edition. Wadsworth Publishing (February 27, 2006).

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