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12. A Study on Scientific Process and Research

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Abstract:

Scientific investigations are experiments which should be prepared before they are carried out systematically. This analysis explains classification and explanation of experimental experiments, randomization and bias in the planning stage.

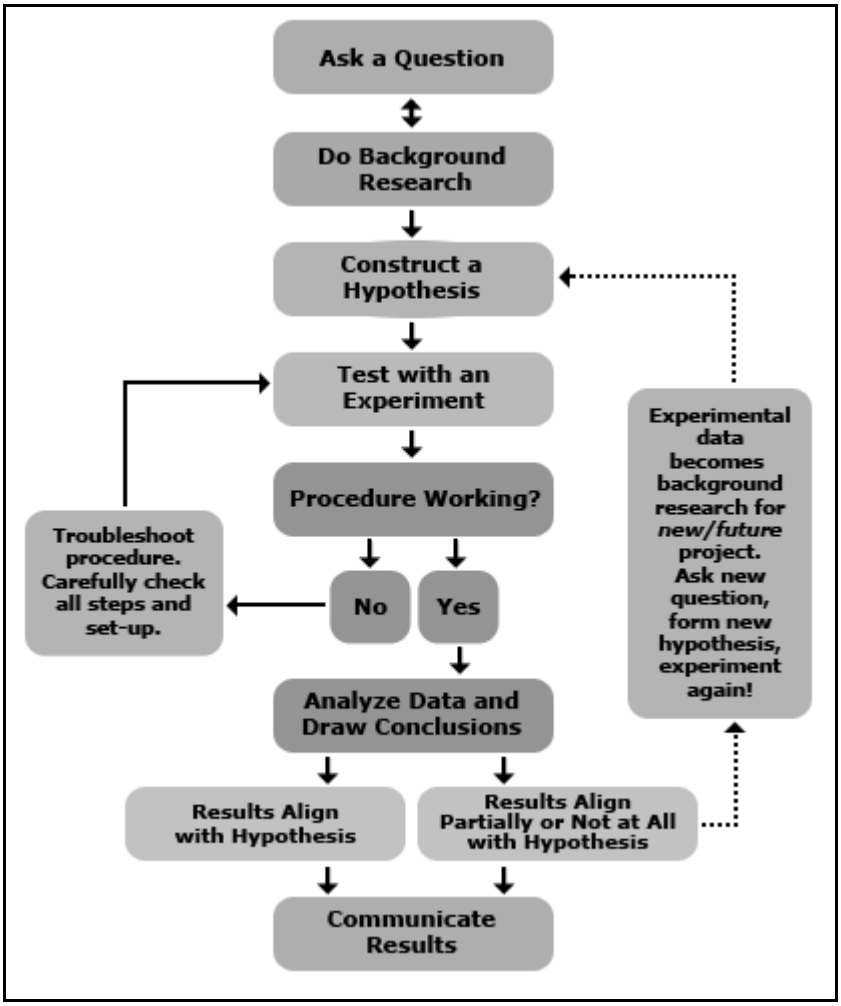
Keywords:

Analysis Methodology, Scientific Process and Science Research

12.1 Introduction:

The scientific method is an experimental process which explores and answers observations. Does this mean that all scientists are following this method exactly? No, not so. Some fields of science can be checked more quickly.

For example, scientists who research how stars evolve as they grow old and how dinosaurs have digested their food will be unable to quickly pursue a star's life by a million years. If direct observation is not feasible, researchers change the scientific method. Indeed, the scientific method probably exists as many versions as scientists! However, the purpose remains the same even when modified: the discovery of causes and effects by queries, the collection and the examination of proofs, and the combination of all the available knowledge to a reasonable answer. Even though it is a series of steps that demonstrate the scientific method, remember that a scientist can at any point during the process provide support and repetition of knowledge or thought. An iterative process is called a process such as the scientific method which involves such support and repeating. When doing a science fair project, a science class, independent research or any other practical scientific research that is aware of the steps of the scientific method, you can concentrate your scientific question and work to address the question as closely as possible through your findings and data. It is important to understand that theory-building and theory-testing are both critical to scientific advancement (inductive research) and theory-testing (deductive research). Unless they fit truth, elegant ideas are not useful. Similarly, mountains of data are worthless unless they can help build concrete theories. Instead of looking in a circular relationship at these two processes as shown in Figure 3, they can be more accurately seen as helix, since each isolation between theory and data contributes to a better understanding of interest phenomena and better theories. Although inductive and inductive research is important for the promotion of research, it seems that inductive research (theory building) is more valuable when there are little theory or explanation, whereas deductive research (theory testing) is more productive if there are several competing theories of the same phenomenon, and researchers want to know which theory works best.



12.2 Steps of the Scientific Method:

A. Ask a Question: The scientific method begins by asking yourself a question: How, When, Who, When, Why, or Where?

B. Do Background Research: You want to be a skilled researcher using library and online research, not beginning at all in developing a strategy to address your question, but helping you find the best way to do things and ensuring you do not make mistakes in the past.

C. Construct a Hypothesis: An informed guess about how things work is a hypothesis. It is an attempt to provide an explaining to answer your question. Then you can make a guess in a strong hypothesis:

"If _____ [I do this] _____, then _____ [this] _____ will happen."

D. Test Your Hypothesis by Doing an Experiment: Your experiment tests whether your prediction is correct, which supports or not your hypothesis. It's necessary to be a reasonable

test for your experiment. You conduct a fair test by ensuring that all the rest of the conditions are the same are changed just one factor at a time.

E. Analyze Your Data and Draw a Conclusion: Once the experiment is over, the measurements are collected and analysed to see whether or not they support your hypothesis.

F. Communicate Your Results: You will inform the others in a final report and/or a display board to complete your science fair project. By posting the final report on a science journal or by sharing their findings on a poster or during a discussion at a scientific conference, professional scientists are almost exactly the same. Judges are interested in your conclusions at a scientific fair, whether or not they accept your original hypothesis.

12.3 Scientific Method:

In the previous sections, we defined science as scientific knowledge. So what is the 'scientific method,' exactly? The scientific method refers to systematic techniques for the development, such as how objective observations can be made, how results can be interpreted and how these results can be generalized.

The scientific method enables researchers to evaluate current hypotheses and previous observations objectively and impartially and subject them to open discussion, revisions or improvements. Four characteristics must be met by the scientific method:

- **Replicability**: Close if not identical findings can be obtained from other people to reproduce or duplicate a science study independently.
- **Precision:** Theoretical concepts that are often difficult to quantify must be described so precisely that other definitions may use them for the measurement and testing of these concepts.
- **Falsifiability:** A theory should be set out in such a way as to disprove it. Untested or falsified theories are not scientific theories, nor are such knowledge scientific knowledge. A theory defined in incorrect terms or the principles of which cannot be precisely measured is therefore not scientific and cannot be evaluated. The psychoanalytic ideas of Sigmund Freud fall in this group and are not therefore considered a
- **Parsimony:** When multiple explanations for a phenomenon exist, scientists must always consider the explanation which is obvious, or logically the most economical. This is known as parsimony or "Occam’s razor." Parsimony prohibits scientists from following excessively complicated or obscene ideas of endless definitions and connections that describe a little but nothing in particular.

Any branch of research that does not permit the scientific method to test its fundamental laws or theories cannot be referred to as 'science.'

For example, theology (the study of religion) does not represent a scientific field because theological ideas (like the existence of God), using a replicable, accurate, fake and parsimonious system, cannot be checked by objective observers.

Likewise, even though they are self-creative and worthwhile endeaktions, arts, music, literature, humanities and law are not considered science.

12.4 Postulates of Scientific Method:

The scientific method is therefore based on certain fundamental postulates underlying:

1. It is based on empirical proof;
2. It uses concepts that are relevant;
3. It has only objectively considered;
4. It presupposes ethical neutrality, that is, aims to only make appropriate and accurate statements about the objects of the population;
5. It leads to probabilistic predictions;
6. Its methodology is used to evaluate the findings by way of replication by all concerned for critical scrutiny;
7. It is designed to develop most general axioms or so-called scientific theories.

"The scientific method thus promotes a systematic, impersonal procedure determined by logical and objective process requirements." Therefore, the scientific method involves a method that is objectives, logical and systematic, i.e. a way that is free of personal partiality or prejudice, a way of identifying demonstrable properties of an event that can be checked, a method that leads to a researcher's logical reasoning, a way where the study goes unordered and a method that implies a method which involves a method of inner understanding

12.5 Scientific Research:

Since scientific research works on two levels - the hypotheses and findings - theory and the empirical level. Scientific research is based on two levels. The theoretical level focuses on the development of abstract ideas regarding natural or social phenomenons and their connection (i.e., build "theories"), while the empirical level examines the theoretical concepts and relationships to see how well they match our observations of reality, in order to finally establish better theories. A theory has been improving over time and the science has become more mature (i.e. best fits the observed reality). Scientific research means constantly reversing hypothesis and findings. Theory and findings also constitute basic elements of scientific study. For example, it is not considered a legitimate scientific study to rely solely on observations to conclude and to ignore theory.

Scientific inquiry may take one of two possible forms, depending on the training and interest of researchers: inductive or deductive. In inductive analysis, a researcher's aim is to deduce observations from theoretical principles and patterns. In deductive investigations, the researchers' objective is to use the latest empirical evidence for testing theories and patterns known from theory. Inductive research is also often referred to as research to construct theory, and inductive research is research that tests theory.

Note here that it is not simply a matter of testing a theory, but perhaps of refining, improving, and extending that theory. Figure 1.1 shows the inductive and inductive analysis complementary existence. It should be noted that the two halves of inductive and deductive analysis are continuously induced by the theory and observations. Unless you are familiar with the theory and data components of science, you cannot do inductive or deductive research. Of course, a full researcher will go through the whole cycle of study and conduct inductive and deductive research.

It is important to understand that theory-building and theory-testing are both critical to scientific progress (deductive research) and theory-testing. Unless they fit truth, elegant ideas are not useful. Similarly, mountains of data are worthless unless they can help build concrete hypotheses. Rather than looking at these two processes in a circular relation, as shown in Figure 1.1, they can be viewed better than a helix, with each iteration among theory and data helping to clarify the phenomenon and better theories. While both inductive and deductive studies are important for the promotion of science, inductive (theory-building) research seems more valued when there are few prior theories or explanations and deductive (theory-testing) studies are more productive if many competing theories of the same phenomenon are found and researchers want to know which theory works best.

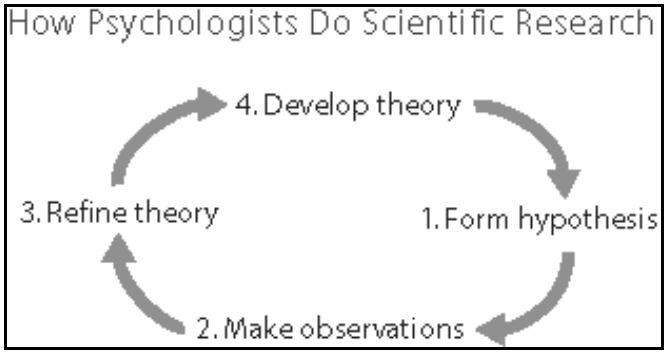


Figure 12.1: The Cycle of Research

Therefore, it is essential to conduct scientific research on two skill sets – theoretical and methodological – which must work at the theoretical and empirical levels. The methodological abilities ("know-how") are relatively normal, invariant and easy to gain in doctoral programmes through various disciplines.

However, it is considerably harder to master theoretical abilities ("Know what"), it takes years of observation and thought, and implicit competencies, which cannot be "learned."

12.5.1 Types of Scientific Research:

Scientific research projects can be classified in three categories, according to the intent of research: exploratory, descriptive and explanatory. Exploratory investigations are also undertaken in new fields of study with the aims of:

a. The degree or scope of a specific phenomenon, problem or behavior can be determined
b. To generate some first ideas about the phenomenon (or "hunches");
c. In order to test whether a more thorough analysis of this phenomenon is possible.

In a country where governmental policies related to the economic recession are not generally satisfactory, for example, exploratory research should focus on measuring the extent of citizen dislike, the extent to which such satisfaction occurs, such as the prevalence of public protests, and the alleged reasons for such disappointment including ineffective governance. Interest rates, unemployment, or higher taxes.

This could involve an analysis of statistics previously published, such as the economic indicator estimates (GDP), unemployment and the price index for consumers archived by third-party outlets, collected from interviews with experts, eminent economists or key government officials, and/or extracted from historical examples of coping with similar problems. This study does not lead to a very precise comprehension of the problem, but it can be useful in the scope and scope of the problem and can act as a useful precursor for further studies.

Descriptive analysis aims at careful observations and thorough recording of an interesting phenomenon. These findings must be focused on experimental methods (i.e. replicable and accurate, etc.), which is therefore more credible than untrained people's casual observations. They use the same or similar measures in several job surveys or censuses to estimate jobs by sector or population growth by ethnicity. Where adjustments are made to the measuring devices, the calculation is given with and without the device being adjusted so that readers can compare their population and employment trends fairly before and after. Other research descriptors may include chronicling ethnographical reports about adolescent youth activities in urban areas, the persistence or development by selected groups of religious, cultural or ethnic practices, and the role of technologies such as Twitter and instant messaging in the spread of democratic movements in countries of the Middle East. Explanatory analysis attempts to explain the phenomenon, issues or behavior observed. Descriptive research explores what a phenomenon, where it is and why it is, and explanatory research looks for answers about why and how questions are asked. It tries to "connect the dots" by defining causal factors and results of the target phenomenon. Examples include identifying why youth crime or gang violence is committed to prescribe solutions to solve these social disturbances. Most academic or doctoral research fall under the explanatory category, although some study and/or description may also be needed during initial academic research phases. Strong theoretical and analysis skills along with perspective, observations and personal experience are essential to seek explanations for observed events. The best scientists in their fields are just those who can do it well

12.5.2 Procedures for Scientific Research: (Major Steps in the Research Process)

Research should be conducted according to plan, system and logic. The emphasis is on a sophisticated and systematic approach that distinguishes research from other less comprehensive knowledge collection practises or problem solving, such as trial and error. For conducting and reporting scientific research, the following steps are recommended:

A. Formulation of the Research Problem: Most new researches begin with the formulation of a general problem of research and with questions of basic importance about the topic of research. This will generate excitement about defining the key points of the investigation properly.

B. Review of Relevant Literature: A critical study of current works in an area under research is a literature review. The critical component of this concept requires the reviewers to detect contributions in the field and to recognise existing shortcomings or weaknesses. The analysis offers an insight or scenery for study and says that the researchers are still not dead end and believes one of the principal functions of a synthesis of relevant literature is to let the reader know that the researcher is well acquainted with existing research materials on this topic. The existing state of knowledge on the topic also is clearly shown.

C. Formulation of Research Hypotheses: The researcher will eventually come to a fundamental formula for the analysis by making provisional assumptions or statements of the relationship between two or more variables. In all scientific study, research hypotheses are quite important (especially in quantitative research).

D. Determination of the Research Design: The method or strategy that guides the data collection for this study is described in this stage of scientific research.

E. Sampling methods and Sample Selection: Samples are chosen using statistical means to ensure that the topic concerned is selected evenly and also to prevent partiality in the collection. Representatively is crucial because the results of the research obtained from the collection of samples are used to generalize their influence on the entire population.

F. Data Collection Techniques: Data collection is the data collection method for the study research, from primary or secondary sources. The main sources are first-hand knowledge or raw data that the researcher obtains himself through the management of research instruments. The secondary sources are current information derived from specific materials such as books, journals, magazines, etc., as well as useful materials accessible to the researcher. List two major research data collection techniques: *survey methods and non-research methods.*

G. Methods of Data Analysis and Presentation: As statistical analysis are carried out on the data, and it is structured in an understandable fashion, the field of study is expanded once more. Via these responses the study is further expanded, exposing some patterns and answers to the initial questions. Analysis can be described as the breakdown and arrangement of the quantitative data gathered for analysis. It also includes the quest for interaction trends and patterns and relationships between these data or groups of data.

H. **Discussion and Interpretation of Findings:** This move addresses theoretical discussions on the data and knowledge derived from the analysis. The debate focuses on the conclusions and comparative interpretation of the data and expectations;

It corroborates or rejects previous positions in the literature examined, examines how it was possible to fill the gaps in knowledge and human development made by the present study. See the central component and one of the most important aspects of the research method of interpreting research results. If its result cannot be correctly evaluated and interpreted, a study method is useless for policy making or planning.

I. **Writing the research Repor**t: A report shall constitute a formal declaration, written by an individual or body charged to do so, of the results of science study or research, or of any topic on which certain information is needed. The writing of reports is a specific communication medium and is of various styles and types. Other forms are study or survey reports, such as those used in both academic, commercial and business environments, apart from the form report needed by students in examinations for a strictly specific reason.

There are short, long and very long reports that vary from basic and relatively complex to technical reports for analysis and business purposes. Therefore, a successful report must be fully readable and formal. The terminology used must comply with the anticipated body standard and style or tradition.

J. Summary, Conclusion and Recommendations: This includes a brief overview of the entire work. It highlights key observations, implications for the current situation and further study, the formulations of policies and their application and theoretical consequences. The results of the study draw the inference and this constitutes the subject of the policy proposals and the effects. Recommendations are also taken on the basis of the study's projections and predictions.

12.6 Writing a Research Paper Using the Scientific Method:

a) **Problem:** In the problem, you have to tell us what your research is about. It is in the form of a query to be written. The intention of this type of research paper should also be explained. These are the questions you would like to answer about your subject, in other words.
b) **Research:** This is when you find more information and questions about your subject. Using a graphical organizer to arrange it later. 3. HYPOTHESIS – That's why, in your opinion, you'll justify the answers you said earlier. You can now plan how you answer questions about your subject for your article.
c) **Experiment:** This is the rough stage of the draught. You will write, read and modify your document, as required, until good flow and good information are available.
d) **Analyze:** You'll edit your paper here. See your questions to ensure that they are all answered or adjusted. See your research for fact-based and clearly articulated knowledge which is included.
e) **Conclusion:** The last section of the paper. Here you can combine anything and have your own thoughts about what you have heard. Make sure that all your material is provided and well communicated to the reader.

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