Research is a systematic inquiry to describe, explain, predict and control the observed phenomenon. Research involves inductive and deductive methods (Babbie, 1998). Inductive methods analyze the observed phenomenon and identify the general principles, structures, or processes underlying the phenomenon observed; deductive methods verify the hypothesized principles through observations. The purposes are different: one is to develop explanations, and the other is to test the validity of the explanations.

One thing that we have to pay attention to research is that the heart of the research is not on statistics, but the thinking behind the research. How we really want to find out, how we build arguments about ideas and concepts, and what evidence that we can support to persuade people to accept our arguments.

Gall, Borg and Gall (1996) proposed four types of knowledge that research contributed to education as follows:

1. *Description*: Results of research can describe natural or social phenomenon, such as its form, structure, activity, change over time, relationship to other phenomena. The descriptive function of research relies on instrumentation for measurement and observations. The descriptive research results in our understanding of what happened. It sometimes produces statistical information about aspects of education.
2. *Prediction*: Prediction research is intended to predict a phenomenon that will occur at time Y from information at an earlier time X. In educational research, researchers have been engaged in:
   * Acquiring knowledge about factors that predict students' success in school and in the world of work
   * Identifying students who are likely to be unsuccessful so that prevention programs can be instituted.
3. *Improvement*: This type of research is mainly concerned with the effectiveness of intervention. The research approach include experimental design and evaluation research.
4. *Explanation*: This type research subsumes the other three: if the researchers are able to explain an educational phenomenon, it means that they can describe, can predict its consequences, and know how to intervene to change those consequences.

**What are the purposes of research?**  
Patton (1990) pointed out the importance of identifying the purpose in a research process. He classified four types of research based on different purposes:

1. *Basic Research*: The purpose of this research is to understand and explain, i.e. the research is interested in formulating and testing theoretical construct and propositions that ideally generalize across time and space. This type of research takes the form of a theory that explains the phenomenon under investigation to give its contribution to knowledge. This research is more descriptive in nature exploring what, why and how questions.
2. *Applied Research*: The purpose of this research is to help people understand the nature of human problems so that human beings can more effectively control their environment. In other words, this type of research pursues potential solutions to human and societal problems. This research is more prescriptive in nature, focusing on how questions.
3. *Evaluation Research*(summative and formative): Evaluation research studies the processes and outcomes aimed at attempted solution. The purpose of formative research is to improve human intervention within specific conditions, such as activities, time, and groups of people; the purpose of summative evaluation is to judge the effectiveness of a program, policy, or product.
4. *Action Research*: Action research aims at solving specific problems within a program, organization, or community. Patton (1990) described that design and data collection in action research tend to be more informal, and the people in the situation are directly involved in gathering information and studying themselves.

**What is the research process?**  
Gall, Borg, and Gall (1996) described the following stages of conducting a research study:

1. Identify a significant research problem: in this stage, find out the research questions that are significant and feasible to study.
2. Prepare a research proposal: a research proposal usually consists of the sections including introductory, literature review, research design, research method, data analysis and protection of human subject section, and timeline.
3. Conduct a pilot study: the purpose is to develop and try out data-collection methods and other procedures.
4. Conduct a main study
5. Prepare a report

Gall, Borg, and Gall (1996) also explained that these five stages may overlap or occur in a different order depending the nature of the study. Qualitative studies which involve emergent research design may gather and analyze some data before developing the proposal, or a pilot study can be done before writing a research proposal or not at all.

Anglin, Ross, and Morrison (1995) took a closer look at the stages of identifying a research problem and preparing the research proposal. They advised a sequence of planning steps:

|  |
| --- |
| **Select a Topic** |
| Research requires commitment. As a researcher, you want to make sure you are doing something that you have a great interest in doing. |
| http://www.personal.psu.edu/wxh139/images/arrow_1.gif |
| **Identify the Research Problem** |
| Based on your own understanding and interest of the topic, think about what issues can be explored? Sometimes, a research problem cannot be immediately identified. But, through reviewing the existing literature and having continuous discourse with peers and scholars, the research problem will start take its shape. |
| http://www.personal.psu.edu/wxh139/images/arrow_1.gif |
| **Conduct a Literature Search** |
| Reviewing literature has two major purposes: one is to build up the researcher's knowledge base of the topic under exploration for a deeper understanding, and the other is to ensure the significance of the research. The researcher needs to make sure how the research will be able to contribute to the knowledge in the related field compared with the existing research literature. |
| http://www.personal.psu.edu/wxh139/images/arrow_1.gif |
| **State the Research Question** |
| The research problem will evolve during your pursuing knowledge base through reviewing literature and discourse with peers and scholars. To specify what questions your research study want to answer helps to provide the basis of planning other parts of your study, e.g. the research design, the methods for data collection and analysis.   |  |  |  | | --- | --- | --- | | Experimental/Positivist Study | Correlational Study | Qualitative/Naturalist Study | | * Questions about whether a certain instructional method or strategy improve a certain skill or learning outcome * Questions about whether a certain student characteristics have effects on a certain skill or learning outcome, or whether the characteristics interact with the instructional strategy or method to affect learning of a certain skill or cognitive process | * Questions about whether two or more variables are related to each other? Those questions intend to use or control one variable to predict a future performance of a particular variable | * Questions to generate a theory to describe certain patterns of interaction or process of an observed phenomenon * Questions about lived experience of research participants * Questions about the cultural patterns or social patterns in the classroom |   *Ideas abstracted from Anglin, Ross, and Morrison (1995)* |
| http://www.personal.psu.edu/wxh139/images/arrow_1.gif |
| **Determine the Research Design** |
| In the intention of the research study is to verify a causal relationship between certain variables, use an experimental design; if the intention of the research study is to find out how variables relate to one another, use a correlational design; if the intention of the research study is to describe and understand a particular social condition/pattern and meaning of a social experience, conduct a qualitative study. |
| http://www.personal.psu.edu/wxh139/images/arrow_1.gif |
| **Determine Methods** |
| Three major elements in the research study need to be considered: participants, materials, and instruments. |
| * ***Participants***: It concerns whom to study. For experimental studies, the researcher needs to consider statistical sampling to make sure that sample is representative of the population, e.g. techniques of random sampling and stratified sampling. For qualitative research, purposeful sampling is the major principle. The selection of individuals, groups, or cases depends on how the characteristics, or properties of the individuals, groups, or cases will best inform the researcher with the focus of what is under investigation. * ***Materials and Instrumentation***: For experimental research, operationalization of the variables is the focus, i.e. what are different treatment conditions, and how to measure the dependent variables. The researcher has to consider issues about the reliability (the consistency of the test), and validity (whether the test is testing what is meant to test) of the measurement. The design of the experimental conditions has taken the threats of the internal and external validity into account. The researcher wants to make sure that the establishing of the causal relationship is not influenced by other factors than the controlling factors, and the researcher needs to consider to what extent the results of the research can be generalized to the population beyond the sample under study.   For qualitative research, the issues are the sources of data, where the researcher can find the information and what methods the researcher can use to get the information. Qualitative research usually focuses on the verbal information gathered from the interviews, observations, documents or cultural artifacts. The very distinctive feature about the qualitative research is that the researcher is part of the instrument. The recognition of this researcher's subjective interpretation of the information yields the process of triangulation, which emphasizes use of multiple sources, methods, investigators, and theories to ensure the credibility of the research.   * ***Procedures***: A procedural planning of how to get approval from IRB, how to get entry to research participants or to the field, how to implement the experimental treatment or to schedule observations and interviews, and how to prepare for write-up. A general outline of the process and a timeline will facilitate the research progress. |
| http://www.personal.psu.edu/wxh139/images/arrow_1.gif |
| **Identify Analysis Procedures** |
| Different research questions and different research designs entail different analysis method to take. Experimental design employs statistical analysis to give statistical descriptions of the groups in terms of different independent variables and dependent variables, and to determine the significance of the differences whether the dependent variables are caused by the independent variables. On the other hand, qualitative design employs semantic analysis to identify themes, categories, processes, and patterns of an observed phenomenon, and provides rich descriptions of the phenomenon in order to develop a deeper understanding of human systems. |

**Research** comprises "creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications."[[1]](http://en.wikipedia.org/wiki/Research#cite_note-1) It is used to establish or confirm facts, reaffirm the results of previous work, solve new or existing problems, support [theorems](http://en.wikipedia.org/wiki/Theorem), or develop new [theories](http://en.wikipedia.org/wiki/Theory). A research project may also be an expansion on past work in the field. To test the validity of instruments, procedures, or experiments, research may replicate elements of prior projects, or the project as a whole. The primary purposes of [basic research](http://en.wikipedia.org/wiki/Basic_research) (as opposed to [applied research](http://en.wikipedia.org/wiki/Applied_research)) are [documentation](http://en.wikipedia.org/wiki/Documentation), [discovery](http://en.wikipedia.org/wiki/Discovery_(observation)), [interpretation](http://en.wikipedia.org/wiki/Interpretation_(philosophy)), or the [research and development](http://en.wikipedia.org/wiki/Research_and_development)(R&D) of methods and systems for the advancement of human [knowledge](http://en.wikipedia.org/wiki/Knowledge). Approaches to research depend on [epistemologies](http://en.wikipedia.org/wiki/Epistemology), which vary considerably both within and between humanities and sciences. There are several forms of research: scientific, humanities, artistic, economic, [social](http://en.wikipedia.org/wiki/Social_research), business,[marketing](http://en.wikipedia.org/wiki/Marketing_research" \o "Marketing research), [practitioner research](http://en.wikipedia.org/wiki/Practitioner_research), etc.

**Contents**

  [[hide](http://en.wikipedia.org/wiki/Research)]

* [1 Forms of research](http://en.wikipedia.org/wiki/Research#Forms_of_research)
* [2 Etymology](http://en.wikipedia.org/wiki/Research#Etymology)
* [3 Definitions](http://en.wikipedia.org/wiki/Research#Definitions)
* [4 Steps in conducting research](http://en.wikipedia.org/wiki/Research#Steps_in_conducting_research)
* [5 Scientific research](http://en.wikipedia.org/wiki/Research#Scientific_research)
* [6 Historical method](http://en.wikipedia.org/wiki/Research#Historical_method)
* [7 Research methods](http://en.wikipedia.org/wiki/Research#Research_methods)
* [8 Professionalization](http://en.wikipedia.org/wiki/Research#Professionalization)
* [9 Publishing](http://en.wikipedia.org/wiki/Research#Publishing)
* [10 Research funding](http://en.wikipedia.org/wiki/Research#Research_funding)
* [11 Original research](http://en.wikipedia.org/wiki/Research#Original_research)
  + [11.1 Different forms](http://en.wikipedia.org/wiki/Research#Different_forms)
* [12 Artistic research](http://en.wikipedia.org/wiki/Research#Artistic_research)
* [13 See also](http://en.wikipedia.org/wiki/Research#See_also)
* [14 References](http://en.wikipedia.org/wiki/Research#References)
* [15 Further reading](http://en.wikipedia.org/wiki/Research#Further_reading)
* [16 External links](http://en.wikipedia.org/wiki/Research#External_links)

Forms of research[[edit](http://en.wikipedia.org/w/index.php?title=Research&action=edit&section=1" \o "Edit section: Forms of research)]

**Scientific research** relies on the application of the scientific method, a harnessing of [curiosity](http://en.wikipedia.org/wiki/Curiosity). This research provides [scientific](http://en.wikipedia.org/wiki/Science) information and theories for the explanation of the [nature](http://en.wikipedia.org/wiki/Nature) and the properties of the world. It makes practical applications possible. Scientific research is funded by public authorities, by charitable organizations and by private groups, including many companies. Scientific research can be subdivided into different classifications according to their academic and application disciplines. Scientific research is a widely used criterion for judging the standing of an academic institution, such as business schools, but some argue that such is an inaccurate assessment of the institution, because the quality of research does not tell about the quality of teaching (these do not necessarily correlate totally).[[2]](http://en.wikipedia.org/wiki/Research#cite_note-2)

**Research in the humanities** involves different methods such as for example [hermeneutics](http://en.wikipedia.org/wiki/Hermeneutics) and [semiotics](http://en.wikipedia.org/wiki/Semiotics), and a different, more [relativist](http://en.wikipedia.org/wiki/Relativist) [epistemology](http://en.wikipedia.org/wiki/Epistemology). Humanities scholars usually do not search for the ultimate correct answer to a question, but instead explore the issues and details that surround it. Context is always important, and context can be social, historical, political, cultural or ethnic. An example of research in the humanities is historical research, which is embodied in [historical method](http://en.wikipedia.org/wiki/Historical_method). Historians use [primary sources](http://en.wikipedia.org/wiki/Primary_sources) and other [evidence](http://en.wikipedia.org/wiki/Evidence) to systematically investigate a topic, and then to write histories in the form of accounts of the past.

**Artistic research**, also seen as 'practice-based research', can take form when creative works are considered both the research and the object of research itself. It is the debatable body of thought which offers an alternative to purely scientific methods in research in its search for knowledge and truth.

Etymology[[edit](http://en.wikipedia.org/w/index.php?title=Research&action=edit&section=2" \o "Edit section: Etymology)]

[](http://en.wikipedia.org/wiki/File:Aristotle_Altemps_Inv8575.jpg)

[http://bits.wikimedia.org/static-1.23wmf15/skins/common/images/magnify-clip.png](http://en.wikipedia.org/wiki/File:Aristotle_Altemps_Inv8575.jpg)

[Aristotle](http://en.wikipedia.org/wiki/Aristotle), 384 BC – 322 BC, - one of the early figures in the development of the[scientific method](http://en.wikipedia.org/wiki/Scientific_method).[[3]](http://en.wikipedia.org/wiki/Research#cite_note-3)

The word *research* is derived from the [Middle French](http://en.wikipedia.org/wiki/French_language) "*recherche*", which means "to go about seeking", the term itself being derived from the [Old French](http://en.wikipedia.org/wiki/Old_French) term "*recerchier*" a compound word from "re-" + "cerchier", or "sercher", meaning 'search'.[[4]](http://en.wikipedia.org/wiki/Research#cite_note-Merriam_webster-4) The earliest recorded use of the term was in 1577.[[4]](http://en.wikipedia.org/wiki/Research#cite_note-Merriam_webster-4)

Definitions[[edit](http://en.wikipedia.org/w/index.php?title=Research&action=edit&section=3" \o "Edit section: Definitions)]

Research has been defined in a number of different ways.

A broad definition of research is given by Martyn Shuttleworth - "In the broadest sense of the word, the definition of research includes any gathering of data, information and facts for the advancement of knowledge."[[5]](http://en.wikipedia.org/wiki/Research#cite_note-Shuttleworth-5)

Another definition of research is given by Creswell who states that - "Research is a process of steps used to collect and analyze information to increase our understanding of a topic or issue". It consists of three steps: Pose a question, collect data to answer the question, and present an answer to the question.[[6]](http://en.wikipedia.org/wiki/Research#cite_note-6)

The Merriam-Webster Online Dictionary defines research in more detail as "a studious inquiry or examination; especially  : investigation or experimentation aimed at the discovery and interpretation of facts, revision of accepted theories or laws in the light of new facts, or practical application of such new or revised theories or laws".[[4]](http://en.wikipedia.org/wiki/Research#cite_note-Merriam_webster-4)

Steps in conducting research[[edit](http://en.wikipedia.org/w/index.php?title=Research&action=edit&section=4" \o "Edit section: Steps in conducting research)]

Research is often conducted using the hourglass model structure of research.[[7]](http://en.wikipedia.org/wiki/Research#cite_note-7) The hourglass model starts with a broad spectrum for research, focusing in on the required information through the method of the project (like the neck of the hourglass), then expands the research in the form of discussion and results. The major steps in conducting research are:[[8]](http://en.wikipedia.org/wiki/Research" \l "cite_note-8)

* Identification of research problem
* Literature review
* Specifying the purpose of research
* Determine specific research questions or hypotheses
* Data collection
* Analyzing and interpreting the data
* Reporting and evaluating research
* Communicating the research findings and, possibly, recommendations

The steps generally represent the overall process, however they should be viewed as an ever-changing iterative process rather than a fixed set of steps.[[9]](http://en.wikipedia.org/wiki/Research#cite_note-9) Most researches begin with a general statement of the problem, or rather, the purpose for engaging in the study.[[10]](http://en.wikipedia.org/wiki/Research#cite_note-10) The literature review identifies flaws or holes in previous research which provides justification for the study. Often, a literature review is conducted in a given subject area before a research question is identified. A gap in the current literature, as identified by a researcher, then engenders a research question. The research question may be parallel to the hypothesis. The hypothesis is the supposition to be tested. The researcher(s) collects data to test the hypothesis. The researcher(s) then analyzes and interprets the data via a variety of statistical methods, engaging in what is known as [Empirical research](http://en.wikipedia.org/wiki/Empirical_research). The results of the data analysis in confirming or failing to reject the [Null hypothesis](http://en.wikipedia.org/wiki/Null_hypothesis) are then reported and evaluated. At the end the researcher may discuss avenues for further research.

[Rudolph Rummel](http://en.wikipedia.org/wiki/Rudolph_Rummel) says, "... no researcher should accept any one or two tests as definitive. It is only when a range of tests are consistent over many kinds of data, researchers, and methods can one have confidence in the results."[[11]](http://en.wikipedia.org/wiki/Research#cite_note-11)

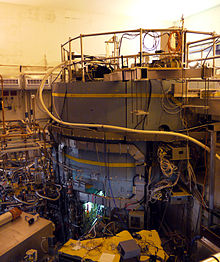
Scientific research[[edit](http://en.wikipedia.org/w/index.php?title=Research&action=edit&section=5" \o "Edit section: Scientific research)]

*Main article:*[*Scientific method*](http://en.wikipedia.org/wiki/Scientific_method)

[](http://en.wikipedia.org/wiki/File:Microscopy_lab.jpg)

[http://bits.wikimedia.org/static-1.23wmf15/skins/common/images/magnify-clip.png](http://en.wikipedia.org/wiki/File:Microscopy_lab.jpg)

Primary scientific research being carried out at the [Microscopy](http://en.wikipedia.org/wiki/Electron_microscope) Laboratory of the[Idaho National Laboratory](http://en.wikipedia.org/wiki/Idaho_National_Laboratory).

[](http://en.wikipedia.org/wiki/File:Alcator_C-Mod.jpg)

[http://bits.wikimedia.org/static-1.23wmf15/skins/common/images/magnify-clip.png](http://en.wikipedia.org/wiki/File:Alcator_C-Mod.jpg)

Scientific research equipment at [MIT](http://en.wikipedia.org/wiki/Massachusetts_Institute_of_Technology).

Generally, research is understood to follow a certain structural [process](http://en.wikipedia.org/wiki/Process_(science)). Though step order may vary depending on the subject matter and researcher, the following steps are usually part of most formal research, both basic and applied:

1. [Observations and Formation of the topic](http://en.wikipedia.org/wiki/Scientific_method#Elements_of_the_scientific_method): Consists of the subject area of ones interest and following that subject area to conduct subject related research. The subject area should not be randomly chosen since it requires reading a vast amount of literature on the topic to determine the gap in the literature the researcher intends to narrow. A keen interest in the chosen subject area is advisable. The research will have to be justified by linking its importance to already existing knowledge about the topic.
2. [Hypothesis](http://en.wikipedia.org/wiki/Hypothesis): A testable prediction which designates the relationship between two or more variables.
3. [Conceptual definition](http://en.wikipedia.org/wiki/Conceptual_definition): Description of a concept by relating it to other concepts.
4. [Operational definition](http://en.wikipedia.org/wiki/Operational_definition): Details in regards to defining the variables and how they will be measured/assessed in the study.
5. [Gathering of data](http://en.wikipedia.org/wiki/Data_collection): Consists of identifying a population and selecting samples, gathering information from and/or about these samples by using specific research instruments. The instruments used for data collection must be valid and reliable.
6. [Analysis of data](http://en.wikipedia.org/wiki/Data_analysis): Involves breaking down the individual pieces of data in order to draw conclusions about it.
7. [Data Interpretation](http://en.wikipedia.org/wiki/Data_Interpretation): This can be represented through tables, figures and pictures, and then described in words.
8. [Test, revising of hypothesis](http://en.wikipedia.org/wiki/Scientific_method#Evaluation_and_improvement)
9. [Conclusion, reiteration if necessary](http://en.wikipedia.org/wiki/Scientific_method#Elements_of_the_scientific_method)

A common misconception is that a hypothesis will be proven (see, rather, [Null hypothesis](http://en.wikipedia.org/wiki/Null_hypothesis)). Generally a hypothesis is used to make predictions that can be tested by observing the outcome of an experiment. If the outcome is inconsistent with the hypothesis, then the hypothesis is rejected (see[falsifiability](http://en.wikipedia.org/wiki/Falsifiability)). However, if the outcome is consistent with the hypothesis, the experiment is said to support the hypothesis. This careful language is used because researchers recognize that alternative hypotheses may also be consistent with the observations. In this sense, a hypothesis can never be proven, but rather only supported by surviving rounds of scientific testing and, eventually, becoming widely thought of as true.

A useful hypothesis allows prediction and within the accuracy of observation of the time, the prediction will be verified. As the accuracy of observation improves with time, the hypothesis may no longer provide an accurate prediction. In this case a new hypothesis will arise to challenge the old, and to the extent that the new hypothesis makes more accurate predictions than the old, the new will supplant it. Researchers can also use a null hypothesis, which state no relationship or difference between the independent or dependent variables. A null hypothesis uses a sample of all possible people to make a conclusion about the population.[[12]](http://en.wikipedia.org/wiki/Research#cite_note-12)

Historical method[[edit](http://en.wikipedia.org/w/index.php?title=Research&action=edit&section=6" \o "Edit section: Historical method)]

*Main article:*[*Historical method*](http://en.wikipedia.org/wiki/Historical_method)

[](http://en.wikipedia.org/wiki/File:Leopold_von_Ranke_1868.jpg)

[http://bits.wikimedia.org/static-1.23wmf15/skins/common/images/magnify-clip.png](http://en.wikipedia.org/wiki/File:Leopold_von_Ranke_1868.jpg)

German historian [Leopold von Ranke](http://en.wikipedia.org/wiki/Leopold_von_Ranke) (1795-1886), considered to be one of the founders of modern source-based [history](http://en.wikipedia.org/wiki/History).

The [historical method](http://en.wikipedia.org/wiki/Historical_method) comprises the techniques and guidelines by which historians use [historical](http://en.wikipedia.org/wiki/Historical) sources and other evidence to research and then to write history. There are various history guidelines that are commonly used by historians in their work, under the headings of external criticism, internal criticism, and synthesis. This includes [lower criticism](http://en.wikipedia.org/wiki/Lower_criticism) and sensual criticism. Though items may vary depending on the subject matter and researcher, the following concepts are part of most formal historical research:[[13]](http://en.wikipedia.org/wiki/Research" \l "cite_note-Garraghan_.281946.29-13)

* [Identification](http://en.wikipedia.org/wiki/Identification_(information)) of origin date
* [Evidence](http://en.wikipedia.org/wiki/Evidence) of localization
* [Recognition](http://en.wikipedia.org/wiki/Recognition_(sociology)) of authorship
* [Analysis](http://en.wikipedia.org/wiki/Analysis) of data
* Identification of [integrity](http://en.wikipedia.org/wiki/Integrity)
* Attribution of [credibility](http://en.wikipedia.org/wiki/Credibility)

Research methods[[edit](http://en.wikipedia.org/w/index.php?title=Research&action=edit&section=7" \o "Edit section: Research methods)]

The goal of the research process is to produce new knowledge or deepen understanding of a topic or issue. This process takes three main forms (although, as previously discussed, the boundaries between them may be obscure):

* [Exploratory research](http://en.wikipedia.org/wiki/Exploratory_research), which helps to identify and define a problem or question.
* [Constructive research](http://en.wikipedia.org/wiki/Constructive_research), which tests theories and proposes solutions to a problem or question.
* [Empirical research](http://en.wikipedia.org/wiki/Empirical_research), which tests the feasibility of a solution using [empirical evidence](http://en.wikipedia.org/wiki/Empirical_evidence).

[](http://en.wikipedia.org/wiki/File:NYC_Public_Library_Research_Room_Jan_2006-1-_3.jpg)

[http://bits.wikimedia.org/static-1.23wmf15/skins/common/images/magnify-clip.png](http://en.wikipedia.org/wiki/File:NYC_Public_Library_Research_Room_Jan_2006-1-_3.jpg)

The research room at the New York Public Library, an example of [secondary research](http://en.wikipedia.org/wiki/Secondary_research) in progress.

There are two major types of research design: qualitative research and quantitative research. Researchers choose qualitative or quantitative methods according to the nature of the research topic they want to investigate and the research questions they aim to answer:

[](http://en.wikipedia.org/wiki/File:Hilleman-Walter-Reed.jpeg)

[http://bits.wikimedia.org/static-1.23wmf15/skins/common/images/magnify-clip.png](http://en.wikipedia.org/wiki/File:Hilleman-Walter-Reed.jpeg)

[Maurice Hilleman](http://en.wikipedia.org/wiki/Maurice_Hilleman) is credited with saving more lives than any other scientist of the 20th century.[[14]](http://en.wikipedia.org/wiki/Research#cite_note-14)

[**Qualitative research**](http://en.wikipedia.org/wiki/Qualitative_research)

Understanding of human behavior and the reasons that govern such behavior. Asking a broad question and collecting data in the form of words, images, video etc that is analyzed and searching for themes. This type of research aims to investigate a question without attempting to quantifiably measure variables or look to potential relationships between variables. It is viewed as more restrictive in testing hypotheses because it can be expensive and time consuming, and typically limited to a single set of research subjects.[[*citation needed*](http://en.wikipedia.org/wiki/Wikipedia:Citation_needed)] Qualitative research is often used as a method of exploratory research as a basis for later quantitative research hypotheses.[[*citation needed*](http://en.wikipedia.org/wiki/Wikipedia:Citation_needed)] Qualitative research is linked with the philosophical and theoretical stance of [social constructionism](http://en.wikipedia.org/wiki/Social_constructionism).

[**Quantitative research**](http://en.wikipedia.org/wiki/Quantitative_research)

Systematic empirical investigation of quantitative properties and phenomena and their relationships. Asking a narrow question and collecting numerical data to analyze utilizing [statistical](http://en.wikipedia.org/wiki/Descriptive_statistical_technique) methods. The quantitative research designs are experimental, correlational, and survey (or descriptive).[[15]](http://en.wikipedia.org/wiki/Research#cite_note-15) Statistics derived from quantitative research can be used to establish the existence of associative or causal relationships between variables. Quantitative research is linked with the philosophical and theoretical stance of [positivism](http://en.wikipedia.org/wiki/Positivism).

The Quantitative data collection methods rely on random sampling and structured data collection instruments that fit diverse experiences into predetermined response categories.[[*citation needed*](http://en.wikipedia.org/wiki/Wikipedia:Citation_needed)] These methods produce results that are easy to summarize, compare, and generalize.[[*citation needed*](http://en.wikipedia.org/wiki/Wikipedia:Citation_needed)] Quantitative research is concerned with testing hypotheses derived from theory and/or being able to estimate the size of a phenomenon of interest. Depending on the research question, participants may be randomly assigned to different treatments (this is the only way that a quantitative study can be considered a true experiment).[[*citation needed*](http://en.wikipedia.org/wiki/Wikipedia:Citation_needed)] If this is not feasible, the researcher may collect data on participant and situational characteristics in order to statistically control for their influence on the dependent, or outcome, variable. If the intent is to generalize from the research participants to a larger population, the researcher will employ probability sampling to select participants.[[16]](http://en.wikipedia.org/wiki/Research#cite_note-16)

In either qualitative or quantitative research, the researcher(s) may collect primary or secondary data. Primary data is data collected specifically for the research, such as through interviews or questionnaires. Secondary data is data that already exists, such as [census](http://en.wikipedia.org/wiki/Census) data, which can be re-used for the research. It is good ethical research practice to use secondary data wherever possible.[[17]](http://en.wikipedia.org/wiki/Research#cite_note-17)

Mixed-method research, i.e. research that includes qualitative and quantitative elements, using both primary and secondary data, is becoming more common.[[18]](http://en.wikipedia.org/wiki/Research#cite_note-18)

Professionalization[[edit](http://en.wikipedia.org/w/index.php?title=Research&action=edit&section=8" \o "Edit section: Professionalization)]

|  |  |
| --- | --- |
| Globe icon. | The examples and perspective in this section **may not represent a**[**worldwide view**](http://en.wikipedia.org/wiki/Wikipedia:WikiProject_Countering_systemic_bias)**of the subject**. Please [improve this article](http://en.wikipedia.org/w/index.php?title=Research&action=edit) and discuss the issue on the [talk page](http://en.wikipedia.org/wiki/Talk:Research). *(January 2014)* |

In several national and private academic systems, the [professionalization](http://en.wikipedia.org/wiki/Professionalization) of research has resulted in formal [job titles](http://en.wikipedia.org/wiki/Job_title).

In [Russia](http://en.wikipedia.org/wiki/Russia), former [Soviet Union](http://en.wikipedia.org/wiki/Soviet_Union) and some [Post-Soviet states](http://en.wikipedia.org/wiki/Post-Soviet_states) the term *researcher* ([Russian](http://en.wikipedia.org/wiki/Russian_language): Научный сотрудник, *nauchny sotrudnik*) is both a generic term for a person who carried out scientific research, as well as a job position within the frameworks of the [USSR Academy of Sciences](http://en.wikipedia.org/wiki/USSR_Academy_of_Sciences), Soviet universities, and in other research-oriented establishments. The term *nauchny sotrudnik* is also sometimes translated as [*research fellow*](http://en.wikipedia.org/wiki/Research_fellow), [*research associate*](http://en.wikipedia.org/wiki/Research_associate), etc.

The following ranks of a *nauchny sotrudnik* are known:

* Junior Researcher (Junior Research Associate)
* Researcher (Research Associate)
* Senior Researcher (Senior Research Associate)
* Leading Researcher (Leading Research Associate)[[19]](http://en.wikipedia.org/wiki/Research#cite_note-19)
* Chief Researcher (Chief Research Associate)

Publishing[[edit](http://en.wikipedia.org/w/index.php?title=Research&action=edit&section=9" \o "Edit section: Publishing)]

[](http://en.wikipedia.org/wiki/File:Nature_cover,_November_4,_1869.jpg)

[http://bits.wikimedia.org/static-1.23wmf15/skins/common/images/magnify-clip.png](http://en.wikipedia.org/wiki/File:Nature_cover,_November_4,_1869.jpg)

Cover of the first issue of [*Nature*](http://en.wikipedia.org/wiki/Nature_(journal)), 4 November 1869.

[Academic publishing](http://en.wikipedia.org/wiki/Academic_publishing) describes a system that is necessary in order for academic [scholars](http://en.wikipedia.org/wiki/Scholar) to [peer review](http://en.wikipedia.org/wiki/Peer_review) the work and make it available for a wider audience. The system varies widely by field, and is also always changing, if often slowly. Most academic work is published in journal article or book form. There is also a large body of research that exists in either a thesis or dissertation form. These forms of research can be found in databases explicitly for theses and dissertations. In publishing, STM publishing is an abbreviation for academic publications in science, technology, and [medicine](http://en.wikipedia.org/wiki/Medicine).

Most established [academic fields](http://en.wikipedia.org/wiki/List_of_academic_disciplines) have their own scientific journals and other outlets for publication, though many [academic journals](http://en.wikipedia.org/wiki/Academic_journal) are somewhat interdisciplinary, and publish work from several distinct fields or subfields. The kinds of publications that are accepted as contributions of knowledge or research vary greatly between fields; from the print to the electronic format. A study suggests that researchers should not give great consideration to findings that are not replicated frequently.[[20]](http://en.wikipedia.org/wiki/Research#cite_note-20) It has also been suggested that all published studies should be subjected to some measure for assessing the validity or reliability of its factors in order to prevent the publication of unproven findings.[[21]](http://en.wikipedia.org/wiki/Research#cite_note-21) [Business models](http://en.wikipedia.org/wiki/Business_model) are different in the electronic environment. Since about the early 1990s, licensing of electronic resources, particularly journals, has been very common. Presently, a major trend, particularly with respect to scholarly journals, is [open access](http://en.wikipedia.org/wiki/Open_access_(publishing)).[[22]](http://en.wikipedia.org/wiki/Research#cite_note-22) There are two main forms of open access: open access publishing, in which the articles or the whole journal is freely available from the time of publication, and [self-archiving](http://en.wikipedia.org/wiki/Self-archiving), where the author makes a copy of their own work freely available on the web.

Research funding[[edit](http://en.wikipedia.org/w/index.php?title=Research&action=edit&section=10" \o "Edit section: Research funding)]

*Main article:*[*Research funding*](http://en.wikipedia.org/wiki/Research_funding)

Most funding for [scientific research](http://en.wikipedia.org/wiki/Scientific_research) comes from three major sources: [corporate](http://en.wikipedia.org/wiki/Corporation) [research and development](http://en.wikipedia.org/wiki/Research_and_development) departments; [private foundations](http://en.wikipedia.org/wiki/Private_foundation), for example, the Bill and Melinda Gates Foundation; and government research councils such as the [National Institutes of Health](http://en.wikipedia.org/wiki/National_Institutes_of_Health) in the USA[[23]](http://en.wikipedia.org/wiki/Research#cite_note-23) and the[Medical Research Council](http://en.wikipedia.org/wiki/Medical_Research_Council_(UK)) in the UK. These are managed primarily through universities and in some cases through military contractors. Many senior researchers (such as group leaders) spend a significant amount of their time applying for grants for research funds. These grants are necessary not only for researchers to carry out their research, but also as a source of merit.

The Social Psychology Network provides a comprehensive list of U.S. Government and private foundation funding sources.

Original research[[edit](http://en.wikipedia.org/w/index.php?title=Research&action=edit&section=11" \o "Edit section: Original research)]

**Original research** is research that is not exclusively based on a summary, review or synthesis of earlier publications on the subject of research. This material is of a [primary source](http://en.wikipedia.org/wiki/Primary_source) character. The purpose of the original research is to produce new [knowledge](http://en.wikipedia.org/wiki/Knowledge), rather than to present the existing knowledge in a new form (*e.g.*, summarized or classified).[[24]](http://en.wikipedia.org/wiki/Research#cite_note-24)[[25]](http://en.wikipedia.org/wiki/Research#cite_note-25)

**Different forms**[[edit](http://en.wikipedia.org/w/index.php?title=Research&action=edit&section=12" \o "Edit section: Different forms)]

Original research can take a number of forms, depending on the discipline it pertains to. In [experimental](http://en.wikipedia.org/wiki/Experiment) work, it typically involves direct or indirect observation of the researched subject(s), e.g., in the laboratory or in the field, documents the methodology, results, and conclusions of an experiment or set of experiments, or offers a novel interpretation of previous results. In [analytical](http://en.wikipedia.org/wiki/Scientific_modelling) work, there are typically some new (for example) mathematical results produced, or a new way of approaching an existing problem. In some subjects which do not typically carry out experimentation or analysis of this kind, the originality is in the particular way existing understanding is changed or re-interpreted based on the outcome of the work of the [researcher](http://en.wikipedia.org/wiki/Academic_authorship).[[26]](http://en.wikipedia.org/wiki/Research#cite_note-26)

The degree of originality of the research is among major criteria for articles to be published in [academic journals](http://en.wikipedia.org/wiki/Academic_journal) and usually established by means of [peer review](http://en.wikipedia.org/wiki/Peer_review).[[27]](http://en.wikipedia.org/wiki/Research#cite_note-27) [Graduate students](http://en.wikipedia.org/wiki/Graduate_student) are commonly required to perform original research as part of a [dissertation](http://en.wikipedia.org/wiki/Dissertation).[[28]](http://en.wikipedia.org/wiki/Research#cite_note-28)

Artistic research[[edit](http://en.wikipedia.org/w/index.php?title=Research&action=edit&section=13" \o "Edit section: Artistic research)]

The controversial trend of artistic teaching becoming more academics-oriented is leading to artistic research being accepted as the primary mode of enquiry in art as in the case of other disciplines.[[29]](http://en.wikipedia.org/wiki/Research#cite_note--29) One of the characteristics of [artistic](http://en.wikipedia.org/wiki/Art) research is that it must accept [subjectivity](http://en.wikipedia.org/wiki/Subjectivity) as opposed to the classical scientific methods. As such, it is similar to the [social sciences](http://en.wikipedia.org/wiki/Social_science) in using[qualitative research](http://en.wikipedia.org/wiki/Qualitative_research) and [intersubjectivity](http://en.wikipedia.org/wiki/Intersubjectivity" \o "Intersubjectivity) as tools to apply measurement and critical analysis.[[30]](http://en.wikipedia.org/wiki/Research#cite_note-30)

Artistic research has been defined by the [University of Dance and Circus](http://en.wikipedia.org/wiki/University_of_Dance_and_Circus) (Dans och Cirkushögskolan, DOCH), [Stockholm](http://en.wikipedia.org/wiki/Stockholm) in the following manner - "Artistic research is to investigate and test with the purpose of gaining knowledge within and for our artistic disciplines. It is based on artistic practices, methods and criticality. Through presented documentation, the insights gained shall be placed in a context."[[31]](http://en.wikipedia.org/wiki/Research#cite_note-DOCH-31) Artistic research aims to enhance knowledge and understanding with presentation of the arts.[[32]](http://en.wikipedia.org/wiki/Research#cite_note-32) For a survey of the central problematics of today's Artistic Research see Giaco Schiesser.[[33]](http://en.wikipedia.org/wiki/Research#cite_note-33)

Most writers, whether of fiction or non-fiction books, also have to do research to support their creative work. This may be factual, historical, or background research. Background research could include, for example, geographical or procedural research.[[34]](http://en.wikipedia.org/wiki/Research#cite_note-34)

BASIC RESEARCH

The research which is done for knowledge enhancement, the research which does not have immediate commercial potential. The research which is done for human welfare, animal welfare and plant kingdom welfare. It is called basic,pure,fundamental research. The main motivation is to expand man's knowledge, not to create or invent something. There is no obvious commercial value to the discoveries that result from basic research. Basic research lay down the foundation for the applied research. Dr.G.Smoot says “people cannot foresee the future well enough to predict what is going to develop from the basic research” Eg:-how did the universe begin?

APPLIED RESEARCH

Applied research is designed to solve practical problem of the modern world, rather than to acquire knowledge for knowledges sake. The goal of applied research is to improve the human condition. It focus on analysis and solving social and real life problems. This research is generally conducted on large scale basis, it is expensive. As such, it often conducted with the support of some financing agency like government , public corporation , world bank, UNICEF, UGC,Etc,. According to hunt, “applied research is an investigation for ways of using scientific knowledge to solve practical problems” for example:- improve agriculture crop production, treat or cure a specific disease, improve the energy efficiency homes, offices, how can communication among workers in large companies be improved? Applied research can be further classified as problem oriented and problem solving research. Problem oriented research:- research is done by industry apex body for sorting out problems faced by all the companies. Eg:- WTO does problem oriented research for developing countries, in india agriculture and processed food export development authority (APEDA) conduct regular research for the benefit of agri-industry. Problem solving:-this type of research is done by an individual company for the problem faced by it. Marketing research and market research are the applied research. For eg:- videocon international conducts research to study customer satisfaction level, it will be problem solving research. In short, the main aim of applied research is to discover some solution for some pressing practical problem.

QUANTITATIVE RESEARCH

Quantitative research aim to measure the quantity or amount and compares it with past records and tries to project for future period. In social sciences, “quantitative research refers to the systematic empirical investigation of quantitative properties and phenomena and their relationships”. The objective of qualitative research is to develop and employ mathematical models, theories or hypothesis pertaining to phenomena. The process of measurement is central to quantitative research because it provides fundamental connection between empirical observation and mathematical expression of quantitative relationships. Statistics is the most widely used branch of mathematics in quantitative research. Statistical methods are used extensively with in fields such as economics and commerce. Quantitative research involving the use of structured questions, where the response options have been Pre-determined and large number of respondents is involved.eg:-total sales of soap industry interms of rupees cores and or quantity interms of lakhs tones for particular year, say 2008,could be researched, compared with past 5 years and then projection for 2009 could be made.

QUALITATIVE RESEARCH.

Qualitative research presents non-qualitative type of analysis. Qualitative research is collecting, analyzing and interpreting data by observing what people do and say. Qualitative research research refers to the meanings, definitions, characteristics, symbols, metaphors, and description of things. Qualitative research is much more subjective and uses very different methods of collecting information,mainly individual, indepth interviews and focus groups. The nature of this type of research is exploratory and open ended. Small number of people are interviewed in depth and or a relatively small number of focus groups are conducted. Qualitative research can be further classified in the following type. I. Phenomenology:-a form of research in which the researcher attempts to understand how one or more individuals experience a phenomenon. Eg:-we might interview 20 victims of bhopal tragedy. II. Ethnography:- this type of research focuses on describing the culture of a group of people. A culture is the shared attributes, values, norms, practices, language, and material things of a group of people. Eg:-the researcher might decide to go and live with the tribal in Andaman island and study the culture and the educational practices. III. Case study:-is a form of qualitative research that is focused on providing a detailed account of one or more cases

Eg:-we may study a classroom that was given a new curriculum for technology use.

IV. Grounded theory:- it is an inductive type of research,based or grounded in the observations of data from which it was developed; it uses a variety of data sources, including quantitative data, review of records, interviews, observation and surveys V. Historical research:-it allows one to discuss past and present events in the context of the present condition, and allows one to reflect and provide possible answers to current issues and problems. Eg:-the lending pattern of business in the 19th century.

In addition to the above, we also have the descriptive research Fundermental research, of which this is based on establishing various theories

Also the research is classified in to 1. Descriptive research 2. Analytical research 3. Fundamental research 4. Conceptual research 5. Empirical research 6. One time research or longitudinal research 7. Field-setting research or laboratory research or simulation research 8. Clinical or diagnostic research 9. Exploratory research 10.Historical research 11.conclusion oriented research

To understand the use of statistics, one needs to know a little bit about experimental design or how a researcher conducts investigations. A little knowledge about methodology will provide us with a place to hang our statistics. In other words, statistics are not numbers that just appear out of nowhere. Rather, the numbers (data) are generated out of research. Statistics are merely a tool to help us answer research questions. As such, an understanding of methodology will facilitate our understanding of basic statistics.

**Validity**

A key concept relevant to a discussion of research methodology is that of validity. When an individual asks, "Is this study valid?", they are questioning the validity of at least one aspect of the study. There are four types of validity that can be discussed in relation to research and statistics. Thus, when discussing the validity of a study, one must be specific as to which type of validity is under discussion. Therefore, the answer to the question asked above might be that the study is valid in relation to one type of validity but invalid in relation to another type of validity.

Each of the four types of validity will be briefly defined and described below. Be aware that this represents a cursory discussion of the concept of validity. Each type of validity has many threats which can pose a problem in a research study. Examples, but not an exhaustive discussion, of threats to each validity will be provided. For a comprehensive discussion of the four types of validity, the threats associated with each type of validity, and additional validity issues see Cook and Campbell (1979).

**Statistical Conclusion Validity:** Unfortunately, without a background in basic statistics, this type of validity is difficult to understand. According to Cook and Campbell (1979), "statistical conclusion validity refers to inferences about whether it is reasonable to presume covariation given a specified alpha level and the obtained variances (p. 41)." Essentially, the question that is being asked is - "Are the variables under study related?" or "Is variable A correlated (does it covary) with Variable B?". If a study has good statistical conclusion validity, we should be relatively certain that the answer to these questions is "yes". Examples of issues or problems that would threaten statistical conclusion validity would be random heterogeneity of the research subjects (the subjects represent a diverse group - this increases statistical error) and small sample size (more difficult to find meaningful relationships with a small number of subjects).

**Internal Validity:** Once it has been determined that the two variables (A & B) are related, the next issue to be determined is one of causality. Does A cause B? If a study is lacking internal validity, one can not make cause and effect statements based on the research; the study would be descriptive but not causal. There are many potential threats to internal validity. For example, if a study has a pretest, an experimental treatment, and a follow-up posttest, history is a threat to internal validity. If a difference is found between the pretest and posttest, it might be due to the experimental treatment but it might also be due to any other event that subjects experienced between the two times of testing (for example, a historical event, a change in weather, etc.).

**Construct Validity:** One is examining the issue of construct validity when one is asking the questions "Am I really measuring the construct that I want to study?" or "Is my study confounded (Am I confusing constructs)?". For example, if I want to know a particular drug (Variable A) will be effective for treating depression (Variable B) , I will need at least one measure of depression. If that measure does not truly reflect depression levels but rather anxiety levels (Confounding Variable X), than my study will be lacking construct validity. Thus, good construct validity means the we will be relatively sure that Construct A is related to Construct B and that this is possibly a causal relationship. Examples of other threats to construct validity include subjects apprehension about being evaluated, hypothesis guessing on the part of subjects, and bias introduced in a study by expectencies on the part of the experimenter.

**External Validity:** External validity addresses the issue of being able to generalize the results of your study to other times, places, and persons. For example, if you conduct a study looking at heart disease in men, can these results be generalized to women? Therefore, one needs to ask the following questions to determine if a threat to the external validity exists: "Would I find these same results with a difference sample?", "Would I get these same results if I conducted my study in a different setting?", and "Would I get these same results if I had conducted this study in the past or if I redo this study in the future?" If I can not answer "yes" to each of these questions, then the external validity of my study is threatened.

**Types of Research Studies**

There are four major classifications of research designs. These include observational research, correlational research, true experiments, and quasi-experiments. Each of these will be discussed further below.

**Observational research:**There are many types of studies which could be defined as observational research including case studies, ethnographic studies, ethological studies, etc. The primary characteristic of each of these types of studies is that phenomena are being observed and recorded. Often times, the studies are qualitative in nature. For example, a psychological case study would entail extensive notes based on observations of and interviews with the client. A detailed report with analysis would be written and reported constituting the study of this individual case. These studies may also be qualitative in nature or include qualitative components in the research. For example, an ethological study of primate behavior in the wild may include measures of behavior durations ie. the amount of time an animal engaged in a specified behavior. This measure of time would be qualitative.

Surveys are often classified as a type of observational research.

**Correlational research:** In general, correlational research examines the covariation of two or more variables. For example, the early research on cigarette smoking examine the covariation of cigarette smoking and a variety of lung diseases. These two variable, smoking and lung disease were found to covary together.

Correlational research can be accomplished by a variety of techniques which include the collection of empirical data. Often times, correlational research is considered type of observational research as nothing is manipulated by the experimenter or individual conducting the research. For example, the early studies on cigarette smoking did not manipulate how many cigarettes were smoked. The researcher only collected the data on the two variables. Nothing was controlled by the researchers.

It is important to not that correlational research is not causal research. In other words, we can not make statements concerning cause and effect on the basis of this type of research. There are two major reasons why we can not make cause and effect statements. First, we donÂ¹t know the direction of the cause. Second, a third variable may be involved of which we are not aware. An example may help clarify these points.

In major clinical depressions, the neurotransmitters serotonin and/or norepinephrine have been found to be depleted (Coppen, 1967; Schildkraut & Kety, 1967). In other words, low levels of these two neurotransmitters have been found to be associated with increased levels of clinical depression. However, while we know that the two variables covary - a relationship exists - we do not know if a causal relationship exists. Thus, it is unclear whether a depletion in serotonin/norepinephrine cause depression or whether depression causes a depletion is neurotransmitter levels. This demonstrates the first problem with correlational research; we don't know the direction of the cause. Second, a third variable has been uncovered which may be affecting both of the variables under study. The number of receptors on the postsynaptic neuron has been found to be increased in depression (Segal, Kuczenski, & Mandell, 1974; Ventulani, Staqarz, Dingell, & Sulser, 1976). Thus, it is possible that the increased number of receptors on the postsynaptic neuron is actually responsible for the relationship between neurotransmitter levels and depression. As you can see from the discussion above, one can not make a simple cause and effect statement concerning neurotransmitter levels and depression based on correlational research. To reiterate, it is inappropriate in correlational research to make statements concerning cause and effect.

Correlational research is often conducted as exploratory or beginning research. Once variables have been identified and defined, experiments are conductable.

**True Experiments:** The true experiment is often thought of as a laboratory study. However, this is not always the case. A true experiment is defined as an experiment conducted where an effort is made to impose control over all other variables except the one under study. It is often easier to impose this sort of control in a laboratory setting. Thus, true experiments have often been erroneously identified as laboratory studies.

To understand the nature of the experiment, we must first define a few terms:

1. Experimental or treatment group - this is the group that receives the experimental treatment, manipulation, or is different from the control group on the variable under study.
2. Control group - this group is used to produce comparisons. The treatment of interest is deliberately withheld or manipulated to provide a baseline performance with which to compare the experimental or treatment group's performance.
3. Independent variable - this is the variable that the experimenter manipulates in a study. It can be any aspect of the environment that is empirically investigated for the purpose of examining its influence on the dependent variable.
4. Dependent variable - the variable that is measured in a study. The experimenter does not control this variable.
5. Random assignment - in a study, each subject has an equal probability of being selected for either the treatment or control group.
6. Double blind - neither the subject nor the experimenter knows whether the subject is in the treatment of the control condition.

Now that we have these terms defined, we can examine further the structure of the true experiment. First, every experiment must have at least two groups: an experimental and a control group. Each group will receive a level of the independent variable. The dependent variable will be measured to determine if the independent variable has an effect. As stated previously, the control group will provide us with a baseline for comparison. All subjects should be randomly assigned to groups, be tested a simultaneously as possible, and the experiment should be conducted double blind. Perhaps an example will help clarify these points.

Wolfer and Visintainer (1975) examined the effects of systematic preparation and support on children who were scheduled for inpatient minor surgery. The hypothesis was that such preparation would reduce the amount of psychological upset and increase the amount of cooperation among thee young patients. Eighty children were selected to participate in the study. Children were randomly assigned to either the treatment or the control condition. During their hospitalization the treatment group received the special program and the control group did not. Care was take such that kids in the treatment and the control groups were not roomed together. Measures that were taken included heart rates before and after blood tests, ease of fluid intake, and self-report anxiety measures. The study demonstrated that the systematic preparation and support reduced the difficulties of being in the hospital for these kids.

Let us examine now the features of the experiment described above. First, there was a treatment and control group. If we had had only the treatment group, we would have no way of knowing whether the reduced anxiety was due to the treatment or the weather, new hospital food, etc. The control group provides us with the basis to make comparisons The independent variable in this study was the presence or absence of the systematic preparation program. The dependent variable consisted of the heart rates, fluid intake, and anxiety measures. The scores on these measures were influenced by and depended on whether the child was in the treatment or control group. The children were randomly assigned to either group. If the "friendly" children had been placed in the treatment group we would have no way of knowing whether they were less anxious and more cooperative because of the treatment or because they were "friendly". In theory, the random assignment should balance the number of "friendly" children between the two groups. The two groups were also tested at about the same time. In other words, one group was not measured during the summer and the other during the winter. By testing the two groups as simultaneously as possible, we can rule out any bias due to time. Finally, the children were unaware that they were participants in an experiment (the parents had agreed to their children's participation in research and the program), thus making the study single blind. If the individuals who were responsible for the dependent measures were also unaware of whether the child was in the treatment or control group, then the experiment would have been double blind.

A special case of the true experiment is the clinical trial. A clinical trial is defined as a carefully designed experiment that seeks to determine the clinical efficacy of a new treatment or drug. The design of a clinical trial is very similar to that of a true experiment. Once again, there are two groups: a treatment group (the group that receives the therapeutic agent) and a control group (the group that receives the placebo). The control group is often called the placebo group. The independent variable in the clinical trial is the level of the therapeutic agent. Once again, subjects are randomly assigned to groups, they are tested simultaneously, and the experiment should be conducted double blind. In other words, neither the patient or the person administering the drug should know whether the patient is receiving the drug or the placebo.

**Quasi-Experiments:**Quasi-experiments are very similar to true experiments but use naturally formed or pre-existing groups. For example, if we wanted to compare young and old subjects on lung capacity, it is impossible to randomly assign subjects to either the young or old group (naturally formed groups). Therefore, this can not be a true experiment. When one has naturally formed groups, the variable under study is a subject variable (in this case - age) as opposed to an independent variable. As such, it also limits the conclusions we can draw from such an research study. If we were to conduct the quasi-experiment, we would find that the older group had less lung capacity as compared to the younger group. We might conclude that old age thus results in less lung capacity. But other variables might also account for this result. It might be that repeated exposure to pollutants as opposed to age has caused the difference in lung capacity. It could also be a generational factor. Perhaps more of the older group smoked in their early years as compared to the younger group due to increased awareness of the hazards of cigarettes. The point is that there are many differences between the groups that we can not control that could account for differences in our dependent measures. Thus, we must be careful concerning making statement of causality with quasi-experimental designs.

Quasi-experiments may result from studying the differences between naturally formed groups (ie. young & old; men & women). However, there are also instances when a researcher designs a study as a traditional experiment only to discover that random assignment to groups is restricted by outside factors. The researcher is forced to divide groups according to some pre-existing criteria. For example, if a corporation wanted to test the effectiveness of a new wellness program, they might decide to implement their program at one site and use a comporable site (no wellness program) as a control. As the employees are not shuffled and randomly assigned to work at each site, the study has pre-existing groups. After a few months of study, the researchers could then see if the wellness site had less absenteeism and lower health costs than the non-wellness site. The results are again restricted due to the quasi-correlational nature of the study. As the study has pre-existing groups, there may be other differences between those groups than just the presence or absence of a wellness program. For example, the wellness program may be in a significantly newer, more attractive building, or the manager from hell may work at the nonwellness program site. Either way, it a difference is found between the two sites it may or may not be due to the presence/absence of the wellness program.

To summarize, quasi-experiments may result from either studying naturally formed groups or use of pre-existing groups. When the study includes naturally formed groups, the variable under study is a subject variable. When a study uses pre-existing groups that are not naturally formed, the variable that is manipulated between the two groups is an independent variable (With the exception of no random assignment, the study looks similar in form to a true experiment). As no random assignment exists in a quasi-experiment, no causal statements can be made based on the results of the study.

**Populations and Samples**

When conducting research, one must often use a sample of the population as opposed to using the entire population. Before we go further into the reasons why, let us first discuss what differentiates between a population and a sample.

A population can be defined as any set of persons/subjects having a common observable characteristic. For example, all individuals who reside in the United States make up a population. Also, all pregnant women make up a population. The characteristics of a population are called a parameter. A statistic can be defined as any subset of the population. The characteristics of a sample are called a statistic.

**Why Sample?**

This brings us to the question of why sample. Why should we not use the population as the focus of study. There are at least four major reasons to sample.

First, it is usually too costly to test the entire population. The United States government spends millions of dollars to conduct the U.S. Census every ten years. While the U.S. government may have that kind of money, most researchers do not.

The second reason to sample is that it may be impossible to test the entire population. For example, let us say that we wanted to test the 5-HIAA (a serotonergic metabolite) levels in the cerebrospinal fluid (CSF) of depressed individuals. There are far too many individuals who do not make it into the mental health system to even be identified as depressed, let alone to test their CSF.

The third reason to sample is that testing the entire population often produces error. Thus, sampling may be more accurate. Perhaps an example will help clarify this point. Say researchers wanted to examine the effectiveness of a new drug on Alzheimer's disease. One dependent variable that could be used is an Activities of Daily Living Checklist. In other words, it is a measure of functioning o a day to day basis. In this experiment, it would make sense to have as few of people rating the patients as possible. If one individual rates the entire sample, there will be some measure of consistency from one patient to the next. If many raters are used, this introduces a source of error. These raters may all use a slightly different criteria for judging Activities of Daily Living. Thus, as in this example, it would be problematic to study an entire population.

The final reason to sample is that testing may be destructive. It makes no sense to lesion the lateral hypothalamus of all rats to determine if it has an effect on food intake. We can get that information from operating on a small sample of rats. Also, you probably would not want to buy a car that had the door slammed five hundred thousand time or had been crash tested. Rather, you probably would want to purchase the car that did not make it into either of those samples.

**Types of Sampling Procedures**

As stated above, a sample consists of a subset of the population. Any member of the defined population can be included in a sample. A theoretical list (an actual list may not exist) of individuals or elements who make up a population is called a sampling frame. There are five major sampling procedures.

The first sampling procedure is **convenience**. Volunteers, members of a class, individuals in the hospital with the specific diagnosis being studied are examples of often used convenience samples. This is by far the most often used sample procedure. It is also by far the most biases sampling procedure as it is not random (not everyone in the population has an equal chance of being selected to participate in the study). Thus, individuals who volunteer to participate in an exersise study may be different that individuals who do not volunteer.

Another form of sampling is the **simple random sample**. In this method, all subject or elements have an equal probability of being selected. There are two major ways of conducting a random sample. The first is to consult a random number table, and the second is to have the computer select a random sample.

A **systematic sample** is conducted by randomly selecting a first case on a list of the population and then proceeding every Nth case until your sample is selected. This is particularly useful if your list of the population is long. For example, if your list was the phone book, it would be easiest to start at perhaps the 17th person, and then select every 50th person from that point on.

**Stratified sampling** makes up the fourth sampling strategy. In a stratified sample, we sample either proportionately or equally to represent various strata or subpopulations. For example if our strata were states we would make sure and sample from each of the fifty states. If our strata were religious affiliation, stratified sampling would ensure sampling from every religious block or grouping. If our strata were gender, we would sample both men and women.

**Cluster sampling** makes up the final sampling procedure. In cluster sampling we take a random sample of strata and then survey every member of the group. For example, if our strata were individuals schools in the St. Louis Public School System, we would randomly select perhaps 20 schools and then test all of the students within those schools.

**Sampling Problems**

There are several potential sampling problems. When designing a study, a sampling procedure is also developed including the potential sampling frame. Several problems may exist within the sampling frame. First, there may be **missing elements** - individuals who should be on your list but for some reason are not on the list. For example, if my population consists of all individuals living in a particular city and I use the phone directory as my sampling frame or list, I will miss individuals with unlisted numbers or who can not afford a phone.

**Foreign elements** make up my second sampling problem. Elements which should not be included in my population and sample appear on my sampling list. Thus, if I were to use property records to create my list of individuals living within a particular city, landlords who live elsewhere would be foreign elements. In this case, renters would be missing elements.

**Duplicates** represent the third sampling problem. These are elements who appear more than once on the sampling frame. For example, if I am a researcher studying patient satisfaction with emergency room care, I may potentially include the same patient more than once in my study. If the patients are completing a patient satisfaction questionnaire, I need to make sure that patients are aware that if they have completed the questionnaire previously, they should not complete it again. If they complete it more that once, their second set of data respresents a duplicate.

**Different Types of Research**Research can be conducted in a number of different ways for many different purposes. Most research conducted today is in the corporate sector, and the reasons for this should be obvious.

[http://uva.ulb.ac.be/cit_courseware/research/images/up.gif](http://uva.ulb.ac.be/cit_courseware/research/chapter6.htm#pagetop) **Survey Research**Developed since the 1930's, survey research seeks to identify what large numbers of people (mass) think or feel about certain things. It is used extensively in politics and marketing (such as TV advertising).

Examples of survey research are

* Public opinion polls
* Mail Surveys
* Telephone Surveys
* Consumer Surveys (in the Mall)

An amazing fact about survey research is that the amount of error (expressed as plus and minus a certain percentage) is determined by the sample size (the number of people surveyed). Most opinion polls use a sample size of around 1500, which has a margin of error of  3%. Using a larger sample size than 1500 gives a slight reduction in the error margin, and using a smaller sample size than 1500 significantly increases the error margin.

Surveys are often considered biased because

* They ask leading questions
* The sample population is biased in a particular way
* The questions were not clear
* The respondents were influenced by the researcher

Increasingly we find the Internet being used to conduct survey research, with the use of opinion polls and questionnaires. This is due to the ease of creating on-line questionnaires and the power of analysing the data in real-time by the use of powerful database servers.

[http://uva.ulb.ac.be/cit_courseware/research/images/up.gif](http://uva.ulb.ac.be/cit_courseware/research/chapter6.htm#pagetop) **Focus Groups**A focus group gathers in-depth information by interviewing six to twelve experts in an informal discussion that lasts one to two hours. An experienced interviewer gathers opinions of the group.

*Benefits of Focus Groups*

* Opinions are canvassed on specific topics
* Immediate feedback or additional questions are possible
* Can help identify key issues quickly

*Problems Using Focus Groups*

* The group can be dominated by a particular person or viewpoint
* Only a limited number of questions can be dealt with
* The interviewer could bias the results

*Typical Uses of Focus Groups*

* Gauging consumer reaction to products (such as the pre-release of a movie or product)
* Understanding why consumers buy or don't buy certain products
* Identifying the use of products and services

[http://uva.ulb.ac.be/cit_courseware/research/images/up.gif](http://uva.ulb.ac.be/cit_courseware/research/chapter6.htm#pagetop) **Case Studies**A case study looks at existing information that is readily available and attempts to draw conclusions from this information. Information has been collected and stored from a wide variety of sources about many issues. Much of this information is readily available in the public domain.

The researcher begins with a number of research questions. For instance, a researcher might want to look at the impact of information technology in South Africa since the overthrow of white rule. The researcher will identify information in the public domain, such as tele-density, number of Internet hosts, and other data. From this information, the researcher will draw qualitative conclusions.

Case studies allow existing information to be reused in new ways that the original collectors of the data did not envisage.

[http://uva.ulb.ac.be/cit_courseware/research/images/up.gif](http://uva.ulb.ac.be/cit_courseware/research/chapter6.htm#pagetop) **Delphi Method**The Delphi method surveys the opinions of "expert panels". The research is conducted in three rounds, where the information is gathered, refined and then feed back to the expert participants. The feedback stage allows issues to be sharpened and helps to highlight the major issues involved.

Round one involves an in-house panel that seeks to identify the research questions for the experts. It also conducts a pre-test of the survey.

The second round involves an examination of the issues by the expert panel. At this stage, additional items are often suggested that may have been overlooked. The panel responses and additional items are combined to the original questionnaire.

In the third round, the panel make judgements on the items. This sometimes takes the form of a multiple-choice questionnaire.

[http://uva.ulb.ac.be/cit_courseware/research/images/up.gif](http://uva.ulb.ac.be/cit_courseware/research/chapter6.htm#pagetop) **Content Analysis**Content analysis is often used in quantitative research to study trends or occurrences of information. During World War II, the allies monitored the number and types of songs played on European radio stations. By comparing the music played on German radio to that of other radio stations in occupied territory, the allies were able to measure the changes in troop concentration on the continent.

Other early uses of content analysis were attempts to verify authorship of documents. Knowing that certain authors chose certain words, many scholars attempted to show that some documents had undergone a process or redaction or rewriting by subsequent editors.

Content analysis is heavily involved in the use of television. A common exercise is to use content analysis to measure the incidences of violence on television or in print.

There are three main characteristics associated with content analysis

* *It is systematic*The content to be analysed is carefully selected, and all content is treated in the same way.
* *It is objective*  
  If another researcher performs the same analysis, the same conclusions should result.
* *It is quantitative*  
  It tries to determine amounts, such as 55% of news items are concerned with domestic violence.

How is content analysis done? Let us consider an exercise. Our research hypothesis is that "More than 75% of leading news items are concerned with violence". This is based on the media assumption that "if it bleeds, it leads". Firstly, we have to define what we mean by violence. Since content analysis of the mass media is a well-established field, there are many sites on the Internet that can assist in providing useful definitions. Let us consider that violence in this research means bodily violence inflicted by one person on another, resulting in injury, hospitalisation or death.

Having decided on what violence means, we then monitor the lead news items over a number of weeks. An adequate sample size must be chosen to eliminate bias, as it is possible that a particular news item could be repeated over several days (for instance, a war could break out). We might decide to select three days a week at random over a period of three to four weeks.

Coders are responsible for coding each story into a violent/non-violent category. There is a form for each day that the coder fills in. These forms are collected at the end of the study and then the results tabulated accordingly.

The coding form shown below is a more comprehensive one for analysing each item of the evening news broadcast. Coders use this form to mark the category of the particular news item under consideration.

Page 3: The importance of Research and Development

Research and Development (R&D) is a key element of many organisations and, when well planned and used, enables a business to generate increased wealth over a period of time.

For a company like Polestar, research involves investigating all the latest technologies that are relevant to the printing industry. Development is the process of trialling and applying relevant technologies. R&D has allowed Polestar to develop its leading position in the printing industry.

For example, as a result of its R&D work, Polestar:

* introduced the first Colour Electronic Page Make Up in the UK (1980/81)
* produced its first Postscript/Desk Top Publishing Magazine in the UK (1991)
* carried out its first 100digital production (1995/96)
* installed its first CTP system in the UK (1997/98).

R&D is essential to keep ahead of the field. For Polestar's business customers to lead their own fields they require excellence from their suppliers in every aspect of their business, including the most attractive images in magazines and brochures, produced as quickly as possible. Their preferred supplier will therefore always be the one that gives them the best products combined with personal service. Digital production means cleaner images reflecting quality and faster production.

Read more: <http://businesscasestudies.co.uk/polestar-group/staying-ahead-embracing-new-technologies-in-a-new-digital-world/the-importance-of-research-and-development.html#ixzz2ub3pHgq0>   
Follow us: [@Thetimes100 on Twitter](http://ec.tynt.com/b/rw?id=c6hoz2Xmer37qbadbi-bnq&u=Thetimes100) | [thetimes100casestudies on Facebook](http://ec.tynt.com/b/rf?id=c6hoz2Xmer37qbadbi-bnq&u=thetimes100casestudies)