# Research Methods

**Research methods** are ways of collecting and analyzing data. Common methods include **surveys**, **experiments**, **interviews**, **observations**, **comparison** and **conclusion**.

## Introduction

## Meaning of Research / What Is Research?

Research in simple terms refers to search for knowledge. It is a scientific and systematic search for information on a particular topic or issue. It is also known as the art of scientific investigation. Several **social scientists** have **defined research in different ways**. In **the *Encyclopedia of Social Sciences*, D. Slesinger and M. Stephension** (**1930**) defined research as **"the manipulation of things, concepts or symbols for the purpose of generalizing to extend, correct or verify knowledge, whether that knowledge aids in the construction of theory or in the practice of an art".**

According to **Redman** and **Mory** (1923), research is a **"systematized effort to gain new knowledge"**. It is an academic activity and therefore the term should be used in a technical sense.

According to Clifford Woody (Kothari, 1988), **research comprises**:

1-**Defining and redefining problems.**

**2-Formulating hypotheses or suggested solutions.**

**3- Collecting, organizing and evaluating data.**

**4- Making deductions and reaching conclusions.**

**5- Finally, carefully testing the conclusions to determine whether they fit the formulated hypotheses.**

Thus, research is **an original addition** to the available knowledge, which contributes to its further advancement. It is an attempt to **pursue truth through**:

1- The methods of study.
2- Observation.

3- Comparison.
4- Experiment.

In sum, research is the search for knowledge, using objective and systematic methods to find solution to a problem.

**Webster's Third International Dictionary of the English Language defines research as "studious inquiry or examination, especially critical and exhaustive investigation or experimentation, having for its aim the discovery of new facts, and their correct interpretation, the revision of accepted conclusions, theories, or laws in the light of newly discovered facts, or practical applications of new or revised conclusions, theories, or laws".**

**Ranganathan** (2015) describes research to represent **a critical and exhaustive investigation to discover new facts, to interpret them in the light of known ideas, theories and laws, to revive the current laws and theories in the light of the newly discovered facts to apply the conclusion to practical purpose** (ANUPAMA SAINI, 2017) The substance of all these samples of definitions of research can be broadly summed up.

**To restate**, the substantive phrases that stand out in all these definitions of research are **that research is an activity as characterized below:**

• An intellectual activity of a high order;

• An investigation of a phenomenon, event or activity;

• Aims to discover data and facts and their interpretations;

• **To arrive at conclusions** to formulate new theories and laws or revise the
already established theories and laws;

• **To communicate** the results for peer review; and

• **To be accepted** or **rejected** before adding this new knowledge to the already existing general pool of knowledge (ANUPAMA SAINI, 2017)

# Principles of research ethics

There are a number of ethical principles that should be taken into account when performing undergraduate and master's level dissertation research. At the core, these ethical principles stress the need to (a) do good (known as beneficence) and (b) **do no harm** (known as **non-malfeasance**). In practice, these ethical principles mean that as a researcher, you need to: (a) **obtain informed consent** from potential research participants; (b) **minimize the risk of harm** to participants; (c) **protect their anonymity** and **confidentiality**; (d) **avoid using deceptive practices;** and (e) **give participants the right to withdraw from research.** This article discusses these five ethical principles and their practical implications when carrying out dissertation research.

Broadly speaking, your dissertation research **should not only aim to do well** (i.e., **beneficence**), but also **avoid** doing any harm (i.e., **non-malfeasance**). Whilst ethical requirements in research can vary **across countries,** these are the basic principles of research ethics. This is important not only for ethical reasons, but also practical ones, since a failure to meet such basic principles may lead to your research being (a) **criticised, potentially leading to a lower mark**, and/or (b) **rejected by your supervisor or Ethics Committee**, costing you valuable time.

- **PRINCIPLE ONE: Minimising the risk of harm**
- **PRINCIPLE TWO: Obtaining informed consent**
- **PRINCIPLE THREE: Protecting anonymity and confidentiality**
- **PRINCIPLE FOUR: Avoiding deceptive practices**
- **PRINCIPLE FIVE: Providing the right to withdraw**

## PRINCIPLE ONE

## Minimising the risk of harm

Dissertation research **should not harm participants**. Where there is the possibility that participants could be harmed or put in **a position of discomfort**, there must be **strong justifications** for this. Such scenarios will also require (a) **additional planning** to illustrate how participant harm (or discomfort) will be reduced, (b) **informed consent**, and (c) **detailed debriefing**.

There are a number of types of harm that participants can be subjected to. **These include:**

- **Physical harm to participants.**
- **Psychological distress and discomfort.**
- **Social disadvantage.**
- **Harm to participants, financial status.**
- **An invasion of participants, Privacy and anonymity**.

**In order to minimising the risk of harm, you should think about:**

- Obtaining informed consent from participants.
- Protecting the anonymity and confidentiality of participants.
- Avoiding deceptive practices when designing your research.
- Providing participants with the right to withdraw from your research at any time.

## PRINCIPLE TWO
## Obtaining informed consent

One of the foundations of research ethics is the idea of informed consent. Simply put, informed consent means that participants should understand that (a) they are taking part in research and (b) what the research requires of them. **Such information may:**

1- Include the purpose of the research.

2- The methods being used.
3- The possible outcomes of the research.
4- As well as associated demands.
5- Discomforts.
6- Inconveniences.
7- In addition, risks that the participants may face. Whilst is it not possible to know exactly what information a potential participant would (or would not) want to know, you should aim not to leave out any material information; that is, information that you feel would influence whether consent would (or would not) be granted.

## PRINCIPLE THREE
## Protecting anonymity and confidentiality

Protecting the anonymity and confidentiality of research participants is another practical component of research ethics. This occurs when data is not treated confidentially, whether in terms of the storage of data, its analysis, or during the publication process (i.e., when submitting your dissertation to be marked). However, this does not mean that all data collected from research participants needs to be kept confidential or anonymous. It may be possible to **disclose the identity** and **views** of **individuals** at various stages of the **research process** (from data collection through to publication of your **dissertation**). Nonetheless, **permissions** should be **sought** before such confidential information is **disclosed**.

An alternative is to remove identifiers (e.g., vernacular terms, names, geographical cues, etc.) or provide **proxies** when writing up. However, such a **stripping** of identifiable information may not always be possible to anticipate at the outset of your dissertation when thinking about issues of research ethics. This is not only a consideration for dissertations following a qualitative research design, but also a quantitative research design.

There are also wide ranges of **potential legal protections** that may affect what research you can and cannot perform, how you must treated the data of research participants, and so forth. In other words, you do not simply

have a duty to protect the data you collect from participants; you may also have (in some cases) a legal responsibility to do so**. Since this varies from country-to-country, you should ask your dissertation supervisor or Ethics Committee for advice (or a legal professional).**

## PRINCIPLE FOUR
## Avoiding deceptive practices

**At first sight, deceptive practices fly in the face of informed consent**. After all, how can participants know (a) that they are **taking part in research** and (b) **what the research requires of them** if they are being **deceived**? This is part of what makes the use of deceptive practices controversial. For this reason, in most circumstances, dissertation research should avoid any kinds of deceptive practices. However, this is not always the case.

Deception is sometimes a necessary component of covert research, which can be **justified** in some cases. **Covert research** reflects research where (a) the identity of the observer and/or (b) the purpose of the research is not known to participants. Cases where you may choose to engage in **covert research may include instances where:**

- **It is not feasible** to let everyone in a particular research setting know what you are doing.
- **Overt observation** or knowledge of the purpose of the research may **alter** the particular phenomenon that is being studied.

**Let's take each of these in turn:**

It is *not **feasible*** to let everyone in a particular research setting know what you are doing

By feasibility, we are not talking about the cost of doing research. Instead, we mean that it is not practically possible to let everyone in a particular research setting know what you are doing. This is most likely to be the case where research involves observation, rather than direct contact with

participants, especially in a public or online setting. There are a number of obvious instances where this may be the case:

- Observing what users are doing in an Internet chat room.
- Observing individuals going about their business (e.g., shopping, going to work, etc.).

Clearly, in these cases, where individuals are coming and going, it may simply be impossible to let everyone known what you are doing. You may not be intentionally trying to engage in deceptive practices, but clearly participants are not giving you their informed consent.

Overt observation or knowledge of the purpose of the research may ***alter*** the particular phenomenon that is being studied

Whilst such **covert research** and **deceptive practices**, especially where used **intentionally**, can be viewed as **controversial**, it can be **argued** that they have a place in research.

## PRINCIPLE FIVE
## providing the right to withdraw

With the exception of those instances of **covert observation** where is not feasible to let everyone that is being observed know what you are doing, research participants should always have the right to withdraw from the research process. **Furthermore, participants should have the right to withdraw at any stage in the research process**. When a participant chooses to withdraw from the research process, they should not be **pressured** or **coerced** in any way to try to **stop them from withdrawing**.

If your supervisor and/or **Ethics Committee** expect you to complete an **Ethics Consent Form**, it is likely that you will have to let participants know that they have the right to withdraw at any time [see the article: **Ethics consent form**].

**Alternatively, principles of research ethics goes, through the following steps:**

**Research ethics are based on three fundamental principles:**

**1. Respect for Persons**

This principle incorporates two elements that deal with respecting people in regard to research:

***People should be treated as autonomous***

The term autonomous means that a person can make his or her own decisions about what to do and what to agree to.
Researchers must respect that individuals should make their own informed decisions about whether to participate in research. In order to treat people as autonomous, individuals must be provided with complete information about a study and decide on their own whether to enroll.

***People with diminished autonomy should be protected***

Some people in society may not have the capacity to make fully informed decisions about what they do or what happens to them. This could include young children, people who are very ill, or those with mental disabilities. In such cases, these people should be protected and only be included in research under specific circumstances, since they cannot make a true informed decision on their own.

**2. Beneficence**

The definition of beneficence is action that is done for the benefit of others. This principle states that research should:

***Do no harm***

The purpose of health research is to discover new information that would be helpful to society. The purpose of research should never be to hurt anyone or find out information at the expense of other people.

***Maximize benefits for participants and minimize risks for participants***

The purpose of much research involving humans is to show whether a drug is safe and effective. This means participants may be exposed to some harms or risks. Researchers are obligated to do their best to minimize those possible risks and to maximize the benefits for participants.

**3. Justice**

This principle deals with the concept of fairness. Researchers designing trials should consider what is fair in terms of recruitment of participants and choice of location to conduct a trial. This encompasses issues related to who benefits from research and who bears the risks of research. It provides the framework for thinking about these decisions in ways that are fair and equitable.

People who are included in research should not be included merely because they are a population that is easy to access, available, or perhaps vulnerable and less able to decline participating.

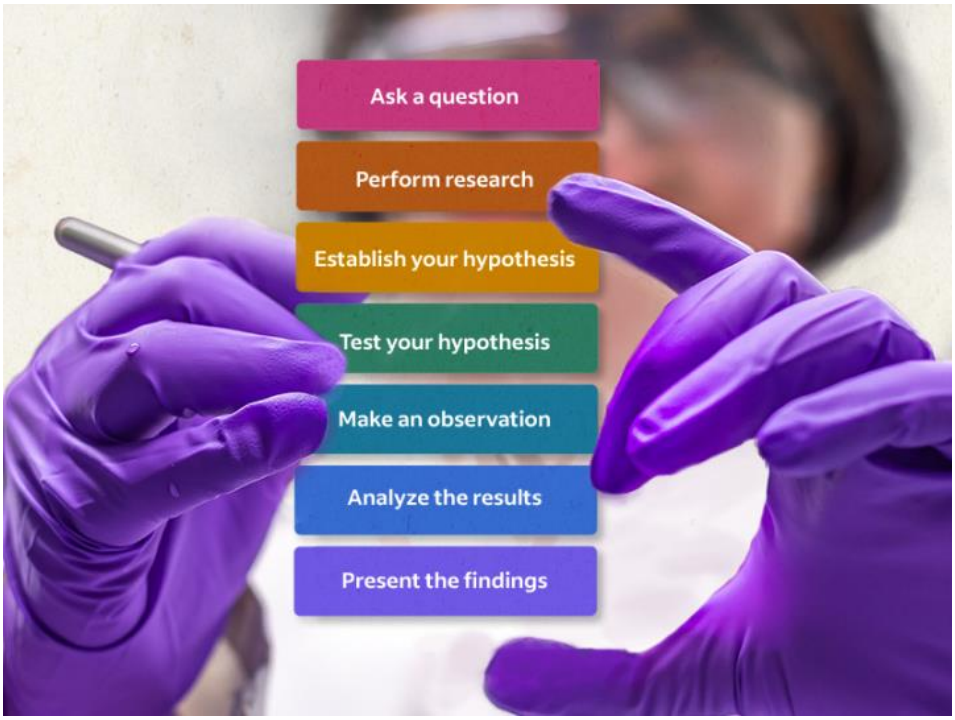
An experimental strategy that is likely to be used by many types of people should be tested in the very populations of people who are likely to use it, to ensure that it is safe, effective, and acceptable for all of the potential users. For example, experimental treatments that are intended for use in the general population must be studied not only on men, but on enough women to ensure that they are also safe and effective for women.

The principle of justice also indicates that questions being asked in trials should be of relevance to the communities participating in the study.

# Scientific Method of Research

The scientific method is a process used when conducting experiments and exploring observations. Some areas of science rely more heavily on this method to answer questions, as they are more easily tested than other areas. The goal of this method is to discover the relationships between cause and effect in various situations and applications.

When following the scientific method, scientists must ask questions, gather and look at the evidence and determine whether the answers to their questions can be found through that evidence. Scientists also use the method to determine whether all information presented and found can combine to create a logical answer. The scientific method provides a way to apply logical and rational problem-solving methods to scientific questions.



## The seven steps of the scientific method

Based on the type of question being asked, the type of science being applied and the laws that apply to that particular branch of science, you may need to modify the method and alter or remove one or several of the steps. Here are the seven steps of the scientific method illustrated by an example scientific hypothesis:

## 1. Ask a question

The first step in the scientific method is asking a question that you want to answer. This question will include one of the key starters, which are how, what when, why, where, who or which. The question you ask should also be measurable and answerable through experimentation. It is often something that can be measured with a numerical result, although behavioral results are part of the scientific method as well.

**Example:** Perhaps, you want to test an experiment about the causal relationship between music and certain domesticated animals.

A good question to begin with might be:"*Does music impact the behavior of certain species of domesticated animals, such as canines and felines?"*

## 2. Perform research

With your question formulated, conduct preliminary background research to prepare yourself for the experiment. You can find information through online searches or in your local library, depending on the question you are asking and the nature of the background data. You may also find previous studies and experiments that can help with your process and conclusions.

In this case, you might start by reviewing previous scientific studies for animal experiments related to their reactions to music. Key to finding pertinent information might be looking at studies about animal behavior concerning art or domestic animals directly affected by music.

## 3. Establish your hypothesis

A hypothesis is an educated guess that seeks to answer a question that can be systematically tested. Your hypothesis should also include your predictions that you can measure through experimentation and research.

**Example:** *Based on your research, you start to fine-tune your thoughts about what will probably happen: "If I play classical music, my dog and cat will remain in the room with me. If I play rock-and-roll music, my dog and cat will leave the room."*

## 4. Test your hypothesis by conducting an experiment

Next, test your hypothesis by experimenting. Your experiment is a way to quantifiably test your predictions and should be able to be repeated by another scientist.

**Example:** *You decide to test it out: You bring the cat and dog into the same room where a sound system is available. You play classical music at a low volume. Both animals remain in the room. Then, you change scientist the music to rock-and-roll at the same volume. Both animals remain in the room.*

## 5. Make an observation

Assess your scientific process and make sure that the conditions remain the same throughout all testing measures. If you change any factors in your experiment, keep all others the same to maintain fairness. After you complete the experiment, repeat it a few more times to make sure the results are accurate.

**Example:** *In reviewing the cause and effect of your experiment, you observe that despite what you had thought would happen, did not. More specifically, the type of music being played did not impact the reaction of the animals.*

*Therefore, you adjust your hypothesis to state that the animals will react based on the volume of the music. You conduct another experiment, playing classical music at a low volume and then at a high volume. The animals*

*remain in the room when the music is quiet and leave the room when the music is loud.*

## 6. Analyze the results and draw a conclusion

You can now take your experiment findings and analyze them to determine if they support your hypothesis.

Drawing a conclusion means determining whether what you believed would happen did happen. If it did not happen, you can create a new hypothesis and return to step four, and conduct a new experiment to prove your new theory. If what you hypothesized happened during the experimentation phase, the final step is putting together your findings and presenting them to others.

**Example:** *You determine the behavior of animals is more affected by the volume of music being played rather than the type of music played.*

## 7. Present the findings

The method for presenting your findings depends on your scientific position and level. If you are entering a project into the science fair, you will likely communicate your findings in a written report, on a display board or during a presentation at the event. If you are a scientist by profession, you may present your findings in a scientific publication or to your supervisors.

## Research Methods versus Methodology:

Research methods include all those techniques/methods that are adopted for conducting research. Thus, research techniques or methods are the methods that the researchers adopt for conducting the research studies.on the other hand, research methodology is the way in which research problems are solved systematically. It is a science of studying how research is conducted scientifically. Under it, the researcher acquaints himself/herself with the various steps generally adopted to study a research

problem, along with the underlying logic behind them. Hence, it is not only important for the researcher to know the research techniques/ methods, but also the scientific approach called methodology.

## Objectives of Research:

The objective of research is to find answers to the questions by applying scientific procedures. In other words, the main aim of research is to find out the truth which is hidden and has not yet been discovered. Although every research study has its own specific objectives, the research objectives may be broadly grouped **as follows**:

1. To gain familiarity with new insights into a phenomenon (i.e., formulative research studies).
2. To accurately portray the characteristics of a particular individual, group, or a situation (i.e., descriptive research studies).
3. To analyse the frequency with which something occurs (i.e., diagnostic research studies).
4. To examine the hypothesis of a causal relationship between two variables (i.e., hypothesis-testing research studies).

- ## Research Approaches:

There are two main approaches to research, namely quantitative approach and qualitative approach. The quantitative approach involves the collection of quantitative data, which are put to rigorous quantitative analysis in a formal and rigid manner. This approach further includes experimental, inferential, and simulation approaches to research. Meanwhile, the qualitative approach uses the method of subjective assessment of opinions, behaviour and attitudes. Research in such a situation is a function of the researcher's impressions and insights. The results generated by this type of research are either in non-quantitative form or in the form which cannot be put to rigorous quantitative analysis. Usually, this approach uses techniques like indepth interviews, focus group interviews, and projective techniques.

## What is Research Design?

At the start of the research, a researcher usually chooses the techniques and methodologies they will use for the research process. **The framework of research techniques and tools is called research design**. It is imperative to have a well-designed and structured research design to ensure the research reaches its goal.

Interestingly, **experts** define **research design as the glue that holds the research project together.** Moreover, they exclaim that the right research design helps provide a structure and direction to the research that yields favourable results. Also believed to be the **blueprint of the research**, a research design has **several elements**, which will be discussed in bellow.

## What Are the Main Elements of Research Design?

Research is a systematic investigation of discovering new knowledge or contributing to generalized knowledge. It follows a unique structure that is prescribed in the research design. So, to yield success from research, it is imperative to include elements that help solve the problem quickly. Here are some of the elements of good research design that incite **great results**:

- **Purpose statement**
- **Data collection methods**
- **Techniques of research data analysis**
- **Types of research methodologies**
- **Challenges of the research**
- **Prerequisites required for research study**
- **The right time for the research study**
- **Measurement of analysis**

After you had known the elements of good research design, let us discuss the important characteristics of research design. Like, the elements, understanding the unique characteristics of research design helps add value to the research.

## What Are the Characteristics of Research Design?

Here are the top characteristics of a research design:

### • Reliability

Different types of research are conducted regularly. In such research, the researcher expects the research design to formulate questions that evoke similar results every time. In addition, a good research design is reliable to satiate the researcher's needs to generate the same results every time.

### • Validity

There are many ways to measure the results of research. However, with the help of a good research design, a researcher can select the right measuring tools that help in gauging the research results and align them with the research objectives to measure its success or failure. Therefore, the research design's measuring tools must be valid and reliable enough to generate favourable results.

### • Generalized

A good research design draws an outcome that can be applied to a large set of people and is not limited to sample size or the research group**. The more applicable the research results are, the more the chances of it being accurate.** Therefore, a good research design helps prove the research's relevance and accuracy.

### • Neutrality

At the start of every research, a researcher needs to make some assumptions that will be tested throughout the research. A proper research design ensures that the assumptions are **free of bias and neutral**. Furthermore, the data collected throughout the research is based on the assumptions made at the beginning of the research.

## What Are the Different Types of Research Design?

**A researcher must be well versed in different types of research design**. Moreover, a clear understanding of different research design types helps choose the right technique that incites favorable outcomes. Research design is broadly divided into quantitative and qualitative research design.

### • Quantitative research design

Quantitative research design aims at finding answers to **who, what, where, how,** and **when** through the course of research. Moreover, the outcome of the quantitative research is easy to represent in the form of statistics, graphs, charts, and numbers.

### • Qualitative research design

Qualitative research design aims at answering the **how** and **why**. It uses **open-ended questions** and helps the subjects express their views clearly. Qualitative research is ideal for businesses that aim to understand customers' behavior and requirements.

## A Detailed Guide to Five Common Types of Research Design

### 1. Experimental design

The experimental design aims to look at a problem scientifically; that is why it tries to establish a clear cause and effect of any event occurring in the research realm. Moreover, the research design tries to understand the impact of the independent variable on the dependable variable. As a result, this research is used to solve issues that try to analyze **independent variables** and their effect on **dependable variables** or **vice-versa**.

## What Is a Dependent Variable?

It does not matter whether you are conducting a sociology survey or doing an experiment in a lab. Dependent and independent variables have the

same role in any sort of study. In the simplest terms, **an independent variable is the *cause*, and the dependent variable is the *effect***. However, it can be hard to figure out which is which when you are looking at any sort of study or **experiment**.

## What Is the Difference Between an Independent Variable and a Dependent Variable?

**If you are conducting an experiment, the independent variable is the condition or factor you manipulate to see an effect. The dependent variable is the outcome of the manipulation.**

**For example**, if you are measuring how the amount of sunlight affects the growth of a type of plant, the independent variable is the amount of sunlight. You can control how much sunlight each plant gets. The growth is the dependent variable. It is the effect of the amount of sunlight.
In some types of research, it is not possible to manipulate a factor, so the researchers must determine the independent variable they are studying in order to measure outcomes. If you are conducting a study like this, you must ask which variable affects the other variables. The one that has an effect is the independent variable, and the effects are the dependent variables.

**For example**, you might be curious if a person's level of education affects their health later in life. The level of education is the independent variable. Their healthiness is the dependent variable. Of course, these types of studies often have more than one independent variable. It is important to account for other factors that can influence your dependent variable.

## How Do You Identify the Dependent Variable?

Dependent variables might also be referred to as the outcome variable or the response variable. Look for the outcome or the effect. That is your dependent variable. However, with some studies, it might not be so simple, especially when there are many other variables at play. Returning to our education and health example, other factors that affect health can include genetics, socioeconomic status, geographic location, and more.

To identify the dependent variable in a study, ask yourself which factor is an effect of the other factors. **A dependent variable *depends* on the independent variables.**

## What Is the Dependent Variable in an Experiment?

Scientific experiments rely on different variables. Here are a couple of hypothetical examples.

**A group of doctors wants to study how stress affects heart rate.** They design an experiment to test the **heart rates** of different individuals in different situations. They show stressful images to some groups and do increasingly difficult physical tasks for other groups. In this situation, they are manipulating **stress** level, which makes ***stress*** the independent variable. The dependent variable would be ***heart rate*** because it results from stress.

**A dog food company promises that their food will increase dental health.** A group of veterinarians decides to test this claim. They look at the **dog food** that their patients eat and document their dental health over a few years, only to find no evidence to support the brand's claim. The ***dog food*** is the variable that is easy to manipulate, so it is the independent variable. ***Dental health*** is the dependent variable.

## What Is the Dependent Variable in Other Types of Studies?

Sometimes research is not an experiment. It is measuring observations. Let us look at some examples. These are all hypothetical studies.

**A city wanted to decrease the high amount of motor vehicle accidents each year.** They examined the data from all of these crashes and found that the areas with more access to public transportation had fewer crashes. Areas that did not have good access to public transit had more vehicle accidents. In this case, crashes are a result of differential access to public transit, which makes the ***number of accidents*** the dependent variable. ***Access to public transit*** is the independent variable.

**Sociologists want to know how the minimum wage can affect rates of non-violent crime.** They study rates of crime in areas with different **minimum wages**. They also compare the **crime rates** to previous years when the minimum wage was lower. The ***minimum wage*** is the variable that is affecting crime rates, so it is the independent variable. ***Crime rates*** are the dependent variable.

## Basic Principles of Experimental Design:

- **Principle of replication**
- **Principle of randomization**
- **Principle of local control**

## Types of Experimental Design:

- **Pre-experimental**
- **True experimental**
- **Quasi experimental**

### 2. Correlational design

Correlation research design establishes a relationship between **two related variables**. Over time, the researcher observes the variables and then draws conclusions based on them. As a result, this type of research design requires two types of variables to function to draw favorable results.

### 3. Descriptive design

Descriptive research design is a hypothesis-based method that defines the primary subject matter of the research and tries to analyze it using different assumptions and techniques. This type of research design uses data collection techniques like natural observation, case studies, and surveys to derive results.

### 4. Diagnostic design

Diagnostic research design examines the elements posing challenges to businesses and customers. The methodology strives to explore the reason behind an issue and find solutions to solve it. Furthermore, this research design tries to solve issues in a structured form that follows **three phases- inception, diagnostic,** and **solution**.

## 5. Explanatory design

In this research design, the researcher explores innovative business concepts and ideas with the help of different scientific tools and techniques. This research design is ideal for a business's research and development department because it offers innovative and creative ideas to solve a business problem.

Design used for research where no design study is done before. Later investigation can be best understood to get knowledge through this design. The study used for explanation whether future study is possible or not and data can be used for further development for more research.

Moreover, it can be used in companies trying to wrap their heads around design research and analytical processes and their uses in the current business milieu.

## There are other designs:

**Longitudinal design.**

**Cross-sectional design.**

**Action research design.**

**Cohort research design.**

**Causal design…etc.**

# Research Process

Is a process of steps used to collect and analyze information to increase our understanding of a topic or issue"?

## Steps of the Research Process:

### The Seven Steps of the Research Process

Research, as a tool for progress, satisfies mankind's curiosity to lots of questions. Whether you are a high school or college student, you have to take research subject for you to be able to receive your diploma. To ease your burden in doing research, here are the seven steps in the research process:

## 1. Identification of a research problem

A good research always starts with a good problem. You can observe people or things, visit places, read print materials, or consult experts to find the research problem that is right for you. The research problem guides you in formulating the hypothesis and interpretation of your findings so that you can formulate the right conclusion. A good research problem is important because it is the basis of all subsequent research activities you are going to undertake. Factors like area of interest, availability of fund, socio-economic significance of the study, and the safety measures to be undertaken should be considered in finding a good research problem.

## 2. Formulation of Hypothesis

After finding your research problem, the next step is to formulate your own hypothesis. A hypothesis is a theoretical statement in solving a logical relationship between variables. Do not be afraid if your hypothesis proves to be incorrect after the experimentation because it is only considered as an educated guess. Always remember that when you formulate a hypothesis, it should be based on the research problem being solved.

## 3. **Review of Related Literature**

A research problem is vague at first. To give you a vivid picture of the whole research, you shall read various publications or surf the internet to become aware of the previous works already done. In doing so, it could spur an idea that can be the subject of your investigation. The review of related literature can be taken from science books, magazines, journals, newspapers, or even in the internet.

## 4. **Preparation of Research Design**

A research design is the blueprint of the research you are going to undertake. It serves as the work plan of the whole study not only because it entails the resources needed in conducting the research but also the ways these resources are utilized.

## 5. **Actual experimentation**

Actual experimentation is an implementation of the research design. In actual experimentation, you have to conduct an experiment to prove the validity of the hypothesis you have formulated. Actual experimentation includes the methodology that you have followed in doing your research. The methodology should be carefully planned prior to the actual experimentation to ensure the validity and accuracy of the result.

## 6. **Results and Discussion**

This is the heart of the research process because this is part where the findings of the research can be found. You can use table (not the table in your kitchen) and graph to interpret the results of your research.

## 7. Formulation of Conclusions and Recommendations

Conclusion is a statement where you will present the solution to the proposed problem based on the findings of the investigation. They are tied up to the questions investigated. Your conclusion will show whether your experiment worked. It should answer your hypothesis and research problem. In your concluding statement you can also infer on the possible benefits to society that your results might present. You can state any plans you might have to continue working on other aspects related to your area of study. **We must remember that recommendations are based on conclusions and conclusions are based on findings**.

Conducting research is a tiresome task because it is a year-round activity. You have to be committed to become successful in making a good research which would benefit not only you but of everyone. The willingness in you in making future researches should always be there because doing research without your '**heart'** and '**mind'** on it is **a burden** on your part. Always enjoy doing it. **Enjoy the ride**. The more that you enjoy doing the task, the more that you ease the burden in conducting this difficult endeavor. Never hesitate to ask questions. Asking questions from other people who is aware of your research topic would help you **arrive** at the **correct conclusions**. Now that you have finally learned the steps in the research process, you can now **start doing one**. **Good luck**!

## OR through the following steps:

**Step 1: Choose your topic**

**Step 2: Identify a problem**

**Step 3: Formulate research questions**

**Step 4: Create a research design**

**Step 5: Write a research proposal**

# Types of Research:

The research carried out for new idea generation, new facts and fundamental principle for human knowledge. Based on experimentation and observation by following rigorous standards and methodologies to meet specific objective and ensure credibility of conclusions of research published into pre- reviewed journals.

## 1- Pure Research or Basic Research:

• Basic Research is also known as '**fundamental'** or 'pure' research. Basic research studies phenomena to get a fuller understanding of it. This is essentially to obtain knowledge of a natural phenomenon whose applications may or may not have any bearing on any application in the immediate future or even after a long time. Hence, it is **fundamental** in nature.

• Generally, this type of research demands a **very high order of intellectual caliber** as well as **intuition**. Those who are involved in basic research devote their efforts to the **formulation** or **reformulation** of theories and may not be concerned at all with their practical application.

•The knowledge obtained thus expands the theoretical base of a subject.

• **Generally, basic research** is conducted by intellectuals at academic institutions who are specially commissioned for this purpose. E.g. **Research Institute or University**.

## 2- Applied Research:

• Applied research on the other hand, is to **acquire knowledge** on the **practical application** of the theoretical base already built up which is expected to solve a critical problem.

• Applied Research is usually conducted for **industries** or **governments** by **universities** or by **specialized research laboratories** or **institutions** or **consultants**.

• Applied Research is always for development purposes. It is generally referred to as **Research** and **Development** (**R& D**).

• Hence, applied research is designed to **solve** practical problems of the **modern world**, rather than to acquire **knowledge** for **knowledge's sake**. One might say that the goal of the applied **scientist** is to improve the human condition.

• Some **scientists** feel that the time has come for a shift in emphasis away from purely basic research and toward applied science. This trend, they feel, is necessitated by the problems resulting from **global overpopulation**, **pollution**, and the **overuse** of the **earth's natural resource**.

• **Applied Research** is carried on to find solution to a real life problem requiring an action or policy decision. It is thus problem oriented and action directed. It has an immediate and practical use. There is a vast scope for applied research in the field of **Technology, Management, Commerce, Economics, Engineering**, and other **Social Sciences**.

• **Applied research** can contribute new facts:-

1- It can put theory to the test.
2- It may aid in conceptual clarification.
3- It may integrate previously existing theories.

Example of **Applied Research**: **Market research** carried on for **developing** a new **market** or **product**.

- Most of the research in the social sciences is applied research. In other words the research **techniques**, **procedures**, and **methods** that form the body of research **methodology** are applied to collection of information about various aspects of a **situation**, issue, event, activity, , **program**, **actions**, **problem** or **phenomena** so that information gathered can be used to find the solution-such as **policy formulation**, administration and **enhancement** of understanding of a **phenomena** or **design** an **intervention** to prevent further harm.
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## Characteristics of Applied Research

1. Applied research is solution-specific and addresses practical questions.

2. It involves collection and analysis of data to examine the usefulness of theory in solving practical **educational problems**.

3. It can be **explanatory** but usually **descriptive**.

4. It involves precise measurement of the characteristics and describes relationships between **variables** of a studies phenomenon.

## Examples of applied research

- **Improve agricultural crop production.**
- **Treat or cure a specific disease.**
- **Improve the energy efficiency of homes, offices, or modes of transportation.**
- **To diagnose the very low use of a certain collection in a library.**
- **To investigate the causes of poor solid waste management.**
- **Investigating which treatment approach is the most effective for reducing anxiety.**

## Action Research

"Action research is focused on the **immediate application** and not the **development** of **theory**. It has placed its emphasis on a **real problem** in a **local setting**. Its findings are to be evaluated in terms of local applicability, not in terms of universal validity."

**Action research is an extension of applied research**. It has its origin in the works of the social psychologist**.**

### 3- Qualitative Research:

Qualitative research refers to much more subjective non- quantitative, use different methods of **collecting data, analyzing data, interpreting data** for meanings, definitions, characteristics, symbols metaphors of things. Qualitative research is concerned with finding the answers to questions, which begin with **why? How? In what way**?

### 4- Quantitative Research:

Quantitative research aim to measure **numeric** figures, **quantity**, **amounts**, used extensively in field of **economics** and **commerce**. Quantitative research refers as systematic empirical investigation of phenomena quantitative data and their relationship. Quantitative research is more concerned with questions about**: how much? How many? How often? To what extent**? etc.

### 5- Descriptive Research:

The research which is determines "**the way things are**". The descriptive research may include **behavior observation research**, you can observe a lot by watching and survey research.

**Types of Descriptive Research:**

- Observational Method.
- Survey Method.
- Case Study Method.

**a. Observation Method**: This is type of correlation research which adopt researcher observes ongoing behavior. **There may be 3 types of approach** for observational researches are **covert observation**, **overt observation** and **research participation**.

**b. Survey Method**: The brief interview or discussion with some person about relevant topic. It is used to take opinion, thought and feelings. In this predetermined set of question should give to the indulging of population interest towards.

**c. Case Study Method**: These studies are related to **analysis of events, periods, persons, decisions, policies, and institutions studied by one or more methods.** Study is conducted on the basis of inquiry of subject instance of class of phenomena that provides an analytical frame.

## 6- Analytical Research:

It is related with carrying analysis on certain phenomenon with the help of analytical tools. **Analytical research** used already available facts and information; analyze them to make critical evaluation.

### Type of Analytical Research:

**a. Reviews**: The search involves meta- analysis of quantitative methods of review. It also relates with making formal assessment of various research with intension of making any useful change or conclusion if necessary.

**b. Historical Research**: It is a systematic collection and evaluation of data to explain, understand events, action and describe that occurred in past. Historical research source material may include documents, numerical records, oral statements and records. Main aim of historical research to find critical search for **truth** to conceptualize, **histories** and **contextualize** to explain there is no agreed definition of what time period constituted on temporary history has existed or can exist.

**c. Philosophical Research**: This research is related to the theoretical bases of branch of experience and knowledge which is fundamental in nature of reality, knowledge and existence.

**d. Research Synthesis**: To summarizing the facts related with particular question, two or more research studies are assessed.

### Techniques of Survey Research are:

- Questionnaires.
- Interviews.
- Survey.

**e. Grounded Theory**: Grounded theory out of many discoveries or construction theories and their data obtained systematically with the

help of comparative analysis. The methodology after revision should be more flexible and widely adopted to assume reality of external world. This may include qualitative data, interviews, and review of records, surveys and observations.

These research place priorities on study phenomenon over method of study, the researcher role are important in creating categories and interpreting data beside strategies as tools or prescriptions.

### 7- Fundamental Research:

It increases scientific knowledge of researcher and has no planned or immediate uses, their results may be useful in future.

**Benefits of Fundamental Research:**

- Economical gaining
- Benefits to society
- New knowledge acquisition

### 8- Conceptual Research:

The research is conducted on the basis of already present information and observation on given topic. It can be used in developing theories or new interpretation by abstract concepts and ideas. While conducting a conceptual research, choose the topic, collect relevant literature, identify specific variables, generate the framework, this type of research is mainly relies on previously conducted studies, already existing relevant information and literature.

### 9- Empirical Research:

This type of research based on collection of data which lead to generation of new ideas, observation and experiments or by using scientific instruments.

The study conclusion is drawn from concretely empirical evidence and verifiable evidence. It is derived from Greek word Empeirikos which means "experienced".

## 10- Longitudinal Research:

In this type of research, we conduct much observation of subject variables for long time (over a weeks, months and years), without interfere with subject. Collection of data at the onset of study and gather repeatedly over a period of time depends on length of study to observe how variable change in this duration.

Main importance of longitudinal research is in studying development and lifespan issues.

### Types of Longitudinal Studies:

**a. Retrospective Study**: This study may involve to looking at historic information for past records.

**b. Cohort Analysis**: In this type of study group being selected based on historical, geographic, birth.

**c. Panel Study**: Involves sampling a cross-section of individuals.

## 11- Laboratory Research:

In laboratory research provide conditions with technological research, measurement and experiments are to be performed. Any chemical substances, microscopically, parasitological, hematological, immunological, biochemical, tissue culture research can be carried out into laboratory. It involves study of natural science with experiments.

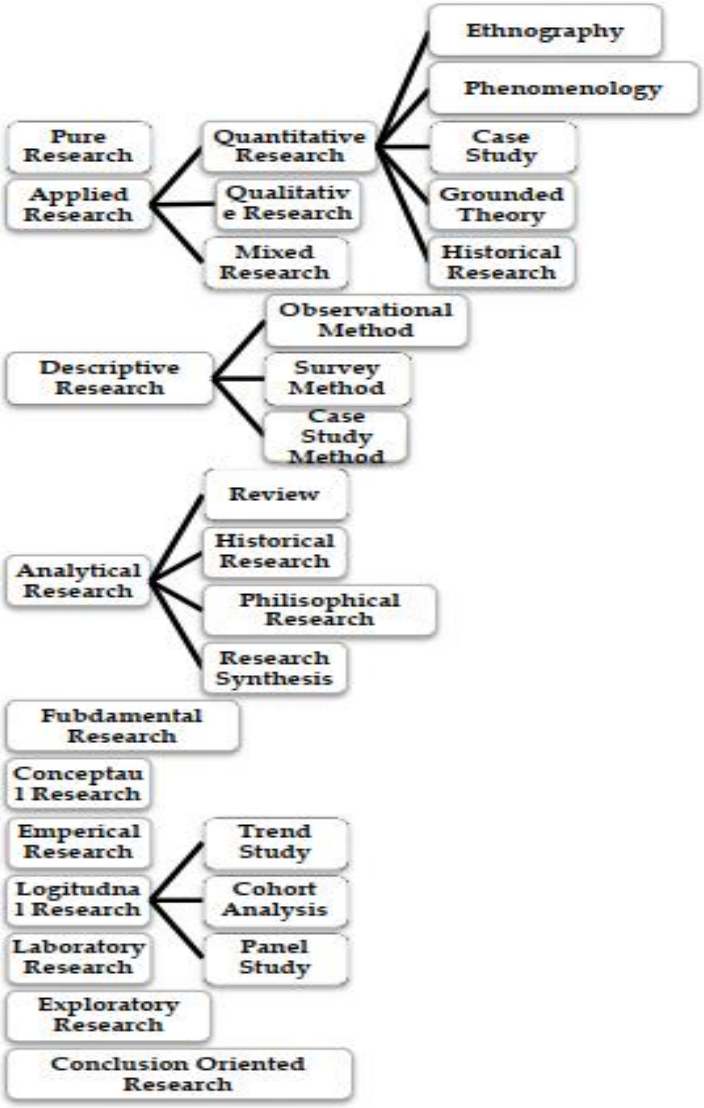
## 12- Exploratory Research:

This research is conducted for not clearly defined problems. It helps to determine data collection method, research design and selection of subjects. It depends on reviewing of literature, information collection through informal discussion with consumer's competition.

Way to implement exploratory research into research plan. We need to focus on groups mainly contain 8 to 12, ask them relevant question on subject and issue being searched.

## 13- Conclusion Oriented Research:

This research deal with redesign enquiry, to pick up problem and prepared to conceptualize.



# What is Clinical Research?

Clinical research **is the study of health and illness in people**. It is the way we learn **how to prevent, diagnose and treat illness**. Clinical research describes many different elements of scientific investigation. Simply put, it involves human participants and helps translate basic research (done in labs) into new treatments and information to benefit patients. Clinical trials as well as research in **epidemiology, physiology and pathophysiology**, **health services, education, outcomes and mental health** can all fall under the **clinical research umbrella**.

## Clinical Trials

A clinical trial is a type of clinical research study. **A clinical trial is an experiment designed to answer specific questions about possible new treatments or new ways of using existing (known) treatments**. Clinical trials are **done to determine whether new drugs or treatments are safe and effective.** Clinical trials **are part of a long**, careful process which may take **many years to complete**. First, **doctors** study a new treatment in the lab. Then they often study the treatment in animals. If a new treatment shows promise, **doctors then test the treatment in people via a clinical trial**.

## Clinical Research vs. Medical Care

People often confuse a **clinical research or clinical trials with medical care**. This topic can be especially confusing if your doctor is also the researcher. When you receive medical care from your own doctor, he or she develops a plan of care just for you. When you take part in a clinical research study, you and the researcher must follow a set plan called the "**study protocol**." The researcher usually can not adjust the plan for you – but the plan includes steps to follow if you are not doing well. It's important to understand that a clinical trial is an experiment. By its nature, that means

the answer to the research question is still unknown. You might or might not benefit directly by participating in a clinical research study. It is important to talk about this topic with your doctor/the researcher.

## Clinical Research

While preclinical research answers basic questions about a drug's safety, it is not a substitute for studies of ways the drug will interact with the human body. **"Clinical research" refers to studies, or trials, that are done in people.** As the developers design the clinical study, they will consider what they want to accomplish for each of the different Clinical Research Phases and begin the Investigational New Drug Process (IND), a process they must go through before clinical research begins.

**On this page, you will find information on:**

- **Designing Clinical Trials.**
- **Clinical Research Phase Studies.**
- **The Investigational New Drug Process.**
- **Asking for Food and Drug Administration (FDA) Assistance.**
- **FDA IND Review Team.**
- **Approval.**

## Designing Clinical Trials

Researchers design clinical trials to answer specific research questions related to a medical product. These trials follow a specific study plan, called a protocol, which is developed by the researcher or manufacturer. Before a clinical trial begins, researchers review prior information about the drug to develop research questions and objectives. **Then, they decide:**

- Who qualifies to participate (selection criteria)?
- How many people will be part of the study?
- How long the study will last.
- Whether there will be a control group and other ways to limit research bias.
- How the drug will be given to patients and at what dosage
- What assessments will be conducted, when, and what data will be collected.

- How the data will be reviewed and analyzed Clinical trials follow a typical series from early, small-scale, Phase 1 studies to late-stage, large scale, Phase 3 studies.

## The Investigational New Drug Process

Drug developers, or sponsors, must submit an Investigational New Drug (IND) application to FDA before beginning clinical research.

In the IND application, **developers must include**:

- Animal study data and toxicity (side effects that cause great harm) data.
- Manufacturing information.
- Clinical protocols (study plans) for studies to be conducted.
- Data from any prior human research.
- Information about the investigator.

## Phase 1

**Study Participants:** 20 to 100 healthy volunteers or people with the disease/condition.

**Length of Study:** Several months

**Purpose:** Safety and dosage

**Approximately 70% of drugs move to the next phase**

## Phase 2

**Study Participants:** Up to several hundred people with the disease/condition.

**Length of Study:** Several months to 2 years

**Purpose:** Efficacy and side effects

**Approximately 33% of drugs move to the next phase**

## Phase 3

**Study Participants:** 300 to 3,000 volunteers who have the disease or condition

**Length of Study:** 1 to 4 years

**Purpose:** Efficacy and monitoring of adverse reactions

**Approximately 25-30% of drugs move to the next phase**

**Phase 4**

**Study Participants:** Several thousand volunteers who have the disease/condition

**Purpose:** Safety and efficacy

## Asking for FDA Assistance

Drug developers are free to ask for help from FDA at any point in the drug development process, **including**:

- Pre-IND application, to review FDA guidance documents and get answers to questions that may help enhance their research.
- After **Phase 2**, to obtain guidance on the design of large **Phase 3** studies.
- Any time during the process, to obtain an assessment of the IND application.

Even though FDA offers extensive technical assistance, drug developers are not required to take FDA's suggestions. As long as clinical trials are thoughtfully designed, reflect what developers know about a product, safeguard participants, and otherwise meet Federal standards, FDA allows wide latitude in clinical trial design.

## FDA IND Review Team

The review team consists of a group of specialists in different scientific fields. Each member has different responsibilities.

- ***Project Manager*:** Coordinates the team's activities throughout the review process, and is the primary contact for the sponsor.
- ***Medical Officer*:** Reviews all clinical study information and data before, during, and after the trial is complete.
- ***Statistician*:** Interprets clinical trial designs and data, and works closely with the medical officer to evaluate protocols and safety and efficacy data.
- ***Pharmacologist*:** Reviews preclinical studies.
- ***Pharmakineticist*:** Focuses on the drug's absorption, distribution, metabolism, and excretion processes. Interprets blood-level data at different time intervals from clinical trials, as a way to assess drug dosages and administration schedules.
- ***Chemist*:** Evaluates a drug's chemical compounds. Analyzes how a drug was made and its stability, quality control, continuity, the presence of impurities, etc.
- ***Microbiologist*:** Reviews the data submitted, if the product is an antimicrobial product, to assess response across different classes of microbes.

## Approval

The FDA review team has 30 days to review the original IND submission. The process protects volunteers who participate in clinical trials from unreasonable and significant risk in clinical trials. FDA responds to IND applications **in one of two ways:**

- **Approval** to begin clinical trials.
- **Clinical** hold to delay or stop the investigation. FDA can place a clinical hold for specific reasons, including:
    - Participants are exposed to unreasonable or significant risk.
    - Investigators are not qualified.
    - Materials for the volunteer participants are misleading.
    - The IND application does not include enough information about the trial's risks.

A clinical hold is rare; instead, FDA often provides comments intended to improve the quality of a clinical trial. In most cases, if FDA is satisfied that the trial meets Federal standards, the applicant is allowed to proceed with the proposed study.

The developer is responsible for informing the review team about new protocols, as well as serious side effects seen during the trial. This information ensures that the team can monitor the trials carefully for signs of any problems. After the trial ends, researchers must submit study reports.

This process continues until the developer decides to end clinical trials or files a marketing application. Before filing a marketing application, a developer must have adequate data from two large, controlled clinical trials.