# Hypothesis

## Definition

A hypothesis proposes relationship between two or more variables. In common usage, a hypothesis refers to a provisional idea whose merit requires evaluation. For example: political participation increases with education. This simple assertion can be seen as a hypothesis. It has a subject (the variable, political participation), a connective verb (a relationship, increases), and an object (the variable, education). This hypothesis takes two basic ideas "political participation" and "education" and suggests that they are connected to the extent that as one increases then the other increases as well. This can be stated in more mathematical terms as one variable being directly proportionate to the other. To clarify the concept of hypothesis further, the following definitions are give**n:**

**Fred N. Kerlinger and H. B. Lee (2000):** "A hypothesis is a conjectured statement that implies or states a relationship between two or more variables".

**John W. Creswell (2014)**: "A hypothesis is a formal statement that presents the expected relationship between independent and dependent variables". A hypothesis is thus a statement about the relationship between two or more variables which needs to be investigated for its truth. It is basically a working assumption. If the relationship between two variables is found as the hypothesis predicts, then the hypothesis is supported and a new theory has been suggested. A good hypothesis states as clearly as possible the expected relationship (or difference) between two variables and defines these variables in operational and measurable terms**.**

## Functions of Hypothesis

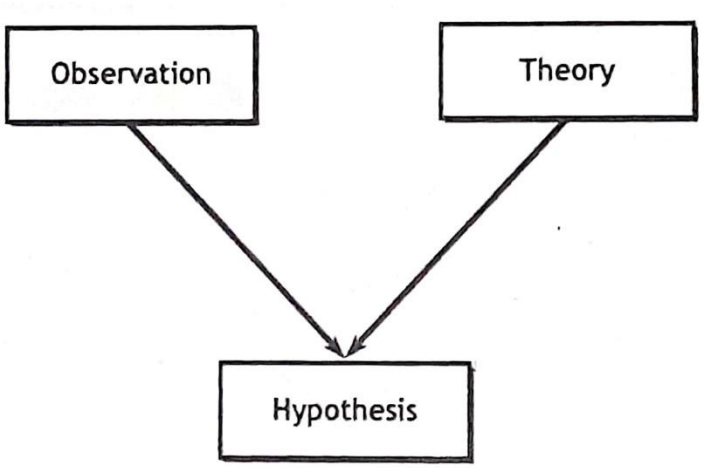
Specifically, a hypothesis serves the following functions (Kumar, 2011):

- The formulation of a hypothesis provides a study the focus. It tells you what specific aspects of a research problem to investigate.
- A hypothesis tells you what data to collect and what not to collect, thereby providing focus to the study.
- As it provides a focus, the construction of a hypothesis enhances objectivity in a study.
- A hypothesis may enable you to add to the formulation of theory. It enables you to specifically conclude what is true or what is false**.**

## Hypothesis Formulation

Hypothesis can be derived in a variety of ways i.e. general culture, past research/scientific theory, personal experience, discussion and conversations and intuition. A researcher observes a social situation and come to a conclusion about some of the variables which are operating within it. You could then develop some hypotheses which connect two or more of these variables.

Generally there are two grounds on which a hypothesis may be justified: logical and empirical. Logical justification is developed from arguments based on concepts and theories relating directly to the research problem. Empirical justification is based on reference to other research found in the literature. Hence, in order to formulate a useful hypothesis, you need to have good knowledge of the background to the subject and the nature of the problem or issue which is being addressed. A hypothesis statement is derived directly from the statement of the problem. Hypothesis can be stated rather easily once the research problem is known. The hypothesis is thus more operational than the problem statement. A diagrammatic presentation of the process of hypothesis formulation is given in figure.




Hypothesis generation and testing require an understanding of the deductive and inductive reasoning. A simple definition of deductive reasoning is "taking a known idea or theory and applying it to a situation with the intention of testing whether it is true". Deduction is thus the process of arriving at conclusion by interpreting the meaning of the results of the data analysis. In this form of reasoning, one goes from general knowledge to specific knowledge. For example, consider the following two arguments**:**

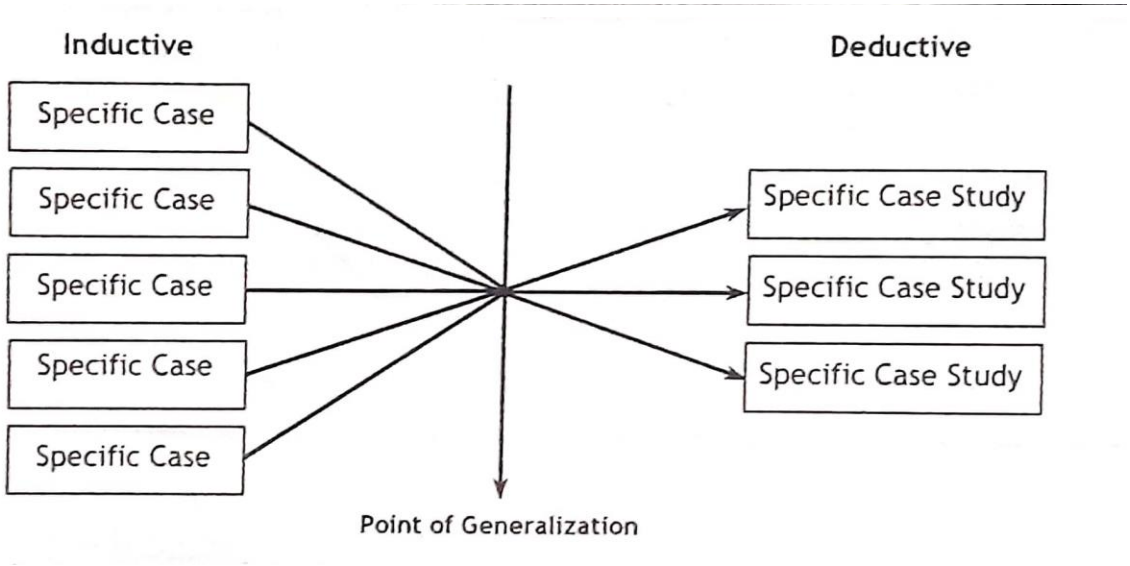
**Argument 1**

- All books have pages (theory or generalization).
- This is a book (empirical observation - fact).
- Therefore, this book has pages (logical conclusion).

**Argument 2**

- Lung cancer is caused by smoking (theory or generalization).
- John has lung-cancer (empirical observation-fact).
- John was a cigarette smoker (logical conclusion).

Deduction starts from a generalization and goes to a specific case. Inductive reasoning is the opposite. A simple definition of inductive reasoning is "using observation to formulate an idea or theory". Induction is thus the process of examining many cases and then generalizing from them. In this form of reasoning, one goes from a specific knowledge to the general knowledge. Looking at the cigarette-cancer example, the researcher would investigate whether the people who have long-cancer had previously smoked before they received cancer. Both induction and deduction are used by the researchers to organize facts, describe results, develop new relationship, and suggest new research.




Deductive logic, as stated above, is useful for going from a general problem to a specific hypothesis. This statement can be understood by an example:

■ **Problem:** Nepal's population is increasing so rapidly that if it continues at its present rate, in 30 years, it will not be possible to feed all of its citizens.

■ **Theory:** Population growth can be controlled through family planning clinics.

■ **Hypothesis:** Family planning can reduce the growth of population in Nepal.

The above example is stated in very general terms and later will be made specific so that it can be tested, but it is a good example of the deductive logic used in a thesis. The problem statement has been created from the facts of Nepal's present population and from the prediction of its growth in the future. The prediction is made from examining past facts of population growth in Nepal. The theory is a very general theory, which has been true in other parts of the world; it has almost become a principle for population control. The hypothesis is the result of deductive logic from the first two statements.

It is now possible to examine the stating of problems and hypotheses. The problem asks about the relation between several facts or observations. Accordingly, the hypothesis suggests that the

relationship exists. It is important to realize that the hypothesis has to be stated in a very specific terms so that the means of investigating the hypothesis are included in the statement. A problem is formulated in the form of a question; it serves as the basis or the origin from which a hypothesis is derived. A hypothesis is a suggested solution to a problem. A problem (question) cannot be directly tested, whereas a hypothesis can be tested and verified. Hence, a problem cannot be scientifically solved unless it is reduced to hypothesis form.

An example is presented here to clarify the use of the problem statement and the hypothesis statement.

***EXAMPLE***

**Research Problem:** What is the relationship between population growth in Kathmandu before the introduction of family planning and after the introduction of family planning?

**Research Hypothesis:** There is a significant difference in the population growth in Kathmandu between when family planning was first introduced and five years later.

The study, which will investigate family planning, now has a specific statement, which is researchable. The information needed to test the hypothesis is defined in the hypothesis statement.

Hypothesis statements should be clear if the definition of a variable is understood as some characteristic, which changes. The above hypothesis is simply stating that two groups exist in relation to some characteristic. If there is a significant difference between the two groups then the hypothesis is supported. The theory that family planning can reduce the growth of population in Nepal is supported and becomes tentative. Hence, there appears to be a solution to the population problem in Nepal.

## One-sided Vs Two-sided Hypothesis

During the planning of your research, you need to specify whether you plan to use a one-sided or two-sided hypothesis. A one-sided hypothesis states a specific direction (e.g. increase or decrease). If a change in the unexpected direction is equivalent in practice to no change, then you should use a one-sided hypothesis. A two-sided hypothesis states that there is a difference between the dependent and independent variable, but does not specify the direction you think this difference will be. If you expect that a change in either direction is possible and that changes in either direction are interested, then you should use a two-sided hypothesis.

## Formats of Stating Hypothesis

The different formats of hypothesis construction based on association and correlation between variables are as follows:

**Correlation** There is a significant relationship between Variable A and Variable B for Group 1,

There is a significant relationship for Group 1 among the following variables:

Variable A Variable B Variable C etc.

There is a significant relationship in Group 1, 2 and 3 among the following variables:

Variable A Variable B etc.

**Difference between Means**

There is a significant difference between mean levels of Variable A for Group 1 and Group 2. There is a significant difference between means for Group 1 and Group 2 in terms of the following variables: Variable A Variable B etc.

There is a significant difference between means for Group 1, 2 and 3 in terms of the following variables:

Variable A Variable B etc.

**Difference between Frequencies**

There is a significant difference between Group 1 and Group 2 for Variable A. There is a significant difference between Group 1, 2 and 3 for the following variables:

Variable A Variable B etc.

(Some writers prefer the word "relationship" to "difference" when using contingency tables))

## Types of Hypothesis

### 1. Descriptive and Relational Hypothesis

Research hypothesis can be classified as: descriptive and relational. Descriptive hypotheses are in the form of propositions that only state the existence, size, form, or distribution of some variable (Cooper & Schindler, 2011).

***EXAMPLES***

- Tribhuvan University (case) is experiencing budget difficulties (variable).
- The Hetauda-Narayangadh sector of the East-West Highway (case) has a higher-than-average accident rates (variable).
- The average stockholders of Nepal Development Bank (case) favor returns in the form of bonus dividends (variable).

These descriptive statements contain only one variable. Hence, the relationship between variable cannot be studied and explored. These statements do not fulfill the criteria of research hypotheses. It is, therefore, advisable to use research questions rather than descriptive hypotheses. The research questions for the above three statements could be stated as follows:

***EXAMPLES***

■ What is the extent of budget difficulties in Tribhuvan University?

■ Why is the accident rate higher in Hetauda-Narayangadh sector of the East-West Highway?

■ Why do the stockholders of commercial banks favor returns in the form of bond dividends?

A relational hypothesis, on the other hand, describes the relationship between two or more variables with respect to some case. Relational hypotheses are of two types: correlational hypothesis and explanatory (causal) hypothesis. When a statement describes the relationship between two variables, it is called a correlational hypothesis. A Correlational hypothesis states that the variables occur together in some specified manner without stating that one causes the other. The following are the examples of correlational hypothesis:

***EXAMPLES***

■ Families with higher incomes spend more for recreation.

■ With education people's political participation will increase.

**2. Explanatory Hypotheses**

In an explanatory hypothesis, the implications of one variable on the other are stated. How one variable would cause or lead to a change in the other variable? Such causal relations can be unidirectional, in which variable A influences variable B, but not vice versa. They can also be bidirectional, in which each variable influences the other. The following are the examples of unidirectional and bidirectional relations:

**EXAMPLES**

- The increase in age would lead to decrease in organizational commitment.
- The productivity of skilled workers will increase if the workers are given added pay for production in access of the standard.

### 3. Directional and Non-directional Hypotheses

The directional hypothesis indicates the particular direction of the expected relationship between two variables. These relationships could be stated in positive or negative form. In stating the relationship between the two variables, the terms such as "positive", "negative", "more than' "less than" and the like are used. The directional hypothesis requires a one-tailed test. The following are the examples of directional hypotheses.

***EXAMPLES***

- Younger workers are less motivated than older workers.
- The greater the workload, the lower the job satisfaction of the workers..

The non-directional hypotheses are formulated when there are no clues available about the positive or negative relationship between two variables. Hence, these hypotheses do not indicate any direction of the relationship or difference and require a two-tailed test. Non-directional hypotheses are formulated in cases where previous studies do not exist or indicate conflicting findings (Sekaran & Bougie, 2013). The following are some examples of non-directional hypothesis:

***EXAMPLES***

■ There is a difference between work attitudes of industrial and agricultural workers.

■ There is no relationship between educated and uneducated employees in their occupational commitments.

### 4. Null and Alternative Hypotheses

There are the two methods of stating the hypothesis: null and alternative: A null hypothesis is a statistical hypothesis that is tested for possible rejection under the assumption that it is true. The hypothesis contrary to null hypothesis is known as alternative hypothesis. In other words, a null hypothesis is a hypothesis set up to be nullified or refuted in order to support an alternative hypothesis.

The null hypothesis is called null because it usually reflects the "no-difference" or "no-effect' situation. This hypothesis is thus the one actually tested statistically. It is an arbitrary convention hypothesizing that any relation or difference in the findings is due to chance or sampling error and puts this supposition to a probability test. Theoretically, it is a hypothesis set up for possible rejection.

The following example would clarify the concepts of null and alternative hypothesis. Suppose you are interested in a study to determine whether production would increase if the skilled

workers are given a bonus or incentive pay for production in excess of a standard. For this investigation, you can formulate a research hypothesis in the following way:

***EXAMPLE***

The productivity of skilled workers will increase if they are given added pay for production in access of the standard.

This is a positive statement whose validity you would attempt to test through your research However, many researchers would object to the use of a positive hypothesis like this. A positive hypothesis like this may indicate a built-in prejudice on the part of the researcher toward a result favoring the hypothesis. To them, a null hypothesis is more desirable. The null hypothesis takes the form of a statement indicating no prejudice toward an answer. How can then this hypothesis be stated in a null form? The following is an example:

***EXAMPLE*** No significant difference will exit between productivity of skilled workers on an incentives plan and productivity of skilled workers on a regular wage plan.

This null hypothesis thus indicates a definitive, exact relationship between two variables. That is, it states that the population correlation between two variables is equal to zero, or that the difference in the means of two groups in the population is equal to zero. In statistics, the only way of supporting your hypothesis is to refute your null hypothesis. Rather than trying to prove your idea (the alternative hypothesis) right, you must show that the null hypothesis is likely to be wrong. You have to refute or nullify the null hypothesis. You have to assume that your alternative hypothesis is wrong until you find evidence to the contrary. The following is another example of null hypothesis:

$H_0$: There is no difference between male and female statistically in their productivity.

Statistically expressed: $H_o$: $\mu_l = \mu_2$

Where, $H_0$= the null hypothesis

$\mu_1$ = the productivity of male workers

$\mu_2$ = the productivity of female workers

The alternate form of the above null hypothesis can be formulated as follows:

$H_A$ : Male workers will have more productivity than female workers, or female workers will have less productivity than male workers.

Statistically expressed: $H_A$ : $\mu_1 > \mu_2$

where, $H_A$ = the alternate hypothesis

$\mu_1$ = the productivity of male workers

$\mu_2$ = the productivity of female workers

From the above example, it is clear that an alternative hypothesis, which is the opposite of the null, is a statement expressing a relationship between two variables or indicating differences between groups. The following are some other examples of null and alternative hypotheses:

• $H_0$: There is no relationship between working conditions and job satisfaction of employees.

$H_A$: If the working conditions are improved, then the job satisfaction of employees will improve.

$H_0$: There is no difference between male and female workers in their organizational commitment.

$H_A$: Male workers will have greater organizational commitment than female workers.

■ $H_0$: There is no relationship between pay and productivity.

$H_A$: Pay and productivity are positively related.

■ $H_0$: Working condition, pay and fringe benefits have no influence on job satisfaction of workers.

$H_A$: Working conditions, pay and fringe benefits all have positive influence on job satisfaction of workers.

**Stating the Null Hypothesis**

■ There is no difference between the means of the two populations from which the two samples were drawn at random.

■ The two means in the two populations from which the samples were respectively drawn at random are equal.

## Criteria of Good Hypothesis Statement

The main requirement of hypothesis formulation is that it should fulfill certain basic criteria. Many different criteria can be found in the literature over what are the desirable qualities of a "good" hypothesis. Mason and Bramble (1997) outline the important features (criteria) of good hypothesis statement as follows: •

- Hypothesis should be stated in declarative form.
- Hypothesis should state the expected (articulated) describe a relationship between two or more variables.
- Hypothesis should be testable empirically.
- Hypothesis should be limited in scope.
- Hypothesis should be clearly and precisely stated. There should be no ambiguity in the variables or the relationships proposed.
- Hypothesis should state the conditions and circumstances under which it is supposed to apply.
- Hypothesis should reflect a guess at a solution or outcome to a problem based upon some knowledge, previous research, or identified needs .It should be consistent with most known facts.

## Linkage between Research Hypothesis and Statistical Hypothesis

A research hypothesis is the proposed answer of the research question. The research hypothesis usually includes an explanation (‘x affects y because …’). A statistical hypothesis, on the other hand, is a mathematical statement about a population parameter. Statistical hypotheses always come in pairs: the null and alternative hypotheses. In a well-designed study, the statistical hypotheses correspond logically to the research hypothesis.