Unit-1: Introduction to Research Methodology

Formulation of Hypotheses

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Introduction

- The important consideration in the formulation of a research problem is the construction of the hypothesis.
- The formulation of hypotheses and their verification are the fundamental aspects of research.
- In their simplest forms, hypotheses are typically phrased as “if-then” statements, based on common sense, theory or empirical facts. It is a hunch, guess, an imaginative idea which becomes the basis for further investigation.
- It provides the researcher with a line of action along which he/she moves to find out answers to the problem he/she is working on.
- Hypotheses can take various forms, depending on the question being asked and the type of study being conducted.
- **At the start of the investigation, the hypothesis is a stimulus to critical thoughts offers insights into the confusion of phenomena.**
- **In the end, it comes to prominence as the proposition to be accepted or rejected in the light of the findings.**
Hypothesis - Means

The word hypothesis is derived form the Greek words “hypotithenai” means to put under.

- ‘Hypo’ means tentative or subject to the verification
- ‘Thesis’ means statement about solution of a problem
- Hypothesis is a tentative statement about the solution of the problem

Hypothesis is called a leap into the dark.

It is a brilliant guess about the solution of a problem.
<table>
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<tr>
<th>Hypothesis - Definitions</th>
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<tr>
<td><strong>Goode &amp; Hatts</strong></td>
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<tr>
<td>• A shrewd guess or inference that is formulated and provisionally adopted to explain observed facts or conditions and to guide in further investigation</td>
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<td><strong>Black and Champion</strong></td>
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<td>• A tentative statement about something, the validity of which is usually unknown</td>
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<td><strong>Mouly G J</strong></td>
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<td>• An assumption or proposition whose testability is to be tested on the basis of the computability of its implications with empirical evidence with previous knowledge.</td>
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<td><strong>Powel</strong></td>
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<td>• An assumption about relations between variables (any property of a person, thing, event, setting and so on that is not fixed.)</td>
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Importance of Hypothesis

- It provides direction to research.
- It prevents the researcher from engaging in fruitless research.
- It is a guide to the thinking process and the process of discovery.
- Without a hypothesis, research would be like a random and aimless wandering.
- It prevents blind research.
- It guides the researcher to facts and conditions that might otherwise be overlooked.
- It places clear and specific goals before the investigator.
- It serves the function of thinking together related facts and information and organizing them into one comprehensible whole.
- It enables a researcher to clarify the procedures and methods to be used in solving his problems and to rule out methods that are capable of providing the necessary data.
- It serves as a framework for drawing conclusions.
Characteristics of Hypothesis

- Clear and precise
- Capable of being tested
- State relationship between variables
- Limited in scope and must be specific
- Stated as far as possible in most simple terms
- Consistent with most known facts
- Amenable to testing within a reasonable time
- Must explain the facts that gave rise to the need for explanation

Source: Kothari, C R, 2004: 185
Characteristics of a Good Hypothesis

A good hypothesis is a very useful aid to organizing the research effort, but it must have certain qualities. It must be a statement that can be put to the test.

Simplicity
Objectivity
Consistency
Theoretical relevance
Availability of Techniques
Testability
Specificity
Conceptual clarity
Functions of Hypothesis

To Test Theories

To suggest Theories

To Describe Social Phenomena
The functions of a Hypothesis

- The formulation of a hypothesis provides a study with 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 conclude specifically what is true or what is false.
Uses of Hypotheses

1. Forms the starting point of investigation
2. Makes observation and experiment possible
3. An aid to explanation
4. Makes deduction possible
5. Acts as a guide (Investigator's eye—a sort of guiding light in the world of research)
Uses of Hypotheses (2)

- It prevents blind research
- It provides direction to research identifying which is relevant and prevent irrelevant data
- It focuses research, without it is like a random and aimless path
- It links up related facts and information in fully understandable
- It serves a frame work for drawing meaningful conclusions.
Sources of Hypotheses

Observation

Continuity of Research

Analogies

Culture

Theory

State of Knowledge
Forms of Hypothesis

- Concerning Law
- Concerning an Agent
- Concerning Collocation
- Descriptive Hypothesis
- Explanatory Hypothesis
- Null Hypothesis
Types of Hypothesis

Hypotheses can be classified into several types by several authors. Broadly, there are two categories of the hypothesis:
Null Hypothesis vs Alternative Hypothesis

The **null hypothesis** always predicts that there will be no differences between the groups being studied.

Symbolised as \( H_0 \)

The **alternative hypothesis** predicts that there will be a difference between the groups.

Symbolised as \( H_1 \) or \( H_a \)
The null hypothesis asserts that there is no true difference between two population means, and the difference found between sample means, accidental and unimportant, that is arising out of fluctuation of sampling and by chance.

Traditionally null hypothesis stated that there is zero relationship between terms of the hypothesis.

The null hypothesis should always be a specific hypothesis i.e., it should not state about or approximately a certain value.
Alternative Hypothesis

- The alternative hypothesis that specifies those values that are researcher believes in holding, and the researcher hopes that sample data will lead to acceptance of this hypothesis as true.
- The alternative hypothesis represents all other possibilities, and it indicates the nature of the relationship.
- It states that the results are not due to chance and that they are significant in terms of supporting the theory being investigated.
Formulation of Hypotheses

A researcher should consider certain points while formulating a hypothesis:

1. Expected relationship or differences between the variables
2. Operational definition of variable
3. Hypotheses are formulated following the review of literature
Problems in Formulating Hypotheses

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<th>Problem</th>
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<td>Absence of a theoretical framework</td>
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<td>Lack of ability to utilize that theoretical framework logically</td>
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<tr>
<td>Failure to acquaint with available research techniques so as to able to phrase the hypothesis properly</td>
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Source: Goode & Hatt, 1952.
The process of testing a hypothesis

Phase I
- Formulate your hunch or assumption

Phase II
- Collect the required data
- Analyse data to draw conclusions about that hunch - true or false

Phase III

Source: Ranjit Kumar, 2011: 86
Procedure for Hypothesis Testing

Making a formal statement

Selecting a significance level
   (Generally, either 5% level or 1% level)

Deciding the distribution to use

Selecting a random sample and computing an appropriate value

Calculation of the probability

Comparing the probability

Source: Kothari, C R, 2004: 191 & 192
The evidence of the work of the hypothesis lies in its ability to meet the test of its validity.

The purpose of testing a hypothesis is to determine the probability that it is supported by fact.

Adopted from Kothari, C R, 2004: 192
Errors in Testing a Hypothesis

- Two common errors exist when testing a hypothesis.

  **Type I error** – Rejection of a null hypothesis when it is true.

  **Type II error** - Acceptance of a null hypothesis when it is false.

Concluding there is a difference between the groups being studied when, if fact, there is no difference.

Concluding there is no difference between the groups being studied when, if fact, there is a difference.
Errors in Testing a Hypothesis (2)

- Study design selected is faulty
- Sampling procedure adopted is faulty
- Method of data collection is inaccurate
- Analysis is wrong
- Statistical procedures applied are inappropriate
- Conclusions drawn are incorrect

Source: Ranjit Kumar, 2011: 92
Tests of Hypotheses

- Hypothesis testing helps to decide based on the sample data, whether a hypothesis about the population is likely to be true or false.
- Statisticians have developed several tests of hypotheses (also known as the tests of significance) for testing of hypotheses which can be classified as:
  1. Parametric tests or standard tests of hypotheses
  2. Non-parametric tests or distribution-free test of hypotheses
Parametric Tests

- Parametric tests are more powerful. The data in this test is derived from interval and ratio measurement.
- In parametric tests, it is assumed that the data follow normal distributions.
- Examples of parametric tests are: (1) \( z\)-test; (2) \( t\)-test; and (3) \( F\)-test.
- Observations must be independent, i.e., selection of any one item should not affect the chances of selecting any others to be included in the sample.
- *All these tests* are based on the assumption of normality, i.e., the source of data is considered to be normally distributed.
Non-Parametric Tests

- The hypothesis of the non-parametric test is concerned with something other than the value of a population parameter.
- They are quick and easy to use. When data are not very accurate, these tests produce fairly good results.
- There are situations when the researcher cannot or does not want to make assumptions. In such cases, non-parametric tests are used.
- Examples of non-parametric tests are the Binomial test, Mann-Whitney U test, Kolmogorov-Smirnov Test, Kruskal-Wallis Test, H-Test Sign test, etc.
- Besides, most non-parametric tests assume only nominal or ordinal data, whereas parametric tests require measurement equivalent to at least an interval scale.
- A non-parametric test involves the higher risk of accepting a false hypothesis and thus committing a Type 2 error.
Criteria for Evaluating Hypothesis

1. Plausibility of Explanation
2. Testability of Explanation
3. Adequacy of Scope
4. The usefulness of False Hypotheses
5. Roots in Existing Theories
6. Suitability for Intended Purpose
7. Simplicity of Explanation
8. Levels of Explanation
Limitations of the Tests of Hypotheses

- The tests should not be used in a mechanical fashion.
- The test does not explain the reasons as to why does the difference exists, say between the means of the two samples.
- Results of significance tests are based on probabilities and, as such, cannot be expressed with full certainty.
- Statistical inferences based on the significance tests cannot be said to be entirely correct evidence concerning the truth of the hypotheses.
Conclusion

- In formulating a hypothesis, it is important to ensure that it is simple, specific, and conceptually clean, can be verified, is rooted in an existing body of knowledge.
- In the absence of any proper or suitable hypothesis, a lot of time, and labour is wasted in fruitless research.
- Hypothesis gives the direction and helps the researcher interpret data.
- The hypotheses are generally derived from earlier research findings, existing theories, and personal observations and experience.
Conclusion (2)

- Hypothesis helps in deciding the direction in which to proceed and aids in selecting pertinent facts.
- As Young (2012) has rightly remarked that “the use of hypothesis prevents a blind search and indiscriminate gathering of masses of data which may later prove irrelevant to the problem under study.”
- Not every research study needs a hypothesis.
- It furnishes the germinal basis of the whole investigation and remains to the end its cornerstone, for the entire research is directed to test it out by facts.
- Hypothesis construction and testing enable researchers to generalize their findings beyond the specific conditions which they were obtained.
- A hypothesis is an essential link between theory and investigations, which leads to the discovery of addition to knowledge.
References and Further Reading

References and Further Reading (2)


Acknowledgements

Thanks to all the authors/websites, whose original works are used in the form of content, references, and images in this presentation for a better understanding of the users and also for academic purposes only.
Thanks for Reading!