CLASSIFICATION, FORMULATION AND TESTING OF HYPOTHESIS

INTRODUCTION

Hypothesis is usually considered as the principal instrument in research. The derivation of a suitable hypothesis goes hand in hand with the selection of a research problem. A hypothesis, as a tentative hunch, explains the situation under observation so as to design the study to prove or disprove it. What a researcher is looking for is a working or positive hypothesis. It is very difficult, laborious and time consuming to make adequate discriminations in the complex interplay of facts without hypothesis. It gives definite point and direction to the study, prevents blind search and indiscriminate gathering of data and helps to delimit the field of inquiry.

MEANING

The word **hypothesis** (plural is **hypotheses**) is derived from the Greek word – 'hypotithenai' meaning 'to put under' or 'to suppose' for a hypothesis to be put forward as a **scientific hypothesis**, the scientific method requires that one can test it. Etymologically hypothesis is made up of two words, "hypo" (less than) and "thesis", which mean less than or less certain than a thesis. It is the presumptive statement of a proposition or a reasonable guess, based upon the available evidence, which the researcher seeks to prove through his study.

According to Lundberg, ―A hypothesis is a tentative generalisation, the validity of which remains to be tested. In its most elementary stage, the hypothesis may be any hunch, guess, imaginative idea, which becomes the basis for action or investigation.

Goode and Hatt have defined it as ―a proposition which can be put to test to determine its validity‖. A hypothesis is a statement temporarily accepted as true in the light of what is, at the time, known about a phenomenon, and it is employed as a basis for action in the search of new truth.

Hypotheses

Hypotheses are statements in quantitative research in which the investigator makes a prediction or a conjecture about the outcome of a relationship among attributes or characteristics.

Traditionally used in experiments, they serve, like research questions, to narrow the purpose statement to specific predictions. These predictions are not simply an "educated guess." Rather, researchers base them on results from past research and literature where investigators have found certain results and can now offer predictions as to what other investigators will find when they repeat the study with new people or at new sites.

A hypothesis is a researcher's prediction of the research findings, a statement of the researcher's expectations about the relations among the variables in the research topic. Many studies contain a number of variables, and it is not uncommon to have more than one hypothesis for a research topic. The researcher does not set out to prove a hypothesis but rather collects data that either support or do not support it. A written statement of your hypothesis will be part of your research plan and report.

Although hypotheses serve several important purposes, some research studies may proceed without them. Hypotheses are tools in the research process, not ends in themselves. Studies are often undertaken in areas in which there is little accumulated background information. A researcher may not know what outcome to predict. For example, surveys that seeks to describe the characteristics of particular phenomena, or to ascertain the attitudes and opinions of groups often proceed without hypotheses.

Two reasons for stating a hypothesis before the data-gathering phase of a quantitative study are

(1) A well-grounded hypothesis indicates that the researcher has sufficient knowledge in the area to undertake the investigation, and

(2) The hypothesis gives direction to the collection and interpretation of the data; it tells the researcher what procedure to follow and what type of data to gather and thus may prevent a great deal of wasted time and effort on the part of the researcher.

Both quantitative and qualitative researchers deal with hypotheses, but the nature of each approach differs. We first discuss the quantitative use of hypotheses and then discuss the qualitative counterpart.

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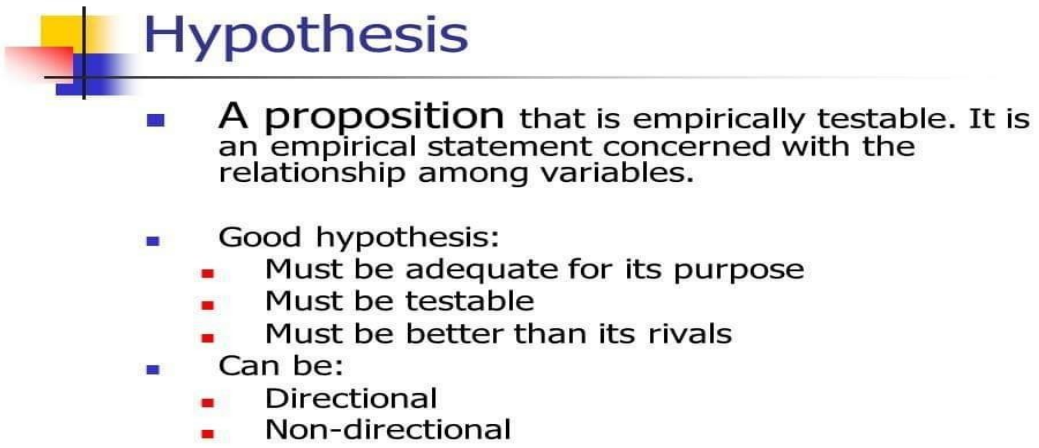

Definition and Purpose of Hypotheses in Quantitative Studies

Hypotheses are essential to all quantitative research studies, with the possible exception of some survey studies whose purpose is to answer certain specific questions. A quantitative researcher formulates a hypothesis before conducting the study because the nature of the study is determined by the hypothesis. Every aspect of the research is affected, including participants, measuring instruments, design, procedures, data analysis, and conclusions. Hypotheses are typically derived from theories or from knowledge gained while reviewing the related literature, which often leads the researcher to expect a certain finding.

Although all hypotheses are based on theory or previous knowledge and are aimed at extending knowledge, they are not all of equal worth. A number of criteria can be, and should be, applied to determine the value of a hypothesis. The following guidelines will help ensure that you develop a good research hypothesis:-

- The hypothesis brings together information to enable the researcher to make a tentative statement about how the variables in the study may be related. By integrating information based on experience, related research, and theory, the researcher states the hypothesis that provides the most satisfactory prediction or the best solution to a problem.
- Because hypotheses propose tentative explanations for phenomena, they stimulate a research endeavor that results in the accumulation of new knowledge. Hypothesis testing research permits investigators to validate or fail to validate theory through an accumulation of data from many studies. In this way, knowledge is extended.
- A hypothesis should be based on a sound rationale. It should derive from previous research or theory and its confirmation or disconfirmation should contribute to educational theory or practice. Therefore, a major characteristic of a good hypothesis is that it is consistent with theory or previous research.
- A good hypothesis provides a reasonable explanation for the predicted outcome. A hypothesis suggesting that children who eat a nutritious breakfast pay attention longer than children who have no breakfast is more reasonable.
- A good hypothesis states as clearly and concisely as possible the expected relation (or difference) between variables and defines those variables in operational, measurable terms. A simply but clearly stated hypothesis makes the relation easier for readers to understand, is simpler to test, and facilitates the formulation of conclusions. A relation between variables may be expressed as a Cor-relational or a causal one.
- A well-stated and well-defined hypothesis must also be testable—and it will be testable if it is well formulated and stated. It should be possible to test the hypothesis by collecting and analyzing data. A good hypothesis should normally be testable within some reasonable period of time.

Types of Hypotheses

Hypotheses can be classified in terms of how they are derived (i.e., inductive versus deductive hypotheses) or how they are stated (i.e., directional versus null hypotheses).

Inductive Hypothesis

An inductive hypothesis is a generalization based on specific observations. The researcher observes that certain patterns or associations among variables occur in a number of situations and uses these tentative observations to form an inductive hypothesis. For example, a researcher observes that, in some eighth-grade classrooms, students who take essay tests appear to show less test anxiety than those who take multiple-choice tests. This observation could become the basis for an inductive hypothesis.

Deductive hypothesis

A deductive hypothesis, in contrast, is derived from theory and provides evidence that supports, expands, or contradicts the theory.

Research Hypothesis

A research hypothesis states an expected relation or difference between variables. In other words, the quantitative researcher specifies the relation he or she expects to test in the research study. Research hypotheses can be directional or non-directional.

Directional hypothesis

A directional hypothesis states the expected direction of the relation or difference. For Example- Tenth-grade science students who are instructed using interactive multimedia achieve at a higher level than those who receive regular instruction only.

Non-directional hypothesis

A non-directional hypothesis states simply that a relation or difference between variables exists. For Example- The achievement of 10th-grade science students who are instructed using interactive multimedia is significantly different than the achievement of those who receive regular instruction only.

Difference between Directional and Non directional Hypothesis

The non-directional hypothesis predicts a difference between the groups; whereas the directional hypothesis predicts not only the difference but also that the difference favors interactive media instruction. A directional hypothesis should be stated only if you have a basis for believing that the results will occur in the stated direction. Non-directional and directional hypotheses involve different types of statistical tests of significance.

Null Hypothesis

It is impossible to test research hypotheses directly. You must first state a null hypothesis (symbolized H_o) and assess the probability that this null hypothesis is true. The null hypothesis is a statistical hypothesis. It is called the null hypothesis because it states that there is no relationship between the variables in the population. A null hypothesis states a negation (not the reverse) of what the experimenter expects or predicts. A researcher may hope to show that after an experimental treatment, two populations will have different means, but the null hypothesis would state that after the treatment the populations' means will *not* be different. A null hypothesis states that there is no significant relation or difference between variables. For example, a null hypothesis may be: The achievement level of 10th-grade science students who are instructed using interactive multimedia is not significantly different than the achievement level of those who receive regular instruction.

The null hypothesis is the hypothesis of choice when a researcher has little research or theoretical support for a hypothesis. Also, statistical tests for the null hypothesis are more conservative than they are for directional hypotheses. The disadvantage of null hypotheses is that they rarely express the researcher's true expectations based on literature, insights and logic.

Stating the Hypothesis

A good hypothesis is stated clearly and concisely, expresses the relation or difference between variables, and defines those variables in measurable terms. A hypothesis should be presented in the form of a concise declarative statement. A complete and concisely stated hypothesis makes clear what the researcher needs to do to test it. It also provides the framework for presenting the findings of the study. If a researcher is exploring more than one relationship, he or she will need to state more than one hypothesis. The general rule is to state only one relationship in any one hypothesis. For example, if you were investigating the effect of a new teaching method on student achievement and student satisfaction, you would state two hypotheses—one for effect on achievement and one for effect on satisfaction.

Deriving hypotheses Inductively

In the inductive procedure, the researcher formulates an inductive hypothesis as a generalization from apparent observed relationships; that is, the researcher observes behavior, notices trends or probable relationships, and then hypothesizes an explanation for this observed behavior. This reasoning process should be accompanied by an examination of previous research to determine what findings other investigators have reported on the question.

In the inductive process, the researcher makes observations, thinks about the problem, turns to the literature for clues, makes additional observations, and then formulates a hypothesis that seeks to account for the observed behavior. The researcher (or teacher) then tests the hypothesis

under controlled conditions to examine scientifically the assumption concerning the relationship between the specified variables.

Deriving hypotheses Deductively

In contrast to hypotheses formulated as generalizations from observed relationships, some others are derived by deduction from theory. These hypotheses have the advantage of leading to a more general system of knowledge because the framework for incorporating them meaningfully into the body of knowledge already exists within the theory. A science cannot develop efficiently if each study results in an isolated bit of knowledge. It becomes cumulative by building on the existing body of facts and theories. A hypothesis derived from a theory is known as a deductive hypothesis.

SOURCES OF HYPOTHESIS

The derivation of a good hypothesis demands characteristic of experience and creativity. Though hypothesis should precede the gathering of data, a good hypothesis can come only from experience. Some degree of data gathering, the review of related literature, or a pilot study must precede the development and gradual refinement of the hypothesis. The various sources of hypotheses may be:

- Review of similar studies in the area or of the studies on similar problems;
- Examination of data and records, if available, concerning the problem for possible trends, peculiarities and other clues;
- Discussions with colleagues and experts about the problem, its origin and the objectives in seeking a solution.
- Exploratory personal investigation which involves original field interviews on a limited scale with interested parties and individuals with a view to secure greater insight into the practical aspects of the problem.
- Intuition is often considered a reasonable source of research hypotheses -- especially when it is the intuition of a well-known researcher or theoretician who “knows what is known”
- Rational Induction is often used to form “new hypotheses” by logically combining the empirical findings from separate areas of research
- Prior empirical research findings are perhaps the most common source of new research hypotheses, especially when carefully combined using rational induction
- Thus hypothesis are formulated as a result of prior thinking about the subject, examination of the available data and material including related studies and the council of experts.

Testing the Hypothesis

A quantitative study begins with a research hypothesis, which should be a simple, clear statement of the expected relationship between the variables. Previously, we explained that hypotheses must be testable—that is, amenable to empirical verification. When researchers speak of testing a hypothesis, however, they are referring to the null hypothesis. Only the null hypothesis can be directly tested by statistical procedures. Hypothesis testing involves the following steps:

- State, in operational terms, the relationships that should be observed if the research hypothesis is true.
- State the null hypothesis.
- Select a research method that will enable the hypothesized relationship to be observed if it is there.
- Gather the empirical data and select and calculate appropriate descriptive statistics for these data.
- Calculate inferential statistics to determine the probability that your obtained results could have occurred by chance when the null hypothesis is true.
- If the probability of the observed findings being due to chance is very small (e.g., only 1 in 100 chances), one would have sufficient evidence to reject the null hypothesis.

The researcher selects the sample, measuring instruments, design, and procedures that will enable him or her to collect the data necessary to test the hypothesis. During the course of a research study, those data are analyzed in a manner that permits the researcher to determine whether the hypothesis is supported. Remember that analysis of the data does not lead to a hypothesis being proven or not proven, only supported or not supported for this particular study. The results of analysis indicate whether a hypothesis is supported or not supported for the particular participants, context, and instruments involved.

Many beginning researchers have the misconception that if the hypothesis is not supported by the data, then the study is a failure, and conversely, if the hypothesis is supported, then the study is a success. Neither of these beliefs is true. If a hypothesis is not supported, a valuable contribution may be made through the development of new research methods or even a revision of some aspect of a theory. Such revisions can generate new or revised hypotheses and new and original studies. Thus, hypothesis testing contributes to education primarily by expanding, refining, or revising its knowledge base.

Definition and Purpose of Hypotheses in Qualitative Studies

The aims and strategies of qualitative researchers may differ substantially from those of quantitative researchers. Typically, qualitative researchers do not state formal hypotheses before conducting studies but rather seek to understand the nature of their participants and contexts before stating a research focus or hypothesis. However, as noted earlier, qualitative researchers may develop guiding hypotheses for the proposed research. Rather than testing hypotheses, qualitative researchers are much more likely to generate new hypotheses as a result of their

studies. The inductive process widely used in qualitative research is based on observing patterns and associations in the participants' natural setting without prior hunches or hypotheses about what researchers will study and observe. Qualitative researchers' reluctance to identify variables and predictions immediately stems from the view that contexts and participants differ and must be understood on their own terms before a researcher can begin hypothesizing or judging. Thus, qualitative researchers have more discretion in determining when and how to examine or narrow a topic

The Pilot Study

After the tentative research plan is approved, it may be helpful to try out the proposed procedures on a few participants. This trial run, or pilot study, will help the researcher to decide whether the study is feasible and whether it is worthwhile to continue. At this point, one can ask a colleague to check one's procedures for any obvious flaws. The pilot study provides the opportunity to assess the appropriateness of the data-collection methods and other procedures and to make changes if necessary. It also permits a preliminary testing of the hypothesis, which may give some indication of its tenability and suggest whether further refinement is needed. Unanticipated problems that appear can be solved at this stage, thereby saving time and effort later. A pilot study is well worth the time required and is especially recommended for the beginning researcher.

Suggested Reading

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