

Chapter 3

Appraise of Related Literature

Nature has made only one thing that is more powerful in the universe and that is called as Human or Man. Man is the only animal that can take advantage of knowledge which has been preserved or accumulated through the centuries or since the origin of man. Human knowledge has the three phases: preservation, transmission and advancement. This fact is of particular importance in research which operates as a continuous function of ever-closer approximation to the truth. Practically all human knowledge can be found in books and libraries and money in the banks. Unlike other animals that must start a new with each generation, man builds upon the accumulated and recorded knowledge of the past. His constant adding to the vast store of knowledge makes possible progress in all areas of human endeavour. The investigator can ensure that his problem vacuum and that considerable work has already been done on topics which are directly related to his proposed investigation.

For any specific research project to occupy this place in the development of a discipline, the researcher must be thoroughly familiar with both previous theory and research. To assure this familiarity, every research project in the behavioural sciences, has as one of its early stage, a review of the theoretical and research literature.

MEANING OF REVIEW OF LITERATURE

The phrase 'review of literature' consists of two words: Review and Literature. The word 'literature' has conveyed different meaning from the traditional meaning. It is used with reference to the languages e.g. Hindi literature, English literature, Sanskrit literature. It includes a subject content: prose, poetry, dramas, novels, stories etc. Here in research methodology the term literature refers to the knowledge of a particular area of investigation of any discipline which includes theoretical, practical and its research studies.

The term 'review' means to organize the knowledge of the specific area of research to evolve an edifice of knowledge to show that his study would be an addition to this field. The task of review of literature is highly creative and tedious because researcher has to synthesize the available knowledge of the field in a unique way to provide the rationale for his study.

The very words 'review' and 'literature' have quite different meanings in the historical approach. In historical research, the researcher does much more than review already published material, he seeks to discover and to integrate new information which has never been reported and never considered. The concept and process implied in the term 'review of literature' have such different meanings in historical as compared with survey and experimental research.

The term 'review of literature' has been defined in the following ways:

According to Good, Barr and Scates "The competent physician must keep abreast of the latest discoveries in the field of medicine. Obviously the careful student of education, the research worker and investigator should become familiar with location and use of sources of educational information."

According to W.R. Borg

“The literature in any field forms the foundation upon which all future work will be built. If we fail to build the foundation of knowledge provided by the review of literature our work is likely to be shallow and naive and will often duplicate work that has already been done better by some one else.”

According to Charter V. Good

“The keys to the vast storehouse of published literature may open doors to sources of significant problems and explanatory hypotheses and provide helpful orientation for definition of the problem, background for selection of procedure, and comparative data for interpretation of results. In order to be creative and original, one must read extensively and critically as a stimulus to thinking.”

According to John W. Best

“Practically all human knowledge can be found in books and libraries. Unlike other animals that must start a new with each generation, man builds upon the accumulated and recorded knowledge of the past. His constant adding to the vast store of knowledge makes possible progress in all areas of human endeavour.”

In survey and experimental research, the review of the literature serves a variety of background functions preparatory to the actual collection of data. In these research approaches, the literature is reviewed to create the context from the past for the new study to be conducted with new subjects and newly gathered data. In the historical approach, we never ignore the past and, in the sense review of the literature is the method of data collection if ‘literature’ is used in the broadest possible sense. In this regard the sources used are the ‘subjects’ of the research and the material reviewed of the ‘data’. Therefore, the primary function of the review of literature in the historical research is to provide the research data.

Reviewing the literature has two phases. The first phase includes identifying all the relevant published material in the problem area and reading that part of it with which we are not thoroughly familiar. We develop the foundation of ideas and results on which our own study will be built. The second phase of the review of literature involves writing this foundation of ideas into a section of the research report. This section is for the joint benefit of the researchers and readers. For the researcher, it establishes the background in the field. For the readers it provides a summary of the thinking and research necessary for them to understand the study.

NEED OF REVIEW OF LITERATURE

The review of literature is essential due to the following reasons:

1. One of the early steps in planning a research work is to review research done previously in the particular area of interest and relevant area quantitative and qualitative analysis of this research usually gives the worker an indication of the direction.
2. It is very essential for every investigator to be up-to-date in his information about the literature, related to his own problem already done by others. It is considered the most important pre-requisite to actual planning and conducting the study.
3. It avoids the replication of the study of findings to take an advantage from similar or related literature as regards, to methodology, techniques of data collection, procedure adopted and conclusions drawn. He can justify his own endeavour in the field.

4. It provides as source of problem of study, an analogy may be drawn for identifying and selecting his own problem of research. The researcher formulates his hypothesis on the basis of review of literature. It also provides the rationale for the study. The results and findings of the study can also be discussed at length.

The review of literature indicates the clear picture of the problem to be solved. The scholarship in the field can be developed by reviewing the literature of the field.

OBJECTIVES OF REVIEW OF LITERATURE

The review of literature serves the following purposes in conducting research work:

1. It provides theories, ideas, explanations or hypothesis which may prove useful in the formulation of a new problem.
2. It indicates whether the evidence already available solves the problem adequately without requiring further investigation. It avoids the replication.
3. It provides the sources for hypothesis. The researcher can formulate research hypothesis on the basis of available studies.
4. It suggests method, procedure, sources of data and statistical techniques appropriate to the solution of the problem.
5. It locates comparative data and findings useful in the interpretation and discussion of results. The conclusions drawn in the related studies may be significantly compared and may be used as the subject for the findings of the study.
6. It helps in developing experts and general scholarship of the investigator in the area investigated.
7. It contributes towards the accurate knowledge of the evidence or literature in one's area of activity is a good avenue towards making oneself. This knowledge is an asset ever afterwards, whether one is employed in an institution of higher learning or a research organization.

Bruce W. Tuckman (1978) has enumerated the following purposes of the review:

1. Discovering important variable.
2. Distinguishing what has been done from what needs to be done.
3. Synthesizing the available studies to have perspective.
4. Determining meanings, relevance of the study and relationship with the study and its deviation from the available studies.

Edward L. Vockell (1983) has pointed out the following two purposes:

- The main purpose of this review is to put the hypothesis to be examined in the research report into its proper context.
- Secondary purposes of this part of the report are to provide readers with guidelines regarding where they can look to find more information and to establish the author's credential by letting readers know that the researcher is aware of what has been going on with regard to the current and related topics.

The review of literature provides some insight regarding strong points and limitations of the previous studies. It enables him to improve his own investigation.

PRINCIPLES AND PROCEDURES FOR THE REVIEW OF LITERATURE

The following is the specific procedure through which review can be done appropriately:

1. It is generally advisable to get first and over all view by consulting a general source, such as a text-book which is more likely to provide the meaning and nature of the concepts and variables or theoretical framework of the field. The logical starting point is to get a clear picture of the problem to be solved. A text-book usually provides the theoretical aspects of the problem. It is very essential to develop deep understanding about the variables and the field.

2. After developing the insight about the general nature of his problem, the investigator should review the empirical researches of the area. The best reference for this phase is the handbook of research. Encyclopaedia of Educational Research, the Review of Educational Research and International Abstracts for more upto-date findings.

The researcher's major concern at this point should be to get a clear picture of the field as a whole; specific details are important at this stage. He should start from a topical outline and a temperature set of classifications, so that whatever he reads can be made meaningful.

3. The research for library material must be systematic and thorough. The investigator generally should start by collecting his references from the educational index. When a large number of references are to be copied, they should be typed because precision is required here.
4. The researcher should take note systematically in the light of such criteria as uniformity, accuracy and ease of assembly. The notes should be taken on the card. Each entry should be made separately; references should be recorded with complete bibliographic data. It should be recorded on front side of the card and content should be taken below and reverse side of it. Each note should be recorded carefully and accurately.
5. The investigator should take as complete notes as he might need. On the other hand, taking unnecessary notes is wasteful. The useful and necessary material should be recorded precisely. It would be better that similar sources are gathered.

It is necessary that a general education of each source, rather than simply a summary of its content be made. Such evaluation is necessary both in presenting the study in the review of literature, and in using the study as background for the interpretation of the findings of the study.

6. A major pre-requisite for effective library work is the ability to read at high speed. This can only be developed through practice. He must learn to skim material to see what it has to contribute to the study, only after its reference has been established, it should be read in detail. Surveying the literature for the purpose of conducting research is not just 'a pleasant excursion in the wonderful word of books', it is a precise and exacting task of locating specific information for the specific purpose.
7. The actual note-taking process is always a difficult task for the researcher. He has to spend long hours in the library taking notes by hand. It is a very tedious job and leads to importance to carelessness and illegibility. He should make use of the facilities available in the library for this purpose.

THE NATURE OF THE REVIEW OF THE LITERATURE

Through a process of integration of past research and thinking with current research and thinking, we move knowledge forward. For this process to function successfully, each researcher must know the past so that he can design research to build on what is already known and study what is not. There are times when researchers lack this knowledge. We see researches are being done on matters which have been demonstrated sufficiently so as not to need further replication. When this is done the research becomes an academic exercise of little interest in consequence to the discipline involved. We also see research into the unknown which does not build on the known. In a sense this is the greater professional loss. Needless repetition is only a waste of the researcher's time, money and energy, but new research which is unconnected to previous thinking and research is a lost opportunity to move knowledge forward. When new research is not based on a thorough review of the literature, it becomes an isolated entity bearing at best accidental relevance to what has gone before. When it is based on the literature, we can hope for cohesive and integrated approaches to our problems and for resolution and solution of them through research.

Reviewing the literature has two phases. The first phase involves identifying all the relevant published material in the problem area and reading that part of it with which we are not thoroughly familiar. As we read what others have done and/or thought about the problem area, we gradually develop the foundation of ideas and results on which our own study will be built. The second phase of the review of the literature involves writing this foundation of ideas into a section of the research report.

A distinction must be made between the literature that is reviewed, that is, read by the researcher, and that which is discussed in the study itself, that is, referred to in the section or chapter headed "Review of the Literature." The amount that anyone researcher needs to spend on anyone problem is determined by the unique combination of the problem which delimits the total amount of knowledge needed and how familiar the researcher may be with none, some or even all of that knowledge. The section in the research report discussing the literature is different matter. For the researcher, it establishes the framework or background in the field and thus, provides the setting in which he reports the new study. For the reader, the section provides a summary of the thinking and research necessary for him to understand the study. It also gives the reader a good estimate of the researcher's scholarliness. One basis for this estimate is the researcher's ability to distinguish the relevant from the irrelevant.

How important this stage will be in the development of the researcher's thinking, depends, of course, on the richness of the literature. There are problem areas in education, psychology, and sociology, and in all branches of knowledge in both the social and physical sciences in which there is little literature. The researcher's obligation is to search the literature, find what exists, and review it. 'He is not responsible for previous generations' disinterest or neglect of a problem area, and so if his search yields little, he is entitled to say this. In this case, the written section will simply be a brief statement, identifying the extent of the search, naming the sources consulted, and reporting how little was found.

But let us assume that there is a literature in the problem area. Then the amount of time devoted to this stage of the research depends upon how well the researcher knows the problem area and literature. If he knows the area well and keeps his knowledge current, then he will need only a once-over-lightly review to be certain that he is aware of the latest research and thinking. In all other instances, where a researcher has less than complete current knowledge, a thorough review of the

literature is needed ranging to the deep and extensive review needed by the researcher working in a problem area new to him.

SOURCES OF REVIEW OF LITERATURE

There are various sources of literature which may be used for this purpose. These sources can be broadly classified into these heads. (1) Books and Text-Books material. (2) The Periodical literature, and (3) General references.

1. Books and Text books Material

The most useful list of books published in the English language is the Cumulative Book Index and Book Review Index, Books Review Digest, Subject Guide to Books indicates that books are in print or press or forthcoming books. National Union Catalogue is also useful for this purpose. There are a number of publications that locate specific references that cover particular area of knowledge. The Cumulative Book Index is published monthly to provide the references, all books published in the English Language.

Sources of Information in the social sciences 'organized' by subject area and indexed by author and title, this work contains comprehensive list of reference books and monographs.

2. Periodicals

A periodical is defined as a publication issued in successive parts, usually at regular intervals, and as a rule, intended to be continued indefinitely. These include Yearbook, Documents, Almanacs, The Cumulative Book Index, International Abstracts, Journals, Newspapers, Magazines, International Index to Periodicals.

Periodicals are generally placed in open shelves in the Periodical room. Their effective use is predicted on the use of an index to identify the articles on subject matter under the study.

The Education Index has served as a comprehensive index of practically all publications in the area of education.

Education Index. New York, published monthly.

Canadian Education Index, Ottawa published by the Council of Education.

Current Index of Journals in Education, New York, it is published monthly. Index of Doctoral Dissertations International. Ann Arbor, it is published annually and consolidates all dissertations accepted American, Canadian and European Universities.

Bibliographic Index, New York, this guide indexes by subject current bibliographies of published books and educational periodicals both in English and in foreign languages.

3. Abstracts

Another type of reference guide is the abstract, review, or digest. In addition to provide a systematized list of reference sources, it includes a summary of the contents. Usually the brief summaries of research studies are given in the form of abstract Educational abstracts, International abstracts in humanities.

ERIC Educational Documents Abstracts, Washington DE., this annual publication includes abstracts of all reports which appeared in Resources in Education for, the year. Education Abstracts, psychological Abstracts and Sociological Abstracts are published including research studies in these disciplines.

A wide variety of indexes and general references can be found to cover almost any area in which the modern researcher might be interested.

4. Encyclopaedias

Encyclopaedias provide concise information on a number of subjects written by specialists. They provide a convenient source of information, and often include illustrations and bibliographies. Only specialized encyclopaedias deal with restricted areas of knowledge.

Encyclopaedia of Educational Research, New York. It is published, every ten years. It refers to important work on educational problems.

5. Almanacs, Handbooks, Yearbooks and Guides

This general category of references includes those publications that present rather detailed up-to-date information on a variety of subjects, organized around a given theme. They are the types of references that one consults to find specific information, often of a statistical nature. Generalized sources are listed first, followed by those with a more specialized emphasis.

'World Almanac' Book of Facts, New York: It is source of miscellaneous information of various subjects.

'Handbook of Research on Teaching' Chicago: It provides comprehensive research on teaching within depth and extensive bibliographies.

'Education Year Book', New York: It is annual publication which includes statistical data on major educational issues and movements with an extensive bibliography and reference guide.

'Year Book of Higher Education' : It provides upto-data information on all aspects of higher education in U.S.A., Canada and Mexico.

Mental Measurement Year Book, Highland Park: It provides the most comprehensive summary on psychological measurement and standardized tests inventories. It is published every four years.

6. References on International Education

This type of publications deals with education outside the United States.

'The World Yearbook of Education', New York: It is issued annually and prepared under the joint responsibility of University of London and Teachers College of Columbia University, each issue is devoted to some aspect of international education.

'Inter-national Yearbook of Education', Geneva: The Yearbook presents in English and French a review of educational development for the previous year in the United States, Canada and more than 40 foreign countries.

'Educational Documentation and Information', Geneva: It is a quarterly issue which provides short-descriptive articles on national, international institutions, documentation and research.

'International Handbook of Universities' Paris: This book describes universities and other higher institutions of bearing in more than 100 countries of the world and the British Common wealth. It provides information about facilities, history, structure, academic year, admission, scholarships degree programme, libraries, teaching staff, publications and language of instruction. There is also a publication 'Common wealth Universities Yearbook.' Edinburgh which provides information of universities in 23 Common wealth Countries.

'Higher Education in Developing Countries.' Cambridge: It is a selected bibliography on students. politics and higher education.

7. Specialized Dictionaries

There are specialized dictionaries of education which includes terms, words and their meanings.

'Dictionary of Education,' New York: This educational dictionary covers technical and professional terms. Foreign educational terms used in comparative education writings are also included.

Government of India has also prepared a 'Dictionary of Education' which includes technical and professional terms from English to Hindi.

The educational worker often needs information about another educator or a prominent person outside the field of education. These are essential to conduct an educational research. It requires biographical and auto-biographical references.

8. ERIC (Educational Research Information Centre)

The current knowledge explosion makes selective data retrieval the key to the research enterprise as well as to effective educational practice. The major developments in this regard as they relate to the educational literature are ERIC (Educational Research Information Centre) and SRIS (School Research Information Service). ERIC is an attempt to facilitate information exchange and to increase the value of research to the educational community by simply making its results readily available in usable form. A related service in SRIS initiated to provide and ERIC type coverage of educational materials.

In our country NCERT has established a separate ERIC cell to facilitate educational research community.

9. Microfiche

The development of the microfiche has been one of the most significant contributions of library services by providing economy and convenience of storing and displaying of scholarly material.

A microfiche is a sheet of film containing micro-images of printed material. A copy of film 4" × 6" card contains the material of one hundred printed pages of 9" × 11" size. There are many document-reproduction services that supply microfiche to libraries upon special order.

Super-and Ultra Microfiche is the recent development in the field of micro-printing. It has transformed the process of storage of published material in libraries of the future. A super microfiche has been developed that contains upto two pages of printed material on a single 4" × 6" transparent card, the equivalent of two or more books. An even more spectacular development is the ultra- microfiche that contains upto 3200 micro-dots on a single card of 4" × 6". When projected each dot contains the equivalent of several pages. Thus, seven to ten volumes can be included on a single 4" × 6" transparent card. Reader printers make hard copy points out of any page in few seconds.

10. Dissertations and Theses

The theses and dissertations which embody the bulk of presenting educational research, are usually housed by the institutions and universities that award the authors their advanced degrees. Sometimes these studies are published in whole or in part in educational journals. The related dissertations and theses are the main sources of review of literature. the entry 'dissertations and theses' issue of the bibliographic index in the most comprehensive listing of sources to these research in progress.

11. Newspaper

The current newspapers provide upto-data information and speeches, reports, conferences, new developments in field of education. The current events and educational news are also reported in newspapers. It is also one of the important sources of review of literature.

Exploring the literature moves the researcher to the frontiers of knowledge where he can evaluate new findings in his field, gaps in knowledge contradictory findings and identifying needed research. He will be familiar with methods and bibliographies that may prove useful in his own investigation.

THE FUNCTIONS OF THE REVIEW OF LITERATURE

There are five functions of review of literature :

1. The conceptual frame of reference for the contemplated research.
2. An understanding of the status of research in problem area.
3. Clues to the research approach, method, instrumentation and data analysis.
4. An estimate of the probability of success of the contemplated research and the significance or usefulness of the findings and, assuming the decision is made to continue.
5. Specific information required to interpret the definitions, assumptions, limitations and hypotheses of research.

The detailed description of these functions have been given in the following paras:

1. Conceptual Frame of Reference

The first function, provides the conceptual framework of research which involves both conceptual and research literature. The most direct way of doing this is to read the basic writings in the field as well as the recent writings of key thinkers. The researcher must feel fully satisfied when he has completed this phase of his view that he is aware of all the points of view in the field and particularly that he has devoted himself diligently to learning about the points of view which differ from or are opposite to his own. All points of view relevant to the research problem should be presented as strongly as the most devoted proponents of that point of view would wish.

The first function of review of literature provides the sound conceptual framework of the research problem. He should feel that, in a debate or seminar, he is able to represent any point of view fully, in the sense that he has come to understand the arguments for that point of view.

2. Status of Research

The second function of the review of the literature is to provide an understanding of the status of research in the field. This comes from reviewing the research literature. This phase has several specific sub-functions which can be described in terms of the questions words: what, when, who and how. These four words provide the basic information which reveals the status of the research in hand.

First, through his review of the research literature the researcher learns what researchers have already been undertaken and completed in the problem area and the results that this research has already achieved. The unnecessary repetition can be avoided. Learning about research in progress is difficult to locate. Within specific university or the experts of research degree committee can help in this direction.

The other aspect of what, learning the results of previous research, is the best known purpose of reviewing the literature. We are more interested in learning about previous research than the result. After intensive review of conceptual and research literature in such an area, a researcher may develop confidence that he has an explanation for the inconsistencies.

In addition to learning what has been done, the researcher seeks to identify when the research has been done, specifically how current research has been done, specifically how current research in the

problem area is. There are periods of time in which a great deal of research is done in the problem area. Learning when previous research has been conducted has several meanings for researcher:

- It will determine how far back chronologically his review of the literature will follow.
- When there is a wealth of recent research in the problem area.
- When there has been a recent lack of interest in the field, he will need to go further back until he comes upon the research.
- Replication is sensible when a research study has provided the basis of some current belief that the findings still hold true.

With 'what and when' considered, let us consider the importance of 'where', that is, identifying the geographic areas in which the previous research has been completed. The major categories within this classification are national, regional, and degree of urbanization. Typically, educational research reviewed by researcher is limited nationally of Indian conditions, in that it consists of previous research done in this country.

The importance of the second category, region, depends on the problem area. For some area, primarily those in educational psychology, studying human characteristics and basic behaviour, region would seem irrelevant. For example, in research in the learning process, it seems sensible to ignore region of the country, and instead to accept the assumption that people learn through the same psychological processes in India as they do in the U.S.A. However, when the research moves into areas involving attitude, patterns administrative policy or educational history, despite the large common areas, it is not possible to assume that the regions of India present relatively the same research settings. They differ in such varied areas as the origin and tradition of the schools and, reflecting climatic and economic differences, in the length of the school as well as in the months which children spend in school. They differ also in levels of achievement, as reflected in the different regional standards of national competitive examinations like the Merit Scholarship Examination. For this reviewing research in these areas, the researcher will take careful note of the regions of the country in which the previous research has been conducted. Then he will have to decide whether or not this research applies to the region of his own research and use it accordingly.

It is important to recognize that research of national scope is now feasible to a much greater extent than was possible' only a few years ago. This is true both because of increased knowledge and facilities for obtaining research data from a broad geographic area and because of increased facilities for processing means of data quickly and inexpensively.

Much the same set of arguments can be applied to the third category, degree of urbanization. This, like region, is a characteristic whose importance depends upon the problem area. The degree of urbanization of the community in which research is done may vary from rural communities at one extreme to large metropolitan centres at the other extreme. The most cursory review of the educational literature will indicate that the preponderance of research in every problem area has been done in metropolitan settings. Thus, the researcher designing a project to be conducted in metropolitan centres will find similar research settings in the literature; the researcher designing a project with a rural setting will find little. Perhaps the most discussed area at present is the education of the culturally disadvantaged child. Reading the literature one would assume that culturally disadvantaged children live only in urban centres. In fact, the educational problems they pose have a much longer history in rural settings.

The solution of this, of course, is to consider not only where previous research was conducted but who was studied. This means identifying the universes or populations which have previously been studied, how they were sampled, and the extent of the sampling. Here the researcher is interested in the

broad general levels of universes studied, as well as in the specific populations sampled. For instance, the researcher in education will seek to determine how much of the research in the problem area involves pupils, teachers, parents, administrators, or the public. He will also want to identify which groups of pupils; elementary or secondary, first graders, second, or third? Finally, he will want to note the size of the samples used. Has the researcher in the problem area typically used small samples or large samples? Is there a study which had usually broad population and substantial sample size? To what extent has population been stratified on variables like socio-economic background, intelligence, sex, interest, and achievement in the problem area? Finally, if he has even tentatively identified his own population, he will be interested specifically in the extent to which there has been previous research on that population.

One purpose of this consideration of the 'who' of previous research is to enable the researcher to make a judgement as to the relevance of a universe and population for his own research. Theoretically, he would advise students not to plan to study those universes or populations which have already been sufficiently studied in the problem area, either at the general or specific level. In reality, with the current status of research in most problem areas in education and the social disciplines, this is not a difficulty as there are no problem areas in which populations have been sufficiently studied.

3. Research Approach, Method, Instrumentation and Data Analysis

This function of the review will serve the third function of providing clues of methodology and instrumentation. Specifically, the researcher will want to learn the extent to which previous research in the problem area has utilized the historical survey, or experimental approaches, because this will help to guide his own choice of research approach. For this same reason, he will want to identify the research methods which have been used so that experience with these can help him select his own. Finally, he seeks to become familiar with the data-gathering instruments which have been used so that if an already existing instrument is appropriate, it can be used intact or adapted for his own research.

For this consideration of the how of previous research the researcher should be as interested in identifying the rationale for the selection of a particular approach method, or instrument. Furthermore, he should also be interested in what alternative approaches methods and instruments were considered and/or tried out and why these were rejected. Unfortunately the rationale for the selection of research approach method, and instrument, and the thinking that motivated the rejection of alternatives, is generally omitted from the research literature in every branch of the social sciences.

In addition to learning rationals for method as fully as possible to completely serve the third function of the review of literature providing clues to methodology and instrumentation, the researcher should know what methods and techniques have been used in his problem area and the success achieved with each. Depending on his purpose in doing research he may decide to use a technique which has been shown to function successfully or to try one which has not been used before in the problem area. He would not try techniques which have been unsuccessfully unless he had specific reasons to believe that his use of the method was significantly different from previous attempts.

In the third function of the review of literature, the review of instruments parallels the review of techniques in that area, too, the researcher is seeking to learn what has worked and what has not. If he is fortunate enough to discover a successful instrument which he can use this is preferable to developing a new instrument for two reasons. It establishes continuity between the new research and the previous research and it spares the researcher the time-consuming and difficult job of instrument development. Even finding an instrument which can be adapted to the needs of research is a tremendous advantage.

Again, we must put in a realistic qualification. Most journals which report research do not print the actual instruments. Often these do appear in the appendix of the complete research report or thesis or dissertation on which many journal articles are based, or else can be obtained directly from the author of the article. The simplest procedure is usually to contact the author directly, since in any event he will be contacted for permission to use or adopt any instruments he has developed.

It is important to distinguish between what are generally considered standardized instruments and those specially developed for some previous research project. Standardized instruments are those which have been used widely enough for normative data to be available. The process of standardizing instruments also provides data on reliability, and sometimes on the availability of the instrument. The availability of these three kinds of data norms, estimate of reliability, and estimate of validity make standardized instruments attractive to researchers, particularly to students doing research. These attractions are quite real using an instrument with norms and established reliability does have great advantages when these data have been obtained from samples from the same universe as we plan to study.

Another instance where the availability of normative data is not enough of an advantage to use an instrument is when the literature indicates that, although standardized data are available, the previous research provides little hope that the instrument will produce meaningful data. For too often in the literature we find studies which use standardized instruments in instances where it was obvious they would not function.

The discussion above on these first three functions of the review of the literature for survey and experimental research should also imply what it is that the researcher is seeking as he reads. For the first, or overview function, he is concerned with identifying each point of view and supporting arguments and evidence for that point of view. For the second function, the status of research, he will do much more structured and specific review, concerned with identifying what was studied, the outcomes of each study, how the outcome of the several separate studies relate to each other, who had studied and where, and when the research was done. For the third function, clues to methodology and instrumentation, he is concerned with how the previous research was done and why it was done, the way it was.

In a sense, it is the combination of these first functions which yield the fourth and fifth functions of the review of the literature.

4. Probability of Success and Significance of Findings

With the full body of the previous research reviewed, the researcher is in a position to evaluate the success which others have had done research in the problem area and the usefulness of their findings. If others have been successful and the findings are useful, then the prognosis for his own research is good, and the decision to continue on with the research is clear and simple to make. However, if others have been unsuccessful and produced inconclusive research or research of little value, then the researcher has a more difficult to make decision. He must ask himself whether there are specific reasons to believe that he can succeed where all others have failed. For the literature truly to serve this function of providing as estimate of the success potential of the contemplated research, the researcher must be willing to make the negative decisions to abandon or alter the project, as well as the positive ones to continue on as intended. All too often in research, only lip service is paid to this function. Researchers do review the literature and do seek to determine the success potential of their contemplated research, but never truly entertain the possibility of altering or abandoning their plan. If no one has ever succeeded in doing what they plan, they argue that they must be the first. This author would say more power to

them, and would be the first to cheer their courage provided it was based on something more substantial than hope.

If the researcher has some new idea, some new method, some new instrument, which leads him to believe he will succeed where all others failed, then he has every right to proceed. However, if he only intends to try again what has never worked before, then he should seriously consider whether he can reasonably expect to do any better than his predecessors. If not, he should devote his time, energy, and ability to a research problem in which there is a greater likelihood of his making a positive professional contribution.

5. Definitions, Assumptions, Limitations, and Hypotheses

After considering the literature the researcher can honestly conclude that there is a reasonable expectation that he will successfully complete the contemplated research with results that will make a contribution of his field. Then he will use the material from the literature as the basis for stating his definitions, assumptions, limitations, and hypotheses. Having read the works presenting opinion and theory in the problem area, and having reviewed the relevant research as well, the researcher should be thoroughly familiar with the way in which terms have been used, both in the theoretical sense in the conceptual literature, and in the more functional sense in the research literature. Thus, he should be able to formulate the definitions for his contemplated project. Where possible and sensible, he should use the definitions which have previously been used in the literature, because this is one way of making old and new research comparable. Where necessary, however, he is free to adapt previous definitions or formulate new ones. The essential point is that this be a knowledge decision made with full awareness of how key terms have been used previously.

In the same way that the review of research makes the researcher aware of how terms have been used, it (the conceptual review as well) should have made him aware of those aspects of the problem area which have been so well demonstrated by previous research that they are widely accepted as true. These he can use as the assumptions of his own research. Finally, he should have become sufficiently attuned to the controversial or open-to-question aspects of the problem area. Then, as he plans his research, he can be alert to which of these aspects he can or which he cannot handle in his own project. Those he cannot handle will form the basis for the statement of limitations of the research.

His awareness of the results of previous research, and his knowledge of the current thinking in the field, can now be combined with his own experience to produce the statement of the hypotheses, or expected results of the research. In addition to identifying the expected outcomes of his study, the researcher should identify the bases in the literature for each specific belief. In this way in both the outline and the report of his project, he can state the rationale for each hypothesis, identifying the theorist, previous research study, personal experience, or combination of these which leads him to expect this particular result.

In addition to the five direct functions discussed above, we can identify one indirect function of the review of the literature; to serve as a sounding board to help the researcher know when his research problem has been sufficiently specified. This function can best be described in terms of two different feeling tones. The first feeling tone is one in which the researcher finds that, simultaneously, all of the literature seems relevant or none of it seems relevant. This is the feeling tone characteristic of the early stages in problem development when the research problem is insufficiently specific. As the problem is specified, however, and the researcher continues to read, a subtle change takes place. He now finds that certain articles or studies have a striking and exciting relevance; others while possibly in the same problem area, are not directly related. When he experiences this feeling as he reviews the literature,

then he knows that the research problem is approaching sufficient specificity. We can restate the general rule mentioned earlier. As long as this judgement of relevance is difficult to make, the literature is reflecting insufficient clarity and/or specificity in the research problem.

HOW TO CONDUCT THE REVIEW OF THE LITERATURE

The place to begin a review of the literature varies, depending upon how familiar the researcher is with the problem area. As we stated earlier, the thoroughly well-read researcher will need to complete only a brief review of the latest writings and research. Since this researcher will also know the major thinkers and sources of research in the field, he does not usually need help in conducting this brief review. This section then, will assume that the researcher is not an expert in the problem area and discuss how the non-expert reviews the literature.

The non-expert should begin by reviewing the conceptual literature, for it is more comprehensive than the research literature and will provide a better overview of issues. An excellent place to begin is with a general text in the problem area in an encyclopaedia or review of recent works. In education, we have excellent general texts in almost all areas as well as general encyclopaedias like the Encyclopaedia of Modern Education and the Encyclopaedia of Educational Research, and more specific works like the Encyclopaedia of child Care and Guidance or the Yearbook of the National Society for the study of Education.

When the research problem has been specified, the researcher should take stock of his reading to date, particularly appraising its relevance in the light of the newly specified research problem. He will want to ascertain whether the conceptual literature already reviewed provides a thorough conceptual framework for the specific problem that he has now decided upon, or whether further work is needed in the conceptual literature. In other event, however, he will also want to move on now to the research literature, and begin to see the what, when, where, who and how of previous research on his specific research problem.

In the course of reading the conceptual literature he will have come upon references to research studies. These may be a good first set of studies to locate and read, preferably as complete report. But usually at some point, his list of references is exhausted and the non-expert will seek other references from the mass of the published literature. We are fortunate in education in having available several basic tools to use for reviewing professional literature, such as the Education Index, Child Development Abstracts, Psychological Abstracts, sociological Abstracts, and parallel tools for the lay literature such as the Cumulative Book Index, and the Reader's guide to Periodical Literature.

In fact there are two guides to reference books and a book on how to locate educational information. These, and the most frequently used indexes and abstracts are listed above, with a brief summation of the main function, purpose, and organization of each. The researcher not already familiar with all of these resources should make it a point to become familiar with each of the sources listed, since at some point in most research, any or all of them might be useful.

The non-expert begins this phase of his review by using the index or abstract most relevant to his problem area. For example, for the researcher interested in developing a research project in the area of teacher-education in the elementary school, the most relevant index is the Education Index. As noted in the list above, this is an alphabetical topical index issued monthly which lists under each topic recent relevant books and journal articles. To use the Education Index in the review of the literature for the teacher-education study, the non-expert would take the specific problem on teacher-education, also

listing several related terms like “teaching practice” criteria of admission, and “identifying teaching skills” and go to the Education Index, pick up the most recent bound volume, look under these headings, and copy every title appearing there which seems to have relevance for the problem.

SOME HINTS FOR REVIEW OF LITERATURE

Some miscellaneous hints are provided here on how to review the literature. First additional library sources will be helpful, such as Specialized dictionaries and biographical references. The dictionaries, of course, are most useful in formulating the research definitions, but also of value in making certain that we understand all of the concepts that we discover in the literature. It is a good policy to verify our understanding of all important terms and concepts, even those which are familiar. We may have enough grasp of the term to use it in conversation, yet not understand it well enough to use it in research. The listings of thesis and dissertations provide the most complete and current contact with a large part of the research done in colleges and universities, much of which is not published and so never indexed or abstracted.

A second hint is to realize that reviewing the literature is essentially the library phase of the project, and so we must become thoroughly conversant not only with the way in which libraries in general function, classify, and catalogue, but also with the way in which the specific library in which we work does these things. Obviously, we must become thoroughly familiar with the general catalogue and Library of Congress cataloguing system/Individual libraries differ. Therefore, the simplest procedure is to thoroughly familiarize ourselves with the rules and techniques of the libraries in which we shall do our bibliographic research. Most libraries have staff available to give an overview of the procedure and rationales by which the library material is catalogued and organized, and we should take advantage of this advice. Trial and error at this stage is needlessly wasteful of that precious research commodity, time, and so is to be avoided.

A third hint is to recognize that there are only two criteria for good bibliographic research; accuracy and consistency. Therefore from the very beginning of the review of the literature it is sound practice to begin recording the essential information accurately and in exactly the same way.

A fourth hint is to copy direct quotations and not paraphrases of an author's remarks on the bibliography cards. It is impossible at the early stage of the research to know in what form we will want to use an idea abstract from the literature. If we have it transcribed directly, we can use it later in our report either as a quotation or paraphrased. If, however, we only paraphrased it and later want to use the quotation, we must make a wasteful and unnecessary trip to the library. When a quotation is put down on the bibliography card, be certain to note the page number of the book or journal on which it appears, for this will be needed in referring to the quoted remark.

Consistently, throughout this library phase of the research, we should be over-compulsive in our note taking. If we err, it is far better to err on the side of writing too much than on the side of writing too little.

The one thing we wish to avoid is the necessity, later in the project when time is precious and needed for activities like data analysis and report writing, of having to return to the library to amplify some brief note or verify a half-remembered quotation. In keeping with this thinking, at every stage of the project we should also make a note and keep a record of every information seeking activity in which we engage. This includes correspondence, conversations and discussions on appropriate techniques or methodology with consulting experts. Remember that until the research project is completed and the report written, it is impossible to know what will and will not ultimately prove to have relevance.

We should also be aware throughout the review of the functions of the review of the literature and organize our material under these different functions. This means that as we read we keep in mind that we seek seven major areas of information:

1. Support for the need for our study; its success potential, and its potential significance.
2. Delineation of the major theoretical points of view. Summary of research results.
3. Clues for the hypotheses of the proposed study.
4. The rationale for each hypotheses.
5. The definitions, assumptions and limitations of the proposed study.
6. Clues for methodology and instrumentation.

The final stage of the review of literature is to write that section of the research outline or report based on the review. There are two reasons why at least a draft of this material should be written at the point in time when the review is completed. First of all, our thinking is fresh and complete; it is astonishing how much we forget when we delay writing. Second, the review will be the foundation on which we build the structure of our study, and we should achieve the precision and closure which come only with writing. With this achieved, we are ready to move on to the next step of the research process.

SUGGESTIONS FOR LIBRARY USE

The educational research studies can be classified into two categories; library research and field research. Philosophical and historical researches are known as library research in which review of literature is considered as method of research. The survey and experimental researches are the field research in which review of research is considered as an inquiry or technique research. In both types of studies library is used for the review of literature.

The major difficulty to use library effectively is to take notes and to sit, for a longer time. For this purpose students should use the advantage of modern facilities wherever possible in the libraries.

The following facilities are available in our good libraries:

1. Most of libraries have typing facilities for the use of research scholars at very nominal charges.
2. He should make use of photo-state facilities for maps, charts, diagram or any figure or table. It is available in our libraries at the minimum charges. It is a very economical device from time and money point of view.
3. Another very satisfactory procedure is to dictate notes directly from the references into a portable tape-recorder for transcription at one's convenience.
4. There is inter-library loan facility provided. The research scholar can request the librarian for references or unpublished thesis from other university library.

Notes Taking: It is an art which can be acquired by practice and persistent efforts. The following precautions are to be taken in taking notes from the library :

1. The researcher should be well acquainted with bibliography references, foot-notes and notations are used for reporting a research work e.g. *ibid*, *op. Cit.*, *loc-cit*, Journal no. and vol. etc.

2. The library note should not be taken on note-book papers or sheet of paper. He should make use of cards measuring 3" × 5" or 4" × 6" which are specially prepared for this purpose because they are easy to carry and easy to arrange topic wise.
3. He should make efforts that a card should include only one topic or one reference or one study on one card so that rearrangement may be easier.
4. At the top of the card library number should be noted down, after that author or editor, year of publication, title of the book or journal, publication edition or no. and volume. These should be written below the reference the reverse or back can also be used for this purpose.
5. Each card, when ready should be fitted under a definite heading or topic marked at the top of the card.
6. Notes must be complete, legible and understandable and no gap should be left.
7. Direct quotation should be carefully acknowledged.
8. The appropriate and relevant material should be noted down and he should not waste time for unnecessary material.

PRECAUTIONS IN LIBRARY USE

The following precautions are to be taken in the use of library for review of the literature:

1. Avoid intellectual dishonesty and guard against the temptation of appropriating large portions of the work of another, without acknowledging indebtedness.
2. Guard against being conditioned by the view point of an earlier investigator and the temptation of blindly following his procedure.
3. In certain cases some studies have no needed to be repeated under similar conditions in order to secure an adequate check on the results of the first investigation. Normative survey type of research which deals with current conditions needs to be replicated on a regular interval in order to keep in touch with change and developments.
4. Merely listing of previous studies without reviewing them or giving their characteristics is not enough. A very brief account of each investigation giving at least the result, the method and the sources of data and the year of research must be provided in the chapter of a research report.
5. It is always helpful to arrange the previous studies in chronological order so that the growth of the field is clearly known to the researcher as well as to the readers.
6. A researcher should have good grasp of library procedures which will help him to locate books and references needed by him without wasting most of time and energy. This process can be classified into three categories:
 - (a) *Preliminary Reading*, for the birds eye view of the whole thing.
 - (b) *Critical Reading*: The references and material which seem useful as a result of preliminary reading are noted down and are read critically and serious evaluation of the available information and data.

Completion of Bibliography

The bibliography of references which are really significant for the study should be read carefully and noted down systematically.

REPORTING REVIEW OF LITERATURE

Generally review of literature is reported in the second chapter of the thesis or dissertation. The purpose of reporting the review of literature is not to write down research abstracts one by one which is usual practice of the researcher of to-day. It is most difficult and creative job on the part of researcher. The following procedure should be followed in reporting it :

1. The research should go through collected research studies of the field. He should make an attempt to exhaust all sources of review of literature. He should try to evolve a criterion for classifying the studies. The usual or traditional classification is: studies conducted abroad and studies conducted in India in educational research. The educational researches can be classified: on the educational level "(primary, secondary and college); and on the basis of variables of the study.
2. After evolving criterion of classification, these studies, are arranged according to criterion. One type studies review should be reported separately. The similar type of findings should be given in next para, and he should try to relate with to his own study. This procedure should be followed for reporting all types of studies.
3. At the end of review of literature. he should try to summarize in brief to provide a global picture of whole knowledge of the studies. After that he should relate his study to them and evolve gaps. In the end he should show that his study is a derivation from these studies.

SUGGESTIONS FOR REPORTING REVIEW OF LITERATURE

The reviewing of literature is the continuous process. A researcher begins the review of literature even before selecting his problem of research. The review of literature generally helps in identifying and selecting a research problem. If researcher has selected a problem of his own or suggested by some expert; even then he has to review literature for its justification that it is a novel problem. After selecting and defining a problem, he has to formulate hypotheses for the problem. The review of literature provides the rationale or basis for these hypotheses. The rationale for method, sample tools and statistical technique are obtained from the review of the studies. The results and findings are discussed at length with the help of review of literature. The findings of earlier studies may support his formulation or contradict. He has to advance some reasons for it. The review of literature is used from selecting a problem upto reporting the findings of a study.

Second suggestion is that knowledge is increasing or advancing rapidly and research studies are on going process. A research scholar should remain in touch with library literature or the field throughout the period of his research work. He should be upto-date at the time of reporting review of literature and discussing his findings.

The reporting review of literature makes the research study very scientific and up-to-data. It is not only useful in preparing and writing a thesis but mastery of the review of literature develops the scholarship in the researcher. He justifies in any interviews, seminars, conferences and also in his teaching job and professional growth.

EXERCISES

1. Define the term 'Review of literature', how is it different from traditional meaning? Enumerate the objectives and significance of review of literature.
2. Explain the need and functions of review of literature.
3. Describe the role of review of literature in historical research and survey, experimental type of research in education.
4. Enumerate the sources of review of literature and suggestions, for the use of library for this purpose.
5. Describe principles and procedures of review of literature and precautions in consulting library material.

Chapter 4

Foundation of Hypotheses

The second step in the research process of social study is to formulate hypotheses. The hypothesis is a tentative solution of a problem. The research activities are planned to verify the hypothesis and not to find out the solution of the problem or to seek an answer of a question. It is very essential to a research worker to understand the meaning and nature of hypothesis. The researcher always plan or formulate a hypothesis in the begining of the problem.

MEANING OF HYPOTHESIS

The word hypothesis is made up of two Greek roots which mean that it is some sort of 'sub-statements', for it is the presumptive statement of a proposition, which the investigation seeks to prove. The scientist observes the man of special class of phenomena and broads over it until by a flash of insight he perceives an order and intelligent harmony in it. This is often referred to as an 'explanation' of the facts he has observed. He has a 'theory' about particular mass of fact. This theory when stated testable proposition formally and clearly subjected to empirical or experimental verification is known as a hypothesis. The hypothesis furnishes the germinal basis of the whole investigation and remains to the end its corner stone, for the whole research is directed to test it out by facts. At the start of investigation the hypothesis is a stimulus to critical thoughts offers insights into the confusion of phenomena. At the end it comes to prominence as the proposition to be accepted or rejected in the light of the findings. The word hypothesis consists of two words:

Hypo + thesis = Hypothesis

'Hypo' means tentative or subject to the verification and 'Thesis' means statement about solution of a problem.

The world meaning of the term hypothesis is a tentative statement about the solution of the problem. Hypothesis offers a solution of the problem that is to be verified empirically and based on some rationale.

Another meaning of the word hypothesis which is composed of two words:

'Hypo' means composition of two or more variables which is to be verified.

'Thesis' means position of these variables in the specific frame of reference.

This is the operational meaning of the term hypothesis. Hypothesis is the composition of some variables which have some specific position or role of the variables i.e. to be verified empirically. It is a proposition about the factual and conceptual' elements. Hypothesis is called a leap into the dark. It is a brilliant guess about the solution of a problem.

A tentative generalization or theory formulated about the character of phenomena under observation are called hypothesis. It is a statement temporarily accepted as true in the light of what is known at the time about the phenomena. It is the basis for planning and action- in the research for new truth.

DEFINITIONS OF HYPOTHESIS

The term hypothesis has been defined in several ways. Some important definitions have been given in the following paragraphs:

1. Hypothesis

A tentative supposition or provisional guess “It is a tentative supposition or provisional guess which seems to explain the situation under observation.”
– James E. Greighton

2. Hypothesis

A Tentative generalization.

A Lungberg thinks “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 further investigation.”

3. Hypothesis: Shrewd Guess

According to John W. Best, “It is a shrewd guess or inference that is formulated and provisionally adopted to explain observed facts or conditions and to guide in further investigation.”

4. Hypothesis: Guides the Thinking Process

According to A.D. Carmichael, “Science employs hypothesis in guiding the thinking process. When our experience tells us that a given phenomenon follows regularly upon the appearance of certain other phenomena, we conclude that the former is connected with the latter by some sort of relationship and we form an hypothesis concerning this relationship.”

5. Hypothesis

A proposition is to be put to test to determine its validity:

Goode and Han, “A hypothesis states what we are looking for. A hypothesis looks forward. It is a proposition which can be put to a test to determine its validity. It may prove to be correct or incorrect.

6. Hypothesis

An expectation about events based on generalization:

Bruce W. Tuckman, “A hypothesis then could be defined as an expectation about events based on generalization of the assumed relationship between variables.”

7. Hypothesis

A tentative statement of the relationship between two or more variables:

“A hypothesis is a tentative statement of the relationship between two or more variables. Hypotheses are always in declarative sentence form and they relate, either generally or specifically variable and variables.”

8. Hypothesis

A theory when it is stated as a testable proposition. M. Verma, “A theory when stated as a testable proposition formally and clearly and subjected to empirical or experimental verification is known as a hypothesis.”

9. Hypothesis

A statement temporarily accepted as true :

Barr and Scates define as, “A hypothesis is a statement temporarily accepted as true in the light of what is, at the time, known about a phenomena, and it is employed as a basis for action in the search for new truth, when the hypothesis is fully established, it may take the form of facts, principles and theories.”

10. Hypothesis

A testable proposition or assumption.

George, J. Mouly defines that, “Hypothesis is 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.”

11. Hypothesis

Tentative relationship of two or more variables either normative or casual:

“A hypothesis is defined as a statement for the tentative relationship of two or more variables. The relationship of the variables may either be normative or causal relationship. It should be based on some rationale.”

ASSUMPTION, POSTULATE AND HYPOTHESIS

The terms assumption. postulate and hypothesis occur most frequently in the research literature, but are often confused by research scholars. Hence these terms need clear explanation.

- (a) **Assumption:** Assumption means taking things for granted so that the situation is simplified for logical procedure. Assumptions are not the very ground of our activity as the postulates are. They merely facilitate the progress of an agreement a partial simplification by introducing restrictive conditions. For example, the formulas of Statistics and measurement are based on number of assumptions. Assumption means restrictive conditions before the argument can become valid. Assumptions are made on the basis of logical insight and their truthfulness can be observed on the basis of data or evidences. The postulates are the basis and form the original point of an argument whereas assumptions are a matter of choice and less use, we make them more free will and our argument be a general proposition or convention.
- (b) **Postulate:** Postulates are the working beliefs of most scientific activity. The mathematician begins by postulating a system of numbers which range from 0 to 9 and can permute and combine only thereafter. Similarly ‘Hull’s Theory of Reinforcement’s is based on eight postulates of behaviour of an organism. With many people God and Spirit is a postulate of the good life or godly life. Postulates are not proven; they are simply accepted at their face value so that their basic work for the discovery of other facts of nature can begin.
- (c) **Hypothesis:** A hypothesis is different from both of these. It is the presumptive statement of a proposition which the investigator seeks to prove. It is a condensed generalization. This generalization requires a knowledge of principles of things or essential characteristics which pertain to entire class of phenomena.

The theory when stated as a testable proposition formally and clearly and subjected to empirical or experimental verification is known as hypothesis.

The hypothesis furnishes the germinal basis of the whole investigation and remains to test it out by facts.

The hypothesis is based on some earlier theory and some rationale whereas postulates are taken as granted true. An assumption is the assumed solution of a major problem. It may be partially true.

The scientific research process is based on some hypotheses. The nature sciences and mathematics are based on postulates. The statistic is based on some assumptions which are considered approximate science. The assumptions are helpful in conducting a research work in behavioural sciences.

OBSERVATION VERSUS SPECIFIC AND GENERAL HYPOTHESIS

Hypotheses are often confused with observation. These terms refer to quite different things. An observation refers to what is...that is to what is seen. From observation researcher may infer. For example a researcher may go into a school and after looking around. Observe that most of the students are back. From that observation he may infer that the school is located in a poor neighbourhood. Though the researcher does not know that the neighbourhood is poor, he expects that the majority of people living there are poor. Then he has formulated a specific hypothesis setting forth an anticipated relationship between two variables like race and income level. For the test of this hypothesis researcher could walk around the neighbourhood, observe the home and the income levels. After observation he provides support for this specific hypothesis for this researcher might make a general hypothesis. The second hypothesis represents a generalization and must be tested by making observation as was the specific hypothesis. Since it would be impossible to observe all universe or population, thus, the researcher will take a sample and reach conclusion on a probability basis for the verification of hypothesis being true or not.

There is some difference between specific and general hypothesis. Specific hypothesis requires fewer observations for testing than the general hypothesis.

For testing purpose a general hypothesis is reformulated to a more specific one.

NATURE OF HYPOTHESIS

The following are the main features of a hypothesis:

1. It is conceptual in nature. Some kind of conceptual elements in the framework are involved in a hypothesis.
2. It is a verbal statement in a declarative form. It is a verbal expression of ideas and concepts, it is not merely idea but in the verbal form, the idea is ready enough for empirical verification.
3. It has the empirical referent. A hypothesis contains some empirical referent. It indicates the tentative relationship between two or more variables.
4. It has a forward or future reference. A hypothesis is future oriented. It relates to the future verification not the past facts and informations.
5. It is the pivot of a scientific research. All the research activities are designed for its verification.

The nature of hypothesis can be well understood by differentiating it with other terms like assumption and postulate.

FUNCTIONS OF HYPOTHESIS

The following are the main functions of hypothesis in the research process suggested by H.H. Mc. Ashan :

1. It is a temporary solution of a problem concerning with some truth which enables an investigator to start his research work.
2. It offers a basis in establishing the specifics what to study for and may provide possible solutions to the problem.
3. Each hypothesis may lead to formulate another hypothesis.
4. A preliminary hypothesis may take the shape of final hypothesis.
5. Each hypothesis provides the investigator with definite statement which may be objectively tested and accepted or rejected and leads for interpreting results and drawing conclusions that is related to original purpose.

The functions of a hypothesis may be condensed into three. The following are the threefold functions of a hypothesis:

- (a) To delimit the field of the investigation.
- (b) To sensitize the researcher so that he should work selectively, and have very realistic approach to the problem.
- (c) To offer the simple means for collecting evidences to the verification.

IMPORTANCE OF A HYPOTHESIS

1. *Hypothesis as the Investigator's "Eyes"*: Carter V. Good thinks that by guiding the investigator in further investigation it serves as the investigator's "Eyes" in seeking answers to tentatively adopted generalization.
2. *It Focuses Research*: Without it, research is unfocussed research and remains like a random empirical wandering. It serves as necessary link between theory and the investigation.
3. *It Places Clear and Specific Goals*: A well thought out set of hypothesis is that they place clear and specific goals before the research worker and provide him with a basis for selecting sample and research procedure to meet these goals.
4. *It Links Together*: "It serves the important function of linking together related facts and information and organizing them into wholes."

– Good Barr and Scates

5. *It Prevents Blind Research*: "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."

– P. V. Young

6. *As a Sort of Guiding Light*: A hypothesis serves as a powerful beacon that lights the way for the research work.

George J. Mouley thinks that Hypotheses serve the following purposes:

1. They provide direction to research and prevent the review of irrelevant literature and the collection of useful or excess data.

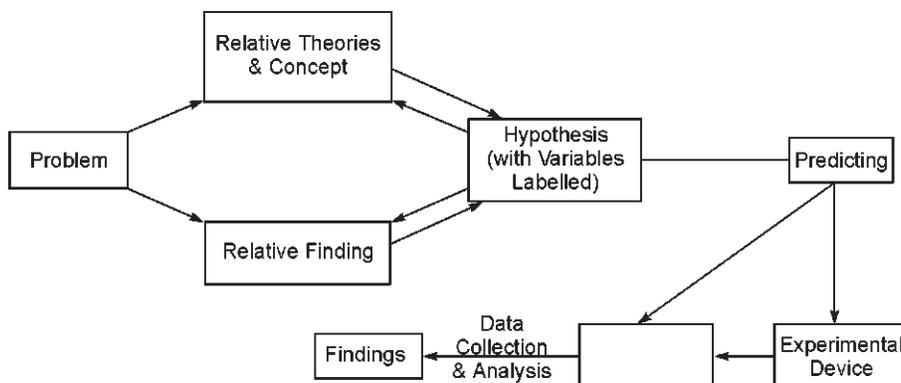
2. They sensitize the investigator certain aspects of situation which are irrelevant from the standpoint of the problem at hand.
3. They enable the investigator to understand with greater clarity his problem and its ramification.
4. They serve as a framework for the conclusive-in short a good hypothesis:
 - (a) Gives help in deciding the direction in which he has to proceed.
 - (b) It helps in selecting pertinent fact.
 - (c) It helps in drawing conclusions.

D.B. Van Dalen advocates the Importance of Hypothesis in the following ways:

1. Hypotheses are indispensable research instrument, for they build a bridge between the problem and the location of empirical evidence that may solve the problem.
2. A hypothesis provides the map that guides and expedites the exploration of the phenomena under consideration.
3. A hypothesis pin points the problem. The investigator can examine thoroughly the factual and conceptual elements that appear to be related to a problem.
4. Using hypothesis determines the relevancy of facts. A hypothesis directs the researcher's efforts into a productive channels.
5. The hypothesis indicates not only what to look for is an investigation but how to obtain data. It helps in deciding research design. It may suggest what subjects, tests, tools, and techniques are needed.
6. The hypothesis provides the investigator with the most efficient instrument for exploring and explaining the unknown facts.
7. A hypothesis provides the framework for drawing conclusions.
8. These hypotheses simulate the investigator for further research studies.

Bruce W. Tuckman presents the importance of Hypothesis in the Research Spectrum :

Research begins with a problem and utilization of both theories and findings in arriving at hypothesis. These hypotheses contain variables which must be labelled and then operationally defined to construct predictions. These steps might be considered the logical stages of the research. These stages are followed by methodological stages, which culminate in the development of research design and development of measures and finally in the finding themselves.



The Research Spectrum

KINDS OF HYPOTHESES

Hypotheses vary in form and some extent, form is determined by some function. Thus a working hypothesis or a tentative hypothesis is described as the best guess or statement derivable from known or available evidence. The amount of evidence and the certainty or quality of it determine other forms of hypotheses. In other cases, the type of statistical treatment generates a need for a particular form of hypothesis.

The following kinds of hypotheses and their examples represent an attempt to order the more commonly observed varieties as well as to provide some general guidelines for hypothesis, development and statement. There are four kinds of hypotheses: (a) Question (b) Declarative Statement (c) Directional Statement and (d) Null form or Non-Directional.

- (a) **Question form of Hypotheses:** Some writers assert that a hypothesis may be stated as a question, however, there is no general consensus on this view. At best, it represents the simplest level of empirical observation. In fact, it fails to fit most definitions of hypothesis. It is included here for two reasons: the first of which is simply that it frequently appears in the lists. The second reason is not so much that question may or may not qualify as a hypothesis. There are cases of simple investigation and search which can be adequately implemented by raising a question, rather than dichotomize hypothesis forms into acceptable/rejectable categories. The following example of a question is used to illustrate the various hypothesis forms:

Is there a significant interaction effect of schedule of reinforcement and extroversion on learning outcomes?

- (b) **Declarative Statement:** A hypothesis may be developed as a declarative which provide an anticipated relationship or difference between variables. The anticipation of a difference between variables would imply that the hypothesis developer has examined existing evidence which led him to believe a difference may be anticipated as processes additional evidence.

The following is an example of this form of hypothesis-

H : There is significant interaction effect of schedule of reinforcement and extroversion on learning outcomes.

It is merely a declaration of the independent variables effect on the criterion variable.

- (c) **Directional Hypothesis:** A hypothesis may be directional which connotes an expected direction in the relationship or difference between variables. The above hypothesis has been written in directional statement form as follows:

H : Extrovert learns better through intermittent schedule of reinforcement whereas introvert learns through continuous schedule of reinforcement.

The hypothesis developer of this type appears more certain of his anticipated evidence than would be the case if he had used either of the previous examples. If seeking a tenable hypothesis is the general interest of the researcher, this kind of hypothesis is less safe than the others because it reveals two possible conditions. These conditions are matter of degree. The first condition is that the problem of seeking relationship between variables is so obvious that additional evidence is scarcely needed. The second condition derives because researcher has examined the variables very thoroughly and the available evidence supports the statement

of a particular anticipated outcomes. An example of the obviously safe hypothesis would be 'hypothesis' that high intelligence students learn better than low intelligent students. The above hypothesis is in the directional statement form but it requires evidence for the relationship of these two variables reinforcement and personality.

- (d) **Non-Directional Hypothesis:** A hypothesis may be stated in the null form which is an assertion that no relationship or no difference exists between or among the variables. This form null hypothesis is a statistical hypothesis which is testable within the framework of probability theory. It is also a non- directional form of hypothesis. The following are the examples of null form of hypothesis

H_0 : There is no significant interaction effect of schedule of reinforcement and extroversion on learning outcomes.

H_0 : There is no significant relationship between intelligence and achievement of students.

Recent trend is to employ or develop null hypotheses in research work of education and psychology. A null hypothesis accepted is tentatively to stating that on the basis of evidence tested it could be that there is no difference. If the null hypothesis is rejected, there is a difference but we do not know the alternative or the differences. In this form of hypothesis, researcher has not to anticipate or give the rationale for the declaration or directional form. Secondly, it does not make researcher biased or prejudiced. He can be objective about the expected outcomes of the research or findings.

Actually this is a form of hypothesis but is a statistical hypothesis which is self explanatory-null hypothesis means zero hypothesis. A researcher has not to do anything in developing such form of hypothesis. In the process of reflective thinking research hypothesis is second step whereas null hypothesis is fifth step of research process.

In order to accommodate the object of the inquiry for extracting this information, a null hypothesis is an appropriate form. A null hypothesis does not necessarily reflect the expectations of the researcher so much as the utility of the null form as the best fitted to the logic of chance in statistical knowledge or science.

A statistical hypothesis must be testable within the framework of probability theory. The theory requires one or the other of two hypotheses forms: the 'null' form and the 'delta' form.

The null form is the no difference form i.e. there is no difference or relationship between or among variables under certain conditions.

The 'delta' form for a test hypothesis is simply that A is greater or lesser than B under conditions C, D,.....A null form or a delta form which specifies only A and B variables in the relationship permits only a bivariate analysis which is not very sophisticated research analysis. The development of computer assisted data analysis permits the manipulation of a number of variables represented in the C, D..., n conditions of the difference or relationship.

General hypothesis is second step and null hypothesis is the fifth step of research process. Null hypothesis provides the basis of accepting or rejecting the general hypothesis.

General Hypothesis: Programmed instruction is effective then the traditional method in terms of learning outcomes.

General Hypothesis: Structural method is more effective than the lecture method of teaching in English.

Null Hypothesis is a statistical hypothesis which is used in analysing the data. It assumes that observed difference is attributable by sampling error and true difference is zero.

<i>Null Hypothesis</i>	<i>Programmed Method</i>	<i>Lecture Method</i>
Mean	M_1	M_2
S. D.	σ_1	σ_2
Size	N_1	N_2

$$H_0 \rightarrow (M_1 = M_2) \text{ or } (M_1 - M_2 = 0)$$

The statistical tests of significance are used to accept and reject the null hypothesis. If it is rejected, the general hypothesis is accepted.

Occam's razor has given a principle of economy in scientific explanation which requires for given set of observations so that generalization can be made.

This class of hypothesis is known as null hypothesis so-called because of it 'nullifies' the positive argument of the findings or non-directional statement of the generalization.

This type of hypothesis is also termed as statistical hypothesis or non-directional hypothesis or zero hypothesis because it denies the existence of any systematic principles apart from the effect of chance. This hypothesis assumes that no or zero difference exists between the two population means or the treatments.

$$H_0 \rightarrow (\mu_1 = \mu_2 = 0) \text{ or } (\mu_1 = \mu_2)$$

The observed difference between the two samples means is attributable to chance factor or sampling error.

The symbol H_0 represents the Null-Hypothesis. An alternative formulation of the hypothesis is to assert that the two samples drawn from population having the same mean. The null hypothesis is a trial hypothesis asserting that no difference exists between population parameters. Thus it involves two types of errors.

	H_0	H_1
Accept	Type I or A	Correct
Accept	Correct	Type II or B

Two Types of Errors

Type I error (a error) : When an alternative hypothesis H_1 may be accepted and H_0 is rejected. It shows that obtained difference exists and not due chance or sampling errors.

Type II error (b error) : When null hypothesis H_0 is accepted and alternative hypothesis H_1 is rejected. It indicates that obtained difference is due to chance or sampling error.

CHARACTERISTICS OF A GOOD HYPOTHESIS

A good hypothesis must possess the following main characteristics:

1. A good hypothesis is in agreement with the observed facts.
2. A good hypothesis does not conflict with any law of nature which is known to be true.

3. A good hypothesis is stated in the simplest possible term.
4. A good hypothesis permits of the application of deductive reasoning.
5. A good hypothesis shows very clear verbalization. It is different from what is generally called hunch.
6. A good hypothesis ensures that the methods of verification are under control of the investigator.
7. A good hypothesis guarantees that available tools and techniques will be effectively used for the purpose of verification.
8. A good hypothesis takes into account the different types controls which are to be exercised for the purpose of verification.
9. A good hypothesis ensures that the sample is readily approachable.
10. A good hypothesis indicates clearly the role of different variables involved in the study.
11. A good hypothesis maintains a very apparent distinction with what is called theory law, facts, assumption and postulate.

VARIABLES IN A HYPOTHESIS

A hypothesis is made testable by providing operational definitions for the terms or variables of the hypothesis. For a testable hypothesis there are two important things :

1. Variables, and
2. Operational definitions.

Variables

There are five types of variables. Among students of the same age and intelligence, skill performance is directly related to the number of practice traits particularly among boys but less directly among girls. In such a hypothesis the variables which must be considered are:

- (i) Independent variable – number of practice trails.
- (ii) Dependent variable – skill performance.
- (iii) Moderator variable – sex.
- (iv) Control variable – age, intelligence.
- (v) Intervening variable – learning.

- (i) **The Independent Variable:** The independent variable which is a stimulus variable or input operates either within a person or within environment to affect his behaviour. It is that factor which is measured, manipulated. or selected by the experimenter to determine its relationship to an observed phenomena.

If a researcher is studying the relationship between two variables X and Y. If X is independent variable, then it affects another variable Y: So the characteristics of independent variables are:

- (a) It is the cause for change in other variables.
 - (b) Independent variables are always interested only it affects another variable, not in what affects it.
- (ii) **The Dependent Variable:** The dependent variable is response variable or output. It is an observed aspect of the behaviour of an organism that has been stimulated. The dependent variable is that factor which is observed and measured to determine the effect of the

independent variables. It is the variable that will change as a result of variations in the independent variable. It is considered dependent because its value depends upon the value of the independent variable. It represents the consequence of change in the person or situation studied.

Relationship Between Independent and Dependent Variables: Most experiments involve many variables when two continuous variables are compared, as in correlation studies, deciding which variable to call independent and which dependent is sometimes arbitrary. In such cases variables are often not labelled as independent or dependent since there is no real distinction. Independent variables may be called factor and their variation may be called levels.

- (iii) **The Moderator Variable:** The term moderator variable describes a special type of independent variable a secondary independent variable selected for study to determine if it affects the relationship between the primary independent variable and the dependent variable.

The moderator variable is defined as that factor which is measured, manipulated or selected by the experimenter to discover whether it modifies the relationship of independent variable to an observed phenomena. The sex and rural urban generally function as moderator variables.

- (iv) **Control Variable:** All the variables in a situation can not be studied at the same time, some must be neutralized to guarantee that they will not have a differential or moderating effect on the relationship between the independent and dependent variables. These variables whose effects must be neutralized or controlled are known as control variables. They are defined as those factors which are controlled by experimenter to cancel out or neutralize any effect they might otherwise have on the observed phenomena. While the effects of the control variables are neutralized, the effect of moderator variables are studied.

Certain variables appear repeatedly as control variables, although they occasionally serve as moderator variables. For example sex, intelligence and socio-economic status are three subject variables that are commonly controlled, noise, task order and task content are common control variables in the situation.

- (v) **Intervening Variable:** Each independent, moderator, and control variable can be manipulated by the experimenter and each variation can be observed by him as it affects the dependent variable. Often these variables are not concrete but hypothetical, the relationship between a hypothetical underlying or intervening variable and dependent variable.

An intervening variable is that factor which affects the observed phenomenon but cannot be seen and measured or manipulated, Its effect must be inferred from the effects of the Independent and moderator variables on the observed phenomena. The attitude, learning process, habit and interest function as Intervening variables.

Hypothesis

Teachers given more positive feedback-experiences will have more positive attitudes towards children than teachers given fewer positive feedback-experiences.

Independent Variable–Number of positive feedback experiences for teacher.

Intervening Variable–Teacher’s self esteem or habit pattern.

Dependent Variable–Possessiveness of teacher’s attitude towards students.

The researcher must operationalized his variables in order to study them and conceptualize his variables in order to generalize from them. Researchers often use the labels independent, dependent,

moderator, and control to describe operational statements of their variables. The intervening variables always refer to a conceptual variable that which is being affected by the independent, moderator control and dependent variables.

The intervening variable can often be discovered by examining a hypothesis. They are usually abstract in nature.

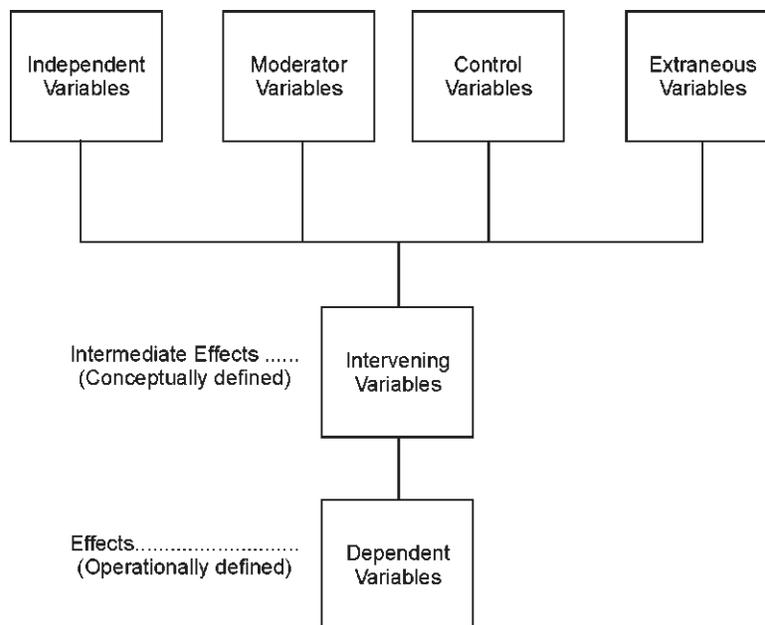
Independent, moderator and control variables are inputs or causes, the first two being these that are studied while the third, control variables are neutralized or ‘eliminated’. At that other end, dependent variables represent effects or it is also known as criterion variable while intervening are conceptualizations which intervene between operationally stated causes, and operationally stated effects.

The Research Variables Combined

The various research variables interact among themselves. The Independent, moderator, and control variables are under the researcher’s control. They cause an impact within the subject. The impact is referred to as the intervening variable. In addition, the extraneous variables have an impact upon this Intervening variable. Such extraneous variables are not under the researcher’s control, their presence weakens a study. One of the goals of a researcher is to remove as many significant factors as possible from the extraneous variables category by bringing them into the categories of moderator and control variables. Such a process of removing extraneous variables strengthens a study.

The Variables in the Research Process

Causes (operationally defined)



The intervening variable is merely hypothesized. It is abstract in nature. It cannot be visually observed. It is defined in conceptual terms. It is produced by some combination of the casual variables in the top row of the figure. It produces the effect or dependent variable. Every experimental study has at least one independent variable and one dependent variable. Both of these variables should be explicitly

stated in the hypothesis and in the research predictor. If either the treatment or the outcome variable is too complex to be stated succinctly, further operational definitions of these variables can be included in the methods section of a report. Every study has also an intervening variable, and often there can be more than one intervening variable. The intervening variable is, not stated in operational terms, but rather conceptual explanation for the observed results. Intervening variables are normally not stated in the hypothesis or research prediction. Sometimes intervening variables are only vaguely described or are not mentioned at all.

Every study does not contain moderator and control variables. When such variables are contained in a study, they should be operationally defined. Moderator and control variables are stated in the research hypothesis and in the research prediction. Often the operational definitions further explanation in the method section of a report.

Identify each of the research variable from the following hypothesis-

High school students who study English for two years will develop better, Hindi vocabulary, skills than those who do not study English. Independent Variable - Studying English vs. not studying it.

Dependent Variable – Vocabulary skills.

Moderator – Hindi class placement (advanced vs. non-advanced).

Control – High School students.

Intervening variable – Increased ability or learning style.

Some Considerations For Variables Choice

After selecting the independent and dependent variables the researcher must decide which variables are to be included as moderator variables and which are to be excluded or hold constant as Control variables. He must decide how to treat the total part of the other variables (other than the independent). That might effect the dependent variables. In making these decisions which variables are 'in' and which are 'out' he should take into account three kinds of considerations:

1. *Theoretical Consideration*: In treating as a moderator variable, the researcher learns how it interacts with the independent variable to produce differential effects on the dependent variable. In term of theoretical base researcher is working and in term of what he is trying to find out in a particular experiment, certain variables highly qualify as the moderator variables. In choosing a moderator variable a researcher should ask: Is the variable related to the theory with which I am working? How helpful would it be to know if an interaction exists? How likely is there to be an interaction?
2. *Design Consideration*: The questions which relate to the experimental design which has been chosen and its adequacy for controlling for sources of bias, the researcher should ask the following question:
Have my decision about moderator and control variables met the requirements of experimental design in terms of dealing with the source of validity?
3. *Practical Consideration*: A researcher can only study so many variables at one time. There are limits to human and financial resources and the dead lines he can meet. By their nature some variables are harder to study than to neutralize, while others are as easily studied as neutralized. In dealing with practical considerations, the researcher must ask question like the following:

How difficult is it to make a variable a moderator as opposed to a control variable? What kinds of resources are available and what kinds are required to create moderator variables?

This is highly significant one. In educational experiment researchers often have less control over the situation than design and the related considerations might necessitate.

Operation Definitions

Immediately upon completion of the testable hypotheses a researcher should examine them and the problem in general to determine if there are any terms which may be abstract or misleading. 'If an are found particularly in the testing hypotheses, they should be defined to make them completely operational for the study being undertaken.

The necessity for operational definitions does not mean that the researcher can define a term to mean whatever he cares to make it mean, but does enable the researcher to limit the meaning of a word. Operational definition should be more specific than those used in ordinary discourse. In other words any special term which must be used in the statement of the problem may require an operational definition to ensure clarity. Particular clarification should be given terms which are used in the formulation of testable hypothesis. The term selected must be useful and make sense. Even common adjectives may be used if you adequately explain what you mean. A point to remember is that once a researcher makes a definition, he must stick to it.

Words which may need defining are those which appear ambiguous, which have confusing interpretation and which might make a difference to a person attempting to replicate the study.

The Conditions for Making Final Decision

H.H. McAshan suggests that new researcher check the following conditions for operationally defining words before making a final decision:

1. The definition decides upon must withstand subjective analysis to determine if other qualified people could look at the word involved and come to the same conclusion.
2. The reliability of each word should be checked to find out if the subjective judgements are consistent.
3. The meaning of the operationally defined words must be mutually exclusive and not synonymous with other words, terms or, expressions.
4. The definition of each word chosen must fit the material researchers intend to study.
5. The definition decides upon must include all situations of use which will be included in the course of the investigation.

An operational definition is a definition based on the observable characteristics of that which is being defined. The word 'observable' is the significant word in describing an operational definition.

There are three approaches to constructing operational definitions:

- (i) Type A,
- (ii) Type B, and
- (iii) Type C.

Type 'A' Operational Definition: The 'Type A' operational definition can be constructed in terms of the operations that must be performed to cause the phenomenon or state than an object or thing. It tells what manipulation to use to induce a particular state. They are useful in defining independent variables as prescriptions carried out by the experimenter. The same variable, of course, be operationally defined by more than one type of definition but when what variable is the independent variable. It is often the most useful.

‘Type B’ Operational Definition: The ‘Type B’ operational definition can be constructed in terms of how the particular object or thing being defined operates, that is, what it does or what constitutes its dynamic properties. ‘Type B’ operational definitions see particularly appropriate in an educational context for describing a type of person.

Though they may be used to define other variables, Type B definitions are particularly useful for defining the dependent variable when it is to be operationally based on behaviour.

‘Type C’ Operational Definitions: The ‘Type C’ operational definition can be constructed in terms of what the object or phenomenon being defined looks like, that is, what constitute its static properties. An Intelligent student can be defined as a person who has good memory, a large vocabulary, good reasoning ability, good arithmetic, skills etc. This type of operational definitions utilize observable structural properties of the object. It describes the qualities, traits, or characteristics of people or thing. Thus, they may be used for defining any type of variable when used for defining a person’s characteristics, they specify the static or internal qualities rather than his behaviour as does the ‘Type B’ definition. ‘Type C’ operational definitions often lend themselves to measurement by tests although the ability to be tested is in requisite part of the definition.

The test ability if any hypothesis depends on whether suitable operational definitions can be constructed for its variables.

ROLE OF HYPOTHESIS

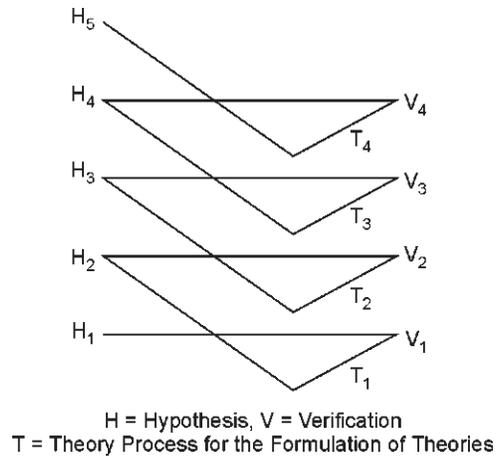
The hypothesis is the basis of a scientific investigation education. It is the pivot of the research process. All the research activities are oriented towards the verification of the hypotheses.

Apart from this role it has a significant role in the formulation of theory, principles and laws. It is also known as tentative theory, after verification it takes the shape of final theory. A theory embers new hypotheses, these are subjected to verification, after the verification it becomes a new theory in field studies. In building up the theories, this cyclic process continues. It has been illustrated with the help of a diagram.

SOURCES OF HYPOTHESES

Hypotheses are originated from essentially the same background that serves to reveal problem. These sources are namely theoretical background, knowledge, insight and imagination that comes from instructional programme and wide reading experiences, familiarity with existing practices. The major sources of hypotheses are given below:

1. Specialization of an educational field.
2. Programme of reading: Pubished studies, abstracts reearch journals. Hand books, seminars on the issue, current trends on the research area.
3. Instructional programmes persuaded.
4. Analyse of the area studied.
5. Considering existing practices and needs.
6. Extension of the investigation.
7. Offshoots of research studies in the field.



Process for the Formulation of Theories

Researcher employs these sources for formulating hypotheses of his investigation. He has to use two logical processes to draw upon in developing a hypothesis. The processes are known as:

- (a) Deductive thinking, and
 - (b) Inductive thinking.
- (a) Deduction is a process which goes from the general to the specific : When general expectations about problems or events based on presumed relationships between variables are used to arrive at more specific expectations, that process is called deduction.
 - (b) Induction is a process which goes from the specific to the general: In the induction process researcher starts with specific observations and combines them to produce a more general statement of relationship namely a hypothesis. Many researchers begin by searching the literature for relevant specific findings in order to induce a hypothesis, and other often run a series of exploratory studies before attempting to induce a hypothesis.

Induction begins with data' and observations or empirical events and proceeds toward hypothesis and theories, while deduction begins with theories and general hypothesis and proceeds towards specific hypothesis.

FORMULATING HYPOTHESIS

From any problem statement, it is generally possible to derive more than one hypothesis. There are three simple hypotheses generated from this problem to determine, "the effect of " massive, positive, verbal rewards on the reading achievement of children."

At first glance these three hypotheses might be offered :

- (A) Reward Increases reading achievement.
- (B) Reward decreases reading achievement.
- (C) Reward has no effect on reading achievement.

Evidence has already been obtained in the laboratory to support the hypothesis (A) rewards increase performance. However, upon closer examination, the primary purpose of this study is to

determine whether the enhancing effect of rewards can be incorporated into a class-room setting to facilitate children's learning to read. This theory is based on the assumption that the 'law' of learning should apply in classroom. If perhaps more subtly than in a laboratory and on the laboratory findings that support the assumed relationship between reward and performance, the logical conclusion would be that rewards would have a demonstrable enhancing effect on classroom performance. This conclusion is based on the first assumption arrived at deductively and the second arrived at inductively.

Both induction and deduction. are needed to choose among the possibilities. Many theories, both psychological and educational deal with stabilization (and rigidifying) of behaviour patterns as a function of their use.

Researchers formulate hypotheses using induction and deduction, one of the goals of researcher is to produce that pieces for generalizable bodies of theory which will provide answers to practical problems. Hypothesis construction and testing enable researchers to generalize their findings beyond the specific conditions which they were obtained.

Since a hypothesis is a formulation of anticipated findings, students are advised to develop a hypothesis as a means of demonstrating the basis for their study to themselves and their reader. The task of introducing a study and discussing the findings are facilitated by existence of a hypothesis.

FORMULATION OF TESTABLE HYPOTHESIS

A hypothesis is a tentative assumption drawn from knowledge and theory which is used as a guide in the investigation of other facts and theory that are as yet unknown. The hypothesis formulation is one of the most difficult and most difficult step in the entire scientific process. A poorly chosen or poorly worded hypothesis can prevent:

- (a) the obtaining of enough pertinent data,
- (b) the drawing of conclusions and generalizations, and
- (c) the application of certain statistical measures in the analysis of the result.

It is impossible to over-emphasize the role of the hypothesis in research. It is the central core of study that directs the selection of the data to be gathered, the experimental design, the statistical analysis, and the conclusions drawn from the study.

A study may be devoted to the testing of one major hypothesis, a number of subsidiary hypotheses, or both major and subsidiary hypotheses. When several hypotheses are used, each should be stated separately in order to anticipate the type of analysis required and in order to definitely accept or reject each hypothesis on its own merit. Regardless of the number or type of hypotheses used, it is extremely important that each be specific testable, and based upon a logical foundation. Hildreth Hoke McAshan says only one possible exception to the above statements, which is that when fact finding alone is the primary aim of the study, it may not always be necessary to formulate an explicit hypothesis. However, this need not be a concern of most scientific researchers.

FUNDAMENTAL BASES OF HYPOTHESIS

The researcher deals with reality on two levels,

- (a) The operational level, and
- (b) Conceptual level.

On the operational level researcher must define events in observable terms in order to operate with the reality necessary to do researches.

On the conceptual level he must define events in terms of underlying communality (usually causal) with other events. Defining at a conceptual level, the researcher can abstract from single specific instance to general ones and thus, begin to understand how phenomena operate and variables interrelate. The formulation of an hypothesis very frequently requires going from the operational or concrete level to the conceptual or abstract level. It is this movement to the conceptual level which enables that the result to be generalized beyond the specific conditions of a particular study and thus to be of wider applicability.

Research requires the ability to move from the operational to the conceptual level and vice-versa. This ability is required not only in constructing experiments but in applying their findings as well.

Consider a hypothetical study in which programmed instruction is being compared to traditional instruction. The term ‘Programmed Instruction’ and ‘Traditional Instruction’ are operational terms. These operational terms should be examined for underlying conceptual similarities and differences. This process of making conceptual contrasts between operational programme is called conceptualization or dimensionalization.

Dimensions useful for contrasting programmed and traditional instruction might be degree of feedback, rate of positive reinforcement, uniqueness of presentation format, control of pacing size of instructional units and degree of incorporation of student performance feedback in instructional design.

These six dimensions or concepts could be used for classifying any instructional model as a basis for understanding its relation to other models.

Such classification at this abstract level would help one not only hypothesize whether instructional ‘model A’ will be more effective than ‘model B’ on certain specific criteria, but to begin to understand why ‘model B’ is better and thus to be able to build ‘model A’ into other instructional procedures.

Moving from the operational to the conceptual level and vice-versa is a critical ingredient of the research to demonstration process.

Difficulties in the Formation of Useful Hypothesis: The following are the difficulties in the formation of hypothesis:

1. Absence of knowledge of a clear theoretical framework.
2. Lack of ability to make use of the theoretical framework logically.
3. Lack of acquaintance with available research technique resulting in failure to be able to phrase the hypothesis properly.

Testing the Hypothesis

The evidence of the work of hypothesis lies in its abilities to meet test of its validity. The purpose of testing a hypothesis is to determine the probability that it is supported by fact. Because a hypothesis is a general expectation about the relationship between variables there is an extremely large number of instances under which it can be tested, and it would be impractical to attempt to gain support in all of these instances. Validity of a hypothesis is established in two stages:

1. The statement of hypothesis allows the investigator to develop deduction and certain implications which when stated in operational terms can lead to rejection of hypothesis that are in conflict with accepted knowledge at the logical level.

For example a hypothesis which says, for instance, that nondirective teachers are more effective than directive teachers would have to be tested for many groups of teachers, in

many subjects and many settings, and with many criteria before it could be accepted. If, on the basis of limited testing the hypothesis fails to yield confirming results, then it would be fair to reject it.

2. If a hypothesis passes the test of logic, it then must be subjected to an empirical test, perhaps through an experiment or a series of measurement. The hypothesis that boys are stronger or taller than girls, for example, can be verified through measurements.

A hypothesis is never proved it is merely sustained or rejected. If it fails to meet the test of its validity, it must be modified or rejected.

The confirmation of a hypothesis, on the other hand, is always, tentative and relative, subject to later revision and even rejection as further evidence appears or as more adequate hypotheses are introduced.

The form of the hypotheses to be tested can be very controversial. The null form' is probably preferred by most experienced research personnel. The null hypothesis states that there is no difference between two groups or treatments. It is generally used to spell out what would be the case if the null hypotheses were true. The no difference statement assumes that the two groups will be tested and found to be equal.

FORMAL CONDITIONS FOR TESTING HYPOTHESES

There are two types of hypothesis statements:

- (a) Null hypothesis, and
- (b) Hypothesis prediction form.

Whether the experimenter chooses the hypothesis prediction or the null form, there are certain formal conditions which must be met in order for the hypothesis to be considered testable. These are listed below:

1. It must be stated so that deductions can be made from it and so that decisions can be reached as to whether or not it explains the facts being considered.
2. It should be worded clearly and unequivocally in operational terms. This should leave no doubt as to what action, what prediction, what quality or quantity, or who is involved ?
3. It must be capable of being refuted. There must be some comparisons possible which will allow the researcher to give either a 'yes' or 'no' answer to the hypothesis stated.
4. It should be specific and testable, with all predictions and operations to be tested spelled out.
5. It should have simplicity. If it is too complex, consideration should be given to dividing it into sub-hypothesis.
6. It should be directly related to the empirical phenomena.
7. It must be stated in final form early in the experiment before any attempt at verification is made.
8. It should be so designed that its test will provide an answer to the original problem which forms the primary purpose of the investigation.
9. It must be related to available techniques of design procedure, and statistical analysis.
10. It should be related to available knowledge or theory concerning the original problem area.

The statement of the problem, review of literature, and other planning of early stages of a project are largely performed so as to enable the researcher to arrive at good, clearly stated, testable hypothesis.

CRITERIA FOR EVALUATING HYPOTHESIS

Some hypotheses are considered more satisfactory than others. The following are the serious considerations of a satisfactory hypothesis and these criteria may be helpful to make this judgement.

1. **Plausibility of Explanation:** Several criteria are involved in establishing the plausibility of explanations. A satisfactory hypothesis should have relevant and logical possibility about the relationship of variables included in them.
2. **Testability of Explanation:** The variables should be defined operationally and the predicted relations among them can be tested empirically. The variables of the hypothesis should be measurable or quantifiable. The suitable measuring instrument is available or it can be considered easily.
3. **Adequacy of Scope:** The most useful hypotheses explain all the facts that are relevant to the phenomena being explained and contradict none of them. The broader the scope of a theory, the more valuable it is. The more consequences that a hypothesis yields, the greater is its fruitfulness.

A hypothesis is of greater value if it establishes a generalization that can be applied in many areas of education or in many fields.

The most satisfactory hypotheses not only explain all the known facts that gave rise to the original problems but also enable scientists to make predictions about as yet unobserved events and relationships.

4. **Usefulness of False Hypotheses:** Hypotheses need not be the correct answers to problems to be useful. In almost every inquiry a scholar formulates several hypotheses and hopes that one will provide a satisfactory solution to the problem. By eliminating the false hypotheses one by one the investigator keeps narrowing the field in which the answer must lie. The testing of false hypotheses is also of value if it directs the attention of scientists to unsuspected facts or relations they eventually help in solving the problem.
5. **Roots in Existing Theories:** A useful educational hypothesis, therefore, adds something to previously established knowledge by supporting, qualifying, refuting or enlarging upon existing theories. A hypothesis that is compatible with well-attested theories is in a favourable position to advance knowledge. If progress is to be made new hypotheses must fit into the framework of existing theories and transform them into more perfect explanatory schemes. Thus, even the more revolutionary theories are not completely different from the existing edifice of knowledge.
6. **Suitability for Intended Purpose:** Each hypothesis that offers a satisfactory explanation of what it intends to explain is useful for that purpose. Every hypothesis serves a specific purpose and must be adequate for the purpose it claims to serve. Thus, suitability is also the important criterion for an effective hypothesis.
7. **Simplicity of Explanation:** If two hypotheses are capable to explain the same facts, the simpler one is the better hypothesis. Simplicity means that the hypothesis explains the phenomena with the least complex theoretical structure. The hypothesis that accounts for all facts with the fewest independent or special assumptions and complexities is always preferable.

- 8. Levels of Explanation:** The value of hypothesis can best be comprehended by tracing their relationship to facts theories and laws. The scientists build gradually a hierarchy of knowledge consisting of (1) hypotheses (2) theories and (3) laws. The following discussion will distinguish among these levels of knowledge.
- (a) *Hypotheses and Facts:* A hypothesis is the first step in the direction of scientific truth. In the hierarchy of scientific knowledge it is the lowest on the scale. If empirical evidence can be found to verify the hypothesis, it gains the status of a fact. Thus, a fact is the verified hypothesis.
 - (b) *Hypotheses and Theories:* A theory may contain several logically interrelated hypotheses and postulates may be used as a synonyms for hypotheses. Hypotheses and theories are both conceptual in nature. A theory usually provides a higher level explanation than a hypothesis. A theory presents a comprehensive conceptual scheme that may involve several related hypotheses and explain diverse phenomena, considerable empirical evidences are needed to support it.
 - (c) *Hypotheses and Laws:* Some hypotheses receive sufficient confirmation to lead to the formulation of theories; some lead to the establishment of laws. Laws utilize highly abstract concepts, for they provide the most comprehensive type of explanations. Laws may explain phenomena that have been explained previously by two or three theories. A law retains its lofty scientific status which it claims to explain.

THE ROLE OF HYPOTHESES

The hypotheses play significant role in the scientific studies. The following are some of the important role of a hypothesis

- The purpose of stating hypothesis, like the purpose of theories that may be involved, is to provide a framework for the research procedure and methodology. It directs the research activities.
- A research project need to proceed from a statement of hypotheses. Such hypotheses are not ends in themselves but rather aids to the research process.
- A hypothesis takes on some characteristics of a theory which is usually considered as a larger set of generalization about a certain phenomenon.
- The verification. of a hypothesis does not prove or disprove it; it merely sustains or refutes the hypotheses.
- The hypotheses may imply research procedures to be used and necessary data to be organized.
- Such hypotheses are not ends in themselves but rather aids to the research process.
- The conclusions of the research problem may also be stated in the context of the initial hypotheses.
- The stating a hypotheses in experimental research provide the basis for designing the experiment and collecting evidences empirically for its verification so as to formulate new theory in field of education.
- The hypothesis orients the research process for its verification rather than finding out the solution of the problem.

OBJECTIONS AGAINST STATING HYPOTHESES

The following objections are raised against stating hypotheses which are directional in nature

- One is that hypotheses bias the researcher in favour of certain conclusions or retain the hypotheses.
- Another is that in his pursuit of the stating hypothesis the researcher may overlook other possibly worthwhile hypotheses.
- The statement of hypotheses in some situations also may appear premature.
- A directional hypothesis needs some theoretical rationale but in some situations there is very little background information about them.
- The researcher may decide to defer any hypothesis or theories until he has some empirical evidence upon which is to base them.
- The hypotheses are stated in vacuum. These should be concerned with a situation in which it can be experienced.
- The directional hypotheses should be so stated as to reveal the role of variables involved in the investigation.

The overall consensus is in favour of stating hypotheses whenever they are feasible. In view of the above objections, researchers prefer to formulate the non-directional hypotheses these days.

HYPOTHESES IN HISTORICAL RESEARCH

The historical researcher uses his information to describe and interpret conditions, events and phenomena that existed during the period under study. Some of the scholars of research methodology are of this view that the historical researcher also can formulate hypotheses to direct the research activities. These hypotheses are attempts at explaining and interpreting the phenomena of the period under the study.

There is difference between scientific hypotheses and historical hypotheses. Hypotheses in historical research are not formulated in a statistical sense or null hypothesis. Historical hypothesis takes on a broader meaning as a conjecture of the situation.

An example, a researcher is pursuing historical research on the development of teacher-education of the secondary stage in India. There would be several hypotheses. One hypothesis may be- 'The development of teacher-education as an outgrowth of secondary schools and inadequate supply of teachers produced by the colleges'. This hypothesis is based on the assumption that there has been development of teacher-education. If this assumption was not correct, the hypothesis would have no basis. The matter of basing hypotheses on accurate assumptions may seem obvious, but failure to do so is not unknown. The position of hypothesis is based on the assumption.

USES OF HYPOTHESES IN EDUCATIONAL RESEARCHES

The educational researches may be classified into four types:

1. Experimental research,
2. Normative survey research,
3. Historical research, and
4. Complex casual research.

1. Hypotheses are indispensable for experimental researches. The experiments are conducted to collect empirical data to verify hypotheses. The experimental method or experimental designs are based on hypotheses. Hypotheses are the crucial aspects of such researches.
2. In normative survey research the investigator may or may not employ hypothetical type thinking, depending upon the purpose of the research study. Hypotheses are essential for analytical studies and there is little scope in descriptive type studies.
3. In historical research the purpose may be either to produce a faithful record of the past events irrespective of present day problem or to extend the experience with phenomena in the present to past in order to make the view of the phenomena. There is a little scope of hypotheses in historical research because hypothesis has the future reference and its verification on empirical data. Case study method has no scope for constructing hypotheses because it is developmental type study.
4. In complex casual research the hypotheses have important role in such investigations. These types of studies are conceptual in nature whereas historical are more factual in nature. Therefore formulation of hypothesis is a crucial step of this type of studies.

EXERCISES

1. Define the term 'Hypothesis'. Differentiate among assumption, postulate and hypothesis.
2. Explain the nature and functions of a hypothesis in a research process.
3. Enumerate the significance and importance of hypotheses in scientific research.
4. There are various kinds of hypotheses. Mention some important hypotheses. Why researchers prefer non-directional hypotheses?
5. Hypothesis is a statement which involves a relationship of variable. Enumerate the types of variables included in stating a hypothesis.
6. Differentiate between research hypotheses and null hypotheses and illustrate your answer with suitable example.
7. Indicate the main characteristics of a good hypothesis and uses of a hypothesis in various types of research studies.
8. Enumerate the criteria for evaluating a hypothesis and role of a hypothesis.
9. "Historical researches may have hypotheses but these are different from the hypotheses of scientific researchers". Comment on this statement.