

Research Methodology

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An Introduction



- It is an Art of Scientific Investigation
- According to Redman and Mory, Research is a "Systematized effort to gain new knowledge"
- Research is an original addition to the available knowledge, which contributes to it's further advancement
- In sum, Research is the search for knowledge, using objective and systematic methods to find solution to a problem

An Introduction



**" a careful investigation or inquiry
specially through search for new
facts in any branch of knowledge"**

The Oxford Advanced Learner's Dictionary

Objectives of Research



- To gain familiarity with new insights into a phenomenon
- To accurately portray the characteristics of a particular individual, group, or a situation
- To analyse the frequency with which something occurs or its association with something else.
- To examine the Hypothesis of a casual relationship between two variables

Research Methods vs. Methodology



- Research Methods are the methods that the researcher adopts for conducting the research Studies
- Research Methodology is the way in which research problems are solved systematically.
- It is the Science of studying how research is conducted Scientifically.

Significance of Research



“All progress is born of inquiry. Doubt is often better than over-confidence, for it leads to inquiry, and inquiry leads to invention”

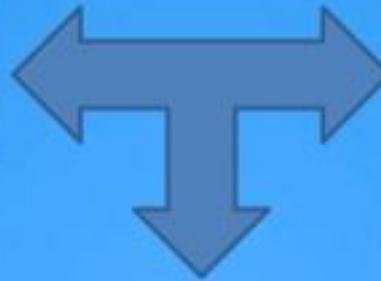
— Hudson Maxim

- Research inculcates scientific and inductive thinking and it promotes the development of logical habits of thinking and organization.

Types of Research



Qualitative



Quantitative

Mixed

Types of Research



- Qualitative research refers to the use of non-numerical observations to answer "Why?" questions, while quantitative methods use data that can be counted or converted into numerical form to address "How?" questions.

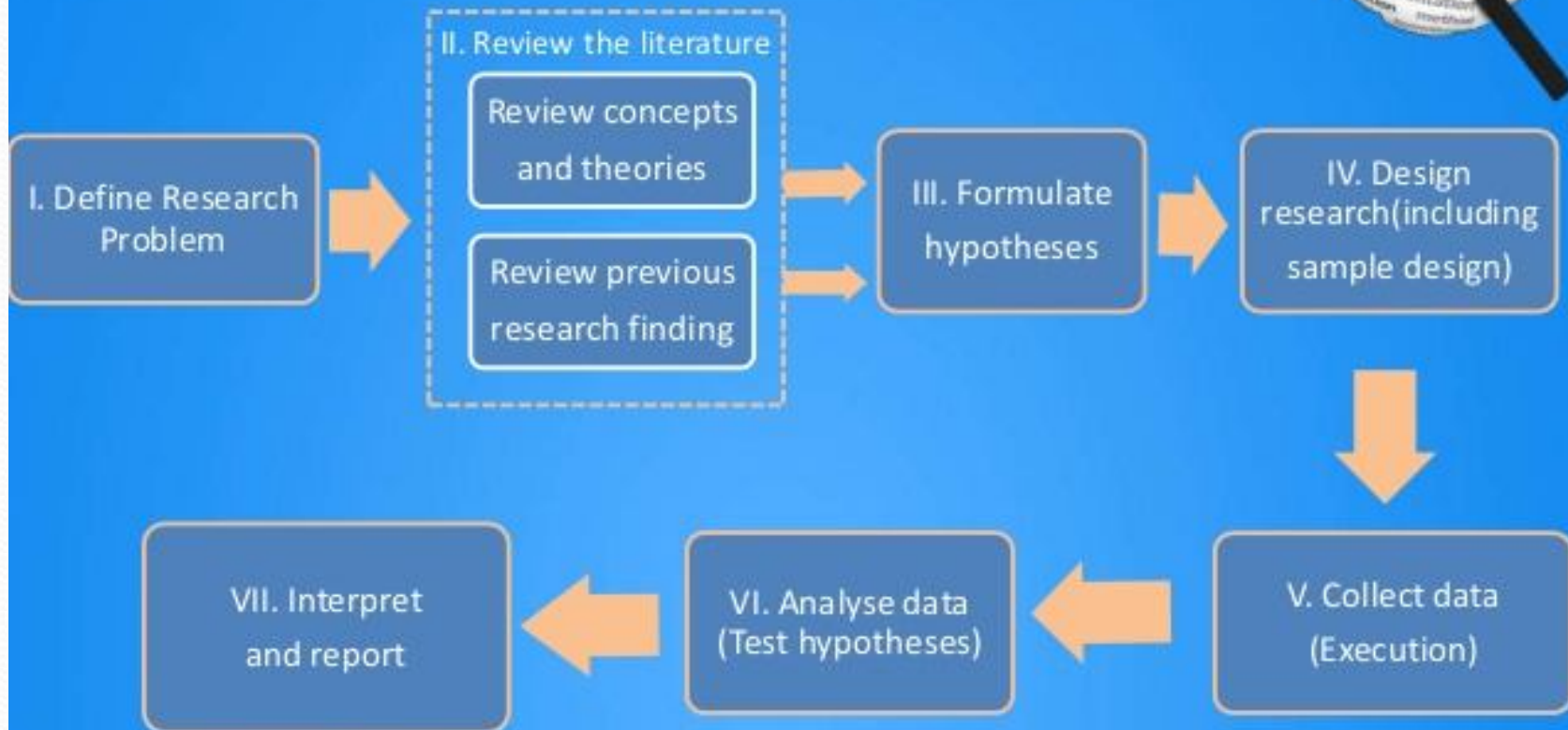


Criteria of Good Research



- **Good research is systematic:** Research is structured with specified steps to be taken in a specified sequence in accordance with the well defined set of rules.
- **Good research is logical:** Research is guided by the rules of logical reasoning
- **Good research is empirical:** Research is related basically to one or more aspects of a real situation and deals with concrete data that provides a basis for external validity.
- **Good research is replicable:** This characteristic allows research results to be verified by replicating the study and thereby building a sound basis for decisions.

Research Process



Defining the Research Problem



- A research problem, in general, refers to some difficulty which a researcher experiences in the context of either a theoretical or practical situation and wants to obtain a solution for the same.
- The research problem undertaken for study must be carefully selected. Help may be taken from a research guide in this connection.



**Ask yourself one key question:
where do YOUR interests lie?**

Defining the Research Problem



The following points may be observed by a researcher in selecting a research problem or a subject for research:

- i. Subject which is overdone should not be normally chosen, for it will be a difficult task to throw any new light in such a case.
- ii. There must be some objective(s) to be attained at. If one wants nothing, one cannot have a problem.
- iii. The subject selected for research should be familiar and feasible so that the related research material or sources of research are within one's reach.

Defining the Research Problem



- iv. The importance of the subject, the qualifications and the training of a researcher, the costs involved, the time factor are few other criteria that must also be considered in selecting a problem. Before the final selection of a problem is done, a researcher must ask himself the following questions:
 - a. Whether he is well equipped in terms of his background to carry out the research?
 - b. Whether the study falls within the budget he can afford?
 - c. Whether the necessary cooperation can be obtained from those who must participate in research as subjects?
- v. If the field of inquiry is relatively new and does not have available a set of well developed techniques, a brief feasibility study must always be undertaken.

Defining the Research Problem



- Defining a research problem properly and clearly is a crucial part of a research study and must in no case be accomplished hurriedly.
- The technique for the purpose involves the undertaking of the following steps generally one after the other:
 - i. statement of the problem in a general way;
 - ii. understanding the nature of the problem;
 - iii. surveying the available literature
 - iv. developing the ideas through discussions; and
 - v. rephrasing the research problem into a working proposition.

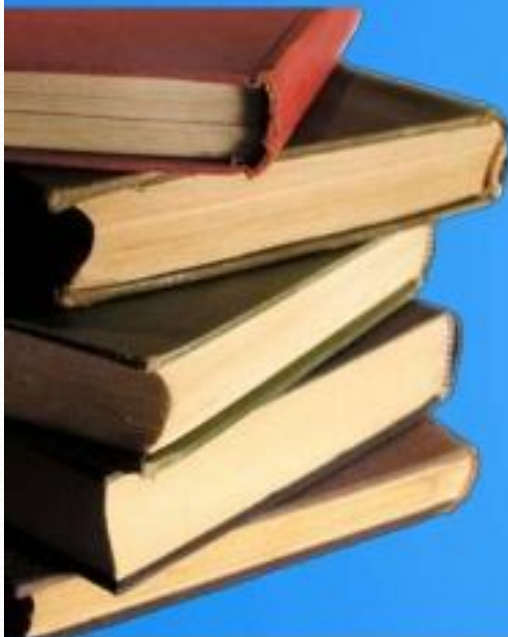
Literature Review



- Once the problem is formulated, the researcher should undertake extensive literature review connected with the problem.

Why Literature Review???????

- i. Assist in refining statement of the problem
- ii. Strengthening the argument of selection of a research topic (Justification)
- iii. It helps to get familiar with various types of methodology that might be used in the study (Design)



Literature Review



What are the major issues and debate about the research problem

whether the research question already has been answered by someone else?

Are there any gaps in knowledge of the subject?

What is the chronology of the development of knowledge about my research problem?

How can I bridge the gap?

What are the key theories, concept and ideas known about the subject?

Questions that can be answered by a review of literature

What directions /methodology are indicated by the work of other researchers?

Literature Review



Sources of Literature:

Books

- Text books
- Monographs
- Edited collections

Journal Articles

- Academic journals
- Conference Proceedings

Indexing and Abstracting journal search engines

- Pubmed
- Google Scholar

Past Dissertations

Vital statistics

- Census
- Government Records
- Surveillance system
- Surveys

International organization documents

- e.g. (WHO,UNICEF)

Media

- Newspaper
- Magazine

Internet



Literature Review



- **Finding too much?** If you find so many citations that there is no end in sight to the number of references you could use, its time to re-evaluate your question. It's too broad/Nothing much to explore
- **Finding too little?** On the other hand, if you can't find much of anything, ask yourself if you're looking in the right area.
- **Take thorough notes.** Be sure to write copious notes on everything as you proceed through your research. It's very frustrating when you can't find a reference found earlier that now you want to read in full.
- **Look for references to papers** from which you can identify the most useful journals.
- **Identify those authors** who seem to be important in your subject area.

Literature Review



- Institutional library serves as a greatest source of literature review.
- Talk to the librarian for greater insight on the number of journals available either as a hard copy or online subscription



- Our JNMC library subscribes 115 International/Foreign and 25 Indian Journals in various specialities. The library has a exclusive collection of about 2000 Thesis and Dissertations of MD/MS/PhD students besides a comprehensive collection of WHO Publications.
- Besides this it also provide access to various consortia e.g. ERMED (2000 Journals),J-Gate, UGC Info-net, Pub Med database of 18 million references/documents and other open source documents .

Literature Review



Important concept related to academic journals

Indexing- Indexing as defined by British indexing standard (BS3700:1988), as a systematic arrangement of entries designed to enable users to locate information in a document.

- Many commercial indexing services available.
- Quality indexing services includes PubMed, Scopus, Embase etc
- A good indexing bodies ensures that journal should have
 - Content, which is of high-quality.
 - It should follow peer-review process.
 - Subject matter of the journal should be compatible with the scope of Indexing body.
 - Disciplined publishing history.
- Now a days predatory publishers' and predatory journals' brag about how many abstracting and indexing services cover their journals. (Check... may b they r lying!!!!!!!!!!!!)

Literature Review



Impact Factor (IF)- Impact Factor was developed by Eugene Garfield as a quantitative method for comparing the journals. He together with Irving H. Sher, proposed IF in 1955 to rank the journals according to the journal citation.

- It is a measure of the frequency with which the "average article" in a journal has been cited in a particular year or period.
- The impact factor of a journal is calculated by dividing the number of current year citations to the source items published in that journal during the previous two years.
- Let us assume that the total number of articles published in a journal in 2010 and 2011 are 50 (Denominator) and in 2012, the citation to everything published in 2010 and 2011 is 500 (Numerator). The IF of will be 10 in 2013.
- Impact Factor is calculated after 3 years of journal launch. New journals should not be expected to have IF from day 1.
- Thomson Reuters, ISI releases Journal Citation Reports every 2 years and publishes IF of every journal.
- Impact Factor, once assigned by Thomson Reuters to a journal, will be eligible from the date of its birth.

Literature Review



Journals and their IF:

Journal Name	Impact Factor
New England Journal of Medicine	53.480
Nature Reviews Molecular Cell Biology	38.65
The Lancet	33.63
Nature	31.434
JAMA - Journal of the American Medical Association	30
Annual Review of Physiology	16.06
Indian Journal of Medical Research	2.061
Journal of Biosciences	1.82
Indian Journal of Physiology & Pharmacology	0.63

Literature Review



Links to useful websites

These websites are excellent for literature search:

- [Medline](#) - Major bibliographic database for biomedical sciences
- [Embase](#) - An extensive biomedical and pharmaceutical database from Elsevier.
- [PubMed Central](#) - is the National Library of Medicine's database of free, full-text medical articles made available by contributing publishers.
- [ScienceDirect](#) - is a part of Elsevier, a publisher of scientific, technical and medical information provider. It is an online collection of published scientific research, including over 2500 journals and 6000 books
- [Proquest](#) – database for biomedical sciences
- [Medscape](#) - is a part of the WebMD Health Professional Network. It aims to make it easier for physicians and healthcare professionals to access clinical reference sources, to stay abreast of the latest clinical information
- And many more.....

Development of Working Hypothesis



- After extensive literature survey, researcher should state in clear terms the working hypothesis.
- For a researcher hypothesis is a formal question that he intends to resolve.
- A hypothesis is a proposed explanation for an observable phenomenon which is capable of being tested by scientific methods .
- For example, consider a statement:
 “the drug A is equally efficacious as drug B.”
This is a hypotheses capable of being objectively verified and tested.

Development of Working Hypothesis



Characteristics of hypothesis: Hypothesis must possess the following characteristics:

- ❖ Hypothesis should be clear and precise. If the hypothesis is not clear and precise, the inferences drawn on its basis cannot be taken as reliable.
- ❖ Hypothesis should be capable of being tested.
- ❖ Hypothesis should be limited in scope and must be specific.
- ❖ Hypothesis should be stated as far as possible in most simple terms so that the same is easily understandable by all concerned.
- ❖ Hypothesis should be amenable to testing within a reasonable time. One should not use even an excellent hypothesis, if the same cannot be tested in reasonable time for one cannot spend a life-time collecting data to test it.
- ❖ Thus hypothesis must actually explain what it claims to explain

Research Design



"A research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure."

Research Methods in Social Sciences, 1962, p. 50

- It constitutes the blueprint for the collection, measurement and analysis of data.
- An outline of what the researcher will do from writing the hypothesis and its operational implications to the final analysis of data.



Research Design



What is the study about?

What will be the sample design?

Why is the study being made?

What periods of time will the study include?

Where will the study be carried out?

What techniques of data collection will be used?

Where can the required data be found?

How will the data be analysed?



Research Design



Important concepts relating to research design:

1. **Dependent and independent variables:**

- A concept which can take on different quantitative values is called a variable. As such the concepts like weight, height are all examples of variables.
- Phenomena which can take on quantitatively different values even in decimal points are called 'continuous variables'.
- If it can only be expressed in integer values, they are non-continuous variables or in statistical language 'discrete variables'.
- If one variable depends upon or is a consequence of the other variable, it is termed as a **dependent variable**, and the variable that is antecedent to the dependent variable is termed as an **independent variable**.
- For instance, if we say that height depends upon age, then height is a dependent variable and age is an independent variable.

Research Design



2. Extraneous variable:

- Independent variables that are not related to the purpose of the study, but may affect the dependent variable are termed as extraneous variables or confounding variables.
- Whatever effect is noticed on dependent variable as a result of extraneous variable(s) is technically described as an 'experimental error'.
- A study must always be so designed that the effect upon the dependent variable is attributed entirely to the independent variable(s), and not to some extraneous variable or variables.



3. Control:

- One important characteristic of a good research design is to minimise the influence or effect of extraneous variable(s).
- The technical term 'control' is used when we design the study minimising the effects of extraneous independent variables.
- In experimental researches, the term 'control' is used to refer to restrain experimental conditions.

4. Experimental and control groups:

- In an experimental hypothesis-testing research when a group is exposed to usual conditions, it is termed a 'control group', but when the group is exposed to some novel or special condition, it is termed an 'experimental group'

5. Treatments:

- The different conditions under which experimental and control groups are put are usually referred to as 'treatments'.

Sampling



- **Population (Universe)**- An aggregate of units of observation either animate or inanimate about which certain information is required.
- *Eg. When recording the pulse rate of boys in the college , all boys in the college constitute the population or universe.*
- **Sample** – It's a portion or part of the universe selected for the study in such a manner that the inference drawn can be applied to the whole universe.

Sampling Techniques



- *The methods of sampling can be divided on the basis of the element of probability associated with the sampling technique.*
- *Probability means chances available to members of the population for getting selected in the sample. Accordingly, the methods of sampling are classified into two broad types:*
 - *Probability Sampling*
 - *Non Probability Sampling*

Sampling Techniques



PROBABILITY METHOD

- Simple Random Sampling
- Systematic Sampling
- Stratified Sampling
- Cluster Sampling

NON PROBABILITY METHOD

- Accidental Sampling
- Convenience Sampling
- Judgment Sampling
- Purposive Sampling
- Quota Sampling

Sampling Techniques



- **Non Probability Methods**

- The probability of any particular member being chosen for the sample is unknown.
- In case of non-probability sampling, units in the population do not have an equal chance or opportunity of being selected in the sample. The non-probability method believes in selecting the sample by choice and not by chance.
- This is an unscientific and less accurate method of sampling, hence it is only occasionally used in research activities

Sampling Techniques



- **Probability Sampling Method**

- Probability Sampling is also known as Random Sampling
- Probability means chance
- Therefore element of the population has known chance or opportunity of being selected in the sample
- It is the only systematic and objective method of sampling that provides equal chance to every element of the population in getting selected in the sample
- The results of probability sampling more accurate and reliable
- It helps in the formulation of a true representative sample by eliminating human biases

Sampling Techniques



- **Simple Random Sampling:**

- This sampling procedure gives every unit in the universe an equal chance or opportunity of being selected.
- This method of sampling can be applied when the parameter to be estimated is homogeneously distributed in the population
- A crude method of which is by drawing a lot.
- A good method of simple random sampling involves the use of published tables called tables of Random Numbers.
- Now a days computer generated random number can also be used for the selection

Hypothesis Testing

BASIC CONCEPTS CONCERNING TESTING OF HYPOTHESES



(a) *Null hypothesis and alternative hypothesis:*

- In the context of statistical analysis, we often talk about null hypothesis and alternative hypothesis.
- According to Fisher, a hypothesis which is tested for plausible rejection under the assumption that it is true is called the '**Null Hypothesis**'.
- If we are to compare drug *A* with drug *B* about its efficacy and if we proceed on the assumption that both drugs are equally efficacious, then this assumption is termed as the null hypothesis.
- Any other rival hypothesis is called '*alternative hypothesis*'

Hypothesis Testing



BASIC CONCEPTS CONCERNING TESTING OF HYPOTHESES

- The null hypothesis is generally symbolized as H_0 and the alternative hypothesis as H_a .
- The null hypothesis and the alternative hypothesis are chosen before the sample is drawn .
- Alternative hypothesis is usually the one which one wishes to prove and the null hypothesis is the one which one wishes to disprove.
- Thus, a null hypothesis represents the hypothesis we are trying to reject, and alternative hypothesis represents all other possibilities.

Hypothesis Testing

BASIC CONCEPTS CONCERNING TESTING OF HYPOTHESES



(b) Type I error and type II error.

- In the context of testing of hypotheses, there are basically two types of errors we can make.
- We may reject H_0 when H_0 is true which results in *Type I error*.
- We may accept H_0 when in fact H_0 is not true which results in *Type II error*.
- Type I error means rejection of hypothesis which should have been accepted and Type II error means accepting the hypothesis which should have been rejected.
- Type I error is denoted by α (alpha) known as α error, also called the level of significance of test; and Type II error is denoted by β (beta) known as β error.



Thank You