

A 2-Day Course at GMI

# Research Methodology

## Module 1

### Overview of Research and its Methodologies

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## Course Objectives

At the end of this course, the students should be able to:

- understand some basic concepts of research and its methodologies
- identify appropriate research topics
- select and define appropriate research problem and parameters
- prepare a project proposal (to undertake a project)
- organize and conduct research (advanced project) in a more appropriate manner
- write a research report and thesis
- write a research proposal (grants)

## What you will not get!

Instant Expertise!

“ Expertise is earned –  
not given”

“Geniuses are made –  
not born”



## *Course Outline*

Module 1:

- [1] Overview of Research  
and its Methodologies
  - 1.1: Concepts of research
  - 1.2: The need for research
  - 1.3: Types of research
  - 1.4: Steps in conducting research

## Module 2:

### [2] Literature review

- 2.1: What is literature review?
- 2.2: Why the need for literature review?
- 2.3: How to carry out a literature review?

### [3] Selecting and defining a research problem

- 3.1: Problem formulation – why the need for this?
- 3.2: What are the criteria for selecting a problem?
- 3.3: Identifying variables
- 3.4: Evaluating problems
- 3.5: Functions of a hypothesis

## Module 3:

### [4] Conducting the research

- 4.1: Research activities
- 4.2: Preparations before conducting your research

### [5] Examples of Research at the University

- 5.1: Differences among Postgraduate and Undergraduate Research
- 5.2: Research at the postgraduate level (PhD and MSc)
- 5.3: Research at the undergraduate level (BSc)
- 5.4: Preparations for an Undergraduate Final Year Project

## Module 4:

### [6] Writing Research Reports and Thesis

- 6.1: Why the need to write papers and reports?
- 6.2: Writing a research report
- 6.3: Writing a technical paper
- 6.4: Contents of a thesis

### [7] Writing Research Proposals

- 7.1: Why do we need to write research proposals?
- 7.2: Research Grants in Malaysia
- 7.3: How to write Good Research Proposals?
- 7.4: Case Study

# *Research Methodology*

## [1] Overview of Research and its Methodologies

- 1.1: Concepts of Research
- 1.2: The need for research
- 1.3: Types of research
- 1.4: Steps in conducting research

## 1.1 Concepts of Research

### What is research?

### Which of these can be classified as research?

- [1] Encik Samad prepared a paper on “computer usage in secondary schools” after reviewing literature on the subject available in his university library and called it a piece of research.
- [2] Encik Muthu says that he has researched and completed a document which gives information about the age of his students, their SPM results, their parents income and distance of their schools from the District Office.
- [3] Encik Lim participated in a workshop on curriculum development and prepared what he calls, a research report on the curriculum for building technicians. He did this through a literature survey on the subject and by discussing with the participants of the workshop.

None of the above examples  
can be classified under the name research.

WHY ?

You will know it when you have understood  
the concept of the term 'research'.

Consider the following case  
which is an example of research:

- A general manager of a car producing company was concerned with the complaints received from the car users that the car they produce have some problems with rattling sound at the dash board and the rear passenger seat after few thousand kilometers of driving.
- He obtained information from the company workers to identify the various factors influencing the problem.
- He then formulated the problem and generated guesses (hypotheses).
- He constructed a checklist and obtained requisite information from a representative sample of cars.
- He analyzed the data thus collected, interpreted the results in the light of his hypotheses and reached conclusions.

- You will notice in the example above that the researcher went through a **sequence of steps which were in order and thus systematic**.
- Secondly, the researcher did not just jump at the conclusions, but used a **scientific method of inquiry in reaching at conclusions**.
- The two important characteristics of research are : it is **systematic** and secondly it follows a **scientific method of enquiry**.

## Definition of Research

- Hunting for facts or truth about a subject
- Organized scientific investigation to solve problems, test hypotheses, develop or invent new products

## What is Research?

Research is systematic, because it follows certain steps that are logical in order. These steps are:

- Understanding the nature of problem to be studied and identifying the related area of knowledge.
- Reviewing literature to understand how others have approached or dealt with the problem.
- Collecting data in an organized and controlled manner so as to arrive at valid decisions.
- Analyzing data appropriate to the problem.
- Drawing conclusions and making generalizations.

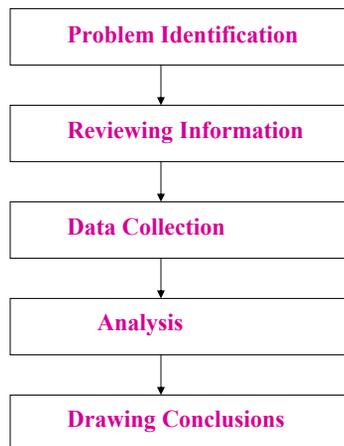
## High Quality Research!

- It is based on the work of others.
- It can be replicated (duplicated).
- It is generalizable to other settings.
- It is based on some logical rationale and tied to theory.
- It is doable!
- It generates new questions or is cyclical in nature.
- It is incremental.
- It is apolitical activity that should be undertaken for the betterment of society.

## Then, what is bad research?

- The opposites of what have been discussed.
- Looking for something when it simply is not to be found.
- Plagiarizing other people's work.
- Falsifying data to prove a point.
- Misrepresenting information and misleading participants.

- This general systematic characteristic of research is illustrated below.



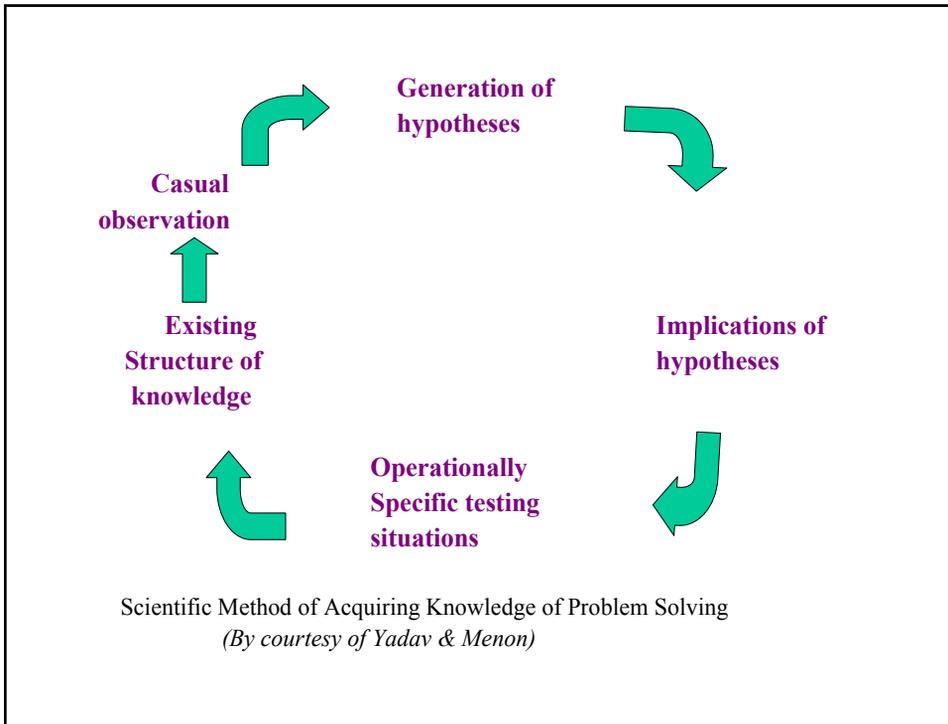
Schematic Characteristic of Research

## What is Research?

- Research follows a scientific method.
- This means that it makes an integrated use of **inductive** and **deductive** reasoning.
- This makes it very useful for explaining and/or predicting phenomena.
- The basic assumption of the scientific method is that **every effect has a cause**.

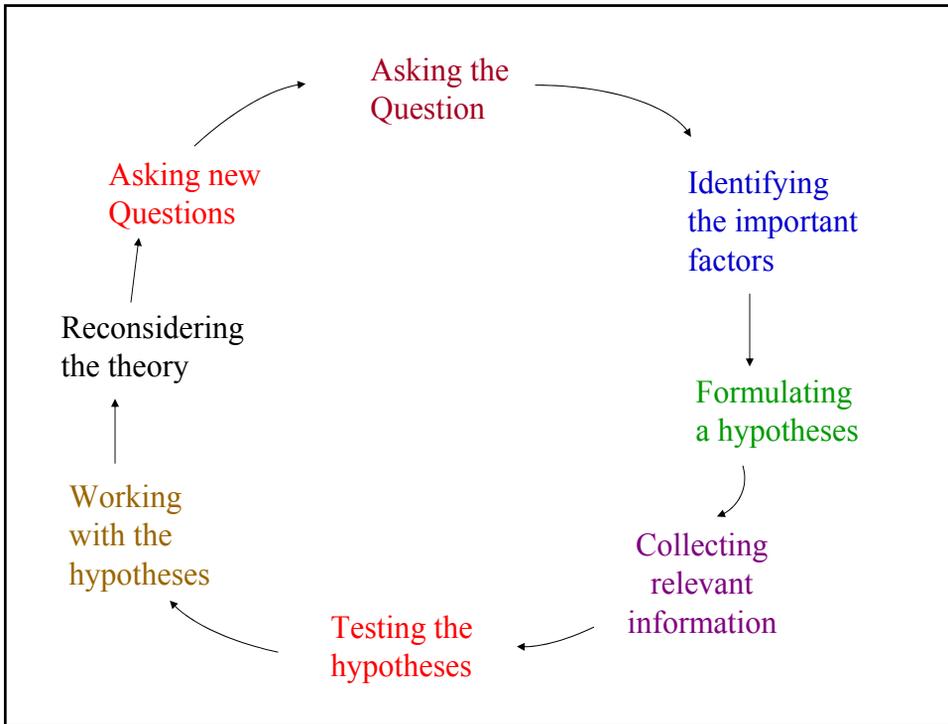
## What is Research (Contd.)?

- It starts with the construction of hypotheses from casual observations and background knowledge (inductive reasoning) to reasoning out consequences or implications of hypotheses (deductive reasoning) followed by testing of the implications and confirmation or rejection of the hypotheses.
- Integrated use of inductive and deductive reasoning is, therefore, the essence of scientific method.



# Research

Where do I begin?



## [1] Overview of research and its methodologies

- 1.1: Concepts of research
- 1.2: **The need for research**
- 1.3: Types of research
- 1.4: Steps in conducting research

## Why do we need research?

- To get PhDs, Masters and Bachelors??
- To provide solutions to complex problems
- To investigate laws of nature
- To make new discoveries
- To develop new products
- To save costs
- To improve our life
- Human desires

### [1] Overview of research and its methodologies

- 1.1: Concepts of research
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- 1.3: [Types of research](#)
- 1.4: Steps in conducting research

## CLASSIFYING RESEARCH

- Reviewing related past research studies is an important step in the process of carrying out research as it helps in problem formulation, hypothesis construction and selection of appropriate research designs.
- It is beneficial if you can classify a research study under a specific category because each category or type of research uses a specific set of procedures.

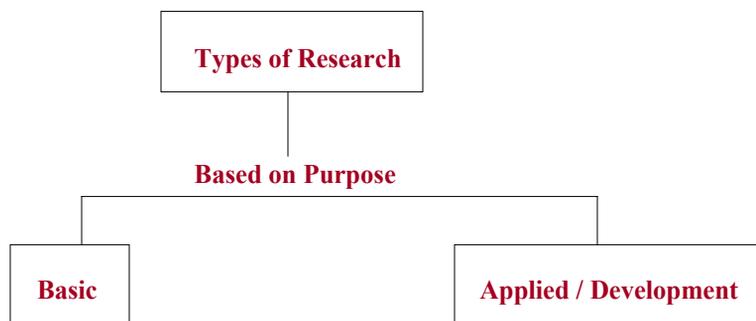
Research can be  
classified into 2 types

Purpose

Method

- There are two ways of classifying research.
- One way is to classify research on the basis of its **purpose** i.e. the degree to which the research findings are applicable to an educational setting and the degree to which they are generalizable.
- The other is to classify research on the basis of the **method** employed in research.

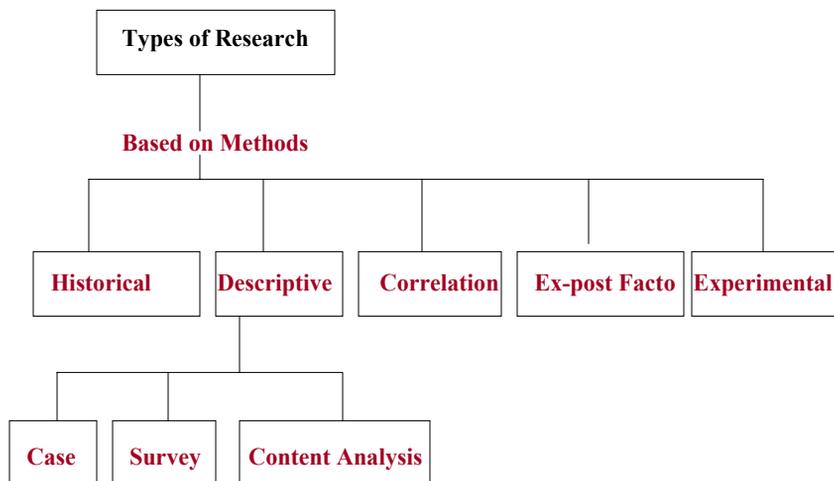
- Taking purpose as the basis of classification, research is considered to be two types-Basic and Applied (including Developmental research).



Classification of Research by Purpose

## CLASSIFYING RESEARCH BY METHODS

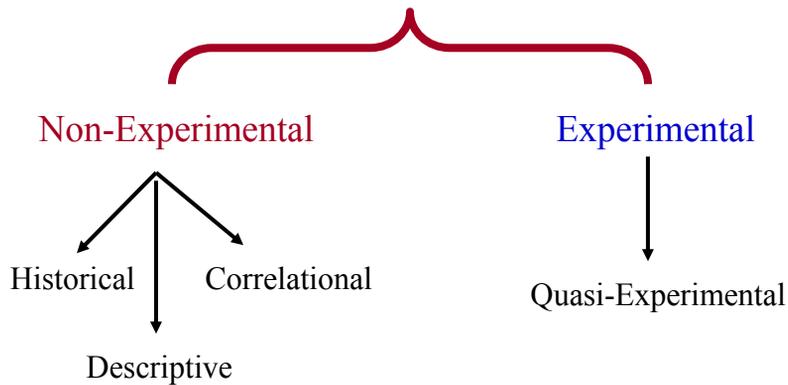
- The other basis for classifying research, is by the method it employs.
- Research method is characterized by the techniques employed in collecting and analyzing data.
- On the basis of method, research can be classified as historical, descriptive, correlational, ex-post facto and experimental.



Classification of Research by Method

# Different Types of Research

(from Salkind)



## 1. HISTORICAL RESEARCH

- The purpose of historical research is **to arrive at conclusions concerning trends, causes or effects of past occurrences.**
- This may help in explaining present events and anticipating future events.
- The data are not gathered by administering instruments to individuals ,but ...

## *HISTORICAL RESEARCH*

- Rather, they are collected from original documents or by interviewing the eye-witnesses (primary source of information).
- In case primary sources are not available, data are collected from those other than eye-witnesses (secondary sources).
- The data thus collected are subjected to scientific analysis to assess its authenticity and accuracy.

### *An Example of Historical Research* *(from Salkind)*

- Nancy Burton and Lyle Jones (1982) examined trends in achievement levels of African American versus White children.
- They examined high school graduation rates between these 2 ethnic groups who were born before 1913, between 1913 and 1922, between 1923 and 1932, etc.
- They also examined a variety of historical indicators in more recent groups of African American and White children.
- One of their conclusions is that differences in achievements between these groups are decreasing.

## 2. DESCRIPTIVE RESEARCH

- Descriptive research studies deal with **collecting data and testing hypotheses or answering questions concerning the current status of the subject of study.**
- It deals with the question “WHAT IS” of a situation.
- It concerns with determining the current practices, status or features of situations.
- Another aspect of descriptive research is that data collection is either done through asking questions from individuals in the situation (through questionnaires or interviews) or by observation.

### *An example of Descriptive Research*

- Peter O. Peretti and Kris G. Majecen (1992) interviewed 58 elderly individuals, from 68 to 87 years of age, using a structured interview to investigate the variables that affect emotional abuse among the elderly.
- As a result of the interviews, they found 9 variables are common to elderly abuse, including lack of affection, threats of violence and confinement.
- *What kind of descriptive research is this?*

### 3. CORRELATIONAL STUDIES

- Descriptive and historical research provide a picture of events that are currently happening or have occurred in the past.
- Researchers often want to go beyond mere description and begin discussing the relationship that certain events might have to one another.
- The most likely type of research to answer the relationship among variables or events is called **correlational research**.

### *CORRELATIONAL STUDIES*

- A correlation study aims at determining the degree of relationship between two or more quantifiable variables.
- Secondly, the relationship thus determined could be used for making predictions.
- A high value of relationship, however, does not signify a cause and effect relationship which must be verified through an experimental study.

## *CORRELATIONAL STUDIES*

- Correlational research are studies that are often conducted to test the reliability and predictive validity of instruments used for decision making concerning selection of individuals for the likely success in a course of study or a specific job.
- Some authors consider this research as a type of descriptive research, since it describes the current conditions in a situation.
- However, the difference lies in the nature of conditions studies.
- A correlational study describes in quantitative terms the degree to which the variables are related.

## *An Example of Correlational research*

- In a study (by Vaughn et.al., 1989) of the relationship between temperament and attachment behavior in infants, the correlation among different types of attachment behaviors, how securely attached the infants were to their mothers, and the infant's general temperament were examined.
- The researchers found that an infant's temperament does not predict how securely attached the child is to his or her mother.

## 4. EX-POST FACTO STUDIES

- There is some research where **both the effect and the alleged cause have already occurred and are studied by the researcher in retrospect.**
- Such research is referred to as EX-POST FACTO (after the fact).
- Kerlinger (1973) defines Ex-post Facto research as :  
“Systematic empirical inquiry in which the scientist does not have direct control of independent variables because their manifestations have already occurred or because they are inherently not manipulable”.
- Thus, in ex-post facto research or causal-comparative research the **researcher has no control on the variables or he cannot manipulate the variables (independent variables) which cause a certain effect (dependent variables) being measured.**

### *EX-POST FACTO STUDIES*

- Since this type of a study lacks manipulation of variables, the cause-effect relationship measured are only tentative.
- Some authors **categorize Ex-post facto studies into the category of descriptive research.**
- Though it too describes conditions that exist in a situation, it attempts to determine reasons or causes for the current status of the phenomena under study.
- The procedures involved in this study are quite different than those in descriptive research.

## 5. EXPERIMENTAL RESEARCH

- We already know that correlational research can help establish the presence of a relationship among variables but not give us any reason to believe that variables are causally related to one another.
- How does one find out if the characteristics or behaviors or events are related in such a way that the relationship is a causal one?
- Two types of research can answer this: (1) quasi-experimental research and (2) experimental research.

## *EXPERIMENTAL RESEARCH*

- Experimental research is where participants are assigned to groups based on some selected criterion often called treatment variable.
- Quasi-experimental research is where participants are preassigned to groups based on some characteristic or quality such as differences in sex, race, age, neighborhood, etc.
- These group assignments have already taken place before the experiment begins, and the researcher has no control as to what the people will belong to each group.

## *EXPERIMENTAL RESEARCH*

- The primary characteristic of experimental research is **manipulation of at least one variables and control over the other relevant variables so as to measure its effect on one or more dependent variables.**
- The variables (s) which is manipulated is also called an independent variables, a treatment, an experimental variables or the cause.
- Some of the examples of an independent variables could be: temperature, pressure, chemical concentration, type of material and conductivity.

### *An Example of Experimental Research*

- Experimental research will always have two or more groups for comparison on the dependent variables.
- It is the only type of research which can establish truly the **cause and effect relations.**
- Consider an Example
  - A researcher in technician education is interested in studying the effects of two methods of instruction-structured lecture method and programmed instruction on the achievement of students in a course of one semester in Applied Mechanics.
  - Sixty students in the class are divided randomly into two groups of thirty each.

- The groups receive the specified treatment for an equal amount of time during the semester.
- The participants are measured for their performance on the achievement test before and after the programme so as to measure the gain.
- In this experiment, the experimental or independent variables is the method of instruction and the dependent variable, is the achievement of students.
- The difference in the gain on achievement between the two groups will show the effect of the methods of instruction.

## Applied Vs. Basic Research

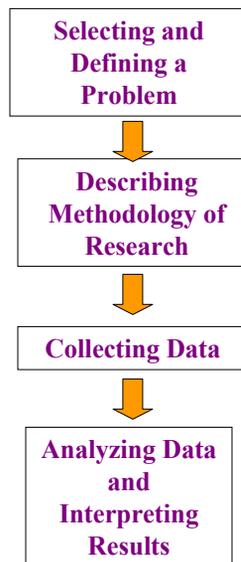
- The most basic distinction between the two research is that basic research is research that has no immediate application, whereas applied research is research that does.
- However, such distinctions are somewhat ambiguous as almost all basic research eventually results in some worthwhile application in the long range.

## [1] Overview of research and its methodologies

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### Steps in Conducting Research

Irrespective of the category of a research study, the steps followed in conducting it are the same. These steps are :



## *Steps in Conducting Research*

### 1. **Selecting and Defining a Problem**

This marks the beginning of a research study and is the most difficult and important step. This involves :

- (1). identifying and stating the problem in specific terms;
- (2). identifying the variables in the problem situation and defining them adequately;
- (3). generating tentative guesses (hypotheses) about the relation of the variables or in other words the solution of the problem, or writing explicitly the questions (research questions) for which answers are sought; and
- (4). evaluating the problem for its research ability.

### *Selecting and Defining a Problem*

- All this is not done in a vacuum.
- To achieve this, you **review the literature** related to the problem to know what other researchers have done and discovered and to identify the possible methodology for conducting the research.

## *Steps In Conducting Research*

### 2. Describing Methodology of Research

You need to state the purpose of the study and to define the problem clearly. This guides you in deciding the methodology of research which involves :

- a. identifying the method of research;
- b. specifying the subjects of study (e.g. heat flow problem, etc.);
- c. selecting an adequate representative sample of subjects;
- d. selecting/constructing valid and reliable instruments for measuring the variables in the problem;
- e. selecting a research design and describing the procedure to be employed for conducting the research study.

## *Steps In Conducting Research*

### 3. Collecting Data

- This step involves conducting the study as per the designed procedure (manipulating the experimental variables in the case of an experimental method), administering instruments for measuring variables and/or gathering information through observation.
- It also involves tabulating the data thus collected for the purpose of analysis.

## *Steps In Conducting Research*

### 4. **Analysing and Interpreting Results**

- The results of the study are generated at this stage.
- The data are summarized, in other words analysed to provide information for testing the hypotheses.
- Appropriate statistical methods of analysis are used to test the hypotheses.
- You can perform the analysis manually, by using a hand calculator or a computer as per the demands of the problem, and the available facilities.
- After completing the analysis results are tied together or summarized.

- The results are interpreted in the light of the hypotheses and/or the research problem.
- These are then discussed in relation to : the existing body of knowledge, consistencies and inconsistencies with the results of other research studies, and then the conclusions are drawn.
- This is followed by writing the research report.

# Summary of Module 1

In this module, we have studied the following:

- Overview and Concepts of research
- The need for research
- Types of research
- Steps in conducting research