

RESEARCH METHOD

CHAPTER 1

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Objectives

At the end of this course, the student 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
- Organize and conduct research in a appropriate manner
- Write a research proposal



After meeting the supervisor



Paper accepted



Debugging your own code



Experiment fails



5th year of Master



Attending a lecture



Why did I choose this supervisor



Attending a talk



Before exam

Review comments on the final report asking you to write 3 chapters and add 2 new ones



Experiment succeeds



Fail in comprehensive exam



Advisor on leave



Paper rejected



2 Semester ends



Advisor praises

Which of these can be classified as research?

- Mr Sam prepared a paper on “computer usage in secondary schools” after reviewing literature on the subject available in his university and called it a piece of research.
- Mr Mann 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 Officer.
- Miss Lynn participated in a workshop on curriculum development and prepared what she calls, a research report on the curriculum for building technicians. She did this through a literature survey on the subject and by discussing with the participants of the workshop.

Which of these can be classified as research?

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 rating 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
- Cover broad spectrum of confusing meanings

What is Research?

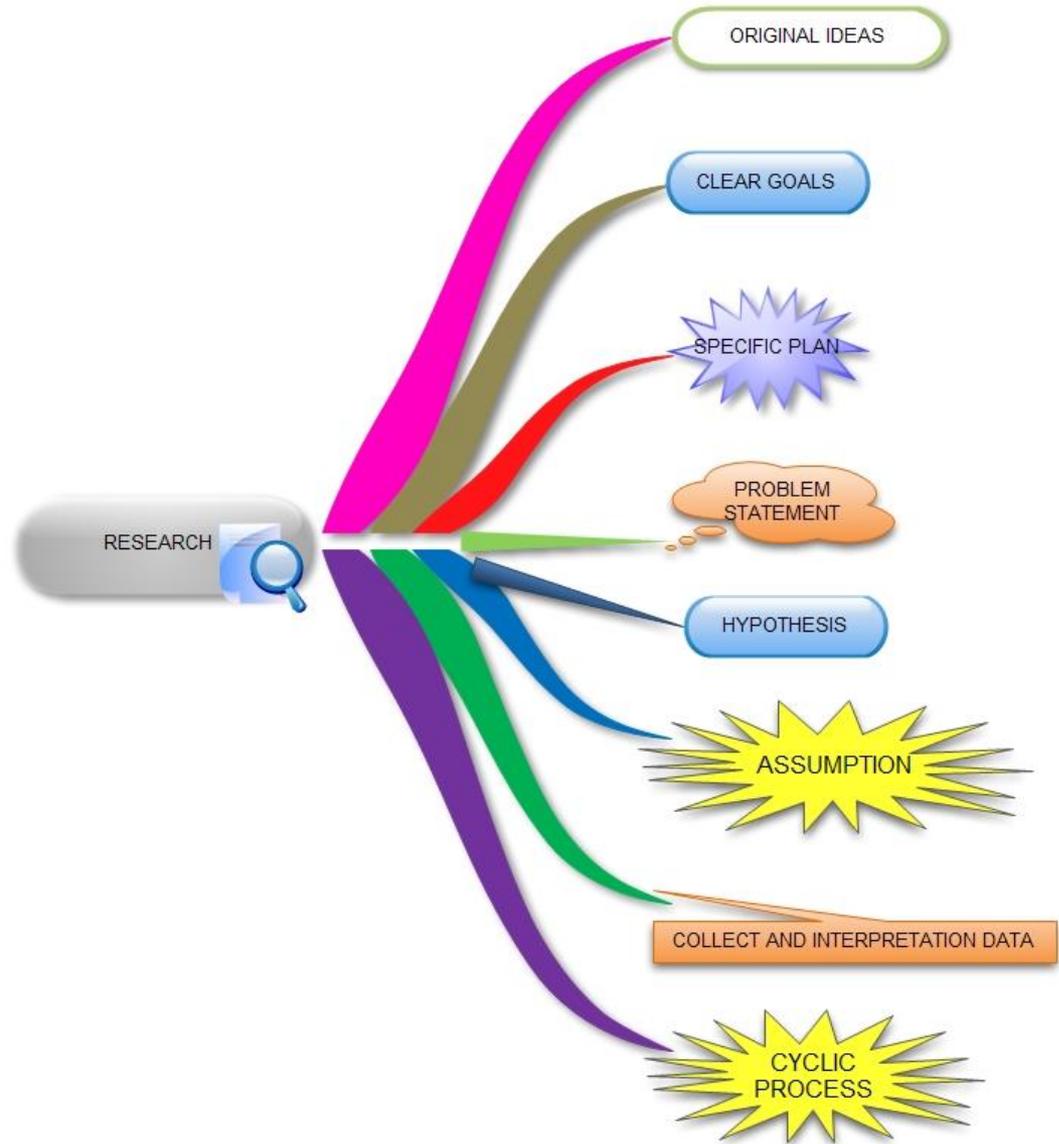
- Research is systematic, because it follows certain steps that are logical in order. These steps are:
- Understanding the nature of problem to be studied and identifying the related area of knowledge.
- Reviewing literature to understand how others have approached or dealt with the problem.
- Collecting 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.

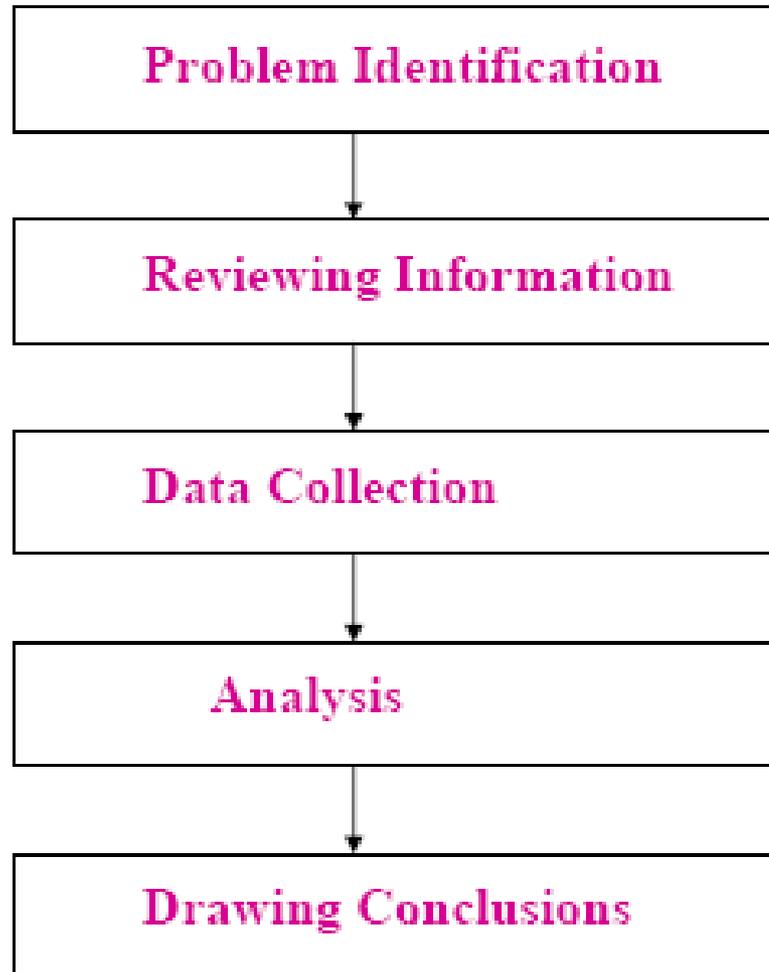
High Quality Research!

- 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.

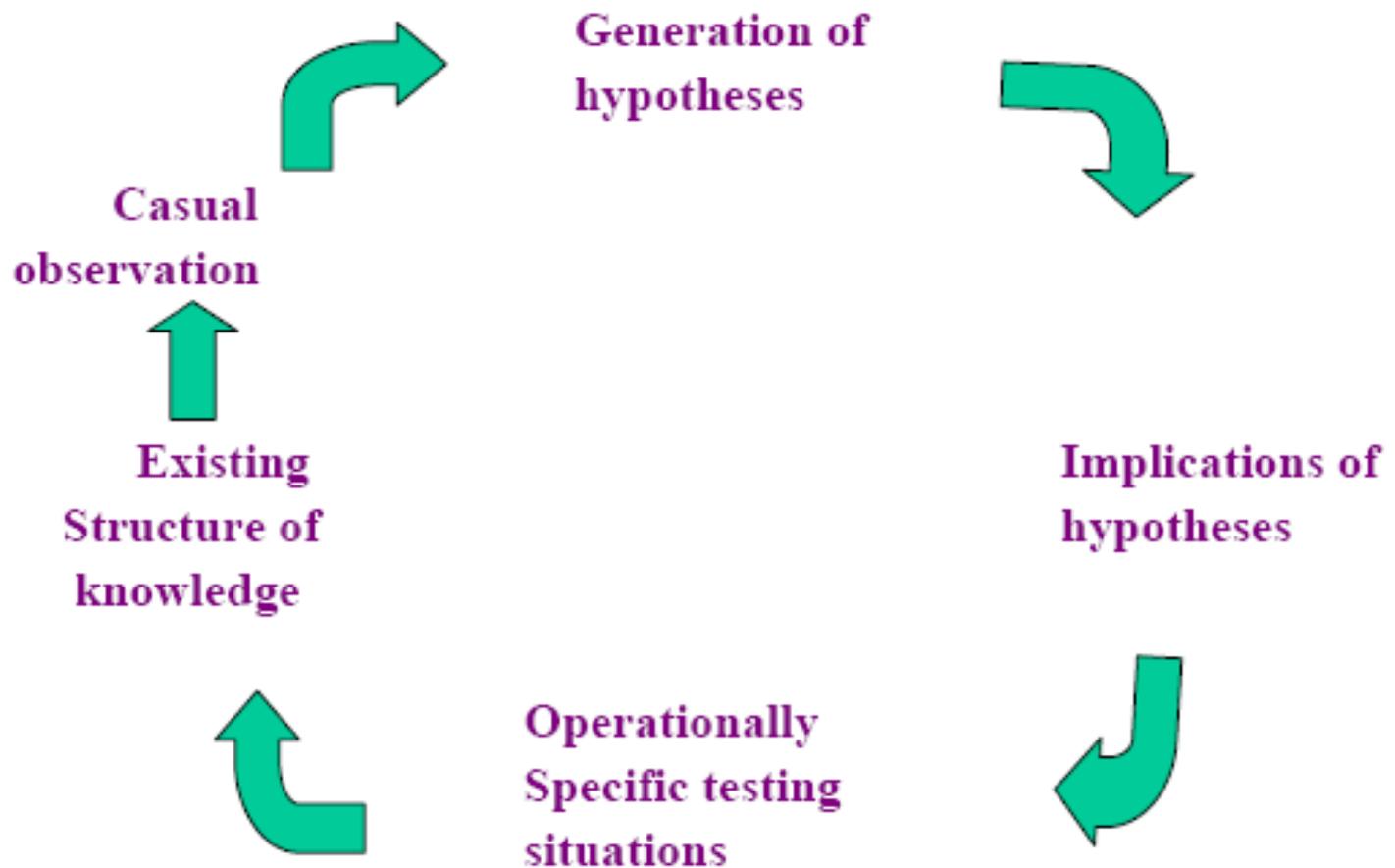




Schematic Characteristic of Research

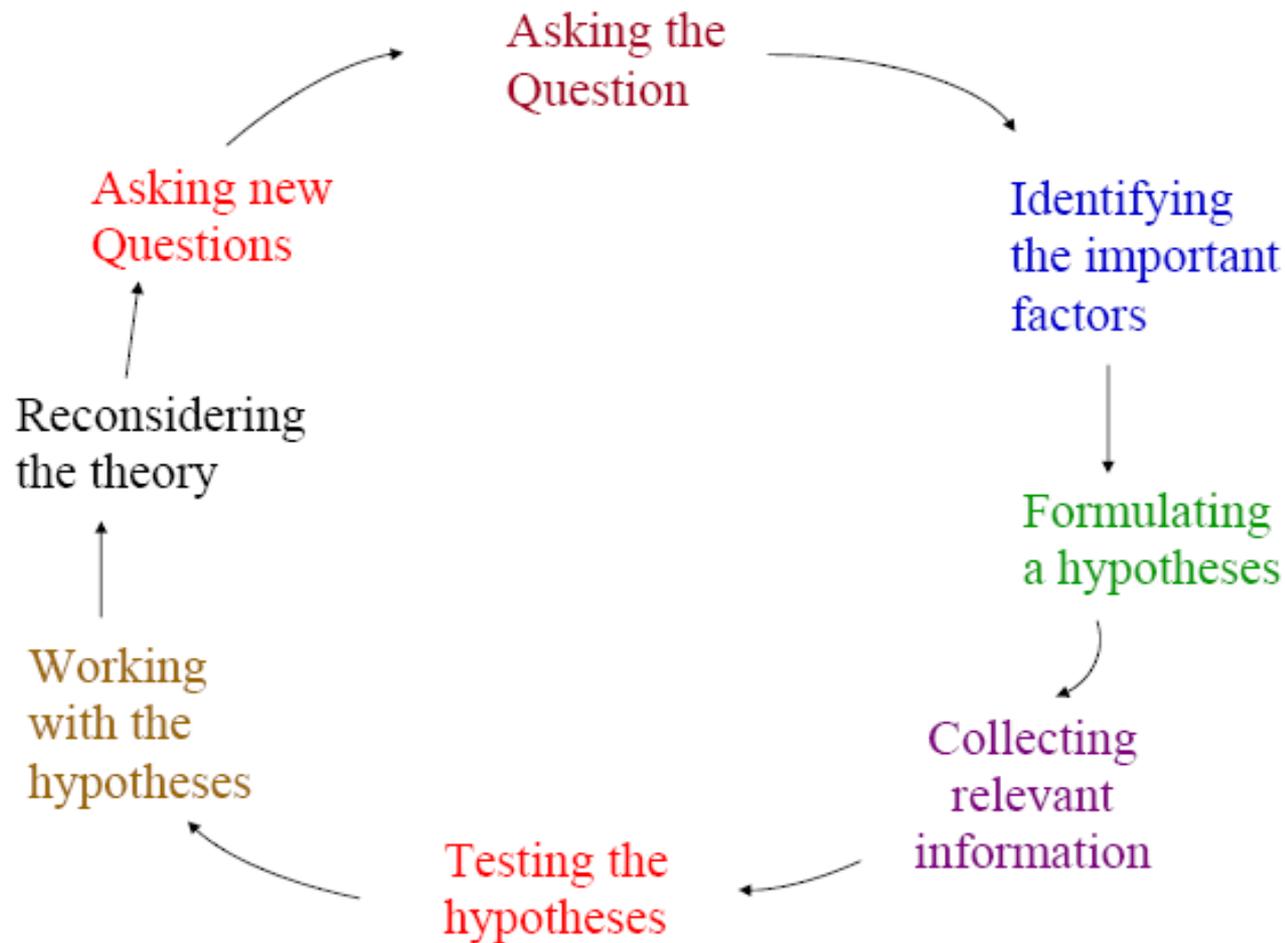
- Research follows a scientific method.
- This means that it makes an integrated use of **inductive reasoning (using known facts to produce general principles)** and **deductive reasoning (using the knowledge and information you have in order to understand or form and opinion about something)**.
- This makes it very useful for explaining and/or predicting phenomena.
- The basic assumption of the scientific method is that every effect has a cause.

- 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.



Scientific Method of Acquiring Knowledge of Problem Solving
(By courtesy of Yadav & Menon)

Where do I begin?



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

CLASSIFYING RESEARCH

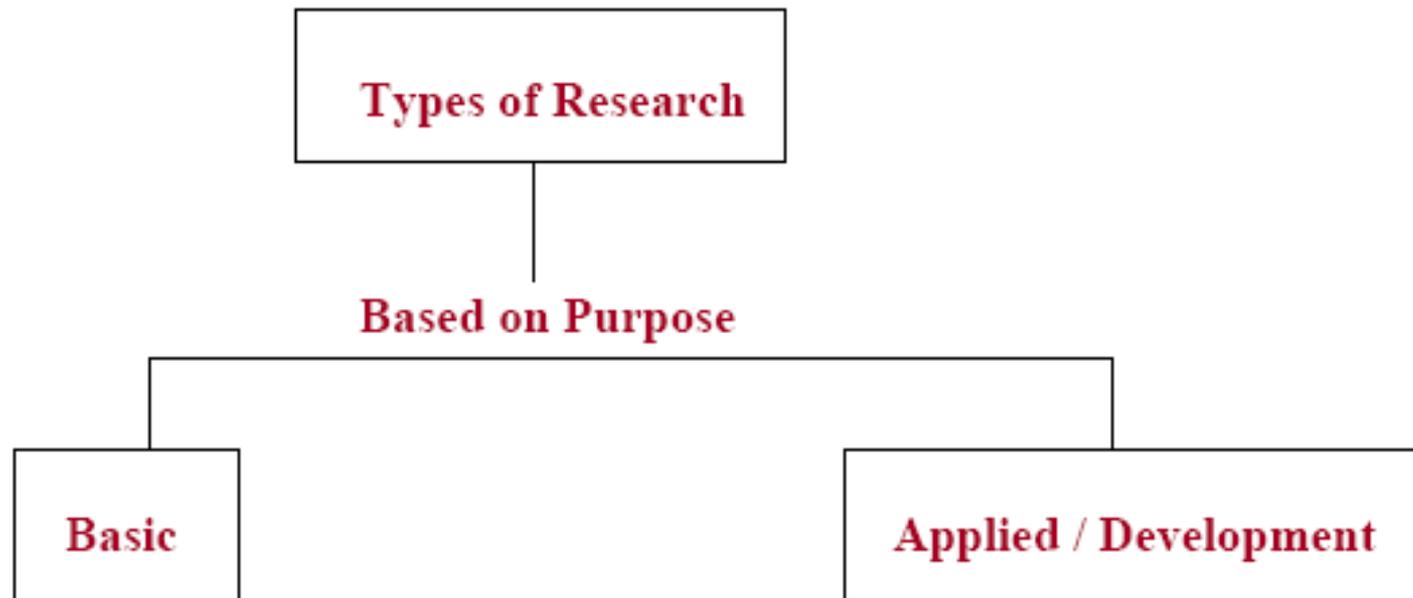
- Reviewing related past research studies is an important step in the process of carrying out research as it helps in problem formulation, hypothesis construction and selection of appropriate research designs.
- It is beneficial if you can classify a research study under a specific category because each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

Research can be
classified into 2 types



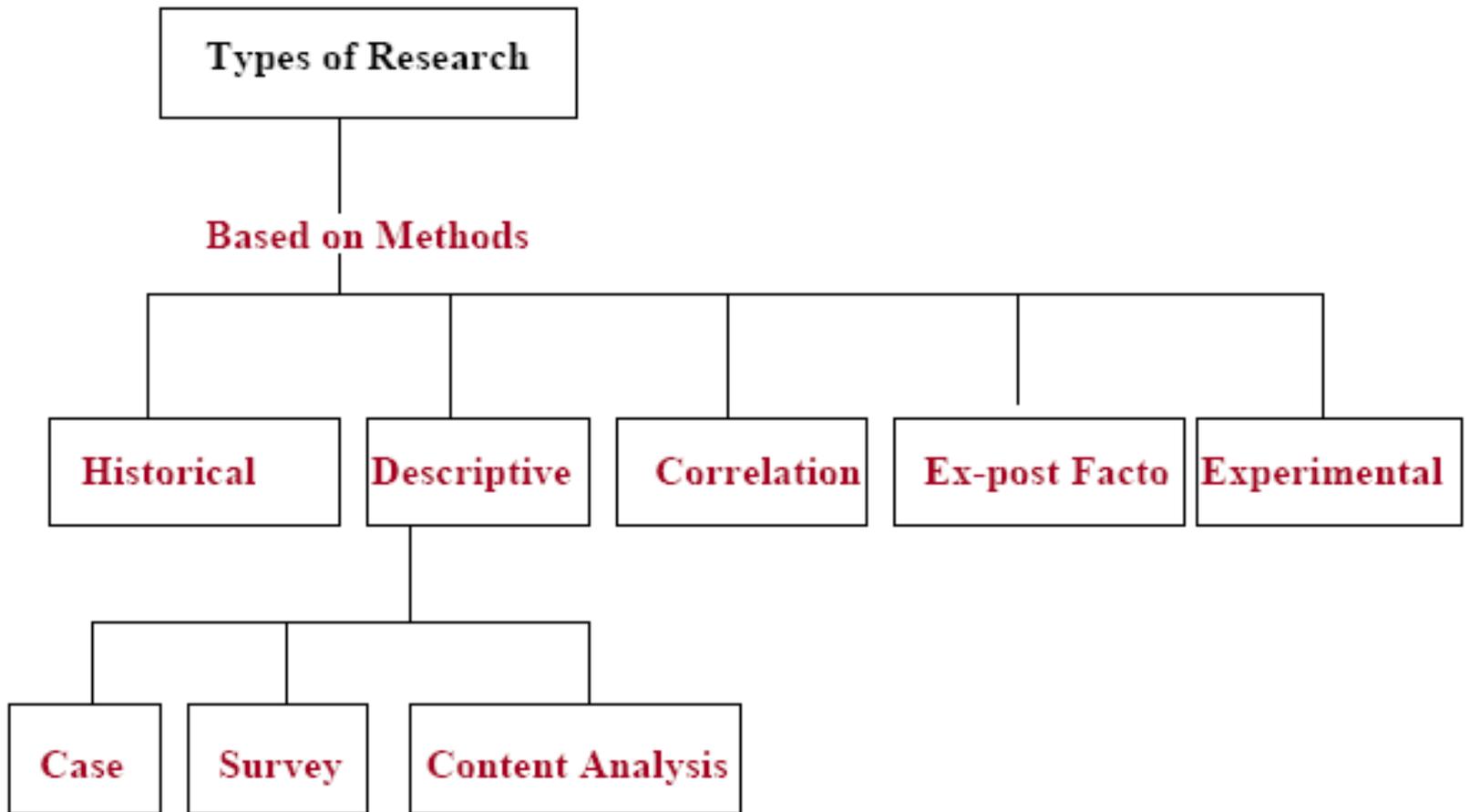
- There are two ways of classifying research.
 - One way is to classify research on the basis of its purpose i.e. the degree to which the research findings are applicable to an educational setting and the degree to which they are generalizable.;
 - The other is to classify research on the basis of the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

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



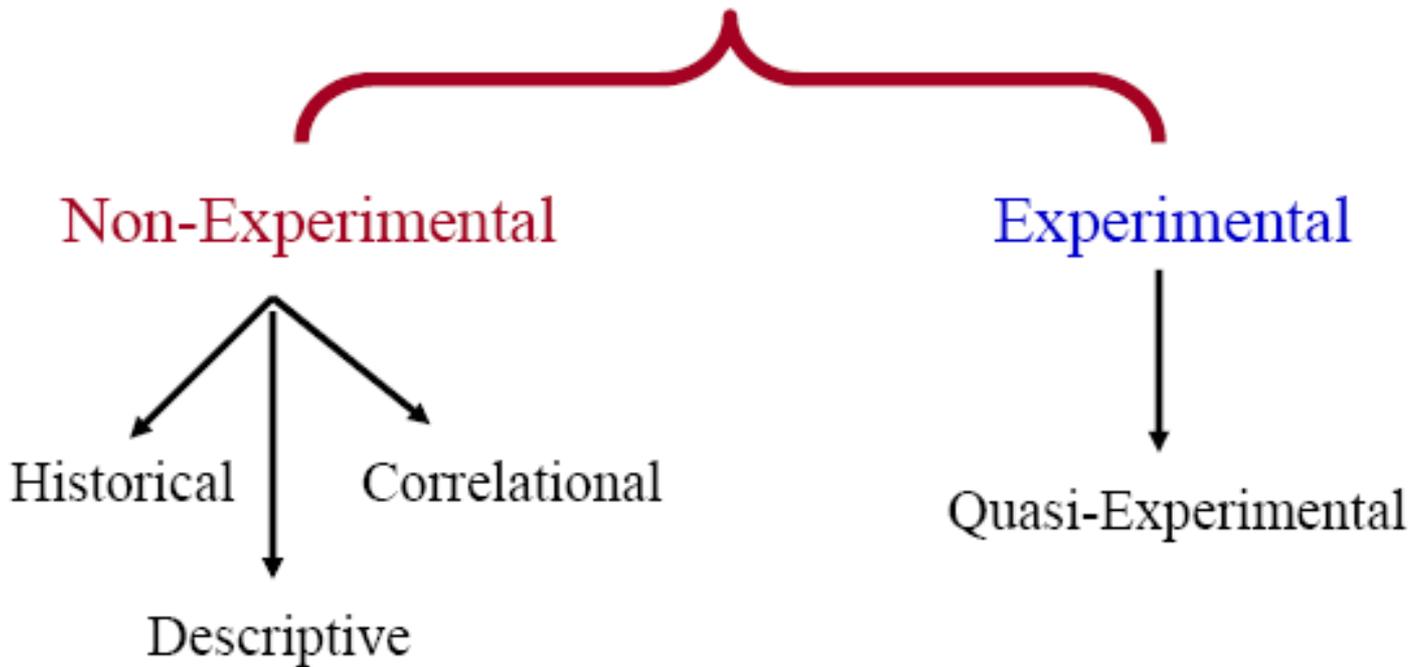
Classification of Research by Purpose

- 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)*



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 ...

- 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

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.

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.

- 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 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.

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.

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.

An Example of Experimental Research

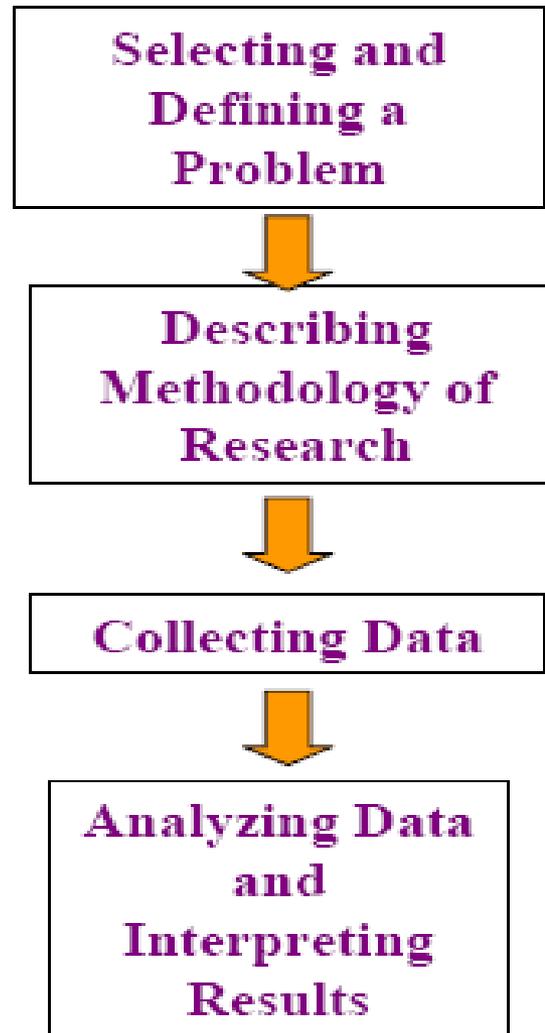
- The groups receive the specified treatment for an equal amount of time during the semester.
- The participants are measured for their performance on the achievement test before and after the program so as to measure the gain.
- In this experiment, the experimental or independent variables is the method 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.

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

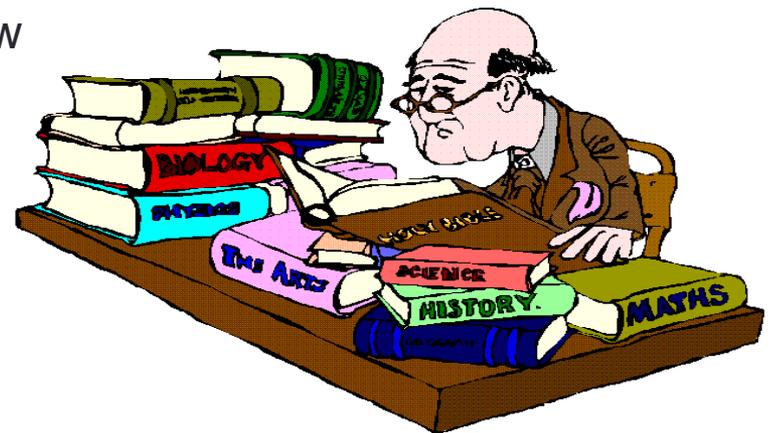
4. Analysing and Interpreting Results

- 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

REVIEW: WHAT IS RESEARCH?

- Research – cover broad spectrum of confusing meanings
- The misconceptions – about the nature
 1. Information gathering – find information and then write documented paper
 2. Library skills – Information discovery, learning reference skills not research skills
 3. Finding something one does not know
 4. Documentation
 5. Self-enlightenment
 6. An attention-getting sales pitch



WHAT IS RESEARCH?

- Research has mystique
 1. Exclusive
 2. Esoteric & aloof individuals
 3. In laboratories
 4. Scholarly libraries
 5. Ivory towers
 6. Within the precincts of an academic environment
- Therefore, public unaware of their contribution to quality of life & general welfare

WHAT RESEARCH IS NOT?

1. Research is not mere information gathering (discovery)
2. Research is not mere transportation of facts from one location to another.
 - Draw conclusion or interpret the facts themselves.
 - Fact discovery, fact transportation, and fact transcription.
 - Missed the essence of research: the interpretation of data.

A large, bold, red 3D-style text graphic of the word "NO" with a reflection effect below it.

WHAT RESEARCH IS NOT?

3. Research is not merely rummaging for information – example of “house for sale” sign board
4. Research is not a catchword, used to get attention

YEARS OF RESEARCH HAVE PRODUCED A NEW CAR WASH!

GIVE YOUR CAR A MIRACLE SHINE WITH SOAPY SUDS!

- ***You said to do some research to determine the market value of your product; it is not research, it is exercise in self-enlightenment***

WHAT TRUE RESEARCH IS

- ❖ Research is a procedure by which we attempt to find systematically, and with the support of demonstrable fact, the answer to a question or the resolution of a problem.
- ❖ Systematic process of collecting, analyzing and interpreting information in order to increase the understanding of the phenomenon about which we are interested or concerned
- ❖ Set out to enhance our understanding of a phenomenon and expect to communicate what we discover to the larger scientific community
- ❖ Research project varies in complexity and duration
- ❖ Research requires the collection and interpretation of data

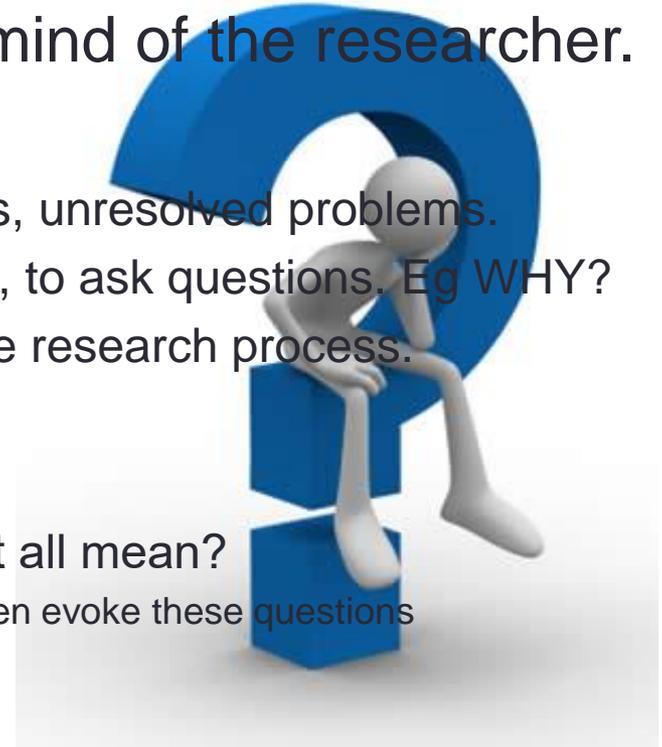
WHAT TRUE RESEARCH IS

Has **EIGHT** distinct characteristics:

1. Originates with a question.
2. Demands a clear articulation of a goal.
3. Requires a specific plan of procedure.
4. Usually divides the principal problem into more manageable subproblems.
5. Is tentatively guided by research problem, research questions, or ***hypotheses***.
6. Accepts certain critical assumptions.
7. Will countenance only hard, measurable data in attempting to resolve the problem that initiated the research.
8. By its nature, circular; or, more exactly, helical.

(1) Originates with a question or problem

- Originates with a question in the mind of the researcher.
 1. The world is filled with unanswered questions, unresolved problems.
 2. Things that cause us to wonder, to speculate, to ask questions. Eg WHY?
 3. Igniting a chain reaction that terminates in the research process.
 4. Inquisitive mind is the beginning of research.
 5. Do not know, do not understand.
 6. Why? What's the cause of that? What does it all mean?
 - Look around you, consider the unresolved situation then evoke these questions
 - These are everyday questions
 - With questions like these, research begins



(2) Requires clear articulation of a goal

- Cannot proceed without a clear articulation of a goal.
 1. A clear, unambiguous statement of the problem.
 2. An exercise in intellectual honesty.
 3. Must set forth in a grammatically complete sentence exactly what the ultimate goal of the research. Your statement answer your question. What problem you intend to solve?
 4. Basic for the success.
 5. Without it, research is on shaky ground.

(3) Requires a specific plan for proceeding

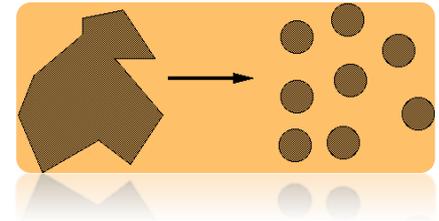
- Requires a specific plan of procedure.
 1. Not an excursion into happy expectation, a carefully planned attack, search-and-discover mission explicitly planned. Do not hope that the data will necessary answer the questions at hand
 2. Logically designed. Researchers plan their overall research design and specific research method in a purposely way so that they can acquire data relevant to their research problem.
 3. How do you propose to reach that goal?
 4. Must not wait until one is chin-deep in the project to plan and design your strategy.
 5. Formative stages, much that can be decided: Where are the data?

(3) Requires a specific plan for proceeding

6. Any existent data that address themselves. Do any existing addressing themselves to the research problem?
7. It is reasonable, have access to them. If the data exist, are you likely to have access to them?
8. What will you do with them after they are in your possession?
9. Cannot be postponed. We should continue; go on and on
10. Procrastination has no place in the agenda.

(4) Divides the principal problem into subproblems

- Dividing it into more manageable subareas. From a design point of view, it is often helpful to break main research problem into several subproblem so that when solved, will resolve the main problem



1. Whole is composed of the sum of its parts.
2. We break down much more frequently than we realize.
3. To proceed logically, should closely inspect the principal problem, soon cause the appropriate, necessary subproblems to float naturally.
4. Many researchers take neither the time nor the trouble to isolate the lesser problems, their research projects become cumbersome and unwieldy.

(4) Divides the principal problem into subproblems

5. It is expedient to reduce the main problem to a series of logical subproblems.
 - **Example: Getting to another town 50km away**
 - Main problem: How do I get there?
 - Subproblems:
 1. What is the direct route?
 2. How far do I travel on highway?
 3. Which exit number should I take?

(5) Guided by specific research problem, question, or hypothesis

- Seeks direction through appropriate hypotheses based upon obvious assumptions.
1. Each of the subproblems is then viewed through a construct called a ***hypothesis***.
 2. Logical supposition, reasonable guess, an educated conjecture. It provides a tentative explanation for a phenomenon under investigation
 3. Hypothesis might direct your thinking to the possible source of facts that will aid in resolving the research problem.
 4. Nothing new.
 5. They are constant, recurring features of everyday life.
 6. They represent natural working of the human mind. Immediately you attempt to account for the cause of the event by making a series of reasonable guesses, you are hypothesizing

(5) Guided by specific research problem, question, or hypothesis

Example: table lamp.

Find the switch. You turn it. No light.

Begin to construct a series of reasonable guesses. (Hypothesis is to explain the lamp's failure)

1. The bulb has burned out.
2. The lamp is not plugged into the wall outlet.
3. A late afternoon thunderstorm interrupted the electrical service.
4. The wire from the lamp to the wall outlet is defective.
5. You forgot to pay your electric bill.

These hypotheses provides a direction for exploration.

(5) Guided by specific research problem, question, or hypothesis

- In research, hypothesis never proved nor disproved; instead they are either supported or not supported by the data.
 1. You go out to your car, get a flashlight, find a new bulb, and insert the new bulb. The lamp fails to light.
(Hypothesis 1 is rejected.)
 2. You glance down at the wall outlet and the lamp is plugged into it.
(Hypothesis 2 is rejected.)
 3. You look at your neighbours' homes. Everyone has electrical power.
(Hypothesis 3 is rejected.)

(5) Guided by specific research problem, question, or hypothesis

4. You go back into your home, lift the cord connecting the lamp to the wall socket. The lamp lights briefly, then goes out. You lift the cord again. Again the lamp lights briefly. The connecting cord is defective.

(Hypothesis 4 is supported.)

5. Fortunately, hypothesis 4 solved the problem, and by repairing or replacing the cord, you can count on adequate light in the near future.

(5) Guided by specific research problem, question, or hypothesis

1. After the hypotheses, come facts.
2. Greatest discoveries begun as hypotheses.
3. Over time, as particular hypotheses are supported by a growing body of data, they evolve into theories. A theory is an organised body of concepts and principles intended to explain a particular phenomenon.
4. Distinction between a hypothesis and an assumption.
5. Assumption is a condition that is taken for granted, without which the research situation would be impossible.
6. Assumptions are self-evident conditions.
7. For the beginning researcher, it is better to be over-explicit than to take too much for granted.

(6) Accepts critical assumptions

- Assumptions are equivalent to axioms in geometry
- Assumptions as bedrock upon which the research rest
- Essential that others know
- Vitally important in judging the quality of the research
- Example: to investigate whether students learn the unique grammatical structure of a language more quickly by studying only one foreign language at a time or two concurrently

(6) Accepts critical assumptions

- At a minimum the researcher must assume
 1. The teachers used in the study are competent to teach the language or languages in question and have mastered the grammatical structures of the language(s) they are teaching
 2. The students taking part in the research are capable of mastering the unique grammatical structures of any language they are studying
 3. The language selected for the study have sufficiently different grammatical structures that students can recognized and learn to distinguish between them

(7) Requires collection and interpretation of data

- Deals with facts and their meaning.
 1. Next step is to collect whatever facts seem appropriate and to organize them in meaningful ways so that they can be interpreted.
 2. Collection of data, not necessarily appropriate for interpretation.
 3. Only facts, events, happenings, observations-nothing more.
 4. These are potentially meaningful.
 5. The significance of the data depends upon the way in which the human brain extracts meaning from those data.



(7) Requires collection and interpretation of data

6. Unprocessed, are worthless in research.
7. Become a travesty (something that can be joked about).
8. Data demands interpretation.
9. No rule, no formula, that will lead the researcher unerringly (accurately) to the correct interpretation.
10. Subjective: entirely upon the logical mind, inductive reasoning skill, objectivity of the researcher.
11. Different minds frequently see different meanings in the same set of facts.
12. An axiom of interpretation that all researchers must recognise.

(7) Requires collection and interpretation of data

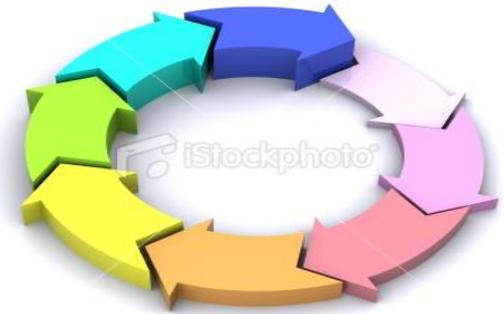
13. Once we believed that clocks measured time and that yardsticks measured space. In one sense, they still do.
14. We further assumed that time and space were two different entities.
15. Then came Einstein's theory of relativity, and time and space became locked into one concept: the time-space continuum.
16. What is the difference between the old perspective and the new perspective? The way we think about, or interpret, the same information.
17. The realities of time and space have not changed; the way we interpret them has.

(8) Research is, by its nature, cyclical or, more exactly, helical

- Is circular
- The research process follows a cycle and begins simply and follows logical, developmental steps.
 1. A questioning mind observes a particular situation and asks, Why? What caused that? How come? (Subjective origin of research.)
 2. One question becomes formally stated as a problem. (Overt beginning of research.)
 3. The problem is divided into several simpler, more specific subproblems.
 4. Preliminary data are gathered that appear to bear on the problem.
 5. The data seem to point to a tentative solution of the problem. A guess is made; a hypothesis or guiding question is formed.

(8) Research is, by its nature, cyclical or, more exactly, helical

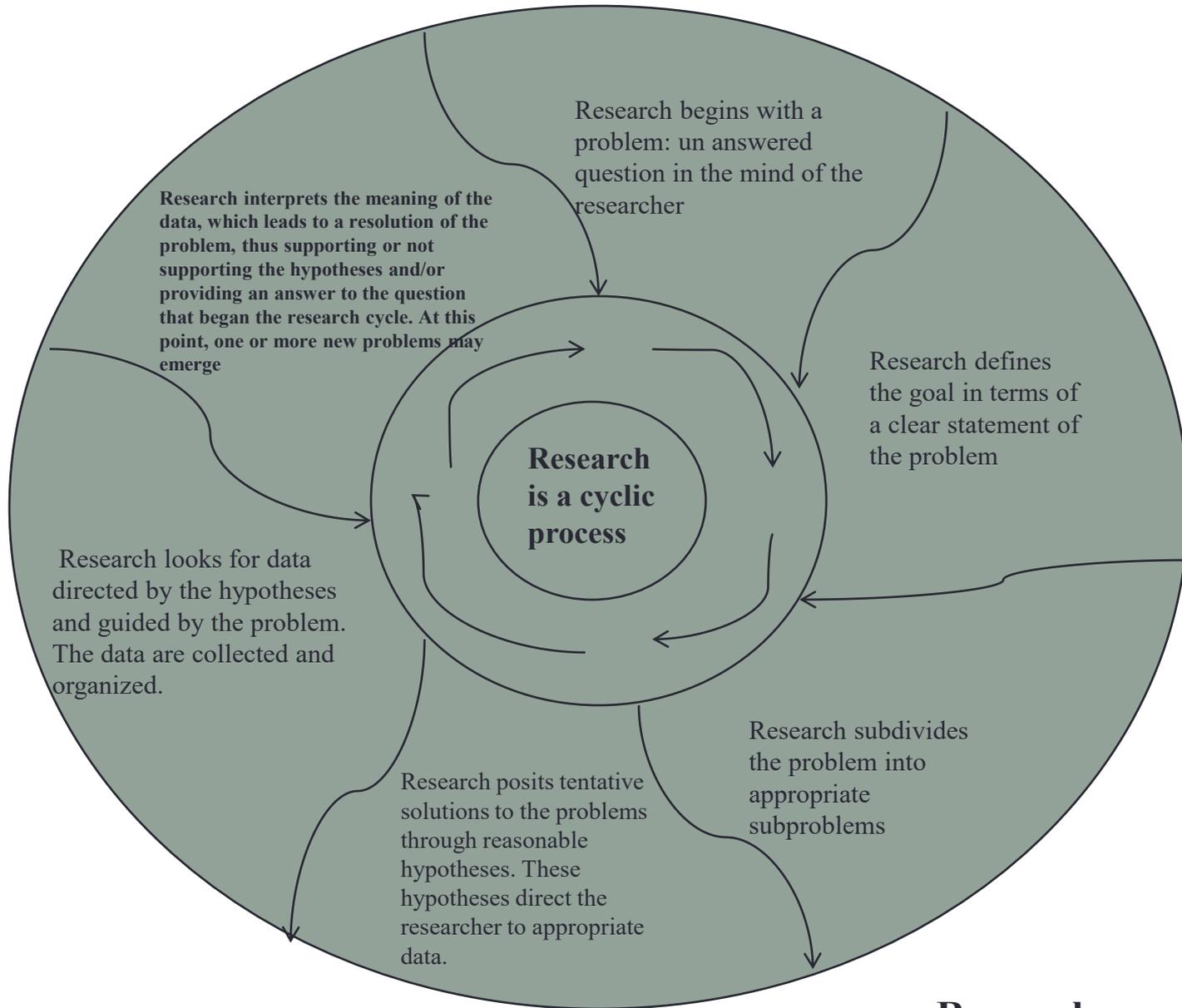
6. Data are collected, processed, and interpreted.
7. A discovery is made; a conclusion is reached.
8. The tentative hypothesis is either supported by the data or is not supported; the question is either answered (partially or completely) or not answered.
9. The cycle is complete.



This is the format of all research.

(8) Research is, by its nature, cyclical or, more exactly, helical

1. Different academic disciplines merely use different routes to arrive at the same destination.
2. Circle is, however, deceptive.
3. Accurately helix, or spiral.
4. One comes across additional problems.
5. Research begets research.
6. Dynamic quality.
7. NOT One-time act (static), self-contained, an end in itself.
8. Genuine research creates more problems than it resolves.
9. The discovery of truth.



Research Methodology

- Methodology is the underlying and unifying of any research project
- Methodology controls the study, dictates how the data are acquired, arranges them in logical relationships, refining and synthesizing the raw data so that the meaning that lie below the surface of those data become manifest, and yields conclusions, that leads to expansion of knowledge.

