

Research Methods

Basic Concepts & Methods

SBCM#19

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Learning Objectives

By the end of this presentation you will able to:

- 1-Define and explain the concept of scientific research, deduction and induction reasoning , theory, hypothesis and empiricism.
- 2- Clarify the Sources of knowledge/truth
- 3 - Identify and explain the features and application of different categories and sub- categories of research methods
- 4- Characteristics of good topic.
- 5- Steps in conducting a research .
- 6- Application and exercises (identification of the research type).

Basic Concepts and Terms

Definition of Research

**Research is a scientific way
of answering questions and
testing hypothesis**

Definition of Research

Research is the systematic and objective analysis and recording of controlled observations that may lead to the development of generalizations, principles, or theories, resulting in prediction and possible control of events .

Definition of Scientific Research

Scientific research may be defined as a systematic, controlled, empirical, and critical investigation of hypothetical propositions about the presumed relations among observed phenomena. This

Key Words

- Systematic, Controlled,
- Empirical, Critical Investigation
- Hypothetical Propositions
- Presumed Relations , Observed Phenomena

Approaches to Knowledge

Five sources of evidence in the pursuit of truth:

1. Authority
2. Custom and tradition
3. Personal experience
4. Deductive reasoning
5. Scientific inquiry

Deductive Reasoning

A.k.a., Logic. الاستنباطي / القياسي

Thinking proceeds from general assumption
to specific application

GENERAL → SPECIFIC

Inductive Reasoning

الاستدلالي / الاستقرائي

Conclusions about events (general) are based on
information generated through many individual and
direct observations (specific).

SPECIFIC → GENERAL

Inductive Reasoning

Researchers observe an individual or group of individuals from a larger population → based on these observations, generalizations are made back to the larger population

- Two kinds of induction:

- **Perfect**

- Conclusions based on observations made from ALL members of a group or population

- **Imperfect**

- Conclusions based on observations made from a random sample of members of a population

Deductive vs. Inductive Reasoning

- **Deductive:**

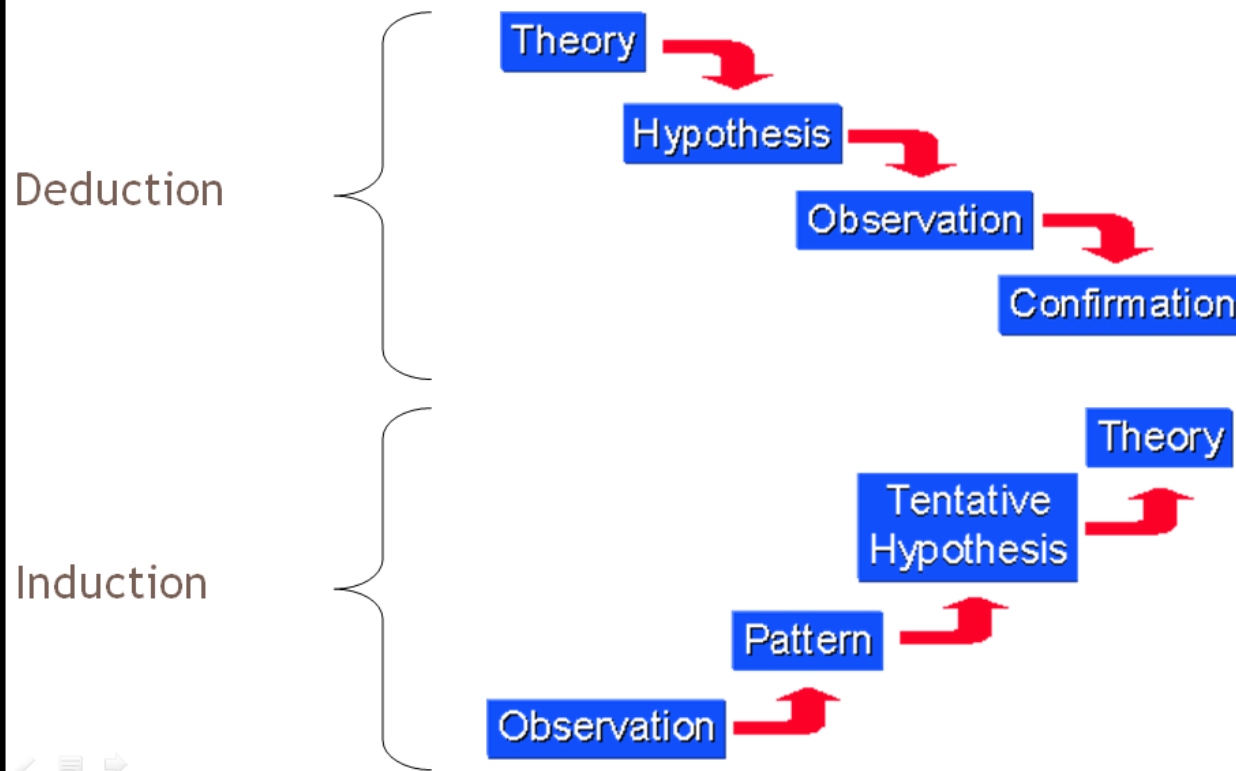
- Every mammal has lungs. All rabbits are mammals.
Therefore, every rabbit has lungs.

- **Inductive:**

- Every rabbit that has been observed has lungs.
Therefore, every rabbit has lungs.

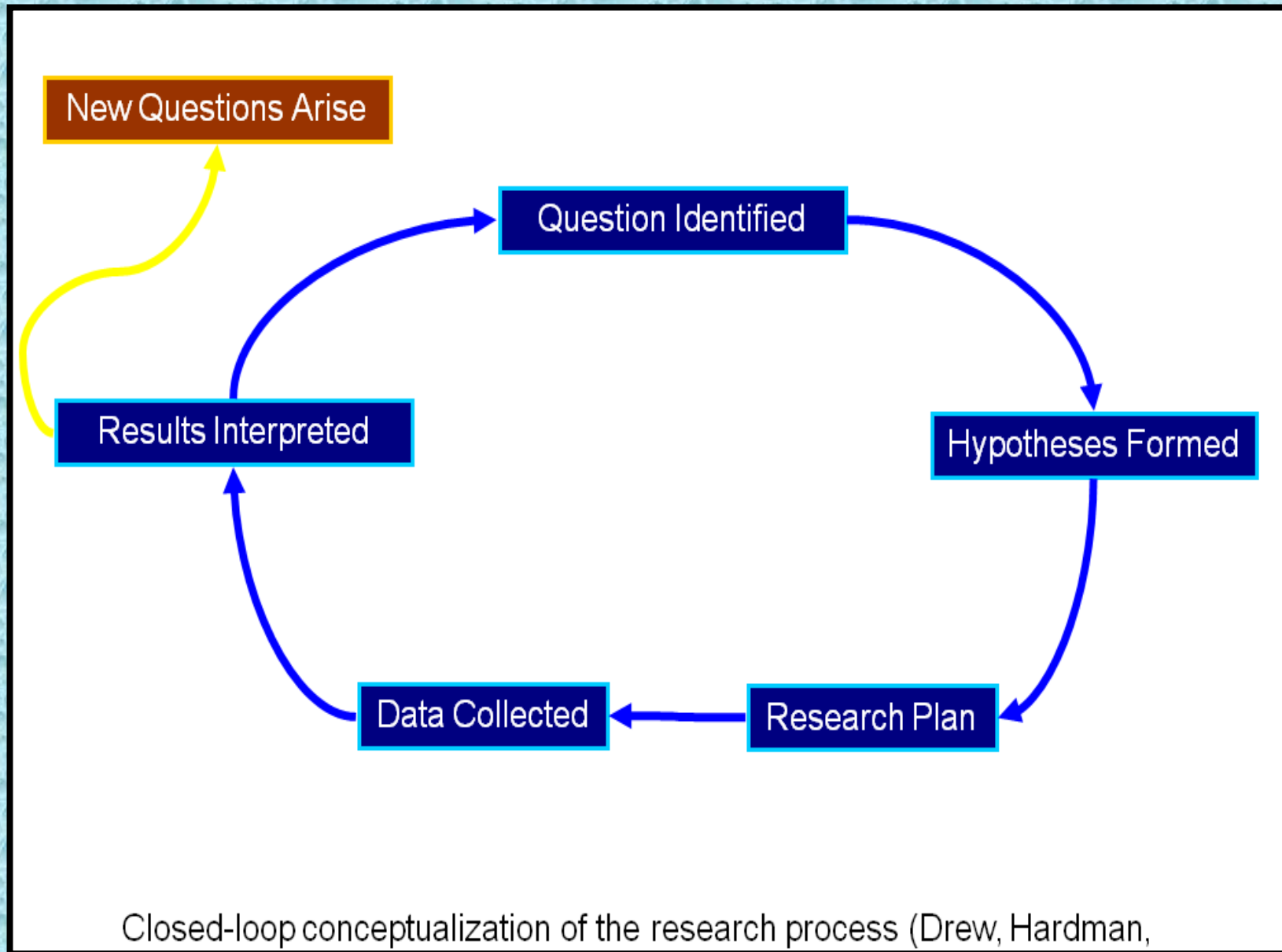
- Sometimes we acquire knowledge through the use of logic. Here is an example of a logical deduction:
 - All birds have feathers.
This animal has feathers.
Therefore, this animal is a bird.
- Many times, as in the case above, logic leads us to the truth. However, sometimes using logic alone leads us to incorrect conclusions.
- Consider the example below:
- (Almost) all birds can fly.
This animal can fly.
Therefore, this animal is a bird.

Deduction and Induction



Logical Steps of Scientific Method

- **Systematic; cyclic; series of logical steps.**
 - **Identifying the problem**
 - **Formulating a hypothesis**
 - **Developing the research plan**
 - **Collecting and analyzing the data**
 - **Interpreting results and forming conclusions**



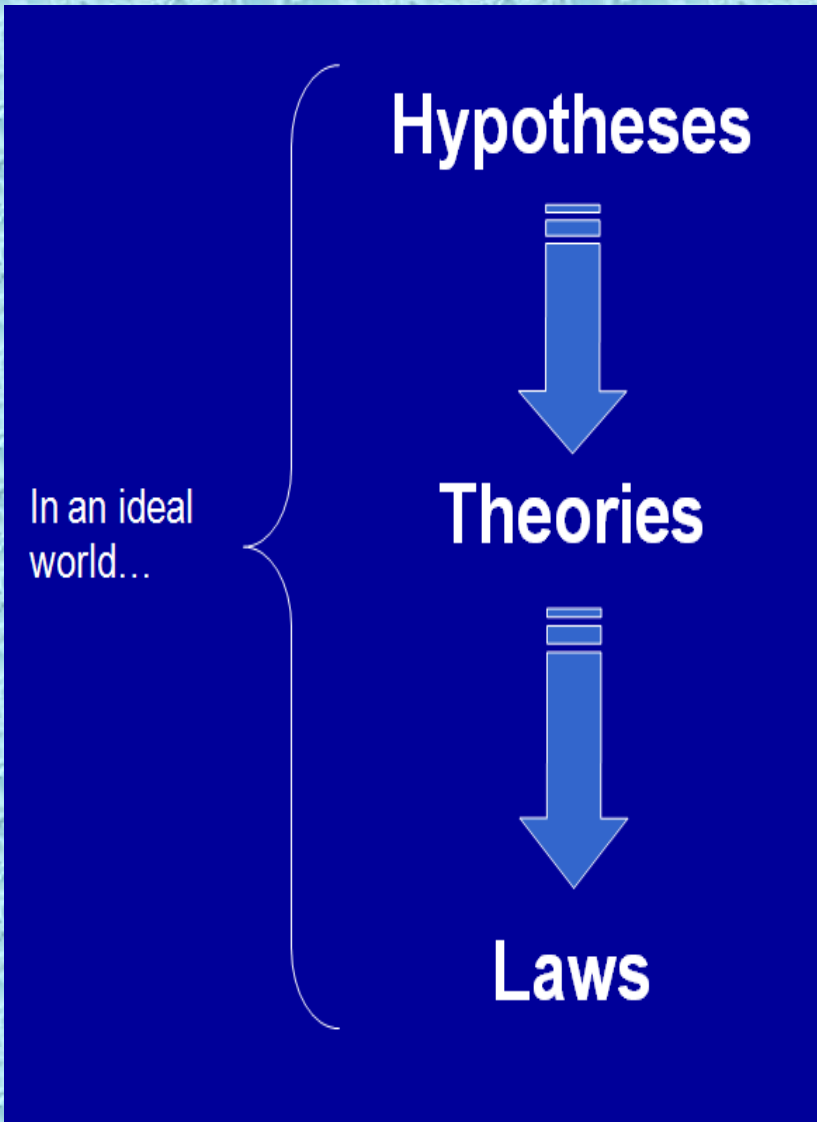
Theory vs. Hypothesis

Hypothesis

- A belief or prediction of the final outcome of the research
- A concrete, specific statement about the relationships between phenomena
- Based on deductive reasoning

Theory

- A belief or assumption about how things relate to each other
- A theory establishes a cause-and-effect relationship between variables with a purpose of explaining and predicting phenomena
- Based on inductive reasoning



Empiricism

- **Acquiring information and facts through the observation of our world**

Pragmatic observations

- **Developing theory through experience and observation**

TYPES OF RESEARCH

Research Classifications

- **System #1:**

- Basic research
- Applied research
-

- **System #2:**

- Quantitative research
- Qualitative research
-

- **System #3:**

- Experimental research
- Nonexperimental research

Research Classifications

1. Application of research study

- *pure research* and
- *applied research*

2. Objectives in undertaking the research

- *descriptive*
- *correlational*
- *explanatory*
- *exploratory*

3. Inquiry mode employed

- *Structured approach*
- *Unstructured approach*

1. Application of research study

From the point of view of application, there are two broad categories of research: Pure & Applied Research.

Pure/ Basic research:

Involves developing and testing theories and hypotheses that are intellectually challenging to the researcher but may or may not have practical application at the present time or in the future. *The knowledge produced through pure research is sought in order to add to the existing body of research methods.*

Applied research

Applied Research is done to solve specific, practical questions; for policy formulation, administration and understanding of a phenomenon. It can be *exploratory*, but is usually *descriptive*. It is almost always done on the basis of basic research

- Basic

- Pure, fundamental research
- Discovery of new knowledge; theoretical in nature
- Takes many years for the results of basic research to find some practical utility

- Applied

- Central purpose to solve an immediate problem
- Improved products or processes
- Infers beyond the group or situation studied
- Interpretation of results relies upon Basic research

2. Objectives of the research

a-Descriptive

b-Correlational

c-Explanatory

a-Descriptive

Descriptive research attempts to describe systematically a situation, problem, phenomenon, service or programme, or provides information about , say, living condition of a community, or describes attitudes towards an issue.

Descriptive research refers to research that provides an accurate portrayal of characteristics of a particular individual, situation, or group.

Descriptive research, also known as statistical research.

Descriptive studies are a means of

- discovering new meaning,
- describing what exists,
- determining the frequency with which something occurs, and categorizing information.

Descriptive research deals with everything that can be counted and studied, which has an impact of the lives of the people it deals with.

For example, finding the most frequent disease that affects the children of a town. The reader of the research will know what to do to prevent that disease thus, more people will live a healthy life.

Advantages:

- The people individual studied are unaware so they act naturally or as they usually do in everyday situation;
- It is less expensive and time consuming than quantitative experiments;
- Collects a large amount of notes for detailed studying;
- As it is used to describe and not make any conclusions it is to start the research with it;

Disadvantages

- Descriptive research requires more skills.
- Does not identify cause behind a phenomenon
- Response rate is low in this research.
- Results of this research can change over the period of time.

b- Correlational research

Correlational research refers to the systematic investigation or statistical study of relationships among two or more variables, without necessarily determining cause and effect.

For example, to test the hypothesis “ Listening to music lowers blood pressure levels” there are 2 ways of conducting research

- Experimental – group samples and make one group listen to music and then compare the Bp levels**
- Survey – ask people how they feel ? How often they listen? And then compare**

Advantages:

- 1) Can collect much information from many subjects at one time.
- 2) Can study a wide range of variables and their interrelations.
- 3) Study variables that are not easily produced in the laboratory.

Disadvantages:

1. Correlation does not indicate causation(cause and effect).
2. Problems with self-report method .

c- Explanatory research

Explanatory research attempts to clarify why and how there is a relationship between two or more aspects of a situation or phenomenon.

Exploratory research is undertaken to explore an area where little is known or to investigate the possibilities of undertaking a particular research study (*feasibility study / pilot study*).

In practice most studies are a combination of the first three categories

3- Inquiry Mode:

a- Structured approach & b- Unstructured approach

a- Structured approach:

The structured approach to inquiry is usually classified as **-Quantitative research.**

Here everything that forms the research process- objectives, design, sample, and the questions that you plan to ask of respondents- is predetermined

It is more appropriate to determine the *extent* of a problem, issue or phenomenon by quantifying the variation.

b- Unstructured approach:

The unstructured approach to inquiry is usually classified as qualitative research.

This approach allows flexibility in all aspects of the research process.

It is more appropriate to explore the *nature* of a problem, issue or phenomenon *without quantifying it*.

Main objective is to describe the *variation* in a phenomenon, situation or attitude.

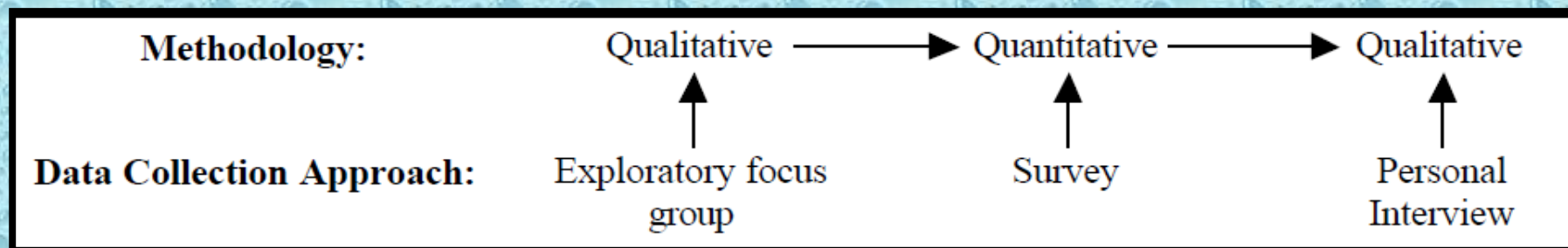
In many studies you have to combine both qualitative and quantitative approaches.

- Quantitative

- Numerical, measurable data
- Traditional or positivist approach
 - Clearly stated questions
 - Rational hypotheses
 - Developed research procedures
 - Extraneous variable controls
 - Large samples
 - Traditional, statistical analyses

- Qualitative

- Generally non-numerical data
- Typically anthropological and sociological research methods
- Observations of a “natural” setting
- In-depth descriptions of situations
- Interpretive and descriptive



Common approaches in qualitative research

1- Ethnography

- **Ethnography:** is an approach relying on the collection of data in the natural environment.
- Ethnographers are interested in how the behavior of individuals is influenced or mediated by culture in which they live.
- So, human behavior can only be understood if studied in the setting in which it occurs. As people can influence and be influenced by the groups they live in.
- The purpose of ethnographic research is to attempt to understand what is happening naturally in the setting and to interpret the data gathered to see what implications could be formed from the data.

2- Phenomenology

Phenomenology: It focuses on individuals' interpretation of their experience and the ways in which they express them.

The researchers task is to describe phenomena as experienced and expressed by individuals.

Phenomenological research an inductive, descriptive research approach developed from phenomenological philosophy; its aim is to describe an experience as it is actually lived by the person

3- Discourse analysis

Discourse is a term used to describe the systems we use in communication with others. These include verbal, non-verbal and written material.

What we say, how we say it, our choice of words, tone, timing are full of values, meanings and intentions.

So, analysis of discourse increases our understanding of human behavior through language and interaction.

4-Grounded theory:

"Theory arises from the data"

GT is an inductive approach to research whereby hypotheses and theories emerge out or are grounded in data.

GT research is a research approach designed to discover what problems exist in a given social environment and how the persons involved handle them; it involves formulation, testing, and reformulation of propositions until a theory is developed.

GT is a research method that operates almost in a reverse fashion from traditional research and at first may appear to be in contradiction to the scientific method.

Four stages:

- 1. Codes-Identifying anchors that allow the key points of the data to be gathered**
- 2. Concepts-Collections of codes of similar content that allows the data to be grouped**
- 3. Categories-Broad groups of similar concepts that are used to generate a *theory***
- 4. Theory-A collection of explanations that explain the subject of the research (hypotheses)**

The above 4 approaches are similar in that they place emphasis on interpretation rather than objective empirical observations. They are different in that;

- **Ethnography focuses onculture,**
- **Phenomenology onconsciousness,**
- **Discourse analysis on..... language and**
- **Ground theory's aim is the development of theory through induction.**

The Critique of Qualitative Research

- 1. Qualitative research is too subjective**
- 2. Difficult to replicate**
- 3. Problems of generalization**
- 4. Lack of transparency**

Action research

Action research is a style of research, rather than a specific methodology. In action research, the researchers work with the people and for the people, rather than undertake research on them. The focus of action research is on generating solutions to problems identified by the people who are going to use the results of research. Action research is not synonymous with qualitative research. But it typically draws on qualitative methods such as interviews and observations.

Experimental vs. Nonexperimental

Experimental research is an objective, systematic, controlled investigation for the purpose of predicting and controlling phenomena and examining probability and causality among selected variables

Advantages

- **Best establishes cause-and-effect relationships**

Disadvantages

- **Feasibility**
- **Ethical Issues**

Experimental Design

The simplest experimental design includes two variables and two groups of participants.

The two variables(IV &DV).

- The IV is the predictor variable whereas the DV is the outcome variable.
- Researchers manipulate and control the IV to study its effect on the DV.

The two groups (Control versus Experimental group).

- **Before beginning the experiment, the researcher (randomly) assigns his/her sample to two different groups: the control group and the experimental (treatment group or clinical group).**
- **The control group receives no manipulation of the IV (no treatment), whereas the experimental group receives the manipulation of the IV**

- Experimental

- IVs and DVs
- Cause-and-effect
- Extraneous variable controls
- 3 fundamental characteristics
 1. At least 1 active IV
 2. Extraneous var controls
 3. Observation of the DV response to the IV

- Nonexperimental

1. Causal-comparative
2. Descriptive
3. Correlational
4. Historical

Experimental Design

1. Pre Experimental
2. Quasi Experimental
3. True Experimental

A- Pre-experimental designs

Pre-experimental designs are so named because they follow basic experimental steps but fail to include a control group. In other words, a single group is often studied but no comparison between an equivalent non-treatment group is made.

Examples include the following:

A.1- One Group Pretest Posttest Study

A.2-The One-Shot Case Study

A.1- The One-Shot Case Study.

In this arrangement, subjects are presented with some type of treatment, such as a semester of college work experience, and then the outcome measure is applied, such as college grades. Like all experimental designs, the goal is to determine if the treatment had any effect on the outcome. Without a comparison group, it is impossible to determine if the outcome scores are any higher than they would have been without the treatment. And, without any pre-test scores, it is impossible to determine if any change within the group itself has taken place.

A.2- One Group Pretest Posttest Study.

A benefit of this design over the previously discussed design is the inclusion of a pretest to determine baseline scores. To use this design in our study of college performance, we could compare college grades prior to gaining the work experience to the grades after completing a semester of work experience. We can now at least state whether a change in the outcome or dependent variable has taken place. What we cannot say is if this change would have occurred even without the application of the treatment or independent variable. It is possible that mere maturation caused the change in grades and not the work experience itself.

B-Quasi-Experimental Design

Quasi designs fair better than pre-experimental studies in that they employ a means to compare groups. They fall short, however on one very important aspect of the experiment: randomization.

B.1- Pretest Posttest Nonequivalent Group. With this design, **both** a control group and an experimental group is compared, however, the groups are chosen and assigned out of convenience rather than through **randomization**. This might be the method of choice for our study on work experience as it would be difficult to choose students in a college setting at random and place them in specific groups and classes. We might ask students to participate in a

one-semester work experience program. We would then measure all of the students' grades prior to the start of the program and then again after the program. Those students who participated would be our treatment group; those who did not would be our control group.

B.2- Time Series Designs. Time series designs refer to the pretesting and posttesting of **one group** of subjects at different intervals. The purpose might be to determine long term effect of treatment and therefore the number of pre- and posttests can vary from one each to many. Sometimes there is an interruption between tests in order to assess the strength of treatment over an extended time period. When such a design is employed, the posttest is referred to as follow-up.

B.3- Nonequivalent Before-After Design. This design is used when we want to compare two groups that are likely

to be different even before the study begins. In other words, if we want to see how a new treatment affects people with different psychological disorders, the disorders themselves would create two or more nonequivalent groups. Once again, the number of pretests and posttests can vary from one each to many.

Whenever subjects are chosen for groups based on convenience rather than randomization, the reason for inclusion in the study itself confounds our results.

Diagrams of Quasi Experimental Designs

Pretest Posttest Nonequivalent Groups

O_1 X O_2
 O_1 X O_2

Time Series Designs

O_1 O_1 X O_2 O_2

Nonequivalent Before-After Design

O_1 O_1 X O_2 O_2
 O_1 O_1 X O_2 O_2

Key:
X = Treatment
 O_1 = Pretest
 O_2 = Posttest
R = Randomization

is random assignment used?

yes

no

**randomized or
true experiment**

is there a control group or
multiple measures?

yes

no

quasi-experiment

non-experiment

C- True Experimental Design

The true experiment is often thought of as the only research method that can adequately measure the cause and effect relationship.

C.1- Posttest Equivalent Groups Study. Randomization and the comparison of both a control and an experimental group are utilized in this type of study. Each group, chosen and assigned at random is presented with either the treatment or some type of control. Posttests are then given to each subject to determine if a difference between the two groups exists. While this is approaching the best method, it falls short in its lack of a pretest measure.

C.2.-Pretest Posttest Equivalent Groups Study.

This method is the most effective in terms of demonstrating cause and effect but it is also the most difficult to perform. The pretest posttest equivalent groups design provides for both a control group and a measure of change but also adds a pretest to assess any differences between the groups prior to the study taking place.

: Diagrams of True Experimental Designs

Posttest Equivalent Groups

R	X	O ₂
R	X	O ₂

Pretest Posttest Equivalent Groups

R	O ₁	X	O ₂
R	O ₁	X	O ₂

Key:
X = Treatment
O₁ = Pretest
O₂ = Posttest
R = Randomization

Final Word

Research Methodology:

1. Quantitative methods
2. Qualitative methods
3. Mixed methods
-

The methodological history can be summarized as

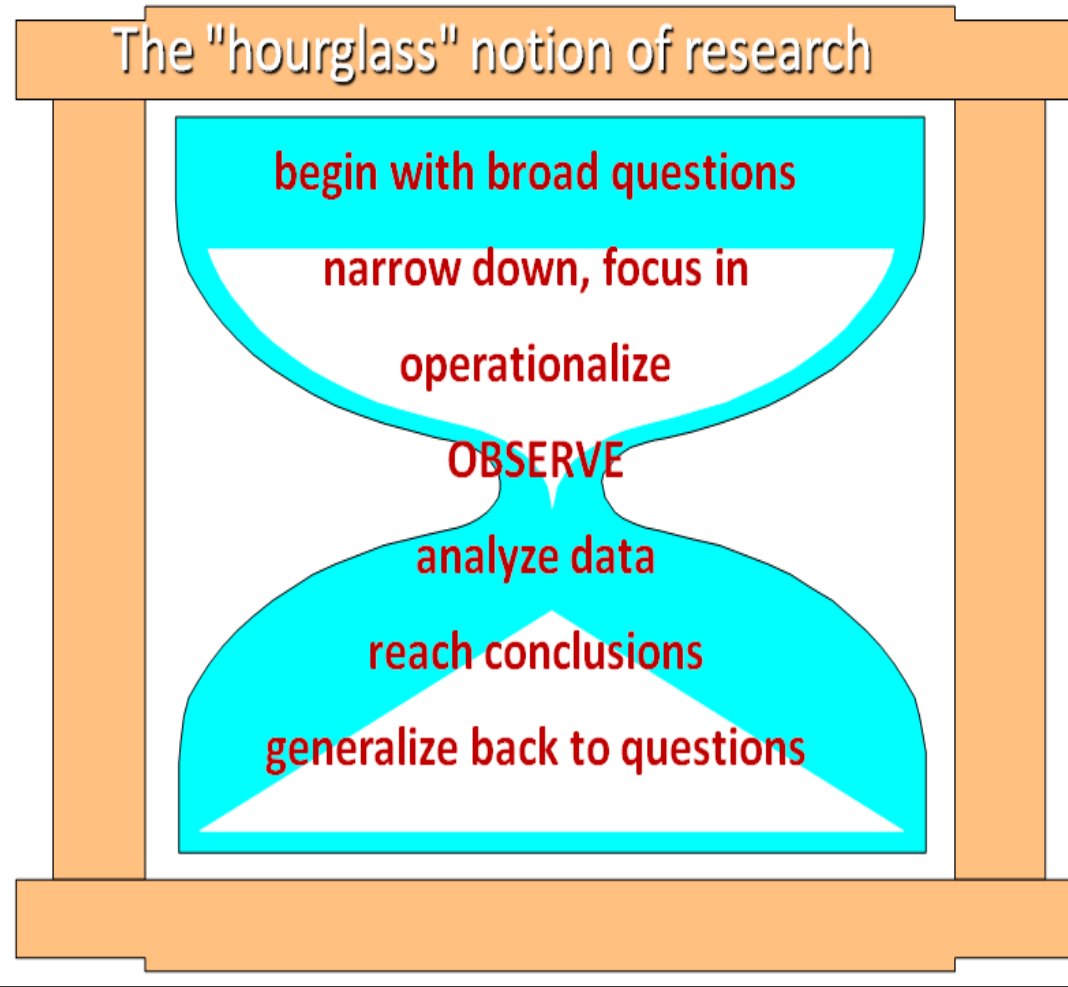
three waves

- The dominance of quantitative methods as wave ..1
- The emergence of qualitative methods as wave2
- The growth of mixed methods as wave3

The scientific approach includes the following steps:

1. Identify an area of interest/research question-RQ.
2. Generate a hypothesis from your RQ.
3. Design a study to test your hypothesis.
4. Formulate predictions based on your hypothesis.
5. Collect data/information.
6. Analyze and interpret the data to test predictions.
7. Accept or reject the hypothesis.
8. Communicate your results .
9. Refine your hypothesis based on the results.
10. Replicate the study.

Structure of Research



Criteria for a good research topic

A good research topic should be **f**easible (can be done), **i**nteresting, **n**ovel, **e**thical and **r**elevant (has an implication). These criteria have been collectively called the

F.I.N.E.R

Feasibility

The following are examples of factors to be considered, depending on the category of research.

- It should be possible to recruit the number of subjects required to provide the answer to the research question within the timeframe of the planned research.
- The research facility available to the investigators should have the equipment, supplies and other requirements to undertake the research.
- The investigators must have the required expertise.
- The cost of doing the research must be affordable and the financial resources available.

Interest

The research topic must be of interest to the investigators and to the scientific community. If the investigators are not excited about the topic, or cannot get colleagues interested in it, the project is probably not worth doing.

Novelty

It is essential that the investigator is familiar with the up-to-date literature on the planned topic for the research. The research must be expected to contribute new information.

Novel does not necessarily mean that the research has not been done before. The prefix “re” in the word research implies searching again.

Most good studies are neither original nor simple duplication of other studies.

The progress of science is incremental, with knowledge gradually building up from different studies. The question should not be about whether the study has been done before, but whether it will add to the existing body of knowledge.

Ethics

Ethical issues must be addressed at the early stage of selecting the research topic.

Other ethical issues will need to be addressed in planning the research. Some ethical problems may indicate that the research should not be considered from the beginning.

If the research topic involves experimentation on human subjects, the following issues should be considered.

- If the topic is about testing a new therapy or procedure, evidence should already be available to suggest that it can be superior to currently available alternatives.**

• Adequate data must be available from animal studies and from studies on a small number of human subjects to confirm safety and to suggest effectiveness, before subjecting patients to a new drug or procedure

It is unjustifiable to do clinical trials on therapies that are unlikely to become available to people in the country or community.

• The research should not conflict with the society's cultural, moral, religious and legal values.

Relevance

This criterion can be called: the “so-what?” test. For the research to be considered relevant, it must have the potential to advance scientific knowledge, influence clinical management, influence health policy, or guide further research

Further Reading & Cited Sources

1- Research Methods and Writing Research Proposals

(Pdf file 135 pages, well organized textbook) - **By: Prof. Dr. Samy Tayie**

http://www.pathways.cu.edu.eg/subpages/training_courses/Research%20Methods%208/C3-1%20Research%20Methods%20and%20Writing%20Research%20Proposals.pdf

2- A Practical Guide for Health Researchers

(Pdf file 235 page , Comprehensive text, from WHO)- **Mahmoud F. Fathalla .**

<http://applications.emro.who.int/dsaf/dsa237.pdf>

3- RESEARCH METHODOLOGY

http://www.ihmctan.edu/PDF/notes/Research_Methodology.pdf

4- Research Methods Knowledge Base:

The Research Methods Knowledge Base is a comprehensive web-based textbook that addresses all of the topics in a typical introductory undergraduate or graduate course in social research methods. It covers the entire research process

<http://www.socialresearchmethods.net/kb/contents.php>

5- Organizing Your Social Sciences Research Paper

(Web site from University of Southern California USA)

The purpose of this guide is to provide advice on how to develop and organize a research paper in the social sciences

<http://libguides.usc.edu/content.php?pid=83009&sid=818072>

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