

## Topic 5. What is research: Definition. Methods. Types & Examples Part 2

Hello and welcome to the second lecture on topic 5

We are going to discuss

Glossary of terms

Research Characteristics

Types of Research with Examples

Learning Outcomes

Let's start with a glossary of terms to be used.

**Inquiry** - an act of asking for information

**Research Characteristics: controlled, rigorous, systematic, valid and verifiable, empirical and critical, ethical**

**Reproducibility** -the ability to be reproduced or copied

**Primary research, Secondary research**

**Basic Research, Applied Research**

**Quantitative and Qualitative Research**

**Inductive and Deductive Research**

**Experimental/Simulation approaches**

### Characteristics of Research

Certain terms are commonly used in research and the success of any research depends on them. These terms determine whether a research is scientifically and ethically correct. They are called the characteristics of research. These characteristics are represented here in simplest terms to understand and to implement. The real understanding of these characteristics is only possible when you practically conduct a research.

So, we have defined research as the process of collecting, analyzing and interpreting information to answer questions. analyzing and interpreting information to answer questions.

To qualify as research, a process must have certain characteristics: it must be *controlled, rigorous, systematic, valid and verifiable, empirical and critical*.

**Controlled** - in real life there are many factors that affect an outcome. The concept of control implies that, in exploring causality in relation to two variables (factors), you set up your study in a way that minimizes the effects of other factors affecting their relationship. So, some factors are taken as controlled factors while others are tested for a possible effect.

**Rigorous** - you must be scrupulous in ensuring that **the procedures** followed to find answers to questions are **relevant, appropriate and justified**.

**Systematic** - this implies that **the procedure** adopted to undertake an investigation **follow a certain logical sequence**. The different steps cannot be taken in a haphazard way. *Some procedures must follow others*.

**Valid and verifiable** - this concept implies that whatever you **conclude on the basis of your findings is correct and can be verified by you and others** (including reproducibility of experiment).

**Empirical** - this means that **any conclusions** drawn are based upon hard evidence gathered from information **collected from real life experiences or observations**.

**Critical** - critical scrutiny of the procedures used and the methods employed is crucial to a research enquiry. **The process of investigation must be foolproof and free from drawbacks**. The process adopted and the procedures used must be able to withstand critical scrutiny.

**Ethical**, i.e. the research has **to comply with accepted moral principles**.

*For a process to be called research, it is imperative that it has the above characteristics*

### **Types of research methods or approaches**

There are different types of research methods which use different tools for data collection:

- Primary and Secondary research
- Quantitative and Qualitative research
- Applied and Basic research
- Deductive and Inductive Research

### **Primary vs Secondary research**

You can find out the difference between primary and secondary research, in the following points in detail.

Research conducted to gather first-hand information, for the current problem is called Primary Research. Secondary Research is one that involves the use of information obtained originally by primary research.

Primary Research is based on raw data, whereas secondary research is based on analyzed and interpreted information.

For the primary research, the data is collected by the researcher himself or by the person hired by him. As against this, for the secondary research, the data collection is performed by someone else.

The primary research process explores the topic deeply. The secondary research process aims at gaining broad understanding about the subject.

In primary research, the data collected is always specific to the needs of the researcher. Primary research is an expensive process; it consumes a lot of time as the research is done from scratch. However, in the case of secondary research, the collection of data is already done, the research takes comparatively less time and the low cost.

### **Quantitative vs Qualitative research**

Qualitative research and quantitative research differ in many ways, including approaches, goals, settings, sampling, data collection and analysis. You can learn more about these approaches using this diagram.

The emphasis of Quantitative research is on *collecting and analyzing numerical data; it concentrates on measuring the scale, range, frequency etc. of phenomena.*

This type of research, although harder to design initially, is usually highly detailed and structured and results can be easily collated and presented statistically.

Quantitative research involves examining and reflecting on the less tangible aspects of a research subject, as *values, attitudes, perceptions.*

Although this type of research can be easier to start, it can be often difficult to interpret and present the findings; the findings can also be challenged more easily.

### **Applied vs Basic research**

Fundamental research, also known as basic research or pure research increase understanding of fundamental principles. It does not usually generate findings that have immediate applications in a practical level. Fundamental research is driven by curiosity and the desire to expand knowledge in specific research area.

This type of research mainly aims to answer the questions why, what or how, they tend to contribute the pool of fundamental knowledge in the research area.

Opposite to fundamental research is applied research that aims to solve specific problems; thus, findings of applied research do have immediate practical implications. It is important to note that although fundamental studies do not pursue immediate commercial objectives, nevertheless, findings of fundamental studies may result in innovations, as well as in generating solutions to practical problems.

### **Deductive vs Inductive Research**

In logic, we often refer to the two broad methods of reasoning as the deductive and inductive approaches.

Deductive reasoning works from the more general to the more specific. Sometimes this is informally called a “top-down” approach. We might begin with thinking up a theory about our topic of interest. We then narrow that down into more

specific hypotheses that we can test. We narrow down even further when we collect observations to address the hypotheses. This ultimately leads us to be able to test the hypotheses with specific data – a confirmation (or not) of our original theories.

Inductive reasoning works the other way, moving from specific observations to broader generalizations and theories.

Deductive reasoning is more narrow in nature and is concerned with testing or confirming hypotheses.

Some examples. **Take a look at this table.** We can clearly see the difference. For deductive methods, a general idea leads to a particular situation. On the contrary, for the inductive method, a specific situation leads to a general idea.

***Deductive reasoning*** starts with a hypothesis, that examines facts and then reaches a logical conclusion. In math terms, think of it this way:  $A=B$ ,  $B=C$ , therefore  $A=C$ .

***Inductive reasoning*** starts with observations that produce generalizations and theories

Now think what comes to our mind first when we hear about the science of deduction? That's right, the name of the brilliant detective Sherlock Holmes!

Look at this table again and remember some of Holmes's cases. This is a contradiction, isn't it? And this was noticed by many readers of Conan Doyle's short stories. This is freshly confirmed in *The Power of Inductive Reasoning*, published in *The Daily Coach* on December 12, 2019.

**“Sherlock Holmes never uses deductive reasoning to assist him in solving a crime. Instead, he uses inductive reasoning”**

Indeed, police officers use the deductive method, but not Sherlock!

Many police officers have a suspect in mind based on previously available information that is not necessarily related to the case, and then they seek out evidence to prove the guilt of that suspect

Sherlock speaks directly about his method “From what I observe I deduce everything”, but the correct phrase there “I utilize inductive reasoning to formulate probable solutions”, right? Hmm, that didn't turn out so catchy, did it?

It is a mystery why Sir Conan Doyle used the wrong method name. Hopefully this illustrative example will allow you to better grasp the essence of these two approaches.

Last but not least, I would like to clarify an experimental approach that also involves modeling. This can be confusing as the simulation approach is different from the usual physics experiment. However, it is an exploratory method where we experiment in an artificially created environment.

*In general, the **Experimental approach** is characterized by control over the research environment and in this case some variables are manipulated to observe their effect on other variables.*

**Simulation approach** or **Modelling** involves the construction of an artificial environment within which relevant information and data can be generated. This permits an observation of the dynamic behaviour of a system (or its sub-system) under controlled conditions.

The term ‘simulation’ refers to “the operation of a numerical model that represents the structure of a dynamic process. Given the values of initial conditions, parameters and exogenous variables, a simulation is run to represent the behaviour of the process over time.”

Simulation approach can also be useful in building models for understanding future conditions.

So, as a result of this lecture you got the following learning outcomes:

- you are able to correctly use all the terms in the glossary for this lecture
- you are able to identify different research approaches and types of research

To test yourself, take a quiz that following this lecture.

This is the list of references used to create this presentation. You can find more useful links in the final section of this topic.

Thank you for watching this!