

INFS 323

RESEARCH METHODOLOGY

Lesson 2– Basic Elements of Research

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UNIVERSITY OF GHANA

College of Education

School of Continuing and Distance Education

2014/2015 – 2016/2017

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Lesson Overview



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Session Overview

Lesson One presented a brief overview of research. In this Lesson we move a step further to discuss four basic elements of research which are Theory; Concepts; Variables; and Hypotheses. To conduct and understand empirical research, it is important that you understand these basic terms.

Session Objectives

Objectives

After completing this Session you should be able to:

1. Define and explain what concepts are
2. Discuss the different types of variables
3. Discuss the role of hypothesis in research
4. Discuss the relationship among theory, concept and propositions

Session Outline

The key topics to be covered in the session are as follows:

1. Topic One: Concepts
2. Topic Two: Theory
3. Topic Three: Variables
4. Topic Four: Hypothesis

Reading List

1. Pickard, A.J. (2007) *Research Methods in Information*, London, Facet Publishing.
2. Powell, R.R. (2004) *Basic Research Methods for Librarians*, (4th ed.) Westport, Connecticut, Libraries Unlimited.

Topic One

CONCEPTS AND CONSTRUCTS

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Explaining Concepts and Constructs

1. A concept is an **idea** that abstractly describes and names an object or phenomenon by providing it with a separate identity or meaning (Burns and Groove).
2. Concepts are words that **label, name, classify, or define** objects, experiences, events, phenomenon or relationships (Sarantakos)

Explaining Concepts and Construct

In simple terms:

A **concept** is a symbolic representation of an actual thing - tree, chair, table, computer, distance, etc.

Construct is the word for concepts with no physical referent - democracy, learning, freedom, etc.

CONCEPTS

SOME EXAMPLES

- Man
- Age
- Income
- Height
- Weight
- Gender
- Level of Education

SOME EXAMPLES

- Leadership, Honesty,
- Competence
- Productivity,
- openness
- Morale
- Motivation
- Inflation
- Happiness
- Authority
- Bureaucracy
- Power
- Self-esteem

Concrete and Abstract Concepts

A concept can be:

Concrete or **Abstract**.

A **concrete** concept does not need a definition to be understood.

Eg. Income; Weight; Height; Age

A concept is abstract if the meaning of a term differs depending on the context in which it is used.

EG.

Adolescent

Youth

Authority

Power

These words are meaningful when they are defined in ways people understand.

A concept can be an idea, a word a phrase, or a shorthand to represent a statement

Topic Two

THEORY

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Theory

What is Theory

A set of interrelated concepts, definitions and propositions that presents a systematic view of phenomena by specifying relations among variables, with the purpose of explaining and predicting the phenomenon. (Cohen and Manion, 1994).

A **theory** is a related set of concepts

- about a phenomenon
- the purpose of which is to explain or predict the phenomenon

A theory must be capable of predicting future occurrences or observations, being tested through experiment or otherwise verified through empirical observation.

Theory

The key element in the definition of a theory is a **proposition**

A proposition is simply a statement concerned with the logical relationships among concepts. In other words propositions represent relationships among concepts.

Example

An **expansion** in a bar of **metal** occurs when it is **heated**.

The statement (proposition) above can be explained as follows:

- Metals are made up of atoms
- The structure of an atom is changed by heat
- Heat causes atoms to expand

Theory

The proposition contains a number of concepts:

Heat

Atoms

Metals

Expansion

Theory explains the relationship among these concepts in the proposition

- Theory: a set of propositions
- Propositions: are made up of concepts
- Propositions explain the relationships among concepts
- Hence concepts are the building blocks of theories.

Role of Theory in Research

- Theory provides concepts to name what we observe and to explain relationships between concepts.
- Theory allows us to explain what we see and to figure out how to bring about change.
- Theory is a tool that enables us to identify a problem and to plan a means for altering the situation.

Topic Three

VARIABLE



Variables

Defining and Explaining Variables

A variable is:

- A concept that varies. It can take on two or more values.
- A variable is a concept that takes on different values.

Variables

Concepts / Variables

Gender

Income

Educational Attainment

Attitude

Age

Temperature

Religion

Height

Weight

Political Affiliation

Values

Male; Female

High; Middle; Low

High; Average; Low

Strongly agree; Agree;

Old; Young; Child; Adult

Hot; Cold

Christian; Moslem;

Tall; Short

Heavy; Light

ABC; DSP; BBA; PCC

Classifying Variables

Classifying Variables by the Nature of Variation

1. Categorical
2. Quantitative / Continuous Variables

1. Categorical Variables

When the variations of the variable are associated with specific categories, we refer to them as categorical variables

So variables are CATEGORICAL if they can be classified into distinct categories) according to some characteristics, attribute or property.

Classifying Variables

SOME EXAMPLES

Variable

Values / Categories

Gender

Male; Female

Eye Colour

Blue; Brown; Green

Age

Young; Old

Temperature

Hot; Cold

Classifying Variables

- The attributes for a categorical variable should be **mutually exclusive** and **exhaustive**. Categories are mutually exclusive if an element or individual fits into one and only one attribute of a variable.
- Categories are **exhaustive** if all the elements fit into one of the attributes of the variable. Each element must fit into one category. EG. Separating males from females. Grouping people into various religious denominations. (Christian, Moslem, Buddhist)

Classifying Variables

- The variation represent different kinds of categories.
- Such variables do not fall along any continuum of measurement.
- The variation is simply identifying a property as having two or more distinct categories

Classifying Variables

Classifying Variables by the Nature of Variation

2. Quantitative / Continuous

Variables are continuous or quantitative if they can be measured in the numerical sense.

- The values can be divided into fractions
- Can take on infinite number of values
- Can take on values within a certain range
- In some cases values cannot be divided into fractions

Classifying Variables

Some Examples

- The values can be divided into fractions
- Can take on infinite number of values
- Can take on values within a certain range
- In some cases values cannot be divided into fractions

Height of all level 300 RM class (6ft. 1inch; 5ft. 8inch,
Ages of students (21, 19, 18, 30, 35 ect)
Income of Bankers (Ghc 4000-9000 /Month
Football scores; Number of correct answers in a test.

Classifying Variables

Classifying variables by the functions they perform in research

We have classified variables according to the nature of variation. We can also classify variables by the functions they perform in research. Under this classification, we have three types of variables

1. Dependent variable
2. Independent variable
3. Extraneous variable

1. Independent Variable

This is the presumed causal variable in a relationship.

Manipulation or variation of this variable is assumed to be the cause of change in other variables.

Independent Variable is the CAUSE VARIABLE. It causes a change to occur in the DEPENDENT VARIABLE

Classifying Variables

2. The dependent variable

The variable that the independent variable is *presumed* to affect is called the **dependent** (or outcome) **variable**. The nature of the dependent variable "depends on" what the independent variable does to it, how it affects it.

Classifying Variables

An example

An experiment seeks to examine the relationship between sunlight and the growth of plants.

Can you identify the dependent and independent variables in this experiment?

Classifying Variables

An example

An experiment seeks to examine the relationship between sunlight and the growth of plants.

Independent Variable: SUNLIGHT

Dependent Variable: GROWTH OF PLANTS

Classifying Variables

Another example

Students of different ages were given the same jigsaw puzzle to put together. They were timed to see how long it took to finish the puzzle.

Identify the variables in this investigation.

Classifying Variables

What was the independent variable?

Ages of the students

- Different ages were tested by the scientist

What was the dependent variable?

The time it took to put the puzzle together

- The time was observed and measured by the scientist

Variable

~~Independent~~
**Independent
Variable**



Influences
CHANGE
in the

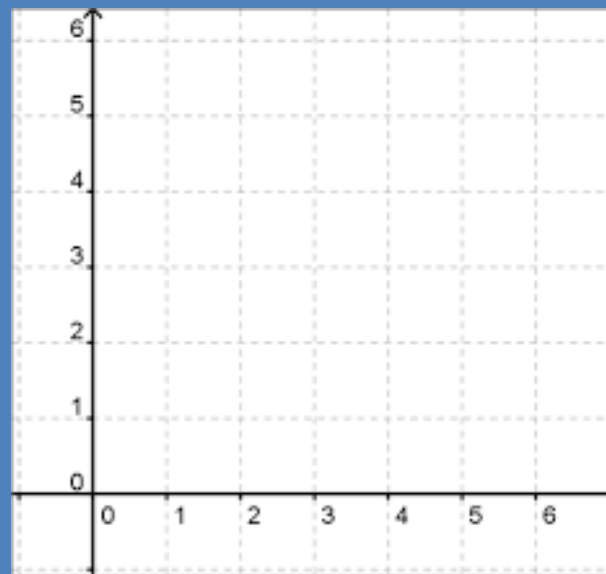
**Dependent
Variable**



Variable

Graphical representation of independent and dependent variables.

In statistical analysis a variable is identified by the symbol (X) for the independent variable and by (Y) for the dependent variable.



Classifying Variables

labels associated with independent and dependent variables

Independent Variable

Presumed cause

Stimulus

Predicted from

Antecedent

Manipulated

Predictor

Dependent Variable

Presumed effect

Response

Predicted to

Consequence

Measured Outcome

Criterion

Classifying Variables

5. Extraneous Variables

These are undesirable that influence the relationship between the variables under investigation.

They influence the outcome of a study, though they are not the variables that are actually of interest.

Variables

Example

The relationship between **background music** and **task performance** amongst employees at a packing facility

Hypothesis

Background music improves employees' task performance

Independent variable:

Background music

Dependent variable:

Task performance

Classifying Variables

- Extraneous variables that can affect the Independent variable:
 - **Type of background music** (e.g., rap music, dance music, easy listening, classical music, etc.)
 - **Loudness of background music** (e.g., low, medium, high volumes, etc.)
 - **Time of day when the background music was played** (e.g., morning, afternoon, night, etc.)

Extraneous variables that could also affect the dependent variable:

Employee tiredness

Employee motivation

Job satisfaction

Variables



HYPOTHESIS

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Hypothesis

Defining an Explaining Hypothesis

- A hypothesis may be defined as a logically conjectured relationship between two or more variables, expressed in the form of a testable statement.
- A proposition to be tested or a tentative statement of a relationship between two variables (Neuman, 2003)
- A testable proposition, one in which the relationship underlying the concepts are operationally defined

Hypothesis

Some Hypotheses:

1. GCB workers have more than average **level of Job satisfaction**(one variable).
2. Level of **job satisfaction** of GCB workers is associated with their **level of efficiency**.
3. **Level of job satisfaction** of GCB workers is positively associated with their **level of efficiency**.
4. The higher the **level of job satisfaction** of GCB workers the lower their **level of absenteeism**.

Types of Hypothesis

1. Descriptive Hypothesis

- Contains only one variable (Univariate Hypothesis).
- Descriptive hypotheses typically state the existence, size, form, or distribution of some variable.

Example: Officers in my organization have higher than average level of job satisfaction (one variable).

This contains only one variable. It only shows the distribution of the level of commitment among the officers of the organization which is higher than average. Such a hypothesis is an example of a Descriptive Hypothesis.

Types of Hypothesis

2. Relational hypothesis

These are the propositions that describe a relationship between two variables.

The relationship could be:

Non-directional

Directional, (positive or negative),

Causal or simply

Correlational.

Types of Hypothesis

(a). **Non-directional** hypothesis is the one in which the direction of the association has not been specified.

The relationship may be very strong but whether it is positive or negative has not been postulated

Example: Level of job satisfaction of GCB workers is associated with their level of efficiency.

Types of Hypothesis

- **(b) Directional hypothesis** Directional hypothesis is the one in which the direction of the relationship has been specified. FOR EXAMPLE: Level of job satisfaction GCB workers is positively associated with their level of efficiency.

Correlational hypothesis

State merely that the variables occur together in some specified manner without implying that one causes the other.

FOR EXAMPLE: Level of job satisfaction GCB workers is positively associated with their level of efficiency.

Hypothesis

Here we do **not** make any claim that **one variable causes the other to change**. That will be possible only if we have control on all other factors that could influence our dependent variable.

Explanatory (causal hypothesis)

Imply the existence of, or a change in, one variable causes or leads to a change in the other variable. This brings in the notions of **independent** and the **dependent** variables.

Example: Sunlight causes plants to grow

Lung cancer is caused by smoking

Different ways to state hypotheses

- High motivation causes high efficiency.
- High motivation leads to hi efficiency.
- High motivation is related to high efficiency.
- High motivation influences high efficiency.
- High motivation is associated with high efficiency.
- High motivation produces high efficiency.
- High motivation results in high efficiency.
- If high motivation then high efficiency.
- The higher the motivation, the higher the efficiency

Null and Alternate Hypotheses



Null Hypothesis

- It is used for testing the hypothesis formulated by the researcher.

The null hypothesis simply states that there is *no relationship* between the variables or the relationship between the variables is "zero." That is why symbolically null hypothesis is denoted as "H0".

For example:

- H_0 = There is no relationship between the *level of job commitment* and the *level of efficiency*. Or
- H_0 = The relationship between *level of job commitment* and the *level of efficiency* is zero. Or

The two variables are independent of each other.

Alternative Hypothesis

- The alternative (to the null) hypothesis simply states that there is a relationship between the variables under study.
- In our example it could be: there is a relationship between the *level of job commitment* and the *level of efficiency*.

Not only is there an association between the two variables under study but also the relationship is perfect which is indicated by the number "1".

Therefore the alternative hypothesis is symbolically denoted as "H1". It can be written like this:

- H1: There is a relationship between the *level of job commitment* of the officers and their *level of efficiency*.

Role Hypothesis in research

- It guides the direction of the study
- It identifies facts that are relevant and those that are not
- It suggests which form of research design is likely to be the most appropriate
- It provides a framework for organizing the conclusions of the findings

Summary

In this session we considered some basic but essential terms in research. These are CONCEPTS, VARIABLES, HYPOTHESES and THEORY. We noted the relationships among these terms and the role they play in research.

