

RESEARCH METHODOLOGY

LECTURE 5 IDENTIFYING VARIABLES

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VARIABLES

- An image, perception or concept that is capable of measurement - hence capable of taking on different values - is called a variable.
- In other words, a concept that can be measured is called a variable.
- A variable is a property that takes on different values. It is a rational unit of measurement that can assume anyone of a number of designated values.

MEASUREMENT SCALES

- A system of classifying objects, responses, characteristics and attributes into different categories.
- These categorizations could be very subjective or objective depending upon the scale used.
- The four commonly used scales are nominal, ordinal, interval and ratio.

THE DIFFERENCE BETWEEN A CONCEPT AND A VARIABLE

- ❑ A concept as such cannot be measured, whereas a variable can be subjected to measurement by crude/refined or subjective/objective units of measurement.
- ❑ Concepts are subjective impressions which, if measured as such, would cause problems in comparing responses obtained from different respondents.

- ❑ It is therefore important for the concepts to be converted into variables (either directly or through a set of indicators) as they can be subjected to measurement, even though the degree of precision with which they can be measured markedly varies from one measurement scale (*nominal*, *ordinal*, *interval* and *ratio*) to another.

CONCEPT

- ❑ In defining a research problem or the study population you may use certain words that are difficult to measure as such and/or the understanding of which may vary from person to person. These words are called concepts.
- ❑ In order to measure them they need to be converted into indicators (not always) and then variables.
- ❑ Words like satisfaction, impact, young, old, happy are concepts as their understanding would vary from person to person.

EXAMPLES OF CONCEPT AND VARIABLES

Concepts	Variables
<ul style="list-style-type: none">• Effectiveness• Satisfaction• Impact• Excellent• High achiever• Self-esteem• Rich• Domestic violence• Extent and pattern of alcohol consumption• etc.	<ul style="list-style-type: none">• Gender (male/female)• Attitude• Age (x years, y months)• Income (\$ __ per year)• Weight (__ kg)• Height (__ cm)• Religion (Catholic, protestant, Jew, Muslim)• etc.
<ul style="list-style-type: none">• Subjective impression• No uniformity as to its understanding among	<ul style="list-style-type: none">• Measurable though the degree of precision varies from scale to scale and from variable

CONVERTING CONCEPTS INTO VARIABLES

- ❑ Some concepts, such as 'rich' (in terms of wealth), can easily be converted into indicators and then variables.
- ❑ For example, to decide objectively if a person is 'rich', one first needs to decide upon the indicators of wealth.
- ❑ Assume that we decide upon income and assets as the indicators.
- ❑ Income is already a variable since it can be measured in some unit of currency, say dollars; therefore, you do not need to convert this into a variable.

TYPES OF VARIABLES

- ❑ A variable can be classified in a number of ways.
- ❑ The classification developed here results from looking at variables in three different ways.
 - ❑ The causal relationship
 - ❑ The study design
 - ❑ The unit of measurement

FROM THE VIEWPOINT OF CAUSAL RELATIONSHIP

- ❑ In studies that attempt to investigate a causal relationship or association, four sets of variables may operate.
- ❑ Variables that are responsible for bringing about change in a phenomenon, situation or circumstance;
- ❑ Outcome variables, which are the effects, impacts or consequences of a change variable;
- ❑ Variables which affect or influence the link between cause and-effect variables; and
- ❑ Connecting or linking variables, which in certain situations are necessary to complete the relationship between cause-and-effect variables.

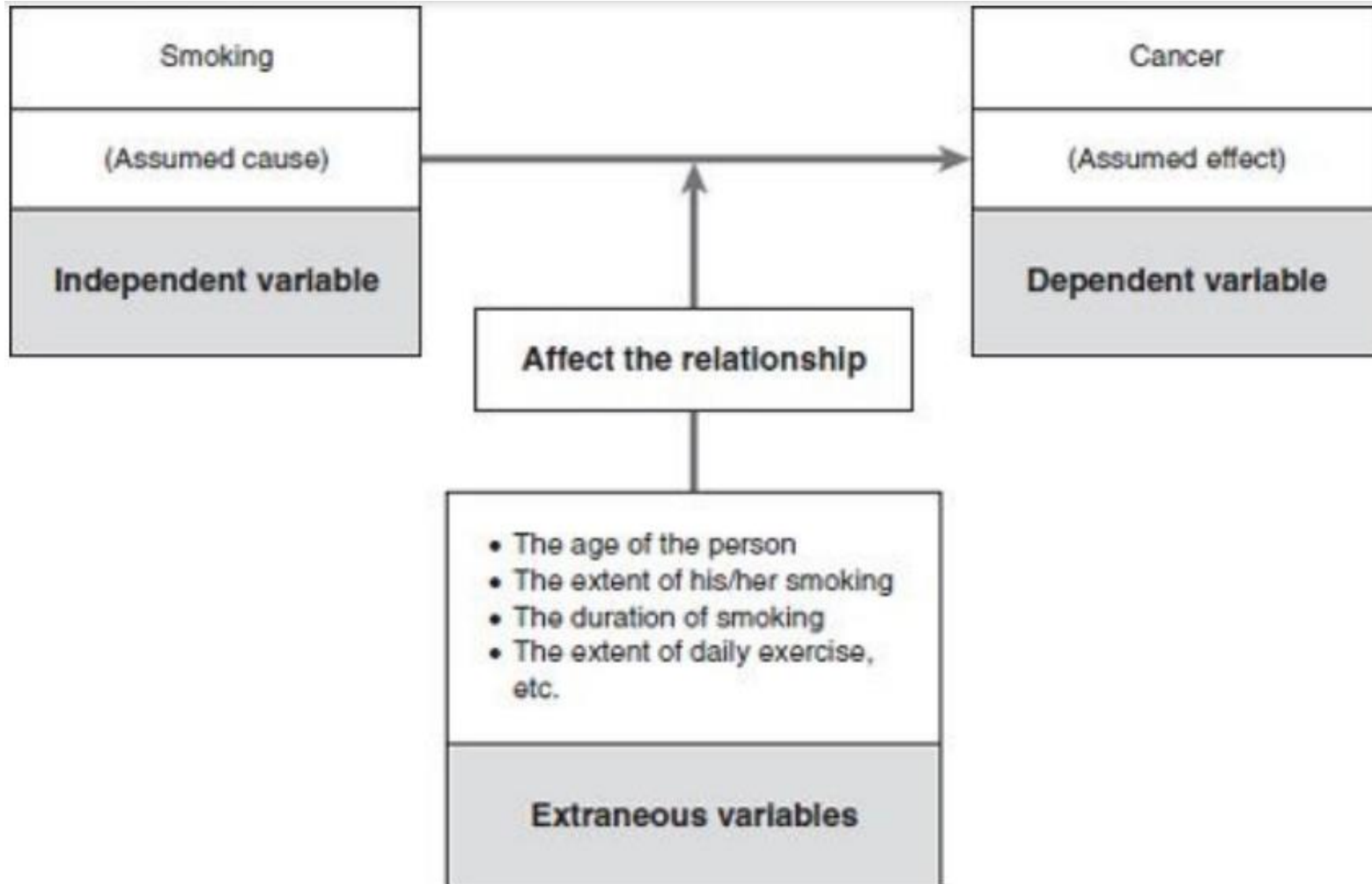
- ❑ In research terminology, change variables are called independent variables, outcome/effect variables are called dependent variables, the unmeasured variables affecting the cause-and-effect relationship are called extraneous variables, and the variables that link a cause-and-effect relationship are called intervening variables.

- **Independent variable** - the cause supposed to be responsible for bringing about change(s) in a phenomenon or situation.
- **Dependent variable** - the outcome or change(s) brought about by introduction of an independent variable.
- **Extraneous variable** - may increase or decrease the magnitude or strength of the relationship between independent and dependent variables.
- **Intervening variable** – In certain situations the relationship between an independent and a dependent variable cannot be established without the intervention of another variable.

EXAMPLE

- Smoking is the independent variable, incidence of cancer is the dependent variable, and all the variables that might affect this relationship, either positively or negatively, are extraneous variables.

EXAMPLE



FROM THE VIEWPOINT OF THE STUDY DESIGN

- Active variables - those variables that can be manipulated, changed or controlled.
- Attribute variables - those variables that cannot be manipulated, changed or controlled, and that reflect the characteristics of the study population, for example age, gender, education and income.

- A researcher has no control over characteristics of the student population such as their age, gender or motivation to study.
- However, a researcher does have the ability to control and/or change the teaching models. S/he can decide what constitutes a teaching model and on which group of the student population it should be tested (if randomization is not used).

FROM THE VIEWPOINT OF THE UNIT OF MEASUREMENT

- Categorical variables: Variables where the unit of measurement is in the form of categories. On the basis of presence or absence of a characteristic, a variable is placed in a category. In terms of measurement scales such variables are measured on nominal or ordinal scales. Rich/poor, high/low, hot/cold are examples of categorical variables.
- Continuous variables: These are variables that have continuity in their unit of measurement; for example, age, income and attitude score. They can take on any value of the scale on which they are measured.

TYPES OF MEASUREMENT SCALE

- Qualitative research mostly uses descriptive statements to seek answers to the research questions, whereas in quantitative research these answers are usually sought on one of the measurement scales (nominal, ordinal, interval or ratio).

THE NOMINAL OR CLASSIFICATORY SCALE

- A nominal scale enables the classification of individuals, objects or responses based on a common/shared property or characteristic. Such individuals, objects or responses are divided into a number of subgroups in such a way that each member of the subgroup shares a common characteristic or a property.
- A variable measured on a nominal scale may have one or more subcategories depending upon the extent of variation. For example the variable 'gender' can be classified into two subcategories: male and female.

THE ORDINAL OR RANKING SCALE

- Ranks the subgroups in a certain order
- For example, income can be measured either quantitatively (in dollars and cents) or qualitatively, using subcategories: 'above average', 'average' and 'below average'. (These categories can also be developed on the basis of quantitative measures)
- For example below \$10 000 is defined as below average, \$10000-\$25 000 as average, and above \$25 000 as above average.

THE INTERVAL SCALE

- This scale has a starting and a terminating point and is divided into equally spaced units/intervals.
- Celsius and Fahrenheit scales are examples of an interval scale. In the Celsius system the starting point (considered as the freezing point) is 0°C and the terminating point (considered as the boiling point) is 100°C . The gap between the freezing and boiling points is divided into 100 equally spaced intervals, known as degrees. In the Fahrenheit system the freezing point is 32°F and the boiling point is 212°F , and the gap between the two points is divided into 180 equally spaced intervals.

THE RATIO SCALE

- It is an absolute scale.
- The measurement of income, age, height and weight are examples of this scale.
- A person who is 40 years of age is twice as old as a 20-year-old.