Variable: Classification, Measurement and Importance in Social Science Research

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Abstract

Variable generally regarded as unit of analysis is defined by scholars in different ways. There is no fixed definition and classification of variable in research. In social science research variable played an important role in the formulation of hypothesis, increase clarity of research problem, in choosing what type of measurement scale to be used. Variable helped to avoid subjectivity and to bring about true picture of events or phenomena or behavior which the social science researchers are dealing with. The objective of this article is to find out the classification, measurement and importance of variable in social science research. The paper argues that even after knowing well the importance of variable, researchers sometimes do not take variable into consideration this leads to wrong conclusion and alter reality to the society and even gives wrong policy prescription for implementation.

Keywords: Variable, concept, construct, observation, classification, measurement, scale, social science research, importance of variable.

Variable: Term and Definition

Variable is defined by many scholars in different ways. According to Kerlingers, ‘A variable is a property that takes on different values. Black and Champion define variable as ‘rational units of analysis that can assume any one of a number of designated sets of values’ (1976: 34). Webster defined variable as "... an able to vary or alter, susceptible to change, having no fixed value…. ".

A concept which can take on different quantitative values is called a variable. It is a value that can be manipulated, measured, described or controlled. Value after giving a name becomes variable e.g., temperature, age, year, etc. It is the measurable characteristic that varies over the unit, and in general, a variable can represent anything whose values change over a set of units. It may change from group to group, person to person or even within one person over time. It is an image, perception or concept that is capable of measurement – hence capable of taking on different values. Etymologically speaking, a variable is a quantity that can vary. In scientific research, a variable is a measurable representation of an abstract construct. Every variable has at least two possible values in order to vary. A variable may have different value and takes on different values from case to case; from time to time e.g., incomes of ten employees in a company. And variable is also time bounded e.g., ‘woman is a weaker section’; this statement may become wrong in some context and according to time. So we have to see with references to time and context and not with history which is constructed.

Differences among Concept, Construct and Variable

Measurability is the main difference between a concept and a variable. Concepts are mental image or perception and therefore it is highly subjective. Their meanings vary from individual to individual. On the other hand, variable is a value which varies. A concept cannot be measured whereas a variable can be measured. In order to measure it, a concept has to be converted into variable. For instance ‘Democracy’ is a concept and in order to measure it, democracy has to be converted into variables like elections, voting, etc.

Sometimes variable and construct are used interchangeably. But both the terms have differences. Variable is a measurable representation of an abstract construct and therefore variable is measurable and construct cannot be measured. Construct is theoretically defined concept and is scientific and theory specific whereas variable is a quantity that can vary. Constructs are conceptualized at the theoretical plane while variable are measured at empirical or observational level.

Classification of Variables

Brenda Rae Lunsford classified variable into two major groups: discrete variables which have finite values, such as sex, blood type and continuous variables which have infinite values such as age, height. Ranjit Kumar in his book “Research Methodology- a step-by-step guide for


classify variable according to three different ways i.e., the causal relationship, the study design and the unit of measurement. Depending on their intended use, variables may be classified as independent, dependent, moderating, mediating or control variables.

There is no fixed classification of variable. Here in this article we will be dealing with the three types of variable i.e., Dependent, Independent and Intervening variables which are commonly used in social science research.

Independent Variable
Variable that explains other variables are called independent variables; it is the variable that is antecedent to the dependent variable. It is also called explanatory, predictor or manipulated variable. The explanatory variable is again divided into “key causal variable” also called “cause” or the “treatment variable” and the “control variable”. The key causal variable always takes on two or more values, which are often denoted by “treatment group” and “control group”. Researchers choose to change them and has effects on dependent variables. For example, poverty leads to drop-out of student from school. In this drop-out of student is the dependent variable and poverty is the independent variable.

Dependent Variable
Dependent variable is a variable which depends upon or is a consequence of the other variable. It is the variable explained by other variables. The “dependent variable” is also sometimes called “the outcome”, “the criterion variable”, “the explained variable”. The outcome or changes brought by introduction of an independent variable. It shows the effect of manipulating or introducing the independent variable. Dependent variable changes or reacts to the state of the independent variable. For example, in a statement ‘smoking causes cancer’. Smoking is the independent variable and cancer is the dependent variable.

Intervening Variable
Variable that is not directly observable but that link the independent and dependent variable is called intervening variable. It is sometimes called the confounding variable (Grinnel 1988: 203). In certain situations the relationship between an independent and a dependent variable cannot be established without the intervention of another variable. And this variable that linked the dependent and independent variable but cannot be observed is called intervening variable because it intervenes in the relationship between dependent and independent variables. For example in the statement ‘smoking causes cancer’ smoking is the independent variable and cancer is the dependent variable and the factor that lead to smoking like age is the intervening variables.

Levels of Measurement
Measurement is the process of assigning numbers to an object of observation. It plays an important role in social science research to avoid subjectivity. It is central to any enquiry. It refers to careful, deliberate observations of the real world and is the essence of empirical research.

There are two main classification systems in social sciences for measuring different types of variable. One was developed by S.S. Stevens (1946) and the other by Duncan (1984). According to Smith (1991: 72), ‘Duncan has enumerated five types of measurement viz., nominal classification, ordinal scaling, cardinal scaling, ratio scaling’. Stevens has classified the different types of measurement scale into four categories; nominal or classificatory scale, ordinal or ranking scale, interval scale and ratio scale.

The most widely used classification of measurement scales are: (a) nominal scale; (b) ordinal scale; (c) interval scale; and (d) ratio scale.

Nominal or Classificatory Scale
Nominal scale is a system of assigning number symbols to events in order to label them. It enables the classification of individuals, objects or responses based on a common/shared property or characteristics. It is also called categorical scales, measure categorical data and simply describes differences between things by assigning them to categories. It indicates no order or distance relationship and has no arithmetic origin.

The variables in nominal measurement are divided into a number of sub-groups in such a way that each member of the sub-group has a common characteristic. It also may have one, two or more sub-groups, depending upon the extent of variation. These variables may have same or different values but cannot compare values whether one has higher value and the other has lower value e.g., gender, sex, etc. The appropriate measure of central tendency of a nominal scale is mode. There is no generally used measure of dispersion for nominal scales. Chi-square test is the most common test of statistical significance that can be utilized.


The Ordinal or Ranking Scale
An ordinal scale has all the properties of a nominal scale - categorizing variables into sub-groups on the basis of a common characteristic but also ranks the sub-groups in a certain order. They are arranged in either ascending or descending order according to the extent that a sub-category reflects the magnitude of variations in the variable. It is the lowest level of the ordered scale. The ordinal scale places events in order, but there is no attempt to make the intervals of the scale equal in terms of some rule. Nominal becomes ordinal when variation exists. For example, just male and female is a nominal, it becomes ordinal when we categorize male on one side and female or other side. Variable measured at the nominal scale has values that fall into some kind of natural ordering from lower to higher. In this we can compare the value of variable but cannot say how much higher or lower.

Ordinal scales only permit the ranking of items from highest to lowest. Ordinal measures have no absolute values, and the real differences between adjacent ranks may not be equal. All that can be said is that one person is higher or lower on the scale than another, but more precise comparisons cannot be made. Thus, the use of an ordinal scale implies a statement of 'greater than' or 'less than' without our being able to state how much greater or less. The central tendency measure of an ordinal scale can be its median or mode.

The Interval Scale
Interval scale measured values that are not only rank-ordered, but are also equidistant from adjacent attributes. It has all the characteristics of an ordinal scale; that is, variables or individuals or responses belonging to a sub-category have a common characteristic and the sub-categories are arranged in an ascending or descending order. In addition, an interval scale uses a unit of measurement that enables the individuals or responses to be placed at equally spaced intervals in relation to the spread of the variable. The scale has a starting and a terminating point and is divided into equally spaced units/intervals. The starting and terminating points and the number of units/intervals between them are arbitrary and vary from scale to scale. In this interval scale, comparison is possible and also allow us to examine how much more which is possible with nominal or ordinal scale. Example of interval scaling is the temperature scale.

A variable measured at the interval level has values that are real numbers that can appropriately be added together, subtracted one from another and averaged. The central tendency measures include mean, median or mode as are measures of dispersion, such as range and standard deviation. The primary limitation of the interval scale is the lack of a true zero; it does not have the capacity to measure the complete absence of a trait or characteristic.

The Ratio Scale
A ratio scale has all the properties of nominal, ordinal and interval scales. Ratio scales have an absolute or true zero of measurement. A variable measured at the ratio level has values that are real numbers. In this measurement one can appropriately divide the value of one by the value of another. The ratio scale can be used for mathematical operations e.g. the measurement of income, age, etc.

Ratio scale represents the actual amounts of variables e.g., measures of physical dimensions such as weight, height, distance, etc. Generally, all statistical techniques and all manipulations that can carry out with real numbers can be carried out with ratio scale values. Multiplication and division can be used with this scale. All measures of central tendencies, including geometric and harmonic means, are allowed for ratio scales, as are ratio measures, such as standardized range or coefficient of variation.

Importance of Variable in Social Science Research
Variable, a unit of analysis plays an important role in social science research. Through variable researchers can measure observations of events and phenomena and concepts which the social science researchers are mainly dealing with. Research is one of ways to discover answers to our questions through objective and scientific finding. Social science research which is the study of social phenomena, events or behavior is highly influenced by subjectivity leading to failure in bringing the true nature of reality. And objectivity in social science research is not fully possible because social science research is to deal with individual, group of behavior, social phenomena or events and is related with mental unlike science which is done in laboratory. Both science and social science research are dealing with the world that is uncertain trying to find out the reasons for things why, how, when, where things are happening. And trying to find out the reality which is uncertain, constructed and seen to be complex. And knowing the complexity depends on how well we understand variables, break down the variable, relation between variables, classify variable and how we deal with variable. In simple sense variable helps in simplifying the perception which is seen to be complex.

Variable also plays an important role in the formulation of hypothesis and in testing hypothesis in research. Falsification of hypothesis may be because of choosing wrong variable or may be because of not breaking down into lower level of variable. Knowledge of different types of variable helps in choosing what type of measurement should be used, how to analyze, interpret data and what statistical method shall be used. Variables can increase the clarity of our thinking about research. Without proper variable, we may not be able to find out the problem of the research. Breaking down of variable at the lower level helps us in finding truth, reality or at least coming closure to truth or reality of our research. For example in an interview with Vice-President Dick Cheney by Gloria Borger on CNBC’s 2004 Capital Report which was taken place on 17 June 2004, Vice-President Dick argued that US attack on Iraq was rational because US has threat perception and Iraq has contact with al Qaeda and there was relation and collaboration between Iraq and al Qaeda. In this the US Vice-President was playing and controlling with the variable and trying to hide the reality. But if we break down the variable contact, relation and collaboration - like contact when, how many times, in which level - relation in which area, among whom and collaboration in which field, then we will be able to come down to the reality.

Conclusion
Variable in social science research is and can be defined in different ways. But in common parlance, it can be defined as a measurable value that varies over the units. It is an image, perception or concept that is capable of measurement. It is also different from concept and construct and measurability is the main difference. There is no fixed classification of variable. Dependent variable, independent variable and intervening variable are the commonly used variable in social science research. And the most widely measurement scaling are nominal scaling, ordinal scaling, interval scaling and ratio scaling.

Variable in research played an important role in measuring observation, formulating and testing of hypothesis and developing research question. It brings clarity to our research problem. Variable also helps in analyzing data and what statistical method shall be used. Knowing and identifying variable not only helps in simplifying the perception but also helps the researcher in coming closer to the reality. But in social science research, it is sometime hard to find out variable and sometimes difficult or even unable to break down. Researchers sometimes neglect variable and do not take into consideration. This leads to wrong conclusion, alter reality or truth and therefore does not able to reflect the reality.

References

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