Variables in Social Science Research

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ABSTRACT

In social science research, a study is framed using various variables. Variable is an entity that can take different values across individuals and time. It is a symbol to which numerals or values are assigned. They are the characteristics or conditions that can be observed, manipulated or controlled by the researcher. The variable that really varies provides information to the research situation in detail. It is important to have the understanding of the variables in order to use them properly and to discover relevant and meaningful results from it. It is also helpful to understand and evaluate their application in other studies. Thus the present paper has been prepared for detail ed explanation the concept of variable and their use in social sciences research.

Keywords: *Variables; Independent variable; Dependent variable; Social science;*

In the process of formulating a research problem, there are two important considerations: the use of concepts and the construction of hypothesis. Researchers once through with the formulation of hypothesis, have to proceed further to test them so as to accept or reject them. It is always necessary to use concepts or properties that permit measurement or observation. These properties which are to be studied are called variables. A variable as the name implies is something which varies. It may be weight, height, anxiety levels, income, body temperature etc.

In social science research variable play an important role in increasing the clarity of research problem. Variable helps to avoid subjectivity and to bring about true picture of events or phenomena or behaviour which the social science researchers are dealing with. There are two more terms, concepts and constructs, which are related to variables. These are discussed as follow:

Concept : A concept is an idea expressed in words. It expresses an abstraction formed by generalization from particulars. Concept expresses an abstract idea, mental image or perception. 'Weight' is a concept; it expresses numerous observations of things that are more or less 'heavy' or 'light'. For example, achievement is an abstraction formed from the observation of certain behaviors of children. These behaviors are associated with the mastery of school tasks----, reading words, doing arithmetic problems, drawing pictures and so on. The various observed behaviours are put together and expressed in a word 'achievement' (*Kerlinger, 1995*).

Concepts are not inherited in the nature itself but are man-made. They are the mental constructs reflecting a certain point of view and focusing upon certain aspects of phenomenon while ignoring others. For example, modernization, development, growth etc. are all concepts having different meaning (*Ahuja, 2015*).

Construct : According to *Kerlinger (1995)*, a construct is a concept with the added meaning of having been deliberately and consciously invented or adopted for a specific scientific purpose.

A construct are theoretical creations that are based on observations but which cannot be observed directly. It is an abstraction from reality, selecting and focusing on certain aspects of reality and ignoring others *(Mangal and Mangal, 2013 & Ahuja, 2015*).

In simple words, when a concept is operationalized for measurement, it becomes a construct. A construct is usually designed for particular research purpose so its exact meaning relates only to the context in which it is found. For example, achievement is a construct which

include good OCPA, getting scholarship and getting a job.

Variable : As already discussed, variable is something which varies. It is a symbol to which numerals or values are assigned. Variable is a characteristic that is common to a number of individuals, groups, events, objects etc. Thus, age (young, middle-aged, old), income class (lower, middle, upper), caste (low, intermediate, high), education (illiterate, less educated, highly educated) etc., are all variables. The individual cases differ in the extent to which they possess the characteristics (*Ahuja, 2015*).

Variable is an entity that can take different values across individuals and time. For example, age can be considered a variable because age can take different values for different people or for the same person at different time. When a characteristic has only one value, it is a constant, not a variable.

It is not unusual to see some confusion between variables and the attributes or categories of which they consist. 'Gender' is a variable consisting of two categories of male and female. 'Income' is a variable consisting of different categories of poor, middle class and rich people. The researcher has to be clear of this distinction between variable and category (*Ahuja, 2015*).

Variables are the characteristics or conditions that can be observed, manipulated or controlled by the researcher. The measurement of variables may be different from everyday notions of measurement such as weight and temperature. Measurements of variables can involve merely categorization (e.g. sex, country etc.). Examples of important variables in sociology, psychology and education are: sex, income, education, social class, occupational mobility, anxiety, religion, political preference, achievement, age etc. (*Kerlinger, 1995*).

Definitions:

- A variable is a property that can take on different values (*Kerlinger, 1995*).
- Variables are attributes or qualities which exhibit differences in magnitude and which vary along some dimension (*Dooley, 2008*).
- A variable can be regarded as some kind of yardsticks that gives us a basis for the evaluation of the single unit of analysis (*Galtung, 1967*).
- Variable is an aspect of a testing condition that can change or take on different characteristics with different conditions (*McBurney, 2007*).

Difference between concept, construct and variable : Measurability is the main difference between a concept and a variable. Concepts are mental images or perceptions and therefore their meanings vary markedly from individual to individual, whereas variables are measureable. Concepts are subjective impressions; their understanding may differ from person to person. It is therefore important for the concepts to be converted into variables as they can be subjected to measurement (*Kumar, 2015*).

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 directly. Construct is theoretically defined concept and is scientific and theory specific whereas variable is a quantity that can vary. Constructs are conceptualized at theoretical plane while variable are measured at empirical or observational level (*Raiphea, 2015*).

Importance of variables : The role of variables in extension research is as follow:

- The variable that really varies provides information to the research situation in detail.
- Variables and their classification provide mass of data for establishing relation up to the prediction point.
- By clear understanding and identification of research variables, researcher can strengthen the quality of the research.
- In addition a thorough understanding of these variables and their interactions help us to make research more useful.

Classification of variable : Following classification of variables are generally used in research :

Independent and dependent variables : The variables which are well known to the researchers and the most frequently used in any empirical research are the independent and dependent variables.

An independent variable is the presumed cause of the dependent variable, the presumed effect. When we say A causes B, it means A is independent variable and B is dependent variable. Independent variable is one which explains or accounts for variation in dependent variable.

The independent variable is antecedent and the dependent variable is the consequent. The independent variable is the variable manipulated by the experimenter to see its effect on dependent variable. For example, if investigator wants to study the effect of teaching methods upon the classroom achievements of students

then the teaching methods constitute the example of independent variable and classroom achievements as dependent variable. Similarly, in the study entitled 'Accessing the level of effectiveness of extension training programmes for enhancing core competencies of extension personnel', independent variable is extension training programme (*Aishwaryaet al, 2019*).

Independent variable is also called experimental, manipulated, treatment, cause and input variable. Other names of dependent variable are measured, response, effect and outcome variable.

A variable which is independent in one study can be dependent in another. Take the case of relation between farmer's income and availability of water. If we take income as dependent variable and water availability (for irrigation) as independent variable, the relation between two can be shown as: higher the availability of water, higher would be the income and vice versa. But, if we want to show the relationship between income (independent variable) and quality of life (dependent variable), we may say: higher the income, higher the quality of life (or living standard). In the first study income is the result and in the second, study it is the cause (*Ahuja, 2015*).

Extraneous variable : Besides independent variable several other factors operating in real life situation may affect changes in dependent variable. These factors, not measured in the study, may increase or decrease the magnitude or strength of relationship between dependent and independent variables. Extraneous variables are those variables that are not related to the purpose of study but may affect the dependent variable. It is therefore essential that extraneous variables are controlled.

Suppose, an investigator is interested in studying the efficacy of method of instruction on the achievement scores (dependent variable) of some trainees. The methods to be evaluated are lecture, seminar and discussion (independent variable). The investigator discover that the achievement scores i.e. the dependent variable is positively correlated with intelligence (an extraneous variable) of the subject (trainees). Thus the variable intelligence (not of direct interest to the investigator) needs to be controlled (*Kumar, 2015*).

The researcher can minimize or nullify the effect of extraneous variable by following ways:

Selecting the subjects from homogeneous population : The subjects may be selected from homogeneous population i.e. same gender, similar qualification, similar range of land holding etc. By this method the effect of extraneous variable can be nullified. For example, in a study 'Information seeking behaviour of women regarding personal health and hygiene practices' entitled was conducted by *Kaur et al, 2019*. As gender can impact the information seeking behaviour of respondents, thus the effect of gender as an extraneous variable was removed by including only women as respondents in the study.

Through randomization : The sample should be selected randomly and whenever possible one should randomly assign subjects to either experimental group or control group. As the subjects are assigned randomly to different groups, the greater is the possibility of being equal.

Building the extraneous variable right into design : To build the extraneous variable right into design as an independent variable is also one way to control extraneous variable. For example, if gender is the extraneous variable, it can be controlled by taking the subject of both genders and then isolating the effect of both, separately. It will also provide additional research information. As it was done in the study entitled 'Information and communication technologies (ICT) use by the students of CCSHAU, Hissar' conducted by Malik and Godara (2020) where they took both male and female students and studied the variation in their level of ICT use.

Matching the groups : If we match the experimental and control groups including the extraneous variable and then study its effect, effect of the extraneous variable is controlled (*Malaviya, 2004*)

Intervening variable : A variable which is hypothesized to exist but cannot be observed and is presumed to occur to explain the relationship between the independent and dependent variables is called intervening or hidden variable. It is also called latent variable.

According to *Kerlinger (1995)*, the constructs which are non-observable, have been called intervening variables. It cannot be seen, heard or felt. It is inferred from the behaviour. Motivation, creativity, achievement, tiredness, boredom etc. are intervening or latent variables.For example; if we study the effect of teaching methods on classroom achievement of students of B.Sc.In this association between teaching methods and classroom achievement needs to be explained. Other variables intervene such as anxiety, fatigue, motivation etc. are intervening variable.

In research terminology,

- Change variables are called independent variables.
- Outcome/effect variables are called *dependent variables.*
- Unmeasured variables affecting cause and effect relationship are called *extraneous variables.*
- Variables those link cause and effect relationships are called *intervening variables.*

Active and attribute variable : Those variables that can be manipulated, changed or controlled are called active variables. Award of prizes, giving punishment etc. are examples of active variables. Those variables that cannot be manipulated changed or controlled and that reflect the characteristics of the study population are called attribute or assigned variables. Age, sex, education and income are attribute variables (*Kumar, 2015*).

For example, if a study is designed to measure the relative effectiveness of three teaching modules (module A, module B and module C). The structure and content of these could vary and any module might be tested on any population group. The content, structure and testability of a module on a population group may also vary from researcher to researcher. As a researcher does have the ability to control or change the teaching modules, he can decide what constitutes a teaching model and on which group of the student population it should be tested. Hence it is an active variable. On the other hand, a researcher does not have any control over characteristics of the student population such as their age, sex or motivation to study. These characteristics of the study population are called attribute variables.

This active-attribute distinction is general, flexible and useful. Some variables are by their very nature always attributes, but other variables that are attributes can also be active. This characteristic makes it possible to investigate the same relations in different way. For example, we can measure the anxiety of subjects. Anxiety is in this case an attribute variable. But we can manipulate anxiety, too.

We can induce different degree of anxiety, for example, by telling the subjects of one experimental group that the task they are about to do is difficult, that their intelligence is being measured, and that their future depends on the scores they get. The subjects of another experimental group are told to do their best but not to strain themselves too much; the outcome is not too important and will have no influence on their futures. Actually, we cannot assume that the measured (attribute) and manipulated (active) anxieties are the same. We may assume that both are anxiety in a broad sense, but they are certainly not same (*Kerlinger, 1995*).

Moderator and control variable : Moderate variable is secondary independent variable which is selected for study to determine if it affects the relationship between the primary independent variable and the dependent variable. Control variables are those which may affect the relationship between the independent variable and the dependent variable, and which are controlled (effect cancelled out) by eliminating the variable or holding the variable constant. For example, if we take a hypothesis: "widow's attitudes towards remarriage are related to their socio-economic background." Here widow's attitudes are dependent variable and their socio-economic background is independent (primary) variable. It is possible that widows having children or no children may also affect attitude towards remarriage. Thus, the third factor 'widows with children' (secondary independent variable) can also affect their attitude towards remarriage.

The difference between a control and a moderator variable is that the effect of control variable are minimised, eliminated or held constant while the effects of the moderator variable are studied. Since both control and moderator variable are independent variables, it is up to researcher to determine the independent, moderator and control variable.

Qualitative and quantitative variables : The qualitative variables refer to those which cannot be manipulated after the research is started and which consists of categories that cannot be ordered in magnitude. Variables such as colour, sex, religion etc. are of qualitative type. They are ready-made and descriptive in nature. Qualitative variables are also known as organism variables i.e. the variable of the organism.

Quantitative variables refer to those variables which are composed of categories that can be ordered in magnitude i.e. it may exist in greater or smaller amounts. Examples of quantitative variables are age, income, size of land holding, size of group, intelligence etc. With quantitative variables, precise measurements are possible because they can easily be ordered in terms of increasing or decreasing magnitudes. For example age of the members of young farmers club can be arranged on a continuum or scale in order of magnitude from young to old (*Mulay, 1980*).

Continuous and discrete variable : Continuous variables are divisible into smaller and smaller units like age, income of farmers, height etc. The characteristic of a continuous variable is that, within whatever limits its values may range, any value is possible. There is no gap in the scales of a continuous variable. They can take on any value on the scale on which they are measured. For example, age can be measured in years, months and days. Similarly, income can be measured in rupees and paisa.

A discrete variable is one which involves counting the number of events. The number of children in a family, the number of females in a particular state and the number of inhabitants in each village are some of the examples of discrete variables, so discrete variable consists of only whole numbers. In other words, a discrete variable is one which can take only certain values and none in between. For example, Number of students in a class is a discrete variable. We can count the number of students in a class. The values can be 19, 20, 21 or 40. But it cannot be 19.5 or 36.7. There is no value between 19 and 20.

Dichotomous and polytomous variable : When a variable can have only two categories or values as in yes/no, good/bad and rich/poor, it is known as a dichotomies or dichotomous variable. Some of the variables used in behavioural research are true dichotomies i.e. they are characterised by the presence or absence of a property: alive/dead, employed/ unemployed. Other examples of two-valued variables are: teacher/non-teacher, viewers/non-viewers of television, etc. Polytomous variable have more than two categories or values. For example, religion (hindu, sikh, muslim, christian, other), of extension managerial skills director (high, somewhat high, medium, low), agreement (Strongly disagree, disagree, neutral, agree, strongly agree) etc.

Most variables are however, theoretically capable of taking on continuous value. It has been common practice in behavioural research to convert continuous variables to dichotomies or polytomies. For example, intelligence, a continuous variable, has been broken down into high and low intelligence or into high, medium and low intelligence.

It is not possible to convert a truly dichotomous variable such as sex to a continuous variable but it is possible to convert a continuous variable to a dichotomy or a polytomy. This conversation can serve a useful conceptual purpose but is a poor practice in analysis of data because it throws information away.

Stimulus and response/behaviour variable : A stimulus variable is the condition or manipulation created by the researcher so as to evoke a response in an organism. The general class of things that researchers observe that relate to the environment, situation or conditions of stimulation are referred to as stimulus variable.The stimulus variables in extension research may be items like a slide show about a new crop variety, a field day, method demonstration etc. For example in the study entitled 'Role of frontline demonstration on chick pea production in district Ramgarh of Jharkhand', frontline demonstration is stimulus variable (*Raghavet al, 2021*).

Any kind of behaviour of the respondent is called behavioural variable. This refers to some action or response of an individual. Behaviour is predicted from the response and so a behaviour variable is also known as the response variable. At one extreme, these actions may consist of relatively simple responses such as yes or no, true or false for a particular question. The behavioural variable in Extension may be frequency with which a particular event occurs or it may be the scale value of a particular event.

Important considerations for selection of variables: While selecting variables the researcher should keep the following points in mind:

Review of literature : The researcher should carefully review the literature before deciding the variables for research. By reviewing the literature he becomes aware of important and unimportant variables in the concerned area of research. A careful review also helps the researcher in selecting variables lying within the scope of his interest in defining and operationalizing variables and in identifying variables which are conceptually and practically important.

Use of intensive method : In this method after reviewing the literature, the investigator selects the relevant variables. These variables are then refined by asking other investigators. After that those variables which obtained high consensus are selected for research study.
Theoretical and logical basis

There must be theoretical and logical basis to determine cause and affect relationship between independent and dependent variables.

Research design consideration : The variable must be selected in view of the scope of designs of the experiment. The variable selected as moderator variable and the extraneous variable must be such that it fulfils the basic

requirement of the research design. The independent variable must be such that its manipulation can be easily done within the framework of the research design.

Avoid repetition : If relationship has already been established in previous studies, repetition must be avoided. In particular, we may choose to study the same dependent variables while manipulating new independent variables. Like in extension research, relationship of background variables with adoption behaviour, communication behaviour, academic performance and aspirations of respondents has already been established, so it should be tested after a period of time with due consideration to new independent variables.

Select the variables having quantitative characteristics : If possible, select variables which have more quantitative characteristics because with the quantitative variables, precise and accurate measurements are possible and these can be ordered in terms of increasing or decreasing magnitude.

Practical consideration : A researcher should also take into account some practical considerations in selecting variables; he should limit the number of variables to be incorporated in the study because it is not possible to study too many variables at a time. In selecting variables he should also keep in view the financial resources available for the purpose. The time consideration should also not be ignored. He should also see the nature of the variable because some variables are easy to study and some are difficult.

CONCLUSION

Variable in social science research can be defined in different ways. But in common, it can be defined as a measurable value that varies across individuals and time. It is also different from concept and construct and measurability is the main difference.

Variables play an important role in research, without variables it becomes difficult to find out the relationships and predictions. The variables should be outlined in the introduction of the paper and explained in more detail in the methods section. Mostly emphasis is led on dependent and independent variables. The effort should be made to classify the extraneous and intervening variables, so that their effect on the dependent variables can be studied. Therefore, researcher should have clear understanding of the variables and should select only those variables which have direct bearing on results of the study.

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