

GLOSSARY OF PROCESS VARIABLES

DATA. Data comes in various types. They are a representation of reality, and show the results of measuring properties or processes – also termed variables. One of the most accepted typologies is Stevens' Scales of Measurement. It divides data into four types as follows below.

EXTENDED DATA TYPES

DATA NOMINAL - Nominal means "name bearing." The nominal scale places things into named categories. These things are assigned to groups according to their common or shared elements.

DATA ORDINAL - The ordinal scale places things in order. Ordinal data show a particular item's position relative to other items, such as "First, second, third, etc." The ordinal scale doesn't specify the distance between each item. It just puts them in order.

DATA INTERVAL - The interval scale uses equal-sized units of measurement (points, minutes, etc.) and, therefore, shows the distances, or intervals, between subjects' performances. It is important to remember that with interval data (as opposed to ratio), the intervals start from an arbitrary point, not absolute zero.

DATA RATIO. The ratio scale is like the interval scale. It employs equal intervals. However, the ratio scale begins at a true zero point. That point represents an absolute lack of the quality being measured. Because of this characteristic, additional mathematical functions are possible with ratio data that are not possible with other types of data.

DEPENDENT AND INDEPENDENT VARIABLES – Refers to variables that have a degree of interaction and relationship to each other.

DEPENDENT VARIABLES - The *outcome variable* from manipulating or introducing independent variables. The dependent variable is the variable that is observed to respond when the Researcher changes the independent variable. In other words, *the variation in the dependent variable depends on the variation in the independent variable.*

INDEPENDENT VARIABLES - Those variables that the researcher has control over. This "control" may involve manipulating existing variables (e.g., modifying existing methods of the process) or introducing new variables (e.g., adopting a totally new method for some sections of a process) in the research setting. Whatever the case may be, the researcher expects that the independent variable(s) will have some effect (change) on (or relationship with) the dependent variables.

EXTENDED VARIABLE TYPES

INTERVENING VARIABLES - Refer to abstract processes that are not directly observable but that link the independent and dependent variables. In chemistry a catalyst can be, and mostly will be, an intervening variable.

MODERATOR VARIABLES - Affect the relationship between the independent and dependent variables by modifying the effect of the intervening variable(s). Unlike extraneous variables, they are measured and taken into consideration.

CONTROL VARIABLES - Chemical processes are very complex. It is not easy to consider every variable in a single research study. Therefore, the variables that are not measured in a particular study must be held constant (fixed), neutralized/balanced, or eliminated, so they will not have a biasing effect on the other variables. Variables controlled in this way are called control variables.

EXTRANEOUS VARIABLES - Are those factors in the research environment which may have an effect on the dependent variable(s) but which are not controlled. Extraneous variables are dangerous. They may damage a study's validity, making it impossible to know whether the effects were caused by the independent and moderator variables or some extraneous factor. If they cannot be controlled, extraneous variables must at least be taken into consideration when interpreting results.

FUNCTION - A function is a mathematical relationship in which the values of a single dependent variable are determined by the values of one or more independent variables. Function means the dependent variable is determined by the independent variable(s). (See also DEPENDENT AND INDEPENDENT VARIABLES).

INPUT AND OUTPUT VARIABLES – More commonly described as dependent and independent variables and this more common usage is recommended. (See also DEPENDENT AND INDEPENDENT VARIABLES).

REACTIVE AND UNREACTIVE VARIABLES – Refers to variables that have a high or relatively fast rate of reaction (with other variables) or variables that have a relatively low, slow, or nil rate of reaction (with other variables) - respectively.

STABLE AND UNSTABLE VARIABLES – Refer to variables that have a low volatility (rate of change) – which are *stable variables* or high volatility (rate of change) – which are *unstable variables*.

RARE VARIABLES – A lesser used term as rare variables in processes are seldom a potential trigger variable or a latent trigger variable and may not ever be a key variable (see also KEY VARIABLES). Rare variables should not be automatically

excluded as they may also be usefully listed as latent variables (see also LATENT VARIABLES).

TRIGGER OR INITIATOR VARIABLES – Variables, which under given circumstances or conditions (often change of another variable), initiate or trigger some critical action. While also a critical variable is often listed and logged separately as a trigger variable, due to the importance of their action or outcomes of their action. Variables that trigger explosions are trigger variables.

LATENT VARIABLES – Variables which are not active and are normally not functioning in any manner. However, the term Latent refers to the fact that the variable can be important and prompted to action by a change in any other variable in the total system (by temperature or change in pH conditions or other trigger variable).

KNOWLEDGE - is a familiarity, awareness, or understanding of facts, information, descriptions, or skills, which is acquired through experience or education by perceiving, discovering, or learning.

KNOWLEDGE MANAGEMENT (KM) - is the process of creating, sharing, using and managing the knowledge and information of an organisation. It refers to a multidisciplinary approach to achieving organisational objectives by making the best use of knowledge.

VARIABLE - is any factor, trait, or condition that can exist in differing amounts or types. Even time is a variable itself. General variables are often termed standard variables.

KEY VARIABLES - these are variables that are essential to the process and are in some cases also critical variables.

CRITICAL VARIABLES - these are variables that are essential to achieve a quality standard and in some cases to even achieve the required process outcome or standard at all. These can be, for example, a chemical parameter or a type of machine or even settings on machines.

VALIDITY - is an indication of how sound your research is. More specifically, validity applies to both the design and the methods of your research. Validity in data collection means that your findings truly represent the phenomenon you are claiming to measure. Valid claims are solid claims.

INTERNAL VALIDITY - is affected by flaws within the study itself such as not controlling some of the major variables (a design problem), or problems with

the research instrument (a data collection problem).

EXTERNAL VALIDITY - is the extent to which you can generalize your findings to a larger group or other contexts. If your research lacks external validity, the findings cannot be applied to contexts other than the one in which you carried out your research. For example, if the subjects are all males from one ethnic group, your findings might not apply to females or other ethnic groups. Or, if you conducted your research in a highly controlled laboratory environment, your findings may not faithfully represent what might happen in the real world. Findings can be said to be externally invalid because (they) cannot be extended or applied to contexts outside those in which the research took place

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