

INTRODUCTION

Fundamentals of social research remains one of the core courses students in Social and Behavioural Sciences must acquire proficiency. The major objective of the book is to bring together in a single volume of modest size, a discussion of the issues, methods and processes of social research. The text provides Students and researchers necessary tools for understanding social research methods and for applying these concepts.

This departmental publication is structured into five sections or parts. These are distinct yet there is always the feeling that suitable links are being made and, as a reader, it possible to dip into particular chapters reasonably easily. Part one of the book reviews introduction to social research.

The structure and methods of social inquiry as well as methods of data collection constitute part two and three respectively. Parts four and five examine Data Analysis and other contexts.

The most appealing aspect of the book is our careful efforts to present the material so first-time research methods students can clearly comprehend it.

The collection of materials that formed this text was written by the faculty at the department of Sociology. The editors seize this opportunity to thank our anonymous referees for their comments and suggestions.

The editors however accepts full responsibility for errors and shortcoming that may remain in this text.

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SECTION A: INTRODUCTION TO RESEARCH

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CHAPTER 7 MEASUREMENT

Introduction

Research is central in the social sciences. The major objective in conducting social research has to do with the necessity of proffering solution to the multifaceted problems confronting the human race. Thus to better the condition of living of the population of any country, social scientists carry out research into social problems in order to explain such problems and make recommendations that should be background for the design of policies meant to remedy social ills. Therefore, it is imperative that our research process is systematic, accurate and precise. An important step towards the achievement of these interrelated goals in social research process is measurement.

Measurement is defined as the process of assigning numerals to variables (observations) in accordance with specified rules (Frankfort - Nachmias and Nachmias 1996, Stevens 1951). This is the process of representing the characteristics of interest to the subject matter of a research with numerals or any other symbols according to a set of rules. It is appropriate to examine the three important concepts utilized in the definition of measurement given: numerals, variables and rules. Numerals are symbols that have no quantitative values that are given only for the purpose of identifying phenomena. For example, i, ii, iii, iv..... or 1, 2, 3, 4, are numerals that may be assigned to phenomena in order to identify them. Numerals become numbers when they are assigned with quantitative undertone. So if the numbers 2, 3, 4 etc., are assigned to family size, they carry quantitative meanings. Variables are the characteristics of a population that is of interest to a researcher that can take any value, for example, sex is a variable (it is either male or female). Variables are generally classified into dependent and independent. A dependent variable is a characteristic that is explained by another variable. On the other

Independent variable is responsible for changes in other variables. For example, in a research on factors influencing scores in an examination, number of the dependent variables and the factors influencing income (e.g. educational status and occupation) are independent variables. Variable can be discrete or continuous. While discrete variables classify observations according to the quality of their characteristics, continuous variables can take any value between two points (Walsh, 1990). In other words, discrete variables measurement uses whole numbers with no possible values between adjacent units (e.g. family size, house, sex etc.); Continuous variables measurement can use smaller increments e.g. age, weight, height, money, etc. (Sarantakos, 1993).

Measurements are done according to certain rules. Generally, the principle of isomorphism (similarity or identity of structure) should be adhered to in social science measurement. It is expected that the numerical system used in mapping (assigning values) observations is similar in structure with the concepts being measured (Siegel, 1988). That is, the numbers being assigned and the characteristics that are measured possess similar structures and relations among their internal parts, or operations they allow for, are also identical (Frankfort-Nachmias and Nachmias, 1996). In most social research concepts or characteristics that are not measured directly, researchers often employ indicators. Indicators should not be selected arbitrarily; measurement can only be scientific if indicators are rooted in explanatory theory.

In summary, measurement is very important in social research. It determines the quality of data gathered in a research, the type and reliability of statistical analysis as well as the conclusions drawn from a research endeavour. In the following sections, the subject of measurement is examined under (1) the levels of measurement, (2) measurement and statistical analysis, and (3) validity and reliability.

Levels of measurement

The specific rules that are observed in assigning numerals to concept give rise to the four levels of measurement - nominal

ordinal, interval and ratio. It enables us to test hypotheses and correlations in the social (and other) sciences. In this section, we shall discuss the four levels of measurement and their characteristics.

Nominal level of measurement is the lowest and the simplest level of measurement. It involves the assignment of values to variables, usually qualitative in nature. In nominal measurement, numerals or any other symbols are assigned to variables for the purpose of identification and classification into categories. At this level, numerals are only assigned in qualitative sense. For example, a set of objects can be classified into categories that are exhaustive (that is, that including all cases of that type) and mutually exclusive (that is, with no case that can be classified as belonging to more than one category), and when each category is represented by a different symbol, a nominal level of measurement is attained (Frankfort-Nachmias and Nachmias, 1996: 159). For example, sex is a variable with two mutually exclusive categories - male and female; male may be assigned 1 while female is assigned 2, the figures 1 and 2 are only used here to identify the two categories. They cannot be subjected to any mathematical operations. Variables such as gender, nationality, state of origin, religion, place of residence and marital status, are measured at the nominal level.

Ordinal level of measurement connotes the assignment of numerals for the purpose of classification and ordering. At this level, the process of measurement involves ordering data and ranking variables on a continuum ranging from the lowest to the highest point. The numbers have actual mathematical meaning in the sense that they exhibit order. The equivalence relation holds among cases of same rank; whereas the "greater than" relation holds between any pair of ranks, the relation is irreflexive (a is not greater than a), asymmetrical (if $a > b$, then b is not $> a$), and transitive (if $a > b$ and $b > c$, then $a > c$) (Frankfort-Nachmias and Nachmias, 1996). Ordinal measurement allows categories to be ranked but it does not specify the amount of difference between the ranks. Example of ordinal measurement are status - low, middle, high; achievement at school - poor, moderate, fair, good, very good (Sarantakos, 1993).

The next higher level of measurement is the interval level of measurement, where real measurement is required. It involves classification and ranking, intervals of measurement, and the equality of distance between values that are assigned and the distance between the values. Measurement at this level provides more information than the ordinal

levels. Interval level of measurement allows the researcher to determine whether two values are the same or different (as in nominal measurement), whether the one is greater or smaller than the other (as in ordinal measurement) and the degree of difference between (Sarantakos, 1998: 75). Thus interval measurement is a clear improvement upon nominal and ordinal levels. The only limitation with this scale is that it lacks a true zero beginning. This implies zero on the scale is arbitrary and does not connote total absence of the attribute being measured. For example, zero on a thermometer does not mean there is no temperature; also, on an IQ test, the difference between 20 and 40 is the same as that between 80 and 100, but it is wrong to say a student who scores 80 is twice smarter than the one having 40 because there is no true zero beginning on this scale. The following salient properties characterize interval level of measurement (adopted from Frankfort-Nachmias and Nachmias, 1996: 162):

1. Uniqueness-if a and b stand for real numbers, then $a + b$ and $a \cdot b$ represent one and only one real numbers.
2. Symmetry-if $a = b$, then $b = a$.
3. Commutation-if a and b denote real numbers, then $a + b = b + a$ and $ab = ba$.
4. Substitution-if $a = b$ and $a + c = d$, then $b + c = d$; and if $a = b$ and $ac = d$, then $bc = d$.
5. Association-if a , b , and c stand for real numbers, then $(a + b) + c = a + (b + c)$, and $(ab)c = a(bc)$.

Ratio level of measurement is the highest level whereby the finest data are generated. At this level of measurement, the values that are assigned can be classified, ranked, the difference between units are known and they are equal, and zero on the scale interprets total absence of the attribute being measured. Hence, the characteristics of nominal, ordinal and interval levels of measurement are incorporated in ratio level of measurement, and in addition, it possesses an absolute zero. In the social sciences, ratio level of measurement is employed mainly when dealing with demographic variables and it is inappropriate for measuring attitudes and opinions (Sarantakos, 1995). Common examples of this level of measurement are: number of family members, weight, length, distance, volume and amount.

Levels of measurement and statistical analysis

One of the reasons a good understanding of the various levels of measurement is required of social scientists is the fact that the choice of statistical technique in analysis depends highly on it. An analyst could only be sure of what he or she is doing with respect to the statistical technique being employed if the technique is compatible with the level of measurement that generated the data. At the levels of nominal and ordinal measurement, because no real measurement is done (values are produced by counting and or ranking) at these levels, only frequencies and non-parametric statistical techniques are possible. Conversely, at the interval and ratio levels of measurement whereby real measurement is done all statistical techniques including parametric and non-parametric statistics can be deployed. Table 1 gives a summary picture of levels of measurement and the relationship between the levels of measurement and statistics analysis.

Table 1: summary of levels of measurement.

Criteria	Nominal	Ordinal	Interval	Ratio
Properties Of measurement	Naming	Naming and ranking	Naming ranking and equal interval	Naming, ranking equal interval and zero point
Nature of Measurement	Categorical	Ranking	Scoring	Scoring
Mathematical Functions	None	None	addition and subtraction	All four functions
Relevant Statistical test	Lambda test, chi-square test and G ²	Spearman correlation, Mann-Whitney, U test and Sign test	Pearson's r, F test, ANOVA	Pearson's r, F test, ANOVA
Nature of Underlying Construct	Discrete	Discrete or continuous	Continuous	Continuous

Adapted from Sarantakos (1995)

Validity and reliability

Validity and reliability are of utmost importance in social science research because exact inferences are drawn from the data.

variables are measured indirectly. For instance, to measure religion a researcher may ask questions on the religious affiliation of respondents or the regularity of attendance in religious programmes. These questions may not really measure how religious an individual is. As a result measurement is a very suspicious task in the social sciences. It is because of this problem that researchers employ these two concepts to provide information on the quality of their measurement procedure and subsequently that of the data generated.

Validity connotes the ability to produce accurate result and to be measured what is supposed to measure (Sarantakos, 1998; Saunders and Lewis and Thornhill, 1997).

Validity is a question of the researcher measuring what he or she intends to measure. For example, does religious affiliation represent religiosity in a population? Validity of a question in a research instrument can be determined through empirical or theoretical validation. That is, validity is claimed if the findings produced through a measure in question are supported by empirical evidence or by theoretical principles (Sarantakos, 1998:79).

Reliability refers to the possibility of an instrument to generate consistent results. If an instrument is able to produce the same result from observation to observation, researchers say their measure is reliable. In other words, it is expected that if an instrument is used repeatedly either by the same researcher or another, it should produce precise and objective result. The SPSS computer software can aid reliability test.

Conclusion

The foregoing chapter has given a simplistic examination of the concept of measurement with special reference to social science research. Measurement is very crucial in research and a good knowledge of the four levels is essential in order to carry out quality research. At the levels of nominal and ordinal measurement, the process basically involves counting and ranking; it is only non-parametric analysis that is allowed. On the other hand, at the interval and ratio levels real measurement takes place because the values assigned are quantitative. parametric statistics can be deployed in analysis. It follows that before a researcher ventures into research, there is need to ascertain the expected result then determine the data requirement in order to make

the appropriate choice in terms of statistical technique to deploy.

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