PHYSICAL EDUCATION

Subject : Physical Education
Semester : 4th
Paper No. and Title : (401) Test, Measurement and Evaluation in Physical Education

Introduction to Statistics- the Subject

1.0 Objectives:

This unit introduces the subject matter of Statistics, different types of data and its collection. After reading this unit we will able to:

- define Statistics
- scope, importance and limitations of Statistics
- know classification of data
- know different methods of collection of data

1.1 Definition of Statistics-the subject

Most people are familiar with the term Statistics as it is used to denote and record numerical facts and figures, for example, the heights of individuals in the city, the daily prices of selected stocks on a stock exchange, the income of all the people living in a town etc. However, this uses of the term is not the central focus of the subject. Statistics primarily deals with the situations in which the occurrence of some events cannot be predicted with certainty. Our conclusions are often uncertain because we based them on incomplete data- assessing. The current rate of unemployment in a state based on a survey of a few thousand people is an example. Uncertainty also arises when repeated observations on a phenomenon yield variable

results even though attempt is made to control the factors governing the event being observed. For instance, on year old mango trees are not all the same height, even if they have grown from the same batch of siblings under identical soil and weather condition. Statistics is a body of concepts and methods used to collect and interpret data concerning a particular area of investigation and draw conclusions in situations where uncertainty and variations are present. There are many definitions of Statistics- the subject, some good and some outrageous. Some acceptable definitions are:

I. Statistics is the art of drawing facts from figures.

II. Statistics is the science which deals with the collection, analysis and interpretation of the data and which also develops methodology for these purposes.

III. Statistics is a method of decision making in the face of uncertainty on the basis of numerical data and calculated risk.

"Is Statistics a Science or Art?" It is an important question. It needs a comprehensive and systematic discussion. Without going into the controversy, whether Statistics is a Science or Art, one thing is clear that if treats the "Data" and develop methodology for the treatments.

1.2 Scope, Importance and Limitations of Statistics

Statistics, or statistical methods as it is sometimes called, is playing an increasing important role in nearly all phases of human endeavour. At the beginning, it dealt with only with affairs of the state, thus accounting for its name. But, at present the subject Statistics has its application to almost all the branches of human knowledge and therefore it becomes more difficult to describe its scope. Even in our day-to-day life we apply statistical methods knowingly or unknowingly. Starting as a science of king now it has covered all branches of science viz.

social, physical and natural. The physical sciences do not benefit as much from Statistics as social sciences. It would be pointless to try to mention all the areas in which statistical methods are used. To mention only a few, Statistics is becoming increasingly important in Agriculture, Business and Commerce, Economics, Astronomy, Biology, Engineering, Medical, Meterology, Physics, Psychology, Sociology, Insurance, Operations Research, Computer Programming, Disaster Management, Demography, Actuarial Science and so on. The use of statistical methods in each of these fields grew in a different way. Statistics is not at the same stage of development in all the fields of study. The application of Statistics in other disciplines has given births some new branches such as- econometrics, bio-metrics, psychometrics, bio-informatics etc.

The field of Statistics, though widely used in all areas of human knowledge and widely applied in a variety of disciplines, it has its limitations. It cannot be applied to all situations. Some of the limitations are:

- Statistics deals only with aggregates and no importance is given to individual items.
- Statistics studies only quantitative characteristics and does not study qualitative characteristics directly.
- Laws of Statistics are true on an average.
- Statistics does not reveal the entire story rather it is a helping hand.
- Statistics can be misused and hence should be applied only by the experts.

1.3 What are Data?

Statistics is the art of learning from data. It is concerned with the collection of data; their subsequent description, and their analysis, which often leads to the drawing of conclusions.

Data refers to any group of observations/measurements required for a purposeful study and decision. For example, if we want to study the economical condition of a town, we have to collect the information (observations) about the income of all the people living there. This will be a set of data. Data are, generally, a set of number (or can be converted into a set of numbers) but every set of numbers is not data. Data are collected or provided for some purposeful study. Data may be of several types depending on:

I. the nature of variable(s) related to

II. the kind of characteristics that are observed and

III. the source from where these are collected or complied.

1.3.1 **Classificatio of Data based on Nature of Variable(s):**

A variable is particular characteristics whose observation changes randomly. For example, the weight keeps changing over time. It varies from individuals to individuals when recorded at any given point of time. Therefore, body weight is a characteristic which is a variable. Likewise, rainfall is a phenomenon and its depth a characteristic which varies from year to year and place to place. National income is also a variable which keep growing every year.

A variable can be a continuous variable or discrete variable accordingly the data are continuous or discrete. Those variables which can take all possible values (integral as well as fraction) in a given specified range are termed as continuous variable. For example, the age of students in a college is a continuous variable because, age can takes all possible values (as it can be measured to the nearest fraction of time: years, months, days, minutes, seconds etc.), in a certain range, say, from three years to twenty years. Some other examples of continuous

variables are heights (in cms.), weight (in kgs.), distance (in kms.), velocity, temperature etc. The data recorded on each of these and other similar characteristics are called continuous data.

Discrete data represents the values of a discrete variable. It cannot take all the possible values within a given specified range. Usually, it takes integral values in a given range which depends on the variable under study. Thus, discrete data are essentially count data. In the sense, that these are the results of counting the number of items which possess or do not possess a certain attribute or a characteristics. For example, number of students visiting a book store every day, the number of incoming flight at an airport and the number of defective item in a consignment of goods received for sale etc. The resulting data in all such cases are discrete data.

1.3.2 **Classification of Data based on kind of Characteristics:**

The data may be qualitative or quantitative. The data, which is obtained by direct measurements or counting is quantitative data. For example, weight of students, income of persons, number of persons per family etc. are quantitative data. These are numerical data but there are certain characteristics which cannot be measure directly; atmost they may be divided into different groups, e.g. male-female, children-adults-olds, different colours etc. or they may be graded, e.g. intelligence, honesty, different shades of colours etc. Such data are qualitative data. These are not numerical data. The statistical methodologies deal with numerical data. As such, quantitative data may be used directly but qualitative data have to be first converted into numbers before statistical methodologies are applied to them.

1.3.3 **Classification of Data based on the Source(s) of collection/compilation:**

Both on the sources of collection or compilation, statistical data may be primary or secondary. The data which are originally collected by an investigator or agency for the first time for any statistical analysis are termed as primary data. On the other hand the data (published or

unpublished) which have already been collected and processed by some agency or person and taken over from there and used by any other agency for their statistical work are termed as secondary data as per as second agency is concerned. It may be observed that the distinction between primary and secondary data is a matter of degree or for relativity only. The same sets of data may be secondary in the hands of one and primary in the hands of other. In general, the data are primary for the source that collects and processes them for the first time and are secondary for all other sources that later used such data. For instance, the data relating to mortality (deaths rates) and Fertility (births rates) in India published by the office of Registrar General of India (RGI), New Delhi are primary whereas the same is reproduced by the United Nations Organization (U.N.O.) in its U.N. Statistical Abstract become secondary in nature as per the later agency (U.N.O.) is concerned. For this data the office of RGI, is the primary source while U.N.O. is the secondary source.

The above three classifications of data are not mutually exclusive. For example, a set of primary data may be either continuous or discrete. Similarly, a set of primary data (or secondary data) may be either quantitative or qualitative. Keeping these points in view, collection of primary and secondary data have only been considered here.

1.3.4 Method of collecting primary data:

If primary data are to be collected, a decision has to be taken whether (i) Census method or (ii) sampling technique, is to be used for data collection. The totality (or aggregate) of objects (not necessarily human beings) under study constitutes a population. Every individual (or elements) of the population from which observations are taken is called unit. In the census method, we resort to 100% inspection of the population and enumerate each and every unit of the

population. A small representative part of population is called a statistical sample (or sample). In the sampling we inspect for study only a part of the population i.e. a sample and after analyzing the results of sample data we draw conclusions about the characteristics of the population. In some situations such as population being infinite or very large, census method fails. Moreover, it is not practicable if the enumeration or testing of the units (objects) is destructive, e.g., for testing the breaking strength of chalk, testing of sweetness of milk, testing of crackers and explosive, testing the life of electric bulb etc. Even if practicable, it may not be feasible from considerations of time and money. Thus, a choice between sampling and census method is to be made depending upon the objectives and scope of the survey, the limitations of the resources in terms of time, money and manpower etc., and the degree of accuracy desired. In case of sampling the size of the sample and the specific technique of the sampling are to be decided.

After deciding the units from which data have to be collected using sampling or census method, the following methods are generally used for collection of primary data:

i) *Direct personal observation:* in this method the investigator collects the data personally from the source concerned.

ii) *Indirect oral investigation:* In this method investigator gets the information from a third person who is expected to know the necessary details about the person from whom the enquiry is meant.

iii) *Information received through Local sources or correspondence:* Here the investigator appoints agents and correspondences to collect the data.

iv) *Data through questionnaires*: The data can be collected by preparing a questionnaire according to objectives of the study and getting it filled by the persons concerned.

v) *Investigation through enumerators*: This method is generally employed by the government for human population census, livestock census etc.

1.3.5 Methods of collecting secondary data:

The secondary data collection involves less cost, time and effort. Such data are collected for some other purpose. So, sometimes, it may not suit for the present purposes. The following are the some sources from which secondary data can be collected: Newspapers, periodicals, journals, the publication of trade associations, research papers, sales records, customer feedback, central and state official publications, publications of the foreign governments, etc.