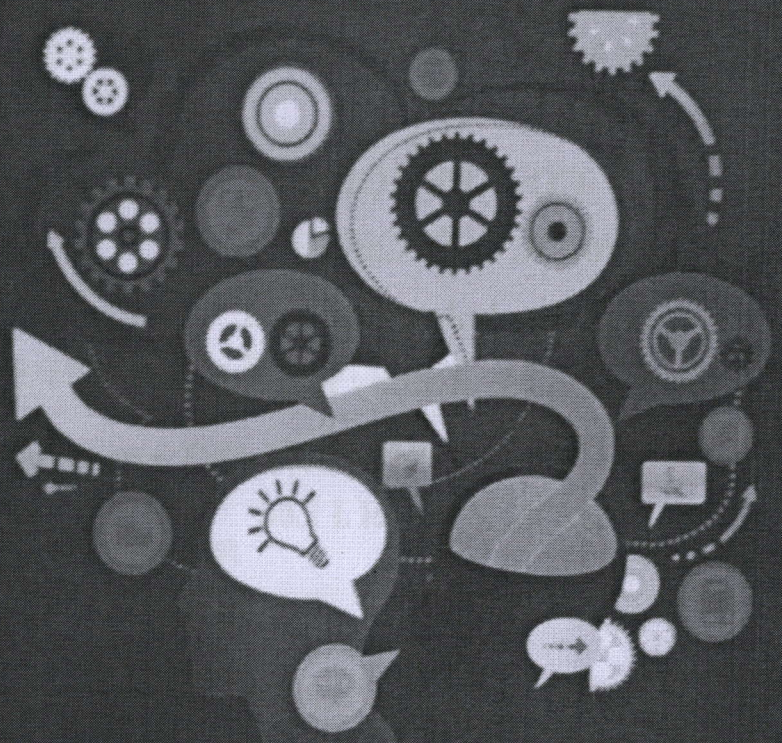
FUNDAMENTALS ON EDUCATIONAL RESEARCH



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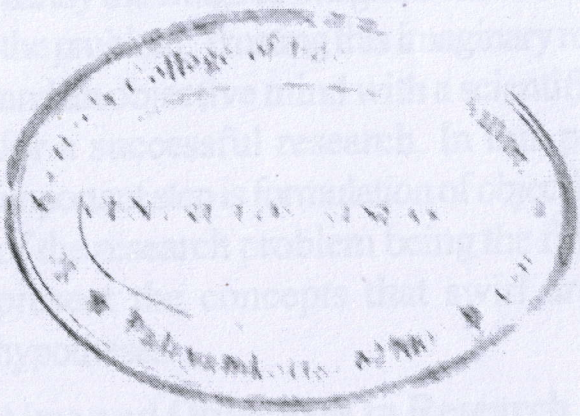
CONTENT



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IV. POPULATION AND SAMPLE

Dr. A. Punitha

Introduction

In the quantified research, the sampling technique is made ma use of, and in no field of research can its importance and value be In researches in the educational, economic, commercial and scie domains the sampling technique is used and considered most e research. Sampling technique also has very high value in day-to- activity. In making our daily purchases of food-stuff, vegetables, etc. it is not considered necessary to examine each and every pie the commodity; only a handful of goods are examined and the about the whole is formed and this usually proves a justified proce In the words of Snedecor "A cart load of coal is accepted or reje on the evidence gained from testing only few pounds. The physic make inferences about a patient's blood through examination of a si drop". Samples are devices for learning about large masses by obser few individuals. In education, sampling is a widely used technique.

Population

A research population is generally a large collection of individuals objects that is the main focus of a scientific query. It is for the benefi the population that researches are done. However, due to the large s of population, researchers often cannot test every individual in t population because it is too expensive and time-consuming. This is t reason why researchers rely on sampling techniques.

A research population is also known as a well-defined collection individuals or objects known to have similar characteristics. A individuals or objects within a certain population usually have a commo binding characteristic or trait. Usually, the description of the populatio and the common binding characteristic of its members are the sam "Government officials" is a well-defined group of individuals which ca be considered as a population and all the members of this populatio are indeed officials of the government. The population element refer to an individual member of the population.

Sampling

Sampling may be defined as the selection of an aggregate or totality on the basis of which a judgment or inference about the aggregate or totality is made. It is the statistical or non-statistical procedure of selecting the sample for investigation.

Need for Sampling

1. Large population can be conveniently covered
2. Time, money and energy is saved
3. Helpful when units of area are homogenous
4. Used when the data is unlimited.

Characteristics of a Good Sample

The following are the characteristics of a good sample,

1. *True Representative:* A good sample is the true representative of the population corresponding to its properties.
2. *Free from bias:* A good sample is free from bias. It does not permit prejudices, pre-conceptions and imaginations to influence its choice.
3. *Objective:* A good sample is an objective one. It refers to objectivity in selecting procedure or absence of subjective elements from the situation.
4. *Accurate:* A good sample maintains accuracy. It yields accurate estimates or statistics and does not involve errors.
5. *Comprehensive:* A good sample is comprehensive in nature. This is closely linked with true-representation. A comprehensive sample is controlled by specific purpose of the investigation. A sample may be comprehensive in traits but may not be a good representative of the population.
6. *Economical:* A good sample is economical from energy, time and money.
7. *Approachable:* The subjects of good sample are easily approachable. The research tools can be easily administered on them and data can be easily collected.

8. *Good size:* The size of the sample is such that it yields an accurate result. The probability of error can be estimated.
9. *Feasible:* A good sample makes the research work more feasible.
10. *Practical:* A good sample has the practicability for research situation.

Sampling Unit

Elementary units or group of such units which besides being clearly defined, identifiable and observable, are convenient for the purpose of sampling are called sampling units. For instance, in a family budget enquiry, usually a family is considered as the sampling unit since it is found to be convenient for sampling and for ascertaining the required information. In a crop survey, a farm or a group of farms owned or operated by a household may be considered as the sampling unit.

Sampling Frame

A list of all the sampling units belonging to the population to be studied with their identification particulars or a map showing the boundaries of the sampling units is known as sampling frame. Examples of a frame are a list of farms and a list of suitable area segments like villages in India or counties in the United States. The frame should be up to date and free from errors of omission and duplication of sampling units.

Sampling Scheme

Method of selecting sampling units from sampling frame is called sampling scheme.

Stages in Selection of a Sample

- Define the target population.
- Select sampling frame.
- Sampling method.
- Plan procedure for selecting sampling units.
- Determine sample size.
- Select actual sampling units.
- Conduct fieldwork.

Types of Sampling Methods

There are two types of sampling methods namely,

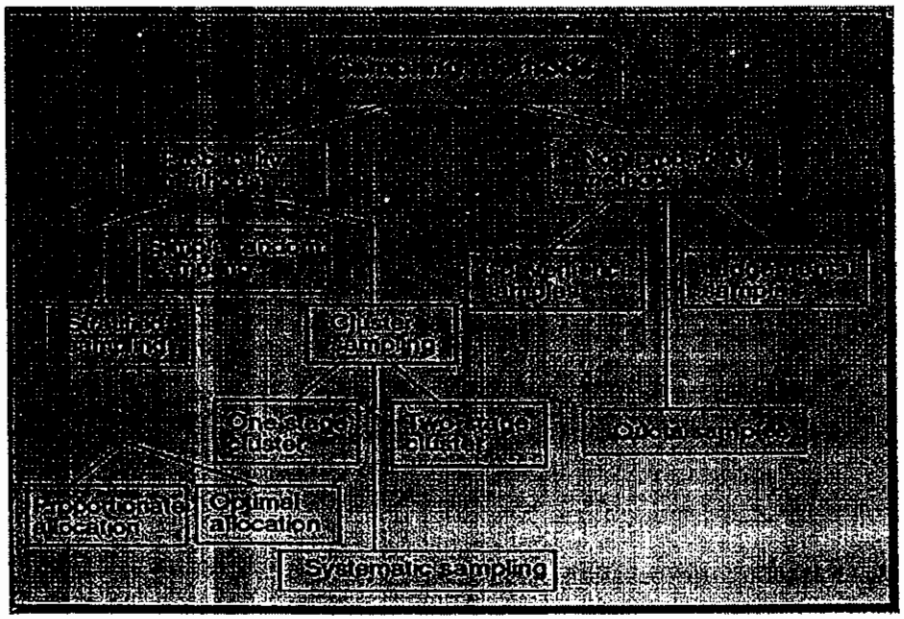
I. Probability Sampling

II. Non-Probability Sampling

I. Probability Sampling

A probability sampling is one in which every unit in the population has a chance (greater than zero) of being selected in the sample, and this probability can be accurately determined. In probability sampling it is possible to determine which sampling units belong to which sample and the probability of each sample will be selected. The following sampling methods, are types of probability sampling:

1. Simple Random Sampling
2. Systematic Sampling
3. Stratified Random Sampling
4. Cluster Sampling



1. Simple Random Sampling

Simple random sampling refers to a sampling method that has the following properties.

- The population consists of 'N' objects.
- The sample consists of 'n' objects.
- All possible samples of 'n' objects are equally likely to occur.

An important benefit of simple random sampling is that it allows researchers to use statistical methods to analyze sample results. For example, given a simple random sample, researchers can use statistical methods to define a confidence interval around a sample mean. Statistical analysis is not appropriate when non-random sampling methods are used.

Total Sample = Those Randomly Selected from Each Schoool

There are many ways to obtain a simple random sample. One way would be the lottery method. Each of the N population members is assigned a unique number. The numbers are placed in a bowl and thoroughly mixed. Then, a blind-folded researcher selects n numbers. Population members having the selected numbers are included in the sample.

Table of Random Numbers

We have to number all the items in the population sequentially. Then every item will bear a unique number. We start at any point in the random number table, obtain the number following the table in any systematic way. The items with the obtained numbers form the sample.

Merits

i. No possibility of personal bias of the researcher in the selection of items for the sample from the population.

ii. The resulting sample is highly representative of the population.

iii. Probability theory can be used to measure the precision of sample results.

Demerits

i. Expensive and time consuming especially when the population is large since cases selected may be too widely dispersed and sometimes even difficult for easy access.

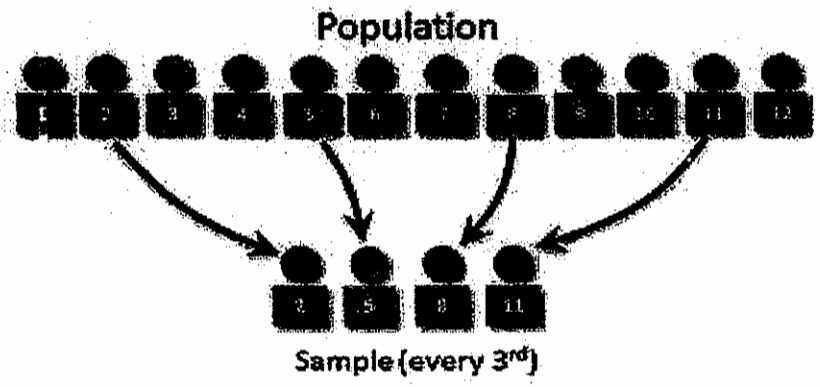
ii. If the items are heterogeneous either in size or in nature, random sampling is inappropriate.

iii. Requires numbering each element in the population.

iv. Larger sampling error than in stratified sampling.

2. Systematic Sampling

Systematic Sampling relies on arranging the study population according to some ordering scheme and then selecting elements at regular intervals through that ordered list. Systematic sampling involves a random start and then proceeds with the selection of every k^{th} element from then onwards.



Systematic sampling is to be applied only if the given population is logically homogeneous, because systematic sample units are uniformly distributed over the population. The researcher must ensure that the chosen sampling interval does not hide a pattern. Any pattern would threaten randomness. Suppose a supermarket wants to study buying habits of their customers, then using systematic sampling they can choose every 10^{th} or 15^{th} customer entering the supermarket and conduct the study on this sample.

Merits

i. It is an easier and less costlier method of sampling and can be conveniently used even for large population.

ii. The sample is fairly representative of the population.

Demerits

i. The process of selection can interact with a hidden periodic trait within the population. If the sampling technique coincides with the periodicity of the trait, the sampling technique will no longer be random and representativeness of the sample is compromised.

3. Stratified Random Sampling

Stratified random sampling is possible when it makes sense to partition the population into groups based on a factor that may influence the variable that is being measured. These groups are then called strata. An individual group is called a stratum. With stratified sampling one should:

- Partition the population into groups (strata).
- Obtain a simple random sample from each group (stratum).
- Collect data on each sampling unit that was randomly sampledfrom each group (stratum).

Stratified sampling works best when a heterogeneous population is split into fairly homogeneous groups. Under these conditions, stratification generally produces more precise estimates of the population percents than estimates that would be found from a simple random sample.

Example

Population: All elementary students in the local school district.

Groups (Strata): 11 different elementary schools in the local school district.

Obtain a Simple Random Sample: 20 students from each of the 11 elementary schools.

Sample: $11 \times 20 = 220$ selected students

Types of Stratified Random Sampling

i. Proportionate Stratified Sampling

The number of units to be drawn from each stratum is the same proportion as they constitute in the universe.

ii. Disproportionate Stratified Sampling

An equal number of cases are taken from each stratum regardless of the size of the strata in proportion to the universe.

iii. Optimum Allocation Stratified Sampling

In cases where strata differ not only in size but also in variability and it is considered reasonable to take larger samples from the more variable strata and smaller samples from the less variable strata.

Merits

i. It is a good representative of the population.
ii. It is an improvement over the earlier.
iii. It is an objective method of sampling.
iv. Observations can be used for inferential purpose.

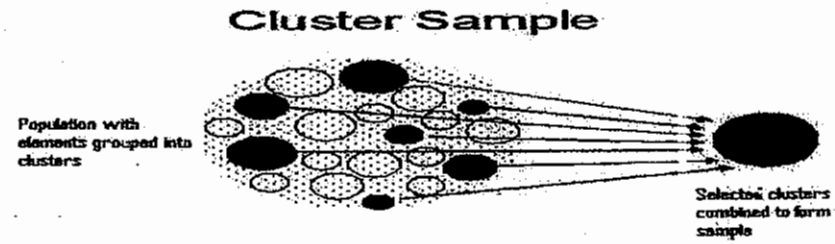
Demerits

i. It is difficult for the researcher to decide the relevant criterion for stratification.
ii. Only the criterion can be used for stratification.
iii. It is costly and time consuming.
iv. Selected sample may be representative with reference to the used criterion but not for the other.
v. There is a risk in generalization.

4. Cluster Sampling

Cluster sampling is very different from stratified sampling. With cluster sampling one should,

- Divide the population into groups (clusters).
- Obtain a simple random sample of so many clusters from all possible clusters.
- Obtain data on every sampling unit in each of the randomly selected clusters.



It is important to note that, unlike with the strata in stratified sampling, the clusters should be microcosms, rather than subsections, of the population. Each cluster should be heterogeneous. Additionally, the statistical analysis used with cluster sampling is not only different, but also more complicated than that used with stratified sampling.

Example

Population : All MSU intercollegiate athletes.
Groups (Clusters) : 26 MSU intercollegiate teams.
Obtain a Simple Random Sample: 8 teams from the 26 possible teams.
Sample : Every athlete on the 8 selected teams.

Merits

i. It is a good representative of the population.
ii. It is an easy method.
iii. It is highly applicable in education.
iv. It is an economical method.
v. Its observation can be used for inferential purpose.

Demerits

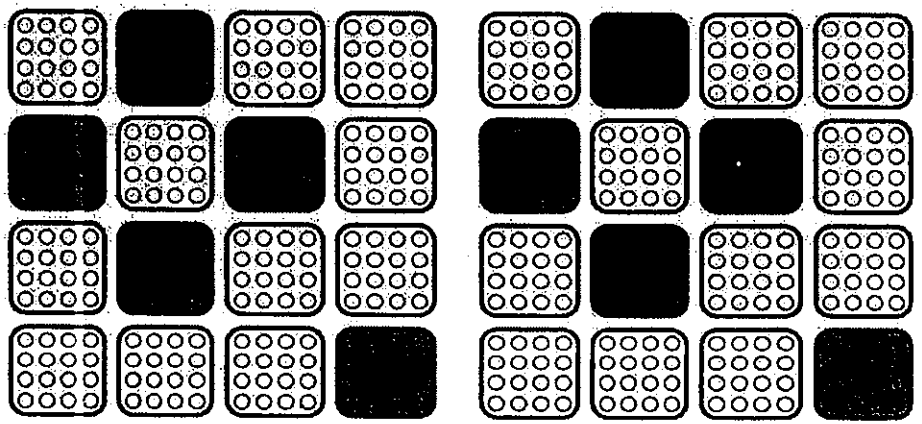
i. Less accurate than simple random, systematic, or stratified.

ii. May be difficult to collect data from all elements in each cluster.

iii. Requires that each population element be assigned to only one cluster.

Two-Stage Cluster Sampling

Two-stage cluster sampling, a simple case of multistage sampling, is obtained by selecting cluster samples in the first stage and then selecting sample of elements from every sampled cluster. Consider a population of 'N' clusters in total. In the first stage, n clusters are selected using ordinary cluster sampling method. In the second stage, simple random sampling is usually used. It is used separately in every cluster and the numbers of elements selected from different clusters are not necessarily equal. The total number of clusters 'N', number of clusters selected n, and number of elements from selected clusters need to be pre-determined by the survey designer. Two-stage cluster sampling aims at minimizing survey costs and at the same time controlling the uncertainty related to estimates of interest. This method can be used in health and social sciences. For instance, researchers used two-stage cluster sampling to generate a representative sample of the female population to conduct mortality surveys. Sampling in this method can be quicker and more reliable than other methods, which is why this method is now used frequently.



(a) Cluster sampling with $m = 5$ (b) Two-stage sampling with $m = 5$ and $n_i = 3$

II. Non-Probability Sampling

Non-probability sampling is any sampling method where some elements of the population have no chance of selection (these are sometimes referred to as 'out of coverage'/ 'undercovered') or where the probability of selection can't be accurately determined.

Types of Non-Probability Sampling

1. Judgement Sampling
2. Convenience Sampling
3. Quota Sampling
4. Snowball Sampling

1. Judgement Sampling

An experienced individual selects the sample based upon his or her judgement about some appropriate characteristics of the sample members. This type of sampling technique is also known as purposive sampling and authoritative sampling. As the investigator takes the judgement sample this sampling is highly risky.

Advantages

i. In it knowledge of the investigator can be best used.

ii. It is economical.

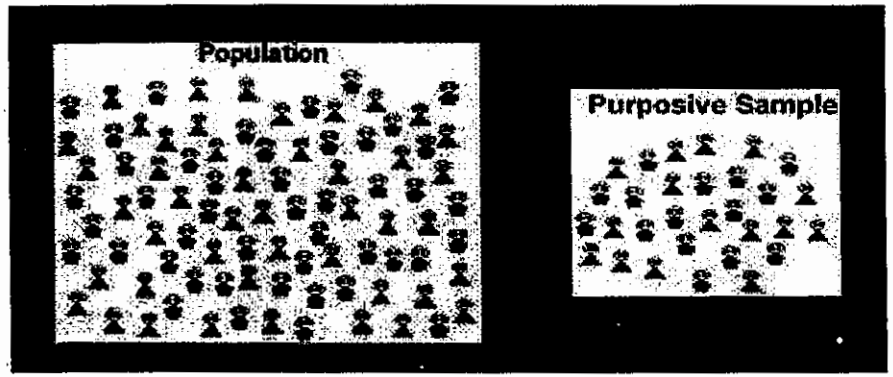
Disadvantages

i. It is objective.

ii. It is not free from error.

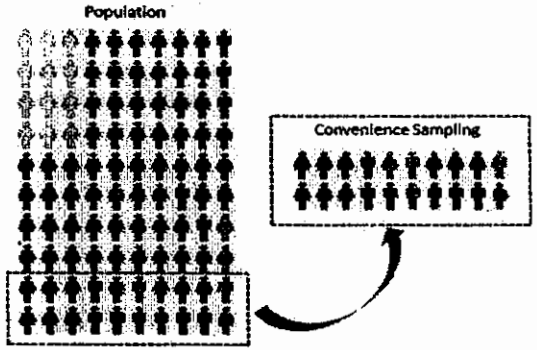
iii. It includes uncontrolled variables.

iv. Inferential statistics cannot be used for observations. Therefore generalization is not possible.



2. Convenience Sampling

It refers to the procedures of obtaining units or people who are most conveniently available. It refers to groups which are used as samples of a population because they are readily available or researcher is unable to employ more acceptable sampling methods.



Advantages

i. It is an easy method of sampling.
ii. It is frequently used in behavioral sciences.
iii. It is economical method with regards to time, money and energy.

Disadvantages

i. Less representative of an identified population.
ii. Difficult to generalize other subjects.
iii. Results are dependent on unique characteristics of the sample.

3. Quota Sampling

It is a technique that combines judgment and probability. It is essentially a stratified sample but the proportion of population under each stratum is decided on judgment or assumption and the quota is fixed. The quotas may be based on population proportions. For example, if there are 100 men and 100 women in a population and a sample of 20 are to be drawn to participate in a cola taste challenge, you may want to divide the sample evenly between the sexes—10 men and 10 women. Quota sampling can be considered preferable to other forms of non-probability sampling (e.g., judgment sampling) because it forces the inclusion of members of different sub-populations.

Example 1: The student council at Public School wants to measure student opinion on the quality of their extracurricular activities. They decide to survey 100 of 1,000 students using the grade levels (7 to 12) as the sub-population.

The table below gives the number of students in each grade level.

Table 1. Number of students enrolled at Public School, by grade

Grade level	Number of students	Percentage of students (%)	Quota of students in sample of 100
7	150	15	15
8	220	22	22
9	160	16	16
10	150	15	15
11	200	20	20
12	120	12	12
Total	**1,000**	**100**	**100**

The main difference between stratified sampling and quota sampling is that stratified sampling would select the students using a probability sampling method such as simple random sampling or systematic sampling. In quota sampling, no such technique is used. 15 students might be selected by choosing the first 15 Grade 10 students

to enter school on a certain day, or by choosing 15 students from the first two rows of a particular classroom. Keep in mind that those students who arrive late or sit at the back of the class may hold different opinions from those who arrived earlier or sat in front.

Advantages

i. It is an improvement over the judgment sampling.

ii. It is an easy sampling technique.

iii. It is most frequently used in social surveys.

Disadvantages

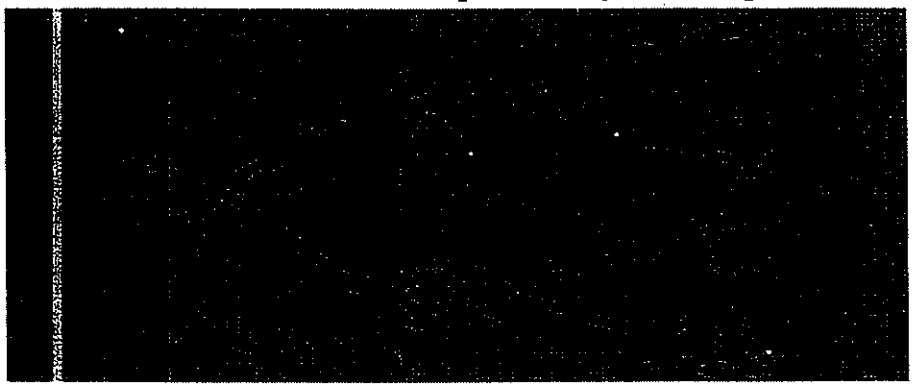
i. It is not a representative sample.

ii. It is not free from error.

iii. It has the influence of regional, geographical and social factors.

4. Snowball Sampling

It refers to the variety of procedures in which initial respondents are selected by probability methods, but in which additional respondents are then obtained from information provided by initial respondents.



Researchers use this sampling method if the sample for the study is very rare or is limited to a very small subgroup of the population. This type of sampling technique works like chain referral. After observing the initial subject, the researcher asks for assistance from the subject to help identify people with a similar trait of interest.

For example, if obtaining subjects for a study that wants to observe a rare disease, the researcher may opt to use snowball sampling

since it will be difficult to obtain subjects. It is also possible that the patients with same disease have a support group; being able to observe one of the members as your initial subject will then lead you to more subjects for the study.

Advantages

i. The chain referral process allows the researcher to reach populations that are difficult to sample when using other sampling methods.

ii. The process is cheap, simple and cost-efficient.

iii. This sampling technique needs little planning and fewer workforce compared to other sampling techniques.

Disadvantages

i. The researcher has little control over the sampling method. The subjects that the researcher can obtain rely mainly on the previous subjects that were observed.

ii. Representativeness of the sample is not guaranteed. The researcher has no idea of the true distribution of the population and of the sample.

iii. Sampling bias is also a fear of researchers when using this sampling technique. Initial subjects tend to nominate people that they know well. Because of this, it is highly possible that the subjects share the same traits and characteristics. Thus, it is possible that the sample that the researcher will obtain is only a small subgroup of the entire population.

Sampling Errors and Biases

Sampling errors and biases are induced by the sample design They include:

1. *Selection bias:* When the true selection probabilities differ from those assumed in calculating the results.
2. *Random sampling error:* Random variation in the results due to the elements in the sample being selected at random.

Non-Sampling Error

Non-sampling errors are other errors which can impact the final survey estimates, caused by problems in data collection, processing, or sample design. They include:

1. *Over-coverage:* Inclusion of data from outside the population.
2. *Under-coverage:* Sampling frame does not include elements in the population.
3. *Measurement error:* e.g. when respondents misunderstand a question, or find it difficult to answer.
4. *Processing error:* Mistakes in data coding.
5. *Non-response:* Failure to obtain complete data from all selected individuals.

Steps in Sampling Design

While developing a sampling design, the researcher must pay attention to the following points:

i. ***Type of universe:*** The first step in developing any sample design is to clearly define the set of objects, technically called the Universe, to be studied. The universe can be finite or infinite. In finite universe the number of items is certain, but in case of an infinite universe the number of items is infinite, i.e. we cannot have any idea about the total number of items. The population of a city, the number of workers in a factory and the like are examples of finite universes, whereas the number of stars in the sky, listeners of a specific radio Programme, throwing of a dice etc. are examples of infinite universes.

ii. ***Sampling unit:*** A decision has to be taken concerning a sampling unit before selecting sample. Sampling unit may be a geographical one such as state, district, village, etc., or a construction unit such as house, flat, etc., or it may be a social unit such as family, club, school, etc., or it may be an individual. The researcher will have to decide one or more of such units that he has to select for his study.

iii. ***Source list:*** It is also known as 'Sampling frame' from which sample is to be drawn. It contains the names of all items of a

universe (in case of finite universe only) If source list is not available, researcher has to prepare it. Such a list should be comprehensive, correct, reliable and appropriate. It is extremely important for the source list to be a representative of the population as possible.

iv. ***Size of sample:*** This refers to the number of items to be selected from the universe to constitute a sample. This is a major problem before a researcher. The size of sample should neither be excessively large, nor too small. It should be optimum. An optimum sample is one which fulfills the requirements of efficiency, representativeness, reliability and flexibility. While deciding the size of sample, researcher must determine the desired precision as also an acceptable confidence level for the estimate. The size of population variance needs to be considered as in case of larger variance usually a bigger sample is needed. The size of population must be kept in view for this also limits the sample size. The parameters of interest in a research study must be kept in view, while deciding the size of the sample. Costs too dictate the size of sample that we can draw. As such, budgetary constraint must invariably be taken into consideration when we decide the sample size.

v. ***Parameters of Interest:*** In determining the sample design, one must consider the question of the specific population parameters which are of interest. For instance, we may be interested in estimating the proportion of persons with some characteristic in the population, or we may be interested in knowing some average or the other measure concerning the population. There may also be important sub-groups in the population about whom we would like to make estimates. All this has a strong impact upon the sample design we would accept.

vi. ***Budgetary constraint:*** Cost considerations, from practical point of view, have a major impact upon decisions relating to not only the size of the sample but also to the type of sample. This fact can even lead to the use of a non-probability sample.

vii. ***Sampling procedure:*** Finally, the researcher must decide the type of sample he will use i.e. he must decide about the technique

to be used in selecting the items for the sample. In fact, this technique or procedure stands for the sample design itself. There are several sample designs (explained in the pages that follow) out of which the researcher must choose one for his study. Obviously, he must select that design which, for a given sample size and for a given cost, has a smaller sampling error.

Conclusion

The importance of sampling is that we can determine the adequate respondents from the total number of target population. Thus, it will be used in the research study which should be adequate to warrant generalization of the findings to the target population. And the sample size represents the characteristics of the whole population (representativeness of the sample). The advantages of sampling are: it is economical and practical; faster and cheaper; it can yield more comprehensive information; it is more accurate; and because of savings it permits in time and money, the sample survey makes possible the use of much larger and much more varied populations than would be possible for the same expenditure if one were making a complete enumeration.

V. PREPARATION OF A RESEARCH TOOL

Dr. M. Antony Raj

Introduction

Research is an academic activity and as such the term should be used in a technical sense (Kothari, 2007). Research is a careful and detailed study into a specific problem, concern, or issue using the scientific method. Psychological researchers want to learn and understand human behavior. It can be about how people think, how they feel, how they behave, or some combination of these issues. Research and understanding that follows, drips down from the researchers and alters society. There is constant and competing research.

More specifically, psychological research is used to measure, describe, and categorize human behavior. This can result in understanding what might be called normal behavior. More interesting and more often researched are the abnormal behaviors, those that eventually become categorized and labeled with a diagnosis. A diagnosis is a constellation of common behaviors, thoughts, and feelings that occur together. Tools or instruments are needed to diagnose.

Research

Research has been defined in a number of different ways. A broad definition of research is given by Martyn Shuttle worth (2008), "In the broadest sense of the word, the definition of research includes any gathering of data, information and facts for the advancement of knowledge."

Another definition of research is given by Creswell (2008) who states that "Research is a process of steps used to collect and analyze information to increase our understanding of a topic or issue". It consists of three steps: Pose a question, collect data to answer the question and present an answer to the question.

Research Tools

Meaning

Research tool can be defined as the instrument in the hands of researchers to measure what they indent to in their study. Research