**III BBA – V SEMESTER- RESEARCH METHODOLOGY**

**UNIT 3,4,5 STUDY MATERIALS**

**Unit-III**

Sample & Population Definition-Steps in developing a sampling design-Characteristics of good sample design- Factors affecting the size of the sample-Types of sampling- Probability sampling, Non Probability sampling.

**Unit-IV**

Measurements of scale-Sources of Data collection- Methods of collecting primary data- Secondary data- Characteristics of secondary data, Selection of appropriate method for data collection. Difference between questionnaires and schedule. What is hypothesis?-Characteristics of hypothesis. Meaning of Chi square- ANOVA.

**Unit-V**

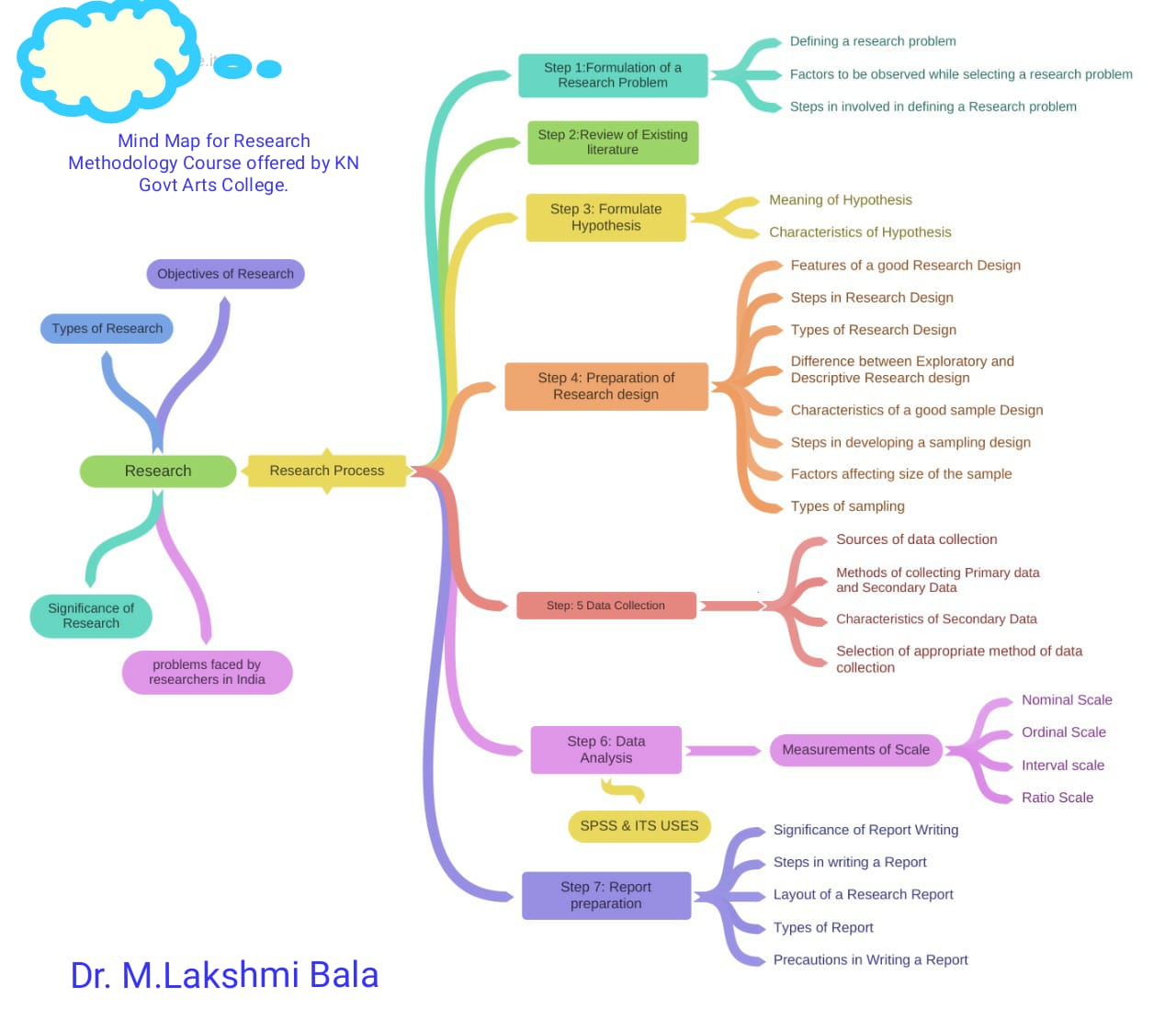
Define Report- Significance of report writing-Steps in writing report-Layout of research report- Types of Reports- Precautions for writing research report- What is SPSS?- Use of SPSS.

**Text Book**

**C.R.Kothari “Research** Methodology Methods And Techniques", New Age International Publishers.

Dr.Vijay Upagade “Research Methodology”

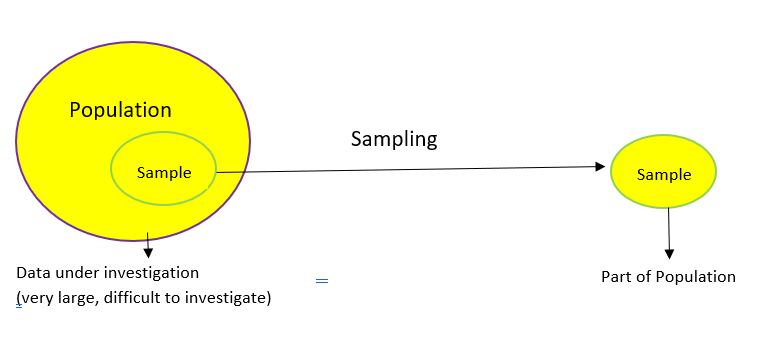
**MIND MAP**

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**Sample & Population Definition**

A population includes all of the elements from a set of data.

A sample consists one or more observations drawn from the population.

Eg: A Study on Business Administration students attitude towards entrepreneurship with special reference to Thanjavur district.

Population : 4 universities, 8 engineering colleges, 15 appx private arts and science colleges.

21 institutes are offering MBA – population -2000 \* 2 = 4000 students.

Sample : 500 students

**Characteristics of good sample design**

* 1. Sample design should be a representative sample: A researcher selects a relatively small number for a sample from an entire population. This sample needs to closely match all the characteristics of the entire population. If the sample used in an experiment is a representative sample then it will help generalize the results from a small group to large universe being studied.
* 2. Sample design should have small sampling error:  Sampling error is the error caused by taking a small sample instead of the whole population for study. Sampling error refers to the discrepancy that may result from judging all on the basis of a small number. Sampling error is reduced by selecting a large sample and by using efficient sample design and estimation strategies.
* **3. Sample design should be economically viable:**Studies have a limited budget called the research budget. The sampling should be done in such a way that it is within the research budget and not too expensive to be replicated.
* **4. Sample design should have marginal systematic bias**: Systematic bias results from errors in the sampling procedures which cannot be reduced or eliminated by increasing the sample size. The best bet for researchers is to detect the causes and correct them.
* **5. Results obtained from the sample should be generalized and applicable to the whole universe**: The sampling design should be created keeping in mind that samples that it covers the whole universe of the study and is not limited to a part.

**Steps in developing a sampling design**

* Types of universe
* Sampling units
* Source list/sampling frame
* Size of sample
* Parameters of interest
* Budgetary constraints
* Sampling procedure

What points should be taken into consideration by a research in developing a Sample design ?

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

1. **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.
2. **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.
3. **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 as representative of the population as possible.
4. **Size of sample:**This refers to the number of items to be selected from the universe to constitute a sample. This 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.
5. **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.
6. **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.
7. **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.

**Types of sampling**

Simple random sampling.

Systematic sampling.

Stratified sampling.

Clustered sampling.

Convenience sampling.

Quota sampling.

Judgement (or Purposive) Sampling.

Probability Sampling Methods

**1. Simple random sampling**

In this case each individual is chosen entirely by chance and each member of the population has an equal chance, or probability, of being selected. One way of obtaining a random sample is to give each individual in a population a number, and then use a table of random numbers to decide which individuals to include.1 For example, if you have a sampling frame of 1000 individuals, labelled 0 to 999, use groups of three digits from the random number table to pick your sample. So, if the first three numbers from the random number table were 094, select the individual labelled “94”, and so on.

As with all probability sampling methods, simple random sampling allows the sampling error to be calculated and reduces selection bias. A specific advantage is that it is the most straightforward method of probability sampling. A disadvantage of simple random sampling is that you may not select enough individuals with your characteristic of interest, especially if that characteristic is uncommon. It may also be difficult to define a complete sampling frame and inconvenient to contact them, especially if different forms of contact are required (email, phone, post) and your sample units are scattered over a wide geographical area.

**2. Systematic sampling**

Individuals are selected at regular intervals from the sampling frame. The intervals are chosen to ensure an adequate sample size. If you need a sample size n from a population of size x, you should select every x/nth individual for the sample. For example, if you wanted a sample size of 100 from a population of 1000, select every 1000/100 = 10th member of the sampling frame.

Systematic sampling is often more convenient than simple random sampling, and it is easy to administer. However, it may also lead to bias, for example if there are underlying patterns in the order of the individuals in the sampling frame, such that the sampling technique coincides with the periodicity of the underlying pattern. As a hypothetical example, if a group of students were being sampled to gain their opinions on college facilities, but the Student Record Department’s central list of all students was arranged such that the sex of students alternated between male and female, choosing an even interval (e.g. every 20th student) would result in a sample of all males or all females. Whilst in this example the bias is obvious and should be easily corrected, this may not always be the case.

**3. Stratified sampling**

In this method, the population is first divided into subgroups (or strata) who all share a similar characteristic. It is used when we might reasonably expect the measurement of interest to vary between the different subgroups, and we want to ensure representation from all the subgroups. For example, in a study of stroke outcomes, we may stratify the population by sex, to ensure equal representation of men and women. The study sample is then obtained by taking equal sample sizes from each stratum. In stratified sampling, it may also be appropriate to choose non-equal sample sizes from each stratum. For example, in a study of the health outcomes of nursing staff in a county, if there are three hospitals each with different numbers of nursing staff (hospital A has 500 nurses, hospital B has 1000 and hospital C has 2000), then it would be appropriate to choose the sample numbers from each hospital proportionally (e.g. 10 from hospital A, 20 from hospital B and 40 from hospital C). This ensures a more realistic and accurate estimation of the health outcomes of nurses across the county, whereas simple random sampling would over-represent nurses from hospitals A and B. The fact that the sample was stratified should be taken into account at the analysis stage.

Stratified sampling improves the accuracy and representativeness of the results by reducing sampling bias. However, it requires knowledge of the appropriate characteristics of the sampling frame (the details of which are not always available), and it can be difficult to decide which characteristic(s) to stratify by.

**4. Clustered sampling**

In a clustered sample, subgroups of the population are used as the sampling unit, rather than individuals. The population is divided into subgroups, known as clusters, which are randomly selected to be included in the study. Clusters are usually already defined, for example individual GP practices or towns could be identified as clusters. In single-stage cluster sampling, all members of the chosen clusters are then included in the study. In two-stage cluster sampling, a selection of individuals from each cluster is then randomly selected for inclusion. Clustering should be taken into account in the analysis. The General Household survey, which is undertaken annually in England, is a good example of a (one-stage) cluster sample. All members of the selected households (clusters) are included in the survey.1

Cluster sampling can be more efficient that simple random sampling, especially where a study takes place over a wide geographical region. For instance, it is easier to contact lots of individuals in a few GP practices than a few individuals in many different GP practices. Disadvantages include an increased risk of bias, if the chosen clusters are not representative of the population, resulting in an increased sampling error.

**Non-Probability Sampling Methods**

**1. Convenience sampling**

Convenience sampling is perhaps the easiest method of sampling, because participants are selected based on availability and willingness to take part. Useful results can be obtained, but the results are prone to significant bias, because those who volunteer to take part may be different from those who choose not to (volunteer bias), and the sample may not be representative of other characteristics, such as age or sex. Note: volunteer bias is a risk of all non-probability sampling methods.

**2. Quota sampling**

This method of sampling is often used by market researchers. Interviewers are given a quota of subjects of a specified type to attempt to recruit. For example, an interviewer might be told to go out and select 20 adult men, 20 adult women, 10 teenage girls and 10 teenage boys so that they could interview them about their television viewing. Ideally the quotas chosen would proportionally represent the characteristics of the underlying population.

Whilst this has the advantage of being relatively straightforward and potentially representative, the chosen sample may not be representative of other characteristics that weren’t considered (a consequence of the non-random nature of sampling). 2

**3. Judgement (or Purposive) Sampling**

Also known as selective, or subjective, sampling, this technique relies on the judgement of the researcher when choosing who to ask to participate. Researchers may implicitly thus choose a “representative” sample to suit their needs, or specifically approach individuals with certain characteristics. This approach is often used by the media when canvassing the public for opinions and in qualitative research.

Judgement sampling has the advantage of being time-and cost-effective to perform whilst resulting in a range of responses (particularly useful in qualitative research). However, in addition to volunteer bias, it is also prone to errors of judgement by the researcher and the findings, whilst being potentially broad, will not necessarily be representative.

**Spot Sampling**

When it not possible to fix sample size in advance because of the complexity of sample design then it is decided at the spot in on going process.

**Factors affecting the size of the sample**

**1.Nature of universe:** Universe may be either homogenous or heterogenous in nature. If the items of the universe are homogenous, a small sample can serve the purpose. But if the items are heteogenous, a large sample would be required. Technically, this can be termed as the dispersion factor.

**2.Number of classes proposed**: If many class-groups (groups and sub-groups) are to be formed, a large sample would be required because a small sample might not be able to give a reasonable number of items in each class-group.

Nature of study: If items are to be intensively and continuously studied, the sample should be small. For a general survey the size of the sample should be large, but a small sample is considered appropriate in technical surveys.

**3.Type of sampling**: Sampling technique plays an important part in determining the size of the sample. A small random sample is apt to be much superior to a larger but badly selected sample.

Standard of accuracy and acceptable confidence level: If the standard of acuracy or the level of precision is to be kept high, we shall require relatively larger sample. For doubling the accuracy for a fixed significance level, the sample size has to be increased fourfold.

**4.Availability of finance**: In prctice, size of the sample depends upon the amount of money available for the study purposes. This factor should be kept in view while determining the size of sample for large samples result in increasing the cost of sampling estimates.

**5.Other considerations**: Nature of units, size of the population, size of questionnaire, availability of trained investigators, the conditions under which the sample is being conducted, the time available for completion of the study are a few other considerations to which a researcher must pay attention while selecting the size of the sample.

**Questions**

1. Define Sample .
2. Define Population
3. Explain the Steps in developing a sampling design
4. What are the Characteristics of good sample design?
5. Explain the Factors affecting the size of the sample.
6. Enumerate the different types of sampling .
7. What do you mean by Probability sampling?
8. What is Non Probability sampling?

**Reference Book: Research methodology – Dr.Vijay upagade and Dr.Aravid shende**

**Unit-IV**

**Measurements of scale-Sources of Data collection- Methods of collecting primary data- Secondary data- Characteristics of secondary data, Selection of appropriate method for data collection. Difference between questionnaires and schedule. What is hypothesis?-Characteristics of hypothesis. Meaning of Chi square- ANOVA.**

**Measurements of scale**

* **Scales of measurement refer to ways in which variables/numbers are defined and** categorized.
* Each scale of measurement has certain properties which in turn determines the appropriateness for use of certain statistical analyses.
* The four scales of measurement are
* Nominal
* Ordinal
* Interval
* ratio

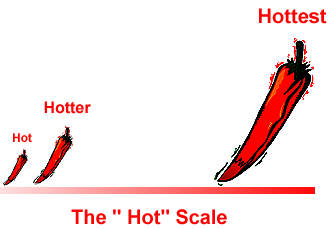
**Nominal Scale**

* Categorical data and numbers that are simply used as identifiers or names represent a nominal scale of measurement.
* Nominal variables (also called categorical variables) can be placed into categories. They don’t have a numeric value and so cannot be added, subtracted, divided or multiplied. They also have no order; if they appear to have an order then you probably have ordinal variables instead.
* If we conduct a study and we are including gender as a variable, We will code Female as 1 and Male as 2 or visa versa when I enter my data into the computer. Thus, we are using the numbers 1 and 2 to represent categories of data.
* Examples:
* Gender: Male, Female, Other.
* Hair Color: Brown, Black, Blonde, Red, Other.
* Type of living accommodation: House, Apartment, Trailer, Other.
* Religious preference: Buddhist, Mormon, Muslim, Jewish, Christian, Other.

**Ordinal Scale**

* An ordinal scale of measurement represents an ordered series of relationships or rank order.
* Individuals competing in a contest may be fortunate to achieve first, second, or third place. First, second, and third place represent ordinal data.
* If X takes first and Y takes second, we do not know if the competition was close; we only know that X outperformed Y.
* Likert-type scales (such as "On a scale of 1 to 10 with one being no pain and ten being high pain, how much pain are you in today?") also represent ordinal data.

The ordinal scale contains things that you can place in order. For example, hottest to coldest, lightest to heaviest, richest to poorest. Basically, if you can rank data by 1st, 2nd, 3rd place (and so on), then you have data that’s on an ordinal scale.



* **Examples**:
* High school class ranking: 1st, 9th, 87th…
* Socioeconomic status: poor, middle class, rich.
* The [Likert Scale](https://www.statisticshowto.com/likert-scale-definition-and-examples/): strongly disagree, disagree, neutral, agree, strongly agree.
* Level of Agreement: yes, maybe, no.
* Time of Day: dawn, morning, noon, afternoon, evening, night.

Political Orientation: left, center, right.

**Interval Scale**

* A scale which represents quantity and has equal units but for which zero represents simply an additional point of measurement is an interval scale.
* The Fahrenheit scale is a clear example of the interval scale of measurement. Fahrenheit are interval data.
* Measurement of Sea Level is another example of an interval scale.
* With each of these scales there is direct, measurable quantity with equality of units.
* In addition, zero does not represent the absolute lowest value. Rather, it is point on the scale with numbers both above and below it (for example, -10 degrees Fahrenheit).

**Ratio**

* *Same as the interval scale except that the zero on the scale means:*does not exist*. For example, a weight of zero doesn’t exist; an age of zero doesn’t exist.*
* *On the other hand, temperature is not a ratio scale, because zero exists (i.e. zero on the Celsius scale is just the freezing point; it doesn’t mean that water ceases to exist*
* The ratio scale of measurement is similar to the interval scale in that it also represents quantity and has equality of units.
* However, this scale also has an absolute zero (no numbers exist below the zero). Very often, physical measures will represent ratio data (for example, height and weight).
* If one is measuring the length of a piece of wood in centimeters, there is quantity, equal units, and that measure can not go below zero centimeters. A negative length is not possible



**Sources of Data collection**

* Data is a collection of facts, figures, objects, symbols, and events that have been gathered from different sources.
* Organizations collect data in order to take better decisions. Without data, it would be difficult for organizations to take appropriate decisions and so data is collected at various points in time from different audiences.
* For instance, before launching a new product, an organization needs to collect data on product demand, customer preferences, competitors, etc.
* Data collection methods can be divided into two categories: primary methods of data collection and secondary methods of data collection.

**Primary Data Collection Methods**

* Primary data is collected from the first-hand experience and is not used in the past. The data gathered by primary data collection methods are specific to the motive of the research, and highly authentic and accurate.
* Primary data collection methods can be divided into two categories: quantitative methods and qualitative methods.

**Quantitative Methods**

* Quantitative techniques for market research and demand forecasting usually make use of statistical tools. In these techniques, demand is forecast based on historical data. These methods of primary data collection are generally used to make long-term forecasts. Statistical methods are highly reliable as the element of subjectivity is minimum in these methods.
* **Observation - Structures observation and participative observation**
* **Interview- personal interview, Focused Interview, Clinical Interview , Non-direct Interview and telephonic interview.**
* **Survey through questionnaire – pilot survey, Mail survey**

**Questionnaire**

* A questionnaire is a printed set of questions, either open-ended or closed-ended, which the respondents are required to answer on the basis of their knowledge and experience with the issue concerned.
* Delphi Technique
* In this method, market experts are provided with the estimates and assumptions of forecasts made by other experts in the industry. Experts may reconsider and revise their own estimates and assumptions based on the information provided by other experts. The consensus of all experts on demand forecasts constitutes the final demand forecast.
* Focus Groups
* A small group of people, around 8-10 members come together to discuss the common areas of the problem. Each individual provides his insights on the issue concerned. A moderator regulates the discussion among the group members. At the end of the discussion, the group reaches a consensus.

**Secondary Data Collection Methods**

* Secondary data is the data that has been used in the past. The researcher can obtain data from the sources both internal and external to the organization.
* Internal sources of secondary data:

1. Organization’s health and safety records
2. Mission and vision statements
3. Financial Statements
4. Magazines
5. Sales Report
6. CRM Software
7. Executive summaries
8. External sources of secondary data:

**Characteristics of secondary data**

* 1. Secondary data are published data, not original data, for the research on the hand.
* 2. They give the latest information
* 3. They can be easily collected from various internal and external sources.
* 4. They are relatively cheaper; they need less efforts, time, and money.
* 5. They have been collected by other people for their own problems and situation in the past.
* 6. They are used as a supplementary to primary data. Mostly, they are used for defining and understanding problems.
* 7. The use of secondary data is optional. Research can be conducted even without the use of this type of data.
* 8. They can be used without processing; no need to analyze them before they are used. They can be used directly.
* 9. Relevance, accuracy, and timing are the main problems related to secondary data

**Selection of appropriate method for data collection.**

* *The Nature of phenomenon under study:* The nature of the phenomenon under study largely influences the choice of the method of the data collection. Each research phenomenon has its particular characteristics and, therefore, needs different approaches and methods of data collection. *For example,* some of the phenomenon  only can be studied appropriately through observation such as clinical practices or processes in particular nursing procedures. Similarly, knowledge of a group of nurses only can be assessed through questioning or interviews. Therefore, the nature of the phenomenon under study significantly affects the selection of particular method of data collection.
* *Type of research subjects:* Data collection methods are also influenced by the type of subjects under study. *For example,* data  collection from physically or psychologically disabled subjects can be done either by interview or through observation, where data collection through questionnaire is not feasible. On the other hand, if data has to be collected from objects or institutions, questionnaires or interviews may not be possible at all, and researchers will have to depend mostly on observation to collect relevant data.
* ***The type of research study:*** Quantitative and qualitative research studies need different methods of data collection. *For examples,* in qualitative research, more in-depth information is required, therefore, focused group interviews or unstructured participatory interviews are feasible for data collection, while for quantitative research studies more structured interviews, questioning, or observation is used for data collection.
* ***The purpose of the research study:*** The purpose of the study also influences the choice of the methods of data collection, such as in a study conducted with the purpose of the exploration of phenomenon, in-depth interviews may be needed for data collection, while studies conducted with purpose of description or correlation of study variables may need more
* structured methods of data collection.
* ***Size of the study sample:*** When a study is conducted on a small sample, interviews or direct observation may be possible, while these methods can be tedious for large samples. For larger samples, questionnaires can be better and more referable methods for data collection. Interviews and observation methods will also be cost-effective and easy for smaller groups, while questionnaires will be convenient, easier and cost-effective methods of data collection for larger samples.
* ***Distribution of the target population:*** If target population is spread in a large geographical area, it will not be possible to carry out interviews or observation, and therefore, mailed questionnaires may be a better option, which will be more convenient and cost-effective in such conditions.
* ***Time frame of the study:*** If a research is conducted for the long time, it may permit the researcher to use the less-structured methods of data collection to gain in-depth information, while short time-frame studies may not allow the researcher to use the unstructured methods of data collection, where he or she gets very little time for data collection and analysis. Therefore, structured methods of data collection are used more short-term research designs.
* ***Literacy level of the subjects:*** Illiterate subjects put constrains on the use of self-responding methods of data collection such as questionnaires. for illiterate subjects, interviews conducted in native language is one of the few possible methods of data collection used, while more varied and numerous options in methods of data collection are available for literate subjects.
* ***Availability of resources and manpower:*** Some of the method of data collection require more quantities of resources and manpower, such as conducting interviews and observation compared to the use of questionnaires. Therefore, availability of resources and manpower also affects the selection of methods of data collection.
* ***Researcher's knowledge level and competence:*** The researcher's knowledge and competence also affects the selection of methods of data collection, for example conducting an interview observation may require special social and psychological knowledge, skills, and competence, while the use of questionnaires may not demand these skills, however for the development and construction of a good questionnaire, good writing skills may be required.

**Difference between questionnaires and schedule**

* The **questionnaire** refers to a technique of data collection which consists of a series of written questions along with alternative answers.
* The **schedule** is a formalized set of questions, statements, and spaces for answers, provided to the enumerators who ask questions to the respondents and note down the answers.

**What is hypothesis?**

* Hypothesis is a assumption to be proved or disproved.
* It is in the form of statement
* For a researcher it is question or statement he intends to resolve.
* A hypothesis (plural hypotheses) is a precise, testable statement of what the researcher(s) predict will be the outcome of the study.
* Eg: Business Administration students like to become entrepreneurs than science students.

**Characteristics of hypothesis: It should be**

* Clear and precise
* Capable of testing
* Simple to understand
* State the relationship between variables
* Should be consistent with most known factas
* Capable of testing

## Characteristics of hypothesis in Research Methodology

**Characteristics of hypothesis:** Hypothesis must possess the following characteristics:

1. Hypothesis should be clear and precise. If the hypothesis is not clear and precise, the inferences drawn on its basis cannot be taken as reliable.
2. Hypothesis should be capable of being tested. In a swamp of untestable hypotheses, many a time the research programmes have bogged down. Some prior study may be done by researcher in order to make hypothesis a testable one. A hypothesis “is testable if other deductions can be made from it which, in turn, can be confirmed or disproved by observation.”
3. Hypothesis should state relationship between variables, if it happens to be a relational hypothesis.
4. Hypothesis should be limited in scope and must be specific. A researcher must remember that narrower hypotheses are generally more testable and he should develop such hypotheses.
5. Hypothesis should be stated as far as possible in most simple terms so that the same is easily understandable by all concerned. But one must remember that simplicity of hypothesis has nothing to do with its significance.
6. Hypothesis should be consistent with most known facts i.e., it must be consistent with a substantial body of established facts. In other words, it should be one which judges accept as being the most likely.
7. Hypothesis should be amenable to testing within a reasonable time. One should not use even an excellent hypothesis, if the same cannot be tested in reasonable time for one cannot spend a life-time collecting data to test it.
8. Hypothesis must explain the facts that gave rise to the need for explanation. This means that by using the hypothesis plus other known and accepted generalizations, one should be able to deduce the original problem condition. Thus hypothesis must actually explain what it claims to explain; it should have empirical reference.

**Source:** [**https://www.wisdomjobs.com/e-university/research-methodology-tutorial-355/what-is-a-hypothesis-11523.html**](https://www.wisdomjobs.com/e-university/research-methodology-tutorial-355/what-is-a-hypothesis-11523.html)

**Meaning of Chi square**

* The chi-square is used to investigate whether the distribution of classes and is compatible with a distribution model . chi square is used when we have two categorical variables (e.g., gender and alive/dead) and want to determine if one variable is related to another.
* This test only works for categorical data (data in categories), such as Gender {Men, Women} or colour {Red, Yellow, Green, Blue} etc, but not numerical data such as height or weight.
* Example: "Which holiday do you prefer?"
* Beach Cruise
* Men 209 280
* Women 225 248
* Does Gender affect Preferred Holiday?

**ANOVA.**

* **ANOVA, which stands for Analysis of Variance, is a statistical test used to analyze the difference between the means of more than two groups.**
* **In an ANOVA, one variable must be categorical and the other must be continuous.**

**One-way** or **two-way** refers to the number of [independent variables](https://www.statisticshowto.com/independent-variable-definition/) (IVs) in your Analysis of Variance test.

* One-way has one independent variable (with 2 [levels](https://www.statisticshowto.com/levels-in-statistics/)). For example: brand of cereal,
* Two-way has two independent variables (it can have multiple levels). For example: brand of cereal, calories.
* A common approach to figure out a reliable treatment method would be to analyse the days it took the patients to be cured. We can use a statistical technique which can compare these three treatment samples and depict how different these samples are from one another. Such a technique, which compares the samples on the basis of their means, is called ANOVA.
* Analysis of variance (ANOVA) is a statistical technique that is used to check if the means of two or more groups are significantly different from each other. ANOVA checks the impact of one or more factors by comparing the means of different samples.
* We can use ANOVA to prove/disprove if all the medication treatments were equally effective or not.

**Questions**

1. Explain the Measurements of scale.
2. Explain the different Sources of Data collection
3. Methods of collecting primary data- Secondary data
4. Explain the Characteristics of secondary data.
5. Explain the steps in Selection of appropriate method for data collection.
6. Difference between questionnaires and schedule
7. What is hypothesis?
8. What are the Characteristics of hypothesis.
9. What is Chi square?
10. What do you mean by ANOVA.?

**UNIT V**

Define Report- Significance of report writing-Steps in writing report-Layout of research report- Types of Reports- Precautions for writing research report- What is SPSS?- Use of SPSS.

**Define Report**

* **Research reports are recorded data prepared by researchers or statisticians after analyzing information gathered by conducting organized research typically in the form of surveys or qualitative methods.**

**Significance of report writing**

* The purpose of research report is to convey the interested persons the whole result of study in sufficient detail and to determine himself the validity of the conclusions.
* Reporting writing is very helpful for making the record of documentation.
* Report writing also helps the director of the industry, business or any organization in order to make quick decisions and planning of anything.
* Information in the report is well organized and can be used for future planning and decision making.
* Report writing helps you to improve the skills of designing, judgments, and means of communication

**Reference and Bibliography**

* **A reference list is the detailed list of references that are cited in your work.**
* **A bibliography is a detailed list of references cited in your work, plus the background readings or other material that you may have read, but not actually cited.**

**CONTENTS OR Layout of research report**

The researcher must keep in mind that his research report must contain following aspects:

* Introduction -Purpose of study, Significance of his study or statement of the problem
* Review of literature
* Research Methodology
* Data Analysis
* Conclusions and suggestions
* Bibliography
* Appendices

The researcher must keep in mind that his research report must contain following aspects:

Purpose of study

Significance of his study or statement of the problem

Review of literature

Methodology

Interpretation of data

Conclusions and suggestions

Bibliography

Appendices

These can be discussed in detail as under:

(1) Purpose of study:

Research is one direction oriented study. He should discuss the problem of his study. He must give background of the problem. He must lay down his hypothesis of the study. Hypothesis is the statement indicating the nature of the problem. He should be able to collect data, analyze it and prove the hypothesis. The importance of the problem for the advancement of knowledge or removed of some evil may also be explained. He must use review of literature or the data from secondary source for explaining the statement of the problems.

(2) Significance of study:

Research is re-search and hence the researcher may highlight the earlier research in new manner or establish new theory. He must refer earlier research work and distinguish his own research from earlier work. He must explain how his research is different and how his research topic is different and how his research topic is important. In a statement of his problem, he must be able to explain in brief the historical account of the topic and way in which he can make and attempt. In his study to conduct the research on his topic.

(3) Review of Literature:

Research is a continuous process. He cannot avoid earlier research work. He must start with earlier work. He should note down all such research work, published in books, journals or unpublished thesis. He will get guidelines for his research from taking a review of literature. He should collect information in respect of earlier research work. He should enlist them in the given below:

Author/researcher

Title of research /Name of book

Publisher

Year of publication

Objectives of his study

Conclusion/suggestions

Then he can compare this information with his study to show separate identity of his study. He must be honest to point out similarities and differences of his study from earlier research work.

(4) Methodology:

It is related to collection of data. There are two sources for collecting data; primary and secondary. Primary data is original and collected in field work, either through questionnaire interviews. The secondary data relied on library work. Such primary data are collected by sampling method. The procedure for selecting the sample must be mentioned. The methodology must give various aspects of the problem that are studied for valid generalization about the phenomena. The scales of measurement must be explained along with different concepts used in the study.

While conducting a research based on field work, the procedural things like definition of universe, preparation of source list must be given. We use case study method, historical research etc. He must make it clear as to which method is used in his research work. When questionnaire is prepared, a copy of it must be given in appendix.

(5) Interpretation of data:

Mainly the data collected from primary source need to be interpreted in systematic manner. The tabulation must be completed to draw conclusions. All the questions are not useful for report writing. One has to select them or club them according to hypothesis or objectives of study.

(6) Conclusions/suggestions:

Data analysis forms the crux of the research problem. The information collected in field work is useful to draw conclusions of study. In relation with the objectives of study the analysis of data may lead the researcher to pin point his suggestions. This is the most important part of study. The conclusions must be based on logical and statistical reasoning. The report should contain not only the generalization of inference but also the basis on which the inferences are drawn. All sorts of proofs, numerical and logical, must be given in support of any theory that has been advanced. He should point out the limitations of his study.

(7) Bibliography:

The list of references must be arranged in alphabetical order and be presented in appendix. The books should be given in first section and articles are in second section and research projects in the third. The pattern of bibliography is considered convenient and satisfactory from the point of view of reader.

(8) Appendices:

The general information in tabular form which is not directly used in the analysis of data but which is useful to understand the background of study can be given in appendix.

**Layout of the Research Report**

There is scientific method for the layout of research report. The layout of research report means as to what the research report should contain. The contents of the research report are noted below:

Preliminary Page

Main Text

End Matter

(1) Preliminary Pages:

These must be title of the research topic and data. There must be preface of foreword to the research work. It should be followed by table of contents. The list of tables, maps should be given.

(2) Main Text:

It provides the complete outline of research report along with all details. The title page is reported in the main text. Details of text are given continuously as divided in different chapters.

(a) Introduction

(b) Statement of the problem

(c) The analysis of data

(d) The implications drawn from the results

(e) The summary

(a) Introduction:

Its purpose is to introduce the research topic to readers. It must cover statement of the research problem, hypotheses, objectives of study, review of literature, and the methodology to cover primary and secondary data, limitations of study and chapter scheme. Some may give in brief in the first chapter the introduction of the research project highlighting the importance of study. This is followed by research methodology in separate chapter.

The methodology should point out the method of study, the research design and method of data collection.

(b) Statement of the problem:

This is crux of his research. It highlights main theme of his study. It must be in nontechnical language. It should be in simple manner so ordinary reader may follow it. The social research must be made available to common man. The research in agricultural problems must be easy for farmers to read it.

(c) Analysis of data:

Data so collected should be presented in systematic manner and with its help, conclusions can be drawn. This helps to test the hypothesis. Data analysis must be made to confirm the objectives of the study.

(d) Implications of Data:

The results based on the analysis of data must be valid. This is the main body of research. It contains statistical summaries and analysis of data. There should be logical sequence in the analysis of data. The primary data may lead to establish the results. He must have separate chapter on conclusions and recommendations. The conclusions must be based on data analysis. The conclusions must be such which may lead to generalization and its applicability in similar circumstances. The conditions of research work limiting its scope for generalization must be made clear by the researcher.

(e) Summary:

This is conclusive part of study. It makes the reader to understand by reading summary the knowledge of the research work. This is also a synopsis of study.

(3) End Matter:

It covers relevant appendices covering general information, the concepts and bibliography. The index may also be added to the report.

**Types of Reports**

* **Short report**
* **Long report**
* **Technical report**
* **Popular report**
* **Long Report and Short Reports:**
* These kinds of reports are quite clear, as the name suggests. A two-page report or sometimes referred to as a [memorandum](https://www.toppr.com/guides/business-communication-and-ethics/inter-departmental-communication/memorandum/) is short, and a thirty-page report is absolutely long. But what makes a clear division of short reports or long reports? Well, usually, notice that longer reports are generally written in a formal manner.
* **Internal and External Reports:**
* As the name suggests, an internal report stays within a certain organization or group of people. In the case of office settings, internal reports are for within the [organization](https://www.toppr.com/guides/business-management-entrepreneurship/organizing/structure-of-organization/).
* We prepare external reports, such as a news report in the newspaper about an incident or the annual reports of [companies](https://www.toppr.com/guides/business-laws/companies-act-2013/meaning-and-features-of-a-company/) for [distribution](https://www.toppr.com/guides/fundamentals-of-business-mathematics-and-statistics/theoretical-distribution/theoretical-distribution/) outside the organization. We call these as public reports.
* **Vertical and Lateral Reports:**
* This is about the hierarchy of the reports’ ultimate target. If the report is for your management or for your mentees, it’s a vertical report. Wherever a direction of upwards or downwards comes into motion, we call it a vertical report.
* Lateral reports, on the other hand, assist in coordination in the organization.  A report traveling between units of the same organization level (for example, a report among the [administration](https://www.toppr.com/guides/civics/rural-administration/rural-administration-in-india/) and finance departments) is lateral

**Precautions for writing research report**

1. While determining the length of the report (since research reports vary greatly in length), one should keep in view the fact that it should be long enough to cover the subject but short enough to maintain interest. In fact, report-writing should not be a means to learning more and more about less and less.
2. A research report should not, if this can be avoided, be dull; it should be such as to sustain reader’s interest.
3. Abstract terminology and technical jargon should be avoided in a research report. The report should be able to convey the matter as simply as possible. This, in other words, means that report should be written in an objective style in simple language, avoiding expressions such as “it seems,” “there may be” and the like.
4. Readers are often interested in acquiring a quick knowledge of the main findings and as such the report must provide a ready availability of the findings. For this purpose, charts, graphs and the statistical tables may be used for the various results in the main report in addition to the summary of important findings.
5. The layout of the report should be well thought out and must be appropriate and in accordance with the objective of the research problem.
6. The reports should be free from grammatical mistakes and must be prepared strictly in accordance with the techniques of composition of report-writing such as the use of quotations, footnotes, documentation, proper punctuation and use of abbreviations in footnotes and the like.
7. The report must present the logical analysis of the subject matter. It must reflect a structure wherein the different pieces of analysis relating to the research problem fit well.
8. A research report should show originality and should necessarily be an attempt to solve some intellectual problem. It must contribute to the solution of a problem and must add to the store of knowledge.
9. Towards the end, the report must also state the policy implications relating to the problem under consideration. It is usually considered desirable if the report makes a forecast of the probable future of the subject concerned and indicates the kinds of research still needs to be done in that particular field.
10. Appendices should be enlisted in respect of all the technical data in the report.
11. Bibliography of sources consulted is a must for a good report and must necessarily be given.
12. Index is also considered an essential part of a good report and as such must be prepared and appended at the end.
13. Report must be attractive in appearance, neat and clean, whether typed or printed.
14. Calculated confidence limits must be mentioned and the various constraints experienced in conducting the research study may also be stated in the report.
15. Objective of the study, the nature of the problem, the methods employed and the analysis techniques adopted must all be clearly stated in the beginning of the report in the form of introduction.

**What is SPSS?- Use of SPSS.**

* SPSS is short for Statistical Package for the Social Sciences, and it’s used by various kinds of researchers for complex statistical data analysis.
* It is well suited to analyzing data from surveys and database.
* The basic application of this program is to analyze scientific data related with the social science. This data can be used for market research, surveys, data mining, etc
* Helpful to research agencies' and researchers.

**Data Collection and Organization**

SPSS is often used as a data collection tool by researchers. The data entry screen in SPSS looks much like any other spreadsheet software. You can enter variables and quantitative data and save the file as a data file. Furthermore, you can organize your data in SPSS by assigning properties to different variables. For example, you can designate a variable as a nominal variable, and that information is stored in SPSS. The next time you access the data file, which could be weeks, months or even years, you'll be able to see exactly how your data is organized.

**Data Output**

Once data is collected and entered into the data sheet in SPSS, you can create an output file from the data. For example, you can create frequency distributions of your data to determine whether your data set is normally distributed. The frequency distribution is displayed in an output file. You can export items from the output file and place them into a research article you're writing. Therefore, instead of recreating a table or graph, you can take the table or graph directly from the data output file from SPSS.

**Statistical Tests**

The most obvious use for SPSS is to use the software to run statistical tests. SPSS has all of the most widely used statistical tests built-in to the software. Therefore, you won't have to do any mathematical equations by hand. Once you run a statistical test, all associated outputs are displayed in the data output file. You can also transform your data by performing advanced statistical transformations. This is especially useful for data that is not normally distributed.

Source:https://bizfluent.com/uses-spss-software-6536198.html

**Questions**

1. Define Report
2. What are the significance of report writing?
3. Explain the Steps in writing report.
4. Explain the Layout of research report.
5. Enumerate the Types of Reports.
6. Explain the Precautions for writing research report.
7. What is SPSS?
8. What are the uses of SPSS?