Self Learning Material

Research METHODOLOGY

M21CM01DC

MASTER OF COMMERCE

SREENARAYANAGURU
OPEN UNIVERSITY

SREENARAYANAGURU OPEN UNIVERSITY

The State University for Education, Training and Research in Blended Format, Kerala

Vision

To increase access of potential learners of all categories to higher education, research and training, and ensure equity through delivery of high quality processes and outcomes fostering inclusive educational empowerment for social advancement.

Mission

To be benchmarked as a model for conservation and dissemination of knowledge and skill on blended and virtual mode in education, training and research for normal, continuing, and adult learners.

Pathway

Access and Quality define Equity.

Research Methodology

Course Code: M21CM01DC

Semester-I

Discipline Core Course
Master of Commerce
Self Learning Material

SREENARAYANAGURU
OPEN UNIVERSITY

SREENARAYANAGURU OPEN UNIVERSITY

The State University for Education, Training and Research in Blended Format, Kerala

Documentation

Course Code: M21CM01DC

Research Methodology

Semester-I

SREENARAYANAGURU
OPEN UNIVERSITY

www.sgou.ac.in

ISBN 978-81-966907-6-2

Academic Committee

Dr. Resia Begum S.

Dr. R. Vasanthagopal
Dr. P. N. Harikumar
Dr. B. Johnson
Dr. G. Raju
Mr. Anilraj V.
Dr. K.S. Sureshkumar
Dr. Balu B.
Dr. Sajith M.
Dr. Sirajudeen
Dr. V.S. Joy

Development of the Content

Dr. Sanjith S.R., Dr. U. Sreevidya, Biji Jose, Beena C.G., Dr. Gauri L.

Review

Content: Dr. Suresh Kumar S.
Format: Dr. I.G. Shibi
Linguistic: Anil Gomez

Edit

Dr. Suresh Kumar S.

Scrutiny

Dr. Bino Joy, Dr. Midhun V., Dr. Sanjith S.R., Dr. Dhanya K.M., Mahesan K.P., Dr. Gauri L.

Co-ordination

Dr. I.G. Shibi and Team SLM

Design Control

Azeem Babu T.A.

Production

November 2023

Copyright

Message from Vice Chancellor

Dear

I greet all of you with deep delight and great excitement. I welcome you to the Sreenarayanaguru Open University.

Sreenarayanaguru Open University was established in September 2020 as a state initiative for fostering higher education in open and distance mode. We shaped our dreams through a pathway defined by a dictum 'access and quality define equity'. It provides all reasons to us for the celebration of quality in the process of education. I am overwhelmed to let you know that we have resolved not to become ourselves a reason or cause a reason for the dissemination of inferior education. It sets the pace as well as the destination. The name of the University centers around the aura of Sreenarayanaguru, the great renaissance thinker of modern India. His name is a reminder for us to ensure quality in the delivery of all academic endeavors.

Sreenarayanaguru Open University rests on the practical framework of the popularly known "blended format". Learner on distance mode obviously has limitations in getting exposed to the full potential of classroom learning experience. Our pedagogical basket has three entities viz Self Learning Material, Classroom Counselling and Virtual modes. This combination is expected to provide high voltage in learning as well as teaching experiences. Care has been taken to ensure quality endeavours across all the entities.

The university is committed to provide you stimulating learning experience. The master's programme in Commerce is considered to be an academic progression of the bachelor programme in form and content. It heavily leans on the knowledge level of a normal undergraduate learner. The discussions on the theories and accounting practices are kept integrated with a view to ensure cohesiveness in understanding of the learner. The worked out problems and its procedures constitute the conspicuous identity of the programme. Mathematical knowledge is enhanced over the modules. We assure you that the university student support services will closely stay with you for the redressal of your grievances during your studentship.

Feel free to write to us about anything that you feel relevant regarding the academic programme.Wish you the best.

Regards,

Dr. P.M. Mubarak Pasha

01.11.2023

Contents

01 BLOCK

RESEARCH PROCESS AND RESEARCH PLAN

Block Content

Unit 1

Concepts of Research

Learning Outcomes

After completing this unit, learners will be able to:

- comprehend the basic concept of research
- identify the objectives of research
- analyse various types of research
- examine the significance of research in social science

Background

Inquisitiveness is one of the basic instincts of a human being. People are always curious about the happenings around their surroundings. This curiosity leads to enquiry. Therefore, people enquire about a particular subject they are interested in seeking clarification. When you conduct an enquiry in a systematic way based on scientific evidence, it is called Research. Research is an essential and powerful tool to lead man towards progress

The field of research is no longer confined to scientific laboratory for the creation of vaccines and the discovery of the molecular structure of DNA. The manufactures, agriculturists,historians,archaeologists, sociologists,educationalists and economists carry out research in their respective fields. This unit gives a basic understanding about research in the field of social science-a branch of research devoted to the study of societies and the relationships among individuals.

Keywords

Basic research, Descriptive research, Diagnostic research, Action research, Experimental research, Inductive approach, Deductive approach

Discussion

1.1.1 Meaning and Definition of Research

In common parlance, research refers to the search of knowledge. It is an endeavour to discover answers to problems through application of scientific methods. It is the transition from the known to the unknown.

- Scientific method

Research is essentially a systematic inquiry into facts using objective verifiable methods in order to find the relationship among them and deduce broad principles or laws from them. It is a critical thinking technique. It entails defining and redefining problems, developing hypotheses or proposed solutions, collecting, organising, and analysing data, making deductions and drawing conclusions, and finally carefully testing the conclusions to see if they fit the formulated hypothesis. Research gathers factual data on current situations and problems in order to develop realistic plans and schemes. Before committing resources, research uncovers necessary facts on which sound decisions can be made. Studies make it possible to test the validity of planning assumptions or premises.

- Systematic investigation

Now let us examine some definitions provided by well-known authors about research:

Emory defines research as "any organised inquiry designed and carried out to provide information for solving a problem". This definition emphasises the purpose of research as problem solving-finding answers to a problem faced by an individual.

- Problem solving

Clover and Balsley define research as "the process of systematically obtaining accurate answers to significant and pertinent questions by the use of the scientific method of gathering and interpreting information". This definition highlights the importance of adopting systematic approach and scientific methods for finding answers to pertinent questions.

- Systematic approach

According to Black and Champion "Scientific research consists of obtaining information through empirical observation that can be used for the systematic development of logically related propositions attempting to establish causal relations among variables". This definition emphasises the importance of determining the relationship between variables used in research.

- Empirical observation

According to Clifford Woody, "research comprises defining and redefining problems, formulating hypotheses, collecting, organising and evaluating data, making deductions and reaching conclusions and at last carefully testing the conclusions to

- Systematic steps

determine whether they agree with the formulated hypothesis or not". This implies that the procedures adopted to undertake an investigation follow a certain logic sequence.

- Organised enquiry

On the basis of the above discussion, we can summarise that the research is an organised inquiry designed and carried out to provide information for solving a problem. Research also provides new information to expand the existing knowledge.

1.1.2 Types and Methods of Research

Research typically encompasses different approaches, methods, or designs employed to conduct scientific investigations. Research can be classified based on its main intent or methods.

1.1.2.1 Types of Research Based on Intent

The overall purpose or goals for conducting the research forms the base for this classification. Some of the types of research based on the intent are:

a. Basic research

Scenario: *Franklin's discovery of electricity and Einstein's theory of relativity.*

- Formulation of theories

Basic research is undertaken for the sake of knowledge without any intention to apply it in practice.It is concerned with the formulation of theories. For insrtance,research studies, concerning human behaviour carried on with a view to make generalisations about human behaviour are the examples of fundamental research. Basic research is also known as pure research or fundamental research.

b. Descriptive research

Scenario: *An investor considering an investment in the ever-changing real estate market needs to understand what the current state of the market is, how it changes (increasing or decreasing), and when it changes (time of the year) before asking for the why.*

- Ex post facto research

The major purpose of descriptive research is description of the state of affairs as it exists at present. The characteristics of a particular individual, situation or a group are depicted using descriptive research. For example, a study conducted to investigate the purchasing behaviour of people towards a specific commodity, frequency of shopping, perception of people towards a particular, organisation study etc. comes under the purview of descriptive research. Since it is a fact-finding enquiry, descriptive research is otherwise known as Ex post facto (After the Fact) research . Descriptive research may be cross sectional survey or longitudinal survey

In cross sectional survey, information is gathered from cross

sections of population at one point of time. Eg. For studying the preference of professional course of higher secondary students, data collected from students belonging to different disciplines of Commerce, Arts, Science (cross sections) at a particular time. In the case of longitudinal survey information is gathered at different point of time.

- Fact-finding study

c. Exploratory research

Scenario: *What effect does using a digital notebook have on the attention span of middle school students?*

Exploratory studies aim only to explore the research area and do not attempt to provide definite answers to research questions. Exploratory research is often qualitative in nature. However, a study with a large sample conducted in an exploratory manner can be quantitative as well. It is also often referred to as interpretative research or a grounded theory approach due to its flexible and open-ended nature. It is a preliminary investigation of an unknown problem about which the researcher knows little or nothing. In exploratory research, the goal is to formulate hypotheses rather than to verify or test them. It is similar to a doctor's initial inquiry of a patient suffering from an unknown illness in order to obtain some clues for identifying it. It lacks structure and is less focused on predetermined goals. It is usually in the form of a pilot study.

- Interpretative research

For example, a domestic company may consider establishing a manufacturing operation abroad. This type of investment is new to the company, and the preliminary research conducted to investigate the feasibility of this new idea is known as exploratory research.

d. Applied research

Scenario: *A study on how to increase student participation in the classroom*.

This study is solution-focused and focuses on a specific problem. Applied research is intended to solve real-life problems or provide answers to specific questions. It is thus problem-oriented and action-directed. The research is intended to provide knowledge that is both applicable and implementable. Applied research can contribute to new facts and it also offers an opportunity to test the validity of existing theory.

- Solving real-life problems

e. Evaluation studies

Scenario: *Assessing the performance of social or economic programmes such as Green revolution, Mid-day meal scheme etc*..

Evaluation study is one type of applied research. Evaluation research is defined as a type of disciplined and systematic inquiry conducted to arrive at an assessment or appraisal of an object, programme, practice, activity, or system with the goal of providing

information useful in decision making. It was made to assess the effectiveness of social or economic programmes implemented (e.g. poverty alleviation programme) or for assessing the impact of developmental projects (e.g. Railway development project) on the development of the project area.

- Assessment of effectiveness

f. Action research

Scenario: *Development of an information source for patients and the public about general practice services.*

A form of applied research is called action research. The difference between applied research and action research is that the former may be taken by a researcher to find results for a problem being faced by a third party. However, action research has a condition attached that the researcher is also the practitioner. Hence action research is being undertaken by a researcher to improve upon his own practices. It is a concurrent evaluation study of an action programme launched for solving problems/for improving an existing situation.

- Action programme

1.1.2.2 Types of Research on the Basis of Method

Types of research on the basis of method refer to the specific approaches or methodologies used to collect and analyse data in a research study.

- Action programme

a. Experimental research

Scenario*: If a cake shop wants to see if adding more flour changes the overall response, it will experiment with different amounts of flour and observe how customers react.*

Motivation, productivity, development, and operational efficiency are all phenomena that are influenced by various variables. It may become necessary to evaluate the impact of a single variable or a set of variables on a phenomenon. This requirement has given rise to experimental research. Experimental research is designed to assess the effects of particular variables on a phenomenon by keeping the other variables constant or controlled. The experiment is the basic tool of the physical sciences for tracing cause and effect relationships and for verifying inferences. Its application in social science is still in its infancy. Experimental research involves systematically manipulating one or more variables in order to observe and analyse the effects and relationships between those variables under controlled conditions. This approach is used to establish cause-and-effect relationships and draw conclusions about how changes in one variable lead to changes in another.

- Causal relationship

b. Analytical research

Scenario: *Explaining why and how U.S. trade balance moves in*

a particular way over time.

Analytical research is a specific type of research that involves critical thinking skills and the evaluation of facts and information relative to the research being conducted. It is a system of procedures and techniques of analysis applied to quantitative data. It could be a set of mathematical models or statistical techniques applied to numerical data. As a result, it is also known as the statistical method. It focuses on in-depth data analysis and examining relationships from various perspectives by incorporating as many relevant variables as possible into the analysis plan. This method is widely used in business and other fields that generate quantitative numerical data.

- Post-facto-analysis

c. Historical research

Scenario: *A study compared the similarities between inquiry-based and problem-solving methods and their potential for improving student performance.*

Historical research is the application of principles learned through study of the past and social forces that shaped the present. Its goal is to apply reflective thinking to unsolved social problems by tracing lines of development in human thought and action and discovering past trends of events, facts, and attitudes. It draws explanations and generalisations from the past trends in order to understand the present and to anticipate the future. Historical data demands a great deal of social insights.

- Historical orientation

d. Case study

Scenario: *A causative study of successful cooperative society.*

A case study is a thorough examination of a person, a social group, an episode, a process, a situation, a programme, a community, an institution, or any other social unit. The goal is to ascertain the natural history, that is, an account of generic development of a person or group, revealing the factors and method of life of the unit within the cultural setting. The case study method is known as 'the social microscope' because it aids in studying behaviour in specific but precise detail.

- Social microscope

1.1.3 Research Approaches

The approaches used in social science research vary depending on the availability of existing literature and theories and also on the purpose for which the research is undertaken. The two key approaches are explained below.

a. Inductive approach

b. Deductive approach

1.1.3.1 Inductive Approach

- Bottom-up approach

The concept of inductive reasoning could be compared with the blowing of a balloon. A new theory is developed from a small thought similar to how a person starts blowing a balloon from a small hole. Inductive reasoning starts with specific observations related to a particular area and develops these observations to make generalisations in that particular area. Hence it can also be called the 'Bottom-up' approach. This approach can be used to draw new theories in those areas where existing literature is not available.

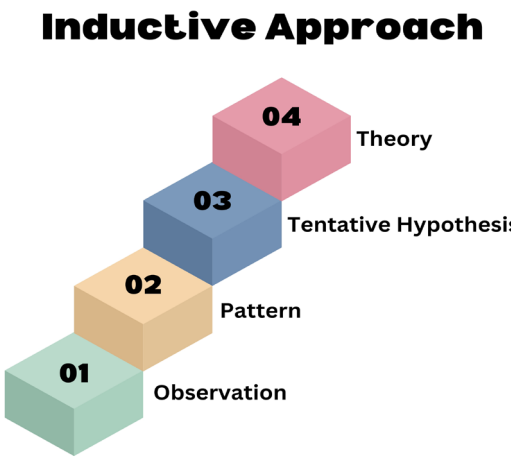


Figure 1.1.1 Inductive approach

- Particular to general

The theory developed using this approach cannot be tested due to lack of existing literature, which is the key limitation of this approach. Therefore, the only way to increase the reliability of theories developed through this approach is to collect the maximum possible amount of data.

1.1.3.2 Deductive Approach

- Top-down approach

The concept of deductive reasoning can be compared to that of a funnel. A funnel has a broad top which gets narrowed down to a small hole at the bottom. Deductive reasoning approach tests the existing literature and theories by framing hypotheses to draw conclusions. Usually the steps involved in this approach are Theory, Hypothesis, Observation and Confirmation. Hence it can also be called the 'Top-down' approach. This approach can be used in areas where existing literature and theories are available.

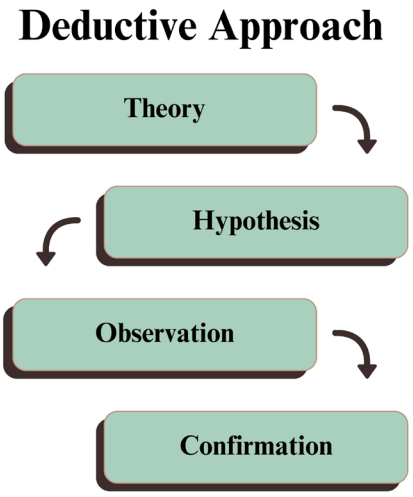


Figure 1.1.2 Steps in Deductive approach

The conclusion of deductive reasoning approach depends on premises. For example, let the major premise be 'All cats have fluffy tails' and the minor premise be 'Bingo is a cat'. The conclusion drawn based on this approach is 'Bingo has a fluffy tail'. The conclusion will not be reliable if the major premise is false. Thus the reliability of this approach depends on the correctness of the premises. The key limitation of deductive approach is that the conclusion will be false if the premises are not true.

- Existing theories

1.1.4 Significance of Social Science Research

Social science research is more complex than physical science research since it deals with a blend of varied spectrums of human life, their attitudes, behaviour, inter relationships and so forth. It is considered as inevitable due to the significant role it plays in the economy. The significance of social science research includes:

- Blend of varied spectrum of human life

a. Provides solutions to problems by offering answers to what, when, where, and how questions. With regard to the above mentioned example, the total amount of funds required during the year and the probable sources from where it could be raised are determined for the budget from the data that is collected from various government departments.

- Solutions to problems

b. It helps the government in policy formulation. Through social science research the key areas where the government should pay more attention could be identified and the measures to be taken to tackle the issues could be developed such as resolving unemployment issues, eliminating poverty, infrastructure development, and so forth. Thus it contributes towards framing monetary and fiscal policies.

- Policy Formulation

- Indicator

c. Paves way towards enhancing the growth of the country by resolving the various social issues. The measures developed to generate employment opportunities, improve infrastructure and reduce poverty would ultimately lead to the growth and development of the country.

- Social control

d. Helps to bring social control and incorporate better human values in the society. Since social science research deals with the interaction of humans with each other and with society, the human behaviour which is the key causes of social evils can be identified and resolved easily. Thereby it helps to improve bonding and smooth relationships in the society.

- Decision making

e. Useful for predictions and thereby helps in decision making. The Government of India's budget 2022 presented a blueprint of the Indian economy from India @ 75 to India @ 100. These predictions are possible because of the use of various tools of research such as trend analysis, which contributes towards the social welfare of the country.

- Exploration

f. Helps to gain insights on new facts and develop new theories. Social science research involves the exploration of the unidentified facts which helps to grab more opportunities. It thereby helps to obtain new knowledge that can be added to the existing literature.

- Application of research

g. Used in various areas of business such as marketing, accounting, finance, human resource management and so forth for enhancing the growth of business.

Thus social science research is an eye opener that brings into light the various unknown and unexplored facts. It forms an integral part of the society by contributing to its overall growth and development.

Summarised Overview

A research study is a systematic investigation of a specific problem, area, or topic. It adds value to the existing knowledge. There are various types of research for various situations. Based on the intent and method of research, thirteen different types of research can be conducted.

In research, various approaches such as inductive and deductive approaches are used to reach conclusions. The primary distinction between inductive and deductive reasoning is that inductive reasoning seeks to develop a theory, whereas deductive reasoning seeks to test an existing theory. Inductive reasoning proceeds from specific observations to broad generalisations, whereas deductive reasoning proceeds in the opposite direction. Both approaches are used in different types of research, and it is not uncommon for them to be combined in a single large study.

Self- Assessment Questions

1. What is research? What are its objectives?
2. What is the significance of social science research?
3. Explain case study in social science research.
4. Elucidate experimental research.
5. What is induction? When is it followed?
6. Write a short note on the classification of research.
7. What is deduction? What is its essential condition?
8. Differentiate action research and applied research?

Assignments

1. Identify the type of research used for investigating the impact of a new educational programme on student's learning outcomes.
2. State which type of research is to be adopted for studying the factors contributing to low employee productivity in a company.
3. Identify the type of research that is used for investigating the buying behaviour of consumers in a specific market.
4. Which type of research is used for improving teaching methods in a school?

References

1. Tandon, B.C; (1979). *Research Methodology in Social Sciences*. Chaitanya Publishing House.
2. Chawla, D; and Sondhi, N., (2016). *Research Methodology: Concepts and Cases*. Vikas Publishing House Pvt. Ltd.
3. Kevin, S., (2021). *Research Methodology for Social Sciences*. Ane Books Pvt. Ltd., New Delhi.
4. Kothari, C. R., (2004). *Research Methodology: Methods and Techniques*. New Age International (P) Limited.

5. Krishnaswami, O.R., Ranganathan, M., & Harikumar, P.N. (2016). *Research Methodology*. Himalaya Publishing House.
6. Panneerselvam, R. (2014) *Research Methodology*. PHI Learning.

Suggested Reading

1. Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education (8th ed.)*. Routledge.
2. Jhunjhunwala, S. (2018). *Research Methodology: Techniques and Trends*. I.K. International Publishing House.
3. Gupta,S.K. & Praneet Rangi. (2018). *Business Research Methodology*. Kalyani Publishers
4. Sharma R, N & Sharma R.K. (2019). *Research Methods in Social Science.* Atlantic Publishers.
5. Singh A.K. (2017). *Tests, Measurements and Research Methods in Behavioural Sciences*. Bharti Bhawan.

Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

Unit 2

Research Process

Learning Outcomes

After completing this unit, learners will be able to:

- learn about the process of research
- gain insights on the concept of research gap
- develop an understanding on how to formulate a research problem
- familiarise the role of literature survey in research
- learn about the concept of hypothesis and its types

Background

Research is an organised endeavour. Like any other organised work, a step-by-step process is required for performing research. Sequential steps required for conducting a research work effectively is called research process.

The research process starts with a clear question which is to be answered called a research problem. An example of a research problem is how exercise affects the thinking of older people. Picking the right question is really important for successful research. The researchers need to find a question that needs an answer or a problem that needs solving. Researchers then read all the existing information about the topic to see what others have discovered. Using that knowledge, they make educated guesses called hypotheses. For example, they might guess that regular exercise can make older people think better.

After that, they plan how they will gather information to test their ideas. Lastly, they look at the information they collected to see if it supports their guesses. This whole process helps the researchers find out new things and learn more about the world. This unit encompasses the process involved in performing a research.

Keywords

Research problem, Literature Review, Research gap, Hypothesis

Discussion

1.2.1 Process of Research

Conducting research involves a series of interconnected steps. These steps typically include defining the research question, reviewing existing literature, designing a research methodology, collecting and analysing data, drawing conclusions, and communicating the findings. Each stage of the research process is critical in ensuring the reliability, validity, and significance of the study's outcomes. Now let us have a look over these steps:

- Identification of problem

a. Discovering the problem area

To begin research, we must first identify the problem that requires a solution. If one wants to solve a problem, he/she should understand well what the problem is. So a well defined problem, half solved. The best way to identify the problem is to look for an unsolved question, a gap in existing knowledge, or an unfulfilled need within the chosen subject. Although the world is filled with unanswered questions, not everything is suitable for research. The important points to be considered while formulating a research problem are explained in detail later in the unit.

- Identification of problem

b. Literature survey

After identifying the problem, the researcher should rephrase the problem in to analytical or operational terms. Academic journals, conference proceedings, government reports, books etc., must be tapped depending on the nature of the problem. This process is called review of literature. The literature review undertaken to understand the concepts or theories is known as the conceptual literature review whereas, the reviews of previous work done by researchers in the related area is known as empirical literature review. The literature review should end up with research gap.

- Summary of sources

c. Research objectives

Research objectives are the specific goals or intentions that guide a research study. They express the desired outcomes or achievements that the researcher aims to attain through the research process. These objectives provide a clear sense of direction and purpose for the study, influencing decisions related to research design, methodology, and data collection methods. Research objectives should be formulated using the SMART concept, which emphasizes that they should be Specific, Measurable, Achievable, Relevant, and Time-

- SMART concept

Bound. This principle guides the process of creating research objectives that are clear, quantifiable, realistic, aligned with the research purpose, and defined within a specific timeframe.

- Specific- Research objective should be clear, precise, and free from ambiguity and should address the questions of what precisely needs to be accomplished and what the desired outcome is.
- Measurable- In order to assess progress and determine completion, research objectives should be measurable. By formulating objectives that are measurable, researchers can track their progress and determine if they have achieved the desired outcomes, thereby improving the overall efficacy of the research process.

- Goals of the study

- Achievable- The researcher should set realistic and attainable objectives only after considering the available resources, time constraints, and the researcher's capabilities.
- Relevant- The research objective should address significant issues and make a valuable contribution to the field of study. They should directly contribute to bridging the research gap or resolving the specific research problem at hand.
- Time-bound- Research objectives should be set in such a way that there should be timeframes for competition. It helps to complete the work in a timely manner.

d. Developing a working hypothesis

- Tentative assumption

Hypothesis is a provisional formulation or possible solution or tentative explanation or suggested answers to the problem facing the researcher. A hypothesis is therefore, essentially tentative, likely to be modified during the investigation of the facts discovered if the course of enquiry demands it. It is an explanation that needs to be established before it can be accepted.

For example, the null and alternate hypothesis related to Corporate Social Responsibility (CSR) activities by companies are as follows:

Null Hypothesis (H_0): There is no significant relationship between a company's CSR activities and its reputation among consumers.

Alternate Hypothesis (H_1): There is a significant relationship between a company's CSR activities and its reputation among consumers.

The H_0 is called the null hypothesis which assumes there is no difference between the population parameter and the sample statistic and the H_1 is called an alternative hypothesis which presents the alternative solution. A hypothesis serves as a guide for the researcher and aids in staying focused on research. The various types of hypotheses are explained later in this unit.

- Guides researcher

e. Research design

Once the researcher has been granted approval, the next step is to develop the research design in detail. A research design is a map developed to guide the research. It is part of the planning stage of research, a blueprint for the collection, measurement and analysis of data. It is a logical and systematic plan prepared for directing a research study. It specifies the objectives of the study, the methodologies and techniques to be adopted for achieving the objectives.

- Blueprint

The essentials of good research design are as follows:

- It is a plan that specifies the objectives of the study and the hypotheses to be tested.
- It is an outline that specifies the sources and types of information relevant to the research questions.
- It is a blueprint specifying the method to be adopted for gathering and analysing data.
- It is a scheme defining the domain of generalisability, i.e., whether the obtained information can be generalised to a larger population or to different situations.

- Outline

f. Execution of the project

From this stage onwards the researcher moves forward from the planning stage to data gathering stage. This includes distributing the data collection instrument, such as questionnaires or interview schedules to respondents as well as training field workers for conducting interviews and observation techniques. Seminars or instruction manuals can be used to provide training at a focal point. The data collection process is kept under strict control. Respondents who were not responding during the first round of communication are contacted again. The researcher would also conduct surprise field checks to ensure that field workers followed the instructions given to them. The primary goal at this stage is to collect data in the correct format and within the timeframe specified.

- Data gathering stage

g. Analysis of data

- Processing of data

All the data gathered in the previous step is meaningless unless it is subjected to data analysis. The processing of this raw data will yield some useful information. Data analysis is the study of tabulated material in order to determine inherent facts or meanings. It entails breaking down existing complex factors into simpler parts and arranging the parts in new ways for interpretation purposes.

Data analysis is concerned with reducing the bulk of accumulated data to manageable size. It involves the following procedures.

- Data correction

- **Editing**

The first step in data processing is editing. The process of examining the data collected in a questionnaire/schedule to detect errors and omissions and ensuring that they are corrected and the schedules are ready for tabulation is known as editing. When all of the data has been collected, a final and thorough check is performed.

- Organised data

- **Coding**

Coding is the process/ operation by which data/responses are organised into classes/categories and numerals or other symbols are given to each item according to the classes in which it falls. In other words coding involves two important operations:

* Deciding the categories to be used.

* Allocating individual answers to them.

- Table form

- **Tabulation**

Tabulation is the process of summarising raw data and displaying it in compact form for further analysis. Analysis of data is made possible through tables. Therefore, preparing tables is a very important step. Tabulation may be by hand, mechanical or electronic.

- Inferences

- **Statistical analysis**

In the last stage, the tabulated data is analysed using various statistical techniques like averages, percentages, trend analysis, correlation and regression techniques etc.. Statistical analysis these days has become highly dependent on computers and software that are readily available in the market.

h. Testing of hypotheses

Post analysis of data, researchers will now move ahead to test the hypothesis that he had formulated in the beginning of the research process. There are various parametric and non-parametric

tests like t-test, z-test, Chi-square test, ANOVA, MANOVA, Mann Whitney-U test, Kruskal Wallis-H test, Friedman test etc.. The type of test used for hypothesis testing is determined by factors such as the nature and objectives of the research, population distribution characteristics, sampling techniques, data type, and so on. Hypothesis testing will assist a researcher in determining the validity of his findings. It would assist him in determining whether the difference, if any, between the two values is due to chance and thus insignificant, or if the difference is actual and significant. It will aid in determining whether the difference is genuine or the result of random fluctuation.

- Tentative statements

i. Data interpretation and generalisation

When no hypothesis is tested in a study, data interpretation is performed with the goal of finding an explanation for the research findings based on existing theories. The findings are interpreted in light of existing theories, and avenues for newer explanations and future research are opened. Generalisations are made to build a new theory in hypothesis testing research studies after the data has been analysed and tested repeatedly to arrive at conclusive results. Such generalisations result in improved explanations and new theories for existing phenomena, and they significantly contribute to the existing data bank.

- Inferences

j. Reporting of result

The final step is to make the findings of the research available to the public so that they can be used. The reporting style and method would be determined by the target audience, the purpose, and the time of reporting the result. Any research report, whether detailed or in the form of a brief note, should essentially contain the following contents.

- Research report

- **Preliminary section**

  Preliminary section consists of the title of the report, table of content, list of tables, graphs, preface and an executive summary, which briefly gives the research objectives and the findings and importance of the study.

- Front matter

- **Main text**

  It includes the problem background, research objective, research methodology, study's significance, and conclusion. A special mention of the researcher's recommendation in light of findings should also be included.

- Main body of study

- **End section**

  It includes appendices that support the research, such as the questionnaire and schedule used, a glossary of terms, and any other information that is not part of the main research but is

- Concluding part

required to support the research.

1.2.2 Research Problem

- Issue to be investigated

A research problem is a statement in the field that addresses a knowledge gap, challenge, or contradiction. Researchers use research problems to identify and define the purpose of their research and analysis. If a researcher is interested in contributing to social or scientific change or adding new knowledge to an existing topic, he may decide to conduct research based on a problem. A research problem can also aid in the identification of key concepts and terms, as well as overarching questions and variables.

- Foundation for research study

The identification and formulation of a research problem is critical and may be one of the most difficult aspects of conducting research. The research problem serves as the foundation for the entire research process.

John Dewey defines research problem as "A problem represents the information acquired by a researcher and seeks solution for it"

According to R.S Woodworth research problem is defined as "A problem is a situation for which we have no ready-made solution".

In the words of Gibson, a research problem is defined as "A problem is really a spring board for a leap into the unknown".

1.2.2.1 Importance of Research Problem

Importance of identifying and formulating a research problem are as follows:

- Relevance of the study

a. Introducing the importance of the study topic

The research problem introduces the reader to the significance of the study as well as the research questions or hypotheses that will be investigated.

- Specifies key elements

b. Defines the context of the problem

The research problem specifies the parameters and elements that will be investigated in the research.

- Structure of reporting

c. Framework for reporting the results

It specifies and provides all of the requirements for carrying out the study. It also describes how the findings will be presented with reference to the information.

1.2.2.2 Nature of Research Problem

- Enhance knowledge

A good research problem should have the following criteria:

a. It should address a gap in knowledge- A good research problem should contribute to existing knowledge by addressing a

gap or a research question that has not been sufficiently answered. It should seek to expand the understanding of a specific topic or provide new insights.

b. It should be limited in scope and should be specific- The research problem should be focused and well-defined, avoiding broad or vague topics. A narrow scope allows for a more in-depth investigation and increases the likelihood of producing meaningful results.

c. It must have a goal- The research problem should have a clear objective or goal that the researcher aims to achieve through their investigation. This goal provides direction and purpose to the research study.

d. It must be free of ethical constraints- While research must adhere to ethical guidelines, this criterion implies that the research problem should not be inherently unethical or involve any potential harm to participants or stakeholders. The researcher should consider the ethical implications and ensure that the study can be conducted ethically.

e. The research problem must be capable of generating research questions- A good research problem should be open-ended and capable of generating specific research questions. These questions guide the research process, help in data collection and analysis, and ultimately contribute to addressing the research problem.

f. It must be relevant to one or more academic fields of study- The research problem should be relevant and significant within one or more academic fields. It should align with the existing knowledge and interests of the discipline(s) it relates to, ensuring that the research contributes to the advancement of knowledge in those areas.

g. It should be possible to conduct research within the time frame or budget constraints- Practical considerations, such as time and budget, should be taken into account when formulating a research problem. It should be feasible to conduct the research within the available resources and constraints, ensuring realistic expectations.

h. The research problem should be new that is not yet answered sufficiently by other researchers- The research problem should bring novelty and originality to the field of study. It should address a question or issue that has not been fully explored or adequately answered by previous research.

i. The research problem must base on the available research literature- A good research problem should be grounded in the existing literature. The researcher should review and analyse

- Precise focus
- Distinct aim
- Ethical considerations
- Generating guiding question
- Relevance across disciplines
- Considering practical constraints
- Seek innovation
- Drawing from literature

- Defining measurable variables

relevant studies, theories, and concepts to inform the formulation of the research problem and ensure that it builds upon the existing knowledge.

j. The variables in the problem must be clear and precise- This criterion means that the researcher should clearly define and identify the variables that will be studied. The variables should be measurable and well-defined to ensure that the research problem can be effectively addressed.

- Theoretical foundation

k. Good research problem should be grounded on solid theory or conceptual framework- A research problem should be based on a theoretical or conceptual framework that provides a solid foundation for the study. The framework helps to structure the research, guide the data collection and analysis, and provide a theoretical basis for interpreting the results.

- Problem stating

1.2.2.3 Formulation of Problem

The problem selected for the research may be vague at first. It is possible that the study question or problem will not be resolved. Why the answer/solution is desired may also be unknown. As a result, the chosen problem must be defined and formulated. This is a challenging procedure. To understand the nature of the selected problem, intensive reading of a few selected articles or chapters in books is required. At this point, the reading should be focused to 'classics' and research papers on the subject.

- Focusing the problem

After the problem has been selected, it must be definitely formulated and selected. If it is to serve as a guide in planning the study and interpreting its results, it is essential that the problem is stated in precise terms. The type of statement to be employed depends on the preference of the researcher and the nature of the problem. Preferably it should be set as a question or in such form that the question to be answered is clearly indicated. The following are two different ways of stating a problem:

- Posing question/questions.
- Making declarative statement/ statements.

- Problem specification

One may select any of these approaches, keeping in mind that the questions form has an advantage in sharpening and focusing the issue, but the declarative form is perhaps more common, and both approaches can be easily combined in an initial statement.

1.2.2.4 Evaluating the Problem

Several probing questions must be raised before the proposed research problem can be considered appropriate. All questions must be related to the problem. Each major issue or element should be divided into its subsidiary or secondary elements, which should be arranged logically under the major division. Only, when

those questions are answered in the affirmative, can the problem be considered a good one.

- Attainability

a. Is the problem researchable?

Is this the kind of problem that can be effectively solved through research? Can relevant data be gathered to test the theory or find an answer to the problem under consideration?

- Impact

b. Is the problem significant?

Will the study contribute something to the society? Would the solution make any difference in terms of theory or practice? If not, there are undoubtedly more serious issues that need to be addressed.

c. Is the problem a new one?

Is the solution already available? Ignorance or prior studies may cause a researcher to waste time on a problem that has already been investigated by another researcher.

- Novelty

Although novelty or originality is an important consideration, the fact that a problem has previously been investigated does not imply that it is no longer worthy of investigation. There are times when it is necessary to replicate (repeat) studies in order to validate its findings or to extend the validity of its findings to a different situation.

d. Is research on the problem feasible?

After a research project has been evaluated, the issue of suitability for a specific researcher needs to be considered. The following points should be kept in mind while checking for feasibility.

- Viability

- Research competencies
- Administrative consideration
- Financial considerations
- Time requirements
- Courage and determination
- Interest and zeal

1.2.2.5 Techniques of Defining a Problem

One of the first tasks is to look for unanswered questions. There are numerous potential problem areas that require the researcher's immediate attention. A researcher may discover a potential research problem from any of the following sources:

- Experience

a. One of the best sources of problems is an individual's personal,

- Previous literatures

professional, and academic experience. It has a great relationship with the researcher's interest because he has encountered it at some point in his life and understands the significance of solving the problem.

- Conference and seminar

b. Another good way to search for research problems is a review of literature. Many studies include a section that discusses future research possibilities. As a result, it is critical that a researcher read the literature in his or her field of interest.

- Imagination and creativity

c. Attending conferences, seminars, and so on can also provide good information about potential research problems. In general, such events include expert discussions on problems and issues pertinent to the conference. Brainstorming among these experts frequently reveals new areas of research.

- Technical and social changes

d. The best brain teasers are 'Imagination and Creativity.' They lead a person to previously unexplored area. It enables the individual to perceive routine thoughts in a new light and seek new answers to previously accepted solutions.

e. Finally, technical and social changes are constantly presenting the researcher with new challenges. Technology evolves at a rapid pace, as do user expectations. As a result, these developments provide a rich source of research opportunities.

- Previous study

1.2.3 Literature Review

From the detailed explanation on the process of research in the previous section, it was understood that literature survey is an important process to be performed while conducting research after the formulation of a research problem. Once a topic has been selected, it is critical to review all relevant material that bears on the topic. In fact, the review of literature begins with the search for a suitable topic and continues throughout the research process. It is essential to demonstrate how the problem under investigation is related to previous research studies.

The review of literature is not simply the reading for the sake of reading; it is also not casual reading, such as reading a story or novel. It is targeted and directed at specific goals. It is also judgmental. A researcher must choose the types of literature to be reviewed and determine why they are being studied. It begins with the selection of a research problem, progresses through the various stages of the research process, and concludes with report writing. The following are the goals of the literature reviews:

- Unexplored area in research

- To identify the research gap- A research gap is simply a topic or area where there is missing or insufficient information to reach a conclusion for a question. However, it should not

be confused with a research question. For example, if we asked what the healthiest diet for humans is, we would find a plethora of studies and potential answers. On the other hand, if we were to ask, "What are the effects of antidepressants on pregnant women?" we would not find much data. There is a research gap here. When we identify a research gap, we identify a potential new and exciting research direction.

- Dimensions

The research gap can have different aspects depending on the situation. The time dimension highlights the need for research that keeps up with changes and updates old information. The space dimension means exploring or validating a theory which has been explored on a different geographical location but remains unexplored in other geographical areas. The scope dimension calls for research that covers a wider range of factors or ideas in a topic. The ethical dimension focuses on addressing gaps related to ethical concerns in research to protect the well-being of participants and follow ethical guidelines. Identifying and addressing these dimensions enables researchers to fill knowledge voids, keep pace with changes, and ensure comprehensive and ethical research practices.

- Conceptual clarity

- To gain background knowledge of the research topic.
- To identify the concepts relating to it, potential relationship between them and to formulate researchable hypotheses.
- To redefine a problem.
- To identify appropriate methodology, research design, methods of measuring concepts, and techniques of analysis.
- To identify data sources used by other researchers.
- To learn how others had structured their points.

- Conceptual literature and empirical literature

There are two types of literature that the researcher can review the conceptual literature concerning the concepts and theories, and the empirical literature consisting of studies made earlier which are similar to the one proposed. The conceptual literature involves analysing existing theories, synthesising information, and presenting conceptual models or frameworks that help to explain or understand a phenomenon. Conceptual literature is often theoretical in nature and aims to provide a comprehensive understanding of the subject matter. It may draw upon various sources such as books, academic papers, philosophical discussions, and theoretical debates. Empirical literature consists of studies and research conducted in the past that involve data collection, analysis, and interpretation. Empirical studies are based on observations, experiments, surveys, case studies, or other research

methodologies aimed at gathering first-hand data. This literature type provides evidence-based findings, empirical support, and empirical insights into specific research questions or hypotheses.

1.2.4 Hypothesis

- Tentative assumptions

When a researcher observes known facts and undertakes an analysis of a problem, he must begin somewhere, and this point of start is the hypothesis. In other words, once the problem at hand has been determined, one must move on to developing preliminary solutions. These proposed solutions or explanations form the hypothesis, which the researcher then tests using facts that are already known or can be made known. Hypotheses are not given to us readymade. This is especially true in the social sciences, where many areas of its subject matter do not yet have highly developed theoretical systems that provide fruitful bases for hypothesis formulation. As a result, in social science at least, a significant portion of research effort is understandably directed toward hypothesis generation rather than hypothesis testing. As a result, it is important to remember that research can begin with a well-formulated hypothesis (during the planning stage of the research) or it can end with a hypothesis (at a later stage)

According to Rummel and Balline, "Hypothesis is a statement capable of being tested and thereby verified or rejected".

Webster says "A hypothesis is a preposition, condition or principle which is assumed, perhaps, without belief, in order to draw out its logical consequences and by this method to test its accord with facts which are known or may be determined".

- One dependent and independent variable

1.2.4.1 Types of Hypotheses

There are six forms of hypothesis and they are:

a. Simple hypothesis

- Two or more dependent and independent variable

It demonstrates the relationship between one dependent variable and one independent variable. For example, if you eat more leafy vegetables, you will lose weight faster. Here, eating more leafy vegetables is an independent variable, while losing weight is the dependent variable.

b. Complex hypothesis

- Effect and its direction

It depicts the interaction of two or more dependent variables and two or more independent variables. For example, consumption of more vegetables and fruits results in weight loss, glowing skin, and a lower risk of many diseases, including heart disease.

c. Directional hypothesis

It demonstrates how a researcher is intellectual and committed to a specific outcome. The nature of the variable can also be predicted by the relationship between the variables. For example, children aged four years who eat proper food over a five-year period have higher IQ levels than children who do not eat proper food. This depicts the effect and its direction. This type of hypothesis predicts the specific direction of the relationship or difference between variables. It states whether the relationship is positive or negative, or whether the difference is higher or lower.

- Non-specific relationship

d. Non-directional hypothesis

It is used when no theory is involved. It is a statement that a relationship exists between two variables, but it does not predict the nature (direction) of the relationship. In other words, a non-directional hypothesis is a two-tailed hypothesis that does not predict the direction of the difference or relationship.

- Negative statement

e. Null hypothesis

It's a negative statement, and states that the independent and dependent variables have no relationship. The symbol is denoted by "H_0". E.g., there is no sex effect regarding those who eat vegetarian meals on a regular basis. This type of hypothesis states that there is no significant relationship or difference between variables being studied. It assumes that any observed results are due to chance or random variation.

- Research hypothesis

f. Alternative hypothesis

The alternate hypothesis proposes that there is a significant relationship or difference between the variables being studied. It is also known as research hypotheses. It opposes the null hypothesis and suggests that the observed results are not due to chance. The alternative hypothesis is formulated based on prior knowledge, theories, or expectations, and it suggests that there is a meaningful effect or relationship between variables. It seeks to challenge or reject the null hypothesis by providing evidence to support the presence of a specific effect, association, or difference.

- Cause and effect relationship

g. Associative and Causal hypothesis

Associative hypothesis occurs when there is a change in one variable resulting in a change in the other variable. The causal hypothesis, on the other hand, proposes a cause-and-effect interaction between two or more variables. e.g., reducing class size increases student's achievement.

Summarised Overview

The research process is the series of steps involved in conducting research. The first step in the research process is to identify the area of research problem. It is analogous to deciding on a destination before embarking on a journey. It serves as the foundation for the entire research procedure. A research problem in the social sciences is presented in the form of a question. It aids in narrowing down the problem to something manageable for a study. Defining a research problem serves three main purposes.

- It emphasises the significance of the research topic.
- It assists the researcher in properly defining the parameters of the investigation by placing the problem in a specific context.
- It provides a framework for future presentations of the results.

The context of this research problem is then discovered through a review of the literature. A literature review is a detailed summary of previous research on a specific topic. The literature review examines scholarly articles, books, and other sources that are relevant to a specific area of study. This previous research should be enumerated, described, summarised, objectively evaluated, and clarified in the review. A literature review creates a "landscape" for the reader, providing a comprehensive understanding of the field's developments. This landscape informs the reader that the author has indeed incorporated all (or a large portion of) previous, significant works in the field into her or his research. A research gap is a question or a problem that has not been addressed by any previous studies or research in your field. A research gap can occur when a concept or new idea has not been thoroughly researched.

The researcher then develops research questions, objectives, and hypotheses based on the research problem. A research study design is created in order to choose a sample size and collect data from it. Following the processing and analysis of the collected data, the research findings are presented in a research report.

Self- Assessment Questions

1. What is a research gap?
2. Why should a researcher review earlier research studies relating to a topic?
3. How can a researcher locate available literature relating to his topic?
4. What do you mean by analysis of data?
5. Identify the importance of research design.
6. What is statistical analysis?

7. What are the practical considerations which a student has to face in the selection and planning of a research project?
8. Identify the principal components in the progressive formulation of a problem for research?
9. What are the sources of research problems?

Assignments

1. Identify a problem of your interest and write 10 literature review comprising of national, and international reviews in that area.
2. Select a research article from your field of interest and analyse its research objectives. Discuss the strengths and weaknesses of the objectives and propose potential improvements.
3. Create hypotheses stating the relationship between the amount of time spent studying and academic performance of a student. Design a survey-based research study to examine the potential correlation between study time and academic achievement.
4. How does technology impact human communication? Conduct a literature review to explore the existing research on the effects of technology on interpersonal interactions and communication patterns.

References

1. Tandon, B.C; (1979). *Research Methodology in Social Sciences*. Chaitanya Publishing House.
2. Chawla, D; and Sondhi, N., (2016). *Research Methodology: Concepts and Cases*. Vikas Publishing House Pvt. Ltd.
3. Kevin, S., (2021). *Research Methodology for Social Sciences*. Ane Books Pvt. Ltd., New Delhi.
4. Kothari, C. R., (2004). *Research Methodology: Methods and Techniques*. New Age International (P) Limited.
5. Krishnaswami, O.R., Ranganathan, M., & Harikumar, P.N. (2016). *Research Methodology*. Himalaya Publishing House.
6. Panneerselvam, R. (2014) *Research Methodology*. PHI Learning.

Suggested Readings

1. Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education (8th ed.)*. Routledge.
2. Jhunjhunwala, S. (2018). *Research Methodology: Techniques and Trends*. I.K. International Publishing House.
3. Gupta,S.K. & Praneet Rangi. (2018). *Business Research Methodology*. Kalyani Publishers
4. Sharma R, N & Sharma R.K. (2019). *Research Methods in Social Science.* Atlantic Publishers.
5. Singh A.K. (2017). *Tests, Measurements and Research Methods in Behavioural Sciences*. Bharti Bhawan.

Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

Unit 3

Research Design

Learning Outcomes

After learning this unit, the learners will be able to:

- gain insight on the need to develop a blueprint of research study.
- familiarise with the various types of research designs.
- differentiate between exploratory research design and conclusive research design.

Background

Before approving a construction, an architect creates a blueprint. The architect decides how big the building will be, how many rooms it will have, how these rooms will be approached in the architectural plan, and what building materials does he intend to use? Perhaps he will make all decisions based solely on the purpose for which the building will be used. Similarly, before launching an attack, an army develops a strategy. Before putting his ideas into action, an artist creates a design. So also the researcher makes a plan of his study before he/she undertakes research work. This will enable the researcher to save time and resources. Such a plan of study or blueprint for study is called a research design.

Keywords

Research design, Exploratory Research design, Descriptive Research design, Diagnostic Research design

Discussion

1.3.1 Research Design

A research design or model indicates a plan of action to be carried out in connection with a proposed research work. It provides only a guideline for the researcher to enable him to keep track of his actions and to know that he is moving in the right direction in order to achieve his goal.

- Plan of action

A research design is the program that guides the investigator in the process of collecting, analysing and interpreting observations. It provides a systematic plan of procedure for the researcher to follow. It is a map developed to guide the research and it is a part of the planning stage of research, a blueprint for the collection, measurement and analysis of data.

- Plan of action

1.3.2 Needs for Research Design

A research plan prescribes the boundaries of research activities and enables the researcher to channel his energies in the right work. With clear research objectives in view, the researcher can proceed systematically towards his achievement.

- Boundary of research activities

The need for research design in social science is as follows:

- Reduce uncertainty, confusion and practical haphazard related to any research problem.
- Helpful for collecting research materials.
- Helpful for testing hypotheses.
- Provides firm foundation to the endeavour.
- It reduces inaccuracy.
- It helps to get maximum efficiency and reliability.
- Eliminates bias and marginal errors.
- Minimises wastage of time.
- Gives an idea regarding the type of resources required in terms of money, manpower, time, and efforts.
- Provides an overview to other experts.
- Guides the research in the right direction.
- Helps to set boundaries and helps prevent blind search.

1.3.3 Types of Research Design

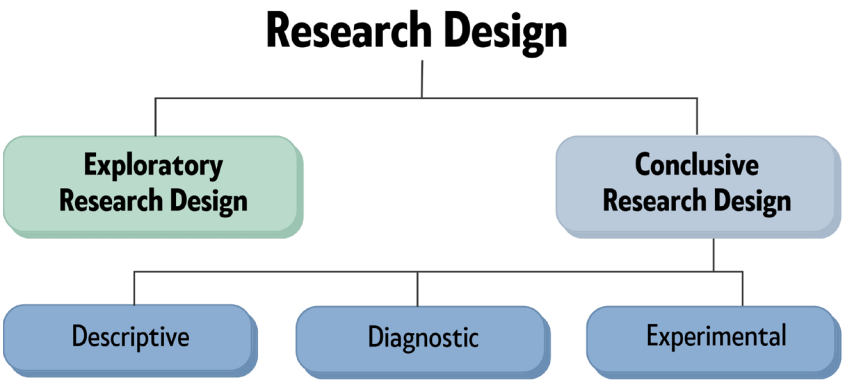


Figure 1.3.1 Types of research design

1.3.3.1 Exploratory Research Design

When the researcher has no previous data or only a few studies for reference, an exploratory research design is used. This research is sometimes informal and unstructured. It is a research tool that provides a hypothetical or theoretical idea of the research problem. It will not provide specific solutions to the research problem. This research is carried out to ascertain the nature of the problem and to assist the researcher in developing a better understanding of the problem. Exploratory research is adaptable and lays the groundwork for future research. Exploratory research requires the researcher to investigate different sources such as published secondary data, data from other surveys, observation of research items, and opinion about a company, product, or service.

- Hypothetical or theoretical idea

The objectives of exploratory research design are as follows:

- Evaluate the feasibility of a study.
- Formulate statement of the problem.
- Provide theoretical basis to a hypothesis.
- Provide alternative option/approaches to a problem.
- Establish priorities or possibilities for further research.

Techniques of exploratory research

There are three different techniques of exploratory research.

a. Secondary data analysis

Secondary data analysis is the use of existing research data to answer a question that was not addressed in the original work. Secondary data can come from large-scale surveys or from personal research.

- Existing data

b. Expert surveys

Expert surveys are often referred to as experience surveys because they involve interaction with people who are experts in the field being studied. Some people come across situations as a result of their position as an individual, official, or social worker that make their experience a valuable source of information.

- Interaction with experts

c. Case study

A case study is a detailed examination of one person, group, or event. A case study examines nearly every aspect of the subject's life and history to look for patterns and causes of behaviour. Case studies have applications in many fields, including psychology, medicine, education, anthropology, political science, and social work.

- In-depth examination

1.3.3.2 Conclusive Research Design

As the name implies, conclusive research design is used to generate findings that are practically useful in reaching conclusions or making decisions. The research objectives and data requirements for this type of study must be clearly defined. Conclusive study findings typically have specific applications. Conclusive research design allows for the verification and quantification of exploratory study findings.

- Decision making

A conclusive research design typically employs quantitative data collection and analysis methods. Furthermore, conclusive studies are typically deductive in nature, with research objectives achieved through the testing of hypotheses.

- Deductive approach

Conclusive research design is classified into three categories:

- **Diagnostic research design**

Diagnostic research is conducted to establish whether two or more variables are associated and to determine the degree to which the variables are associated. For example, a study may be carried out to find if there is any association between tourism package preference and purpose of visit. Diagnostic research design is employed to examine the factors and variables that impact a particular situation or condition. The correlation between the variables are also identified through diagnostic research.

- Association between variables

- **Descriptive research design**

Descriptive research is used to answer questions such as "what", "when", "where", and "how", rather than "why". It is a type of research that describes a population, situation, or phenomenon. Descriptive research is conducted to the following objective:

* To describe the characteristics of relevant group like a tourist, investors etc..

- Describes the characteristics

* To study or estimate the proportion of people in a particular population who hold certain specific attitudes, opinions etc. e.g., number of people who are in favour of the Contributory Pension Scheme.

* To make predictions about a specific phenomenon e.g., what will be the growth of online trading among people.

- **Experimental research design**

Experimental research is a scientific method of conducting research in which one or more independent variables are manipulated and applied to one or more dependent variables in order to determine their effect on the latter. The effect of independent variables on dependent variables is typically observed and recorded over time to assist researchers in reaching a reasonable conclusion about the relationship between these two variable types. Experimental research is conducted to study the cause and effect relationship between variables under study.

- Cause and effect relationship

Types of experimental design

Experimental designs can be classified in four categories.

a. Pre-experimental research design

In a pre-experimental research design, one or more dependent groups are observed for the effect of an independent variable that is assumed to cause change. It is the most basic type of experimental research design and has no control group.

- One or more dependent group

Although very practical, experimental research is lacking in several areas of the true-experimental criteria. The pre-experimental research design is further divided into three types:

- **One-shot case study research design**

Only one dependent group or variable is considered in this type of experimental study. The study is conducted after some treatment that is expected to cause change, making it a post-test study.

- One dependent variable

- **Before-and-after without control design or One-group pre-test-post-test research design**

This research design combines a post-test and a pre-test study

by administering a test to a single group both before and after the treatment is administered. The former is given at the start of treatment and the latter at the end.

- Before after treatment

- **Static-group comparison**

  In a static-group comparison study, two or more groups are observed, with only one of the groups receiving treatment while the others remain static. All of the groups are post-tested, and the observed differences between the groups are attributed to the treatment.

- Post tested group

b. Quasi-experimental research design

The term "quasi" means partial, half, or pseudo. As a result, quasi-experimental research resembles a research but is not the same as true experimental research. In quasi-experiments, the participants are not randomly assigned, and as such, they are used in settings where randomisation is difficult or impossible. This is common in educational research, where administrators are unwilling to allow students to be chosen at random for experimental samples. Time series, no equivalent control group, and counterbalanced designs are all examples of quasi-experimental research designs.

- Impossible randomisation

Quasi- experiment designs consists of

- **Time- series design**

  This involves pre-testing and post-testing of subjects at different intervals. The aim of this design could be to determine the long-term effect of the treatment, hence measurement is taken over a period of time.

- Long term effect

- **Multiple time series design**

  The main difference between this design and the previously described time series design is the addition of a control group in addition to an experimental group that is exposed to treatments. Following that, multiple post-treatment test scores are collected from both groups.

- Control group

c. True experimental research design

To prove or disprove a hypothesis, a true experimental research design relies on statistical analysis. It is the most accurate type of experimental design and can be performed on at least two randomly assigned dependent subjects with or without a pre-test. A true experimental research design must include a control group, a variable that can be manipulated by the researcher, and a random distribution.

- Statistical analysis

True experimental design is classified as follows:

- **After-only with control design or Post-test-only control**

group design

In this design, subjects are randomly selected and assigned to the 2 groups (control and experimental), and only the experimental group is treated. After close observation, both groups are post-tested, and a conclusion is drawn from the difference between these groups.

- Post tested experiment and control group

- **Before-and-after with control design or Pre-test - post-test control group design**

For this control group design, subjects are randomly assigned to the 2 groups, both are presented, but only the experimental group is treated. After close observation, both groups are post-tested to measure the degree of change in each group.

- Only experiment group is treated

- **Solomon four-group design**

This is the combination of the pre-test-only and the pre-test – post-test control groups. The Solomon four-group design is a research design commonly used in experimental studies to address potential confounding variables and enhance the internal validity of the research findings. It involves four different groups of participants, each assigned to a specific condition within the study.

- Minimise the effect of pre-testing

d. Statistical design

Statistical design permits the researcher to measure and eliminate the effect of extraneous variables. In statistical design a 'block factor' is introduced. It is the extraneous variable which the research is able to isolate and eliminate its effect.

- Principles of local control

Statistical design is classified in to four:

- **Completely randomised design**

Two experimental design principles were used in this design: the principle of replication and the principle of randomization. It is used when a single independent variable influences the dependent variable. In this design, participants or subjects are randomly assigned to different treatment groups. Each participant has an equal chance of being assigned to any group, ensuring that the groups are comparable at the start of the study. This design is commonly used when the primary interest is comparing the effects of different treatments or interventions on a single outcome variable.

- Principles of replication and principles of randomisation

- **Randomised block design**

In randomised block design, the principle of local control is applied using blocks. Blocks are developed with a variable in mind. The subjects within each block are homogeneous in terms of the chosen variable. This variable is the extraneous

variable that influences the dependent variable even when it is not explicitly stated in the study. An example of randomised block design is a researcher investigating the effects of three different exercise programmes (A, B, and C) on cardiovascular fitness. In this example, the researcher can make age as the blocking variable. The researcher divides participants into three distinct age groups: young adults (18-25 years), middle-aged adults (35-50 years), and older adults (60+ years). Each age group serves as a separate block. Participants are randomly assigned to one of the three exercise programmes within each block. This random assignment guarantees that participants in the fitness programmes for each age group are distributed equally.

- Principles of local control

- **Latin square design**

Latin square design enables the researcher to manipulate two extraneous variables. Each treatment appears an equal number of times in each row and column in any one ordinate position. The latin square design is used when there are multiple treatments or conditions to be compared, while also controlling for potential confounding factors. The design is structured like a grid, with each row and column representing a treatment or condition. Each participant receives one treatment from each row and column, resulting in a balanced distribution of treatments. The latin square design is useful when there are factors other than the treatment of interest that could influence the outcome, such as time, order, or specific sequences of treatments. For example, a researcher aims to examine the effects of three different fertilizers (A, B, and C) on plant growth at three different locations (X, Y, and Z). The latin square design ensures that each fertilizer is used once at each location, and each location is used once with each fertilizer.

- Controls two extraneous variables

The latin square design will be as follows:

Locations Fertilizers

X	A	B	C
Y	B	C	A
Z	C	A	B

- **Factorial design**

Factorial designs are used to measure the effect of multiple independent variables on the dependent variable. Factorial designs, unlike any other statistical design, allow for variable interaction. An interaction occurs when the sum of the effects of two or more variables taken together differs from the sum

- Study the interaction effect

of their individual effects. Consider a study investigating the effects of two factors, A and B, on a dependent variable, C. Factor A has two levels (A1 and A2), while Factor B has three levels (B1, B2, and B3). In this study, researchers would create six distinct experimental conditions or cells to represent all possible combinations of the levels of factors A and B. These conditions would be labelled as A1B1, A1B2, A1B3, A2B1, A2B2, and A2B3. The dependent variable, C, would then be measured or observed within each of these conditions. Thus factorial design helps to identify relationship between the independent and dependent variables and provides insights into the complexities of real-world phenomena.

Summarised Overview

The research design refers to the overall strategy that a researcher chooses to integrate the various components of the study in a coherent and logical manner, ensuring that the researcher will effectively address the research problem. It serves as the blueprint for data collection, measurement, and analysis. It is important to note that the type of design used by the researcher is determined by the research problem, not the other way around.

The function of a research design is to ensure that the evidence obtained enables the researcher to effectively address the research problem as unambiguously as possible. Obtaining evidence relevant to the research problem in social sciences research generally entails specifying the type of evidence required to test a theory, evaluate a programme, or accurately describes a phenomenon. Often, researchers rush into their investigations without giving due consideration to the essential information required to address the research questions effectively. By neglecting these crucial design issues at the outset, the resulting conclusions may lack strength and conviction, ultimately falling short in adequately tackling the overall research problem.

Self- Assessment Questions

1. What is termed as the blueprint of research work? Explain its importance.
2. Which research design enables the researcher to manipulate two extraneous variables? Explain.
3. Explain multiple time series design.
4. Explain the research design that determines the long term effect of the treatment.
5. What is true experimental research design?

6. What are the types of research design?
7. Write a short note on exploratory research design.
8. Explain the classification of conclusive research design.

Assignments

1. Refer a doctoral thesis on any topic of your interest and analyse the research design of the study. Prepare a brief report explaining the details.
2. How does pricing strategy affect consumer perceptions and buying decisions? Develop a research design to investigate the impact of different pricing strategies (e.g., discounts, bundle pricing, premium pricing) on consumer perceptions of product value and purchase intentions, examining a specific product or market segment in the commerce industry.
3. How are social media influencers impacting consumer buying decisions? Develop a research design to investigate the role and influence of social media influencers in shaping consumer opinions, preferences, and purchase decisions in the commerce industry.

References

1. Tandon, B.C; (1979). *Research Methodology in Social Sciences*. Chaitanya Publishing House.
2. Chawla, D; and Sondhi, N., (2016). *Research Methodology: Concepts and Cases*. Vikas Publishing House Pvt. Ltd.
3. Kevin, S., (2021). *Research Methodology for Social Sciences*. Ane Books Pvt. Ltd., New Delhi.
4. Kothari, C. R., (2004). *Research Methodology: Methods and Techniques*. New Age International (P) Limited.
5. Krishnaswami, O.R., Ranganathan, M., & Harikumar, P.N. (2016). *Research Methodology*. Himalaya Publishing House.
6. Panneerselvam, R. (2014) *Research Methodology*. PHI Learning.

Suggested Readings

1. Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education (8th ed.)*. Routledge.
2. Jhunjhunwala, S. (2018). *Research Methodology: Techniques and Trends*. I.K. International Publishing House.
3. Gupta,S.K. & Praneet Rangi. (2018). *Business Research Methodology*. Kalyani Publishers
4. Sharma R, N & Sharma R.K. (2019). *Research Methods in Social Science.* Atlantic Publishers.
5. Singh A.K. (2017). *Tests, Measurements and Research Methods in Behavioural Sciences*. Bharti Bhawan.

Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

Unit 4

Research Proposal

Learning Outcomes

After learning this unit, the learners will be able to:

- gain insights on the concept of a research proposal
- learn the process of preparing a research proposal

Background

All research endeavours are preceded by a research proposal. It informs the research supervisor (in academic research) or potential sponsoring agency (in case of funded projects) in conceptualising the research idea of proposed research project. The author of a research proposal demonstrates how and why the research is relevant to their field. A research proposal also demonstrates that the author is capable of carrying out the research and making a significant contribution to the current state of their field. The research proposal reveals what the researcher is proposing to do, how the researcher plans to proceed, and how the researcher justifies the research strategy.

Keywords

Research Proposal, Literature survey, Research gap, Research design, Bibliography, Appendices

Discussion

1.4.1 Research Proposal

A research proposal is an outline, or rough plan, of the researcher's proposed research work. A research proposal is also termed as a synopsis. It contains a statement of the problem,

the proposed methodology, the benefits of the research and the resource required to conduct the research. The proposal is the result of continuous revision in response to constructive criticism and suggestions from experts.

- Draft plan

Research proposals are written for a variety of reasons, including requesting funding for the research they describe, meeting research certification requirements, as a task in tertiary education, or as a requirement for employment at a research institution.

- Purpose of research proposal

1.4.2 Process of Preparation of Research Proposal

The primary goal of a research proposal is to persuade the reader of the project's value. The researcher must demonstrate that he/she has a work plan and that his/her project will be successful. The following are the steps to writing a research proposal:

- Work plan

a. Determine the area of research

The first and most basic step is to select a general study topic or subject area to investigate. Researchers should take care that the problem should be one which can be clearly identified and formulated. Further, while choosing the research area the researcher should look into the availability of information relevant to the topic.

- Selection of broad area

b. Literature survey

In the second stage, researchers must read as much literature as possible on the general topic. Take notes and summarise the purpose and findings of each study. It is also possible for the researcher to get in touch with people who have authorised books or conducted research relevant to this area of study. The researcher can either access a bibliographic database which displays only the bibliographic citations like name of author, title of the book, publisher, year, volume and page number. He can also use an abstract database which along with bibliographic citation also provides him with an abstract of the article. The researcher can also use full text databases which contain the entire text.

- Extensive literature review

c. Identification of research gaps

The previous step's goal is to determine what studies have already been done on the subject of the research proposal and then identify any obvious gaps in the literature. Determine where the researcher can add to the existing body of knowledge.

- Choosing unexplored area

d. Make a purpose statement

The research proposal's goal is to sell the idea to the funding agency. At this stage, the researcher must explain why he is investigating this topic, what he intends to do, and why others should be interested in his research. This is known as a purpose

- Formulate research purpose

statement.

- Construct research inquiries and hypotheses

e. Formulate a question and hypotheses

Following that, the researcher should develop a research question and hypotheses for his study. The hypothesis is a predictive statement which is made in the light of the available facts relating to the problem under study. The research hypotheses determine what will be investigated and what will be found in the study. They are the supposed answers to the research question.

- Introduction composition

f. Write an introduction

The components should be included in the introduction to the research proposal that the researcher created during the previous stages: a problem statement, a brief description of the literature gap, a purpose statement, and a research question.

- Methodology overview

g. Define method of study

In this section, the researcher should outline the procedures he intends to use to complete the proposed study. In general, the section includes an explanation of the research design as well as some information on the data collection process.

- Designing research approach

h. Define research design

Outline the research design for the academic research proposal. A research design is a method for answering a research question through the use of empirical data. Making decisions about the overall aims and approach, the type of research design the researcher will use, sampling methods or criteria for selecting subjects, and data collection methods are all part of creating a research design.

- Primary and secondary sources

i. Data collection procedures

Describe how the researcher will collect the data in this section. Explain the procedure for collecting data and reporting the results. There are two sources of data i.e., primary and secondary data. Primary data refers to the collection of data by the researcher for the first time whereas secondary data is the data that has already been collected through primary sources and made readily available for researchers to use for their own research.

- Schedule and finances

j. Provide a timeline and budget

At this stage, researchers need to give some information on the estimated budget and schedule of the research. Notes on the funds required are listed in this section. It is important to include this section if the researcher is applying to a funding body.

The schedule should state all the aspects of the project, their time tables and the milestones that signify the completion of the project. This section will describe the sequence of activities necessary to conduct the research.

k. Bibliography

A bibliography citing all the relevant literature is included at the end of the proposal. The bibliography should include the full reference documentation for all articles and texts mentioned in the proposal.

- Comprehensive referencing

l. Appendices

Appendices section should be used to provide secondary information that is relevant to the research project. It may include a glossary of terms used in the research proposal. Glossary becomes important when many new and technical terms have been used in the proposal.

- Supplementary information

Summarised Overview

The research proposal is an opportunity to explain the significance of research work to those who may wish to fund or otherwise support it. Ideally, it will demonstrate the quality and significance of the research, as well as the researcher's ability to carry out the proposed research. The proposal also allows the researcher to think through the research project, refine their focus, and anticipate any challenges that may arise. Referring back to the proposal at various stages of the research process may be useful for refocusing and tracking how the project has progressed.

Self- Assessment Questions

1. What is a research proposal?
2. What is termed as the synopsis of research work?
3. Explain the process involved in the preparation of a research proposal.
4. What are objectives of preparing a research proposal?
5. Which part of the research proposal cites all the relevant literature?
6. Elucidate the use of 'purpose statement' in research proposals.
7. What do you mean by bibliography?
8. What is an appendix in research?

Assignments

1. Perform a literature review on the area- 'The impact of social media on mental health and well-being' and summarise the current understanding on the subject matter. Develop a research proposal also in that area.
2. Formulate a research question that you wish to investigate, ensuring that it is clearly stated, specific, and can be feasibly addressed through research.
3. Create a brief literature review by summarising key findings from at least three relevant sources. Highlight the main points of each source and identify common themes or gaps in the literature.

References

1. Tandon, B.C; (1979). *Research Methodology in Social Sciences*. Chaitanya Publishing House.
2. Chawla, D; and Sondhi, N., (2016). *Research Methodology: Concepts and Cases*. Vikas Publishing House Pvt. Ltd.
3. Kevin, S., (2021). *Research Methodology for Social Sciences*. Ane Books Pvt. Ltd., New Delhi.
4. Kothari, C. R., (2004). *Research Methodology: Methods and Techniques*. New Age International (P) Limited.
5. Krishnaswami, O.R., Ranganathan, M., & Harikumar, P.N. (2016). *Research Methodology*. Himalaya Publishing House.
6. Panneerselvam, R. (2014) *Research Methodology*. PHI Learning.

Suggested Readings

1. Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education (8th ed.)*. Routledge.
2. Jhunjhunwala, S. (2018). *Research Methodology: Techniques and Trends*. I.K. International Publishing House.
3. Gupta,S.K. & Praneet Rangi. (2018). *Business Research Methodology*. Kalyani Publishers
4. Sharma R, N & Sharma R.K. (2019). *Research Methods in Social Science.* Atlantic Publishers.
5. Singh A.K. (2017). *Tests, Measurements and Research Methods in Behavioural Sciences*. Bharti Bhawan.

Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

02 BLOCK

POPULATION AND SAMPLE STUDY

Block Content

Unit 1

Sampling Theory and Techniques

Learning Outcomes

After completing this unit, leaners will be able to;

- learn about population and sampling
- discuss various theories of sampling
- gain insights on the sampling techniques
- differentiate random and non-random sampling techniques

Background

Imagine you want to know the opinion of all the students in your school about their favourite subjects. The entire group of students is called the population. However, interviewing every student would be time-consuming and impractical. Instead, you can select a smaller group of students, called a sample, and gather their opinions. By analysing the data collected from sample, you can make educated assumptions about the preferences of the entire population. Proper understanding of sampling theories helps researchers to select an appropriate sample that reflects the population's characteristics. It allows researchers to gather information efficiently and draw meaningful conclusions.

Keywords

Population, Sample, Random Sampling, Non-Random Sampling

Discussion

2.1.1 Population

- Aggregate of units

Population refers to the entire group or collection of subjects relevant to a particular study. It represents the target group to which the study's findings are meant to be applied. For instance,

in the given examples, the total amount of rice in a pot and the overall volume of blood in a person's body would be considered the population.

To study the population effectively, researchers can choose from two methods, depending on their feasibility. One approach involves taking a representative sample from the population for the study instead of examining every single unit. For instance, when testing blood sugar levels in a glucometer for diabetics, only a few drops of blood are used instead of draining the entire blood from the body. On the other hand, when determining the average height of students in a class of 100 students, all 100 students' heights are considered for the study. In this case, the entire population is examined rather than using a representative sample.

- Universe of study

2.1.2 Census and Sampling

Census and Sampling are the two main techniques to identify respondents.

2.1.2.1 Census

A census is when we count and collect data from every single person or thing in a population. However, doing a census for a large population can be difficult because it takes a lot of time and money. That's why we usually only do a census once every ten years.

Even though a census seems like it would give us the most accurate information since we're counting everything, it's not always practical. Sometimes, small errors or biases in the data can become magnified when we have a lot of observations. And there's no easy way to check for these errors or biases without redoing the entire census or doing sample checks. Because of these challenges, researchers often use a different method called sampling. Instead of counting everyone, they take a smaller group, called a sample, and study them. By studying this smaller group, they can make predictions and understand the larger population without the huge time and resource investment of a census.

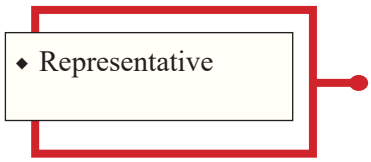
- Complete enumeration

2.1.2.2 Sampling

In order to reach the conclusion about a phenomenon, we need to analyse bit by bit and then render a statement. When it comes to a simple household decision like checking if rice has been cooked properly, it is common practice to take a small sample of two or three grains of rice to test instead of examining every single grain in the pot. It is not always necessary to check each and every item as a whole (which is popularly known as population) to understand its characteristics or reach a conclusion or opinion about the same, rather a representative part (known as sample) can be effectively

- Drawing conclusions

taken to analyse the population.



The technique of choosing or adopting a representative part of the population for the purpose of data collection to facilitate research is known as sampling. The representative part is known as a sample and each element in the sample is known as the sample unit. The sample selection process or technique is called sampling and the survey conducted on the basis of sample is described as sample survey.

Characteristics of a good sample

The quality of the sample decides whether the outcome of the research is reliable or not. Hence, while choosing the sample one must keep the following points in mind.

- Should ensure that the sample is true representative of the population.
- Should be unbiased in order to be accurate.
- Should be capable of giving a precise estimate free from errors.
- Should be of adequate size in order to yield reliable results.

Advantages

- Sampling helps in saving time
- Sampling helps in saving cost
- It helps to give reliable result
- It is necessary when population is infinite
- It is necessary when study of an item causes its destructions

Disadvantages

- Sample surveys should be carefully planned and executed. Otherwise, the result obtained may be inaccurate.
- It requires the service of experts. In their absence, information from samples may not be relied upon.
- If information is required for each and every unit, it cannot be applied.
- The chances of errors and bias affects the reliability of results.

2.1.3 Sampling Theories

There are two fundamental principles that play an important role in understanding the behaviour of population. They are Law of Inertia of Large Numbers and the Law of Statistical Regularity.

2.1.3.1 Law of Inertia of Large Numbers

- Sample convergence

The law of inertia of large numbers states that as the sample size increases, the sample mean becomes closer to the population mean. The Law of Inertia of Large Numbers suggests that when we analyse a larger sample, the individual variations will have only a less influence on the overall result. Thus, we get a more reliable estimate or average that reflects the true characteristics of the entire population we are studying.

2.1.3.2 Law of Statistical Regularity

- Randomness and representativeness of sample

The statistical regularity principle states that if on an average the sample chosen is a random one, the sample will have the same composition and characteristics as the universe. The statistical regularity principle in sampling is a concept in statistics that says when we take a random group of items from a larger group, the smaller group will typically have similar patterns and characteristics as the larger group. This principle forms the basis for various statistical inference techniques used in research and data analysis. This is the reason why random sampling is considered as the best technique of selecting a representative sample. Statistical regularity implies that certain statistical properties observed in the sample, such as means, variances, or correlations, are likely to approximate the corresponding parameters of the population. This assumption allows researchers to make generalisations or draw inferences about the population based on the observed sample data.

2.1.4 Sampling Techniques

There are two types of sampling techniques:

- Random Sampling or Probability Sampling
- Non- Random Sampling or Non-Probability Sampling

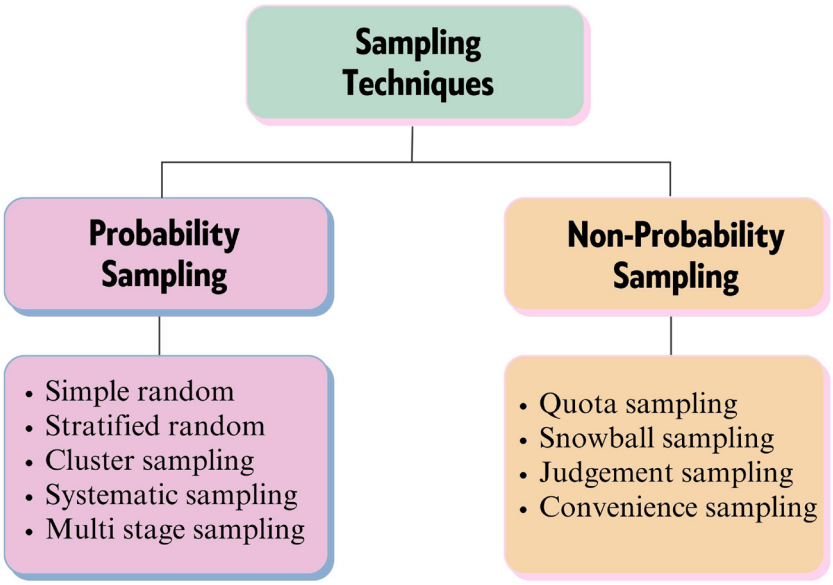


Fig 2.1.1 Sampling techniques

2.1.4.1 Random Sampling

- Equal chance of selection

This technique implies that every unit in the population has an equal and non-zero chance of being selected. There is no bias on the part of the researcher and the sample selected is at random. For example, if a teacher tries to select five students for a task from the list of students in the class without any prejudice, every student has an equal chance of being selected. This would be a representative sample which can be generalised to the population. By reducing sampling bias, more closeness to the population can be ensured. Random sampling is also known as Probability Sampling.

Types of random sampling

A. *Simple random sampling*

- Equal and independent chance

This is the easiest way of random sampling, where samples are chosen effortlessly. Each item has an equal chance of being included in the sample. For example, in a class of 50 students, we can easily select 10 students using simple random sampling. When dealing with an infinitely large population, each item in the random sample is chosen with the same probability, and each selection is independent of the others. Simple random sampling consists of Lottery method and random number table method.

a. Lottery method

The lottery method is a simple random sampling technique used to select a sample from a population. In the previous example,

if 50 sample students have to selected from the whole school comprising of 500 students, we write the names or roll numbers of all students in each class on chits and put them in a box. Then we drew 50 chits from it constitutes samples. This method works well when we have a proper sample frame like a nominal roll of students or a payroll of employees.

If we draw chits and put them back for another chance, it's called unrestricted random sampling. If we draw chits and don't allow them to participate again, it's restricted random sampling.

- Unrestricted and restricted random sampling

b. Random numbers table method

Kendall and Smith (1939) Fisher and Yates (1963) and Tippet (1927) developed a table of random numbers. We can select samples by reading numbers within a given range of the frame. A random number table is a series of digits (0 to 9) arranged randomly in rows and columns, as demonstrated in the small sample shown below.

Table of Random Numbers

36518	36777	89116	05542	29705	83775	21564	81639	27973	62413	85652	62817	57881
46132	81380	75635	19428	88048	08747	20092	12615	35046	67753	69630	10883	13683
31841	77367	40791	97402	27569	90184	02338	39318	54936	34641	95525	86316	87384
84180	93793	64953	51472	65358	23701	75230	47200	78176	85248	90589	74567	22633
78435	37586	07015	98729	76703	16224	97661	79907	06611	26501	93389	92725	68158
41859	94198	37182	61345	88857	53204	86721	59613	67494	17292	94457	89520	77771
13019	07274	51068	93129	40386	51731	44254	66685	72835	01270	42523	45323	63481
82448	72430	29041	59208	95266	33978	70958	60017	39723	00606	17956	19024	15819
25432	96593	83112	96997	55340	80312	78839	09815	16887	22228	06206	54272	83516
69226	38655	03811	08342	47863	02743	11547	38250	58140	98470	24364	99797	73498
25837	68821	66426	20496	84843	18360	91252	99134	48931	99538	21160	09411	44659
38914	82707	24769	72026	56813	49336	71767	04474	32909	74162	50404	68562	14088
04070	60681	64290	26905	65617	76039	91657	71362	32246	49595	50663	47459	57072
01674	14751	28637	86980	11951	10479	41454	48527	53868	37846	85912	15156	00865
70294	35450	39982	79503	34382	43186	69890	63222	30110	56004	04879	05138	57476
73903	98066	52136	89925	50000	96334	30773	80571	31178	52799	41050	76298	43995
87789	56408	77107	88452	80975	03406	36114	64549	79244	82044	00202	45727	35709
92320	95929	58545	70699	07679	23296	03002	63885	54677	55745	52540	62154	33314
46391	60276	92061	43591	42118	73094	53608	58949	42927	90993	46795	05947	01934
67090	45063	84584	66022	48268	74971	94861	61749	61085	81758	89640	39437	90044
11666	99916	35165	29420	73213	15275	62532	47319	39842	62273	94980	23415	64668
40910	59068	04594	94576	51187	54796	17411	56123	66545	82163	61868	22752	40101
41169	37965	47578	92180	05257	19143	77486	02457	00985	31960	39033	44374	28352
76418												

Fig 2.1.2 Random Numbers Table

The table usually contains 5-digit numbers, arranged in rows and columns, for ease of reading.

- Assume you have the test scores for a population of 200 students. Each student has been assigned a number from 1 to 200. We want to randomly sample only 5 of the students for this demo.
- Since the population size is a three-digit number, we will use the first three digits of the numbers listed in the table.
- Without looking, point to a starting spot in the table. Assume we land on 75635 (3rd column, 2nd entry).

- Series of digits arranged in rows and columns

- This location gives the first three digits to be 756. This choice is too large (> 200), so we choose the next number in that column. Keep in mind that we are looking for numbers whose first three digits are from 001 to 200 (representing students).
- The second choice gives the first three digits to be 407, also too large. Continue down the column until you find 5 of the numbers whose first three digits are less than or equal to 200.
- From this table, we arrive at 070 (07015), 038 (03811), 045 (04594), 055 (05542), and 194 (19428).
- RESULT: Students 38, 45, 55, 70, and 194 will be used for our random sample.

B. *Stratified random sampling*

- Heterogeneous strata with homogeneous elements

This is similar to simple random sampling but the population is first divided into groups which possess similar characteristics known as 'strata'. Sample is drawn from each stratum to constitute a representative sample. For example, a class of 50 students can be divided based on gender as boys (20) and girls (30) then this sample would be 6 and 9 respectively if we are to take 30 percent as sample.

All the sub groups have a chance of being selected thus making the sample more representative. Higher statistical efficiency is ensured and it is easy to carry out. Whereas to adopt stratified sampling the researcher has to know the composition of the population so as to effectively form strata. This is comparatively expensive and time consuming than simple random sampling. Also, there are chances of classification errors while building up strata.

- Proportionate and disproportionate stratified sampling

Stratified samples can be taken in two ways: one is to take proportionate samples from each of the strata (like in earlier example 6 and 9). This is called proportionate stratified sampling.

The other method is to take an equal number from each stratum irrespective of strata's shares (like 10 boys and 10 girls). This method is called disproportionate stratified sampling.

C. *Systematic sampling or fixed interval method*

This method considers every k^{th} item from the population as a sample after a random start. For example, if an employer wants to take a survey of 30 employees from a group of 350, then he can divide 350/30 and the quotient he gets would be 11.6 (ignore the fraction and consider the integer or whole number). So he can take either 11 or 12 as the k^{th} item. Then the first sample must be drawn randomly from the sample frame. Say if he gets 14 then the 14^{th} employee in the roll will be taken as the first sample. Then 25 (14+11), 36 (25+11), 47 (36+11)... and so on till the required number 30 is reached. The interval for selecting samples is fixed (that is, the quotient calculated) and hence this method is also known as fixed interval method.

- Every kth item after a random start

This method is simple, less time consuming and cheaper. It is also easy to understand and execute. As the sample is drawn from a chronologically arranged frame it gives a highly representative sample.

D. *Cluster sampling*

When we have a scattered population, cluster sampling method can be used. This involves dividing the population into different clusters which are homogeneous and then choosing samples systematically. Elements within each cluster are heterogeneous. Suppose we need to select banks all over Kerala. We can divide the geographical region of Kerala into 3 as northern, central and southern clusters and then choose the required number of samples from each cluster. This provides a chance for all units to be selected in particular regions.

- Homogeneous clusters with heterogeneous elements

This differs from stratified sampling as the clusters are the sampling elements and strata the population element. Clusters are made on geographical areas but strata are based on demographic variables. Strata yield higher representative samples than clusters and sampling error is comparatively less in stratified sampling.

Cluster sampling is well suited when there is a large population or larger geographical area to be covered. This method involves lesser cost. Easy replacement of units is possible from the same random section. The varying size of clusters can be a matter of concern.

- Cluster- geographical area
- Strata- demographic variables

Area sampling

This is a form of cluster sampling which is used in large field surveys. Geographical areas like city, blocks, village, taluks, districts etc. are selected as samples. Hence it is called area

sampling. Under area sampling we first divide the total area into a number of smaller non-overlapping areas, generally called geographical clusters, then a number of these smaller areas are randomly selected, and all units in these small areas are included in the sample. Area sampling is helpful where we do not have the list of the population concerned. It also makes the field interviewing more efficient since interviewer can do many interviews at each location. In a study where we are trying to find out socio-economic status in a Taluk, then we need to take the map of the Taluk and lay out a grid with lines of equal intervals. Say if we get 50 equal squares that mean we have 50 areas. We can exclude non-residential areas in the area. Put sequential numbers to all other squares. Make a house count in each area, say 40 households and the total sample required is 320. In this case, we need to study 8 squares (area) {320/40=8}. If we study all the households in these 8 areas we can attain the required sample.

- Based on geographical areas

E. *Multi stage sampling*

Where sampling is carried out in multiple numbers of stages it is called multi-stage sampling. In order to draw the final sample, a researcher does a stage-by-stage selection and finally arrives at the required number of respondents. This is a further development of the idea of cluster sampling. This technique is meant for big inquiries extending to a considerably large geographical area like an entire country.

- Multiple stages

For example, in a study of employees in the service sector in Kerala, the researcher in the first stage may select the service sector which he intends to study, say banks and insurance. At the next stage, the kind of institutes are identified, say National, State or local banks and then at the third stage, the respondents are selected from the institutions identified at the second stage. This method helps in identifying samples very systematically covering the entire population. It saves time, money and labour as it can concentrate on small areas.

2.1.4.2 Non- Random Sampling or Non-Probability Sampling

- Unequal chance for selection

When probability sampling ensures equal chance for each element to be selected, non-probability sampling doesn't offer equal chance of selection to each element in the population. There are various methods adopted under this technique discussed as under.

A. *Purposive or judgement sampling*

Under this method the researcher fixes a predetermined criteria and selects a sample which matches the said criteria alone as sample. The selection of the sample depends on the judgement of the researcher. For example, a teacher may select only those who he/she thinks would be aspiring for CA in order to conduct

a study about CA aspiration of commerce students. Here the entire class doesn't have an equal chance of being selected; rather only those who have hinted such an interest earlier have become part of the selection based on the judgement of the teacher. This method is costly and it makes sure those elements that have the desired characteristic fall as samples. But this may not be a true representative of the population and hence cannot be effectively generalised. Also, thorough knowledge of the characteristics of the element is necessary to make a decision of inclusion.

- Based on predetermined criteria

B. *Convenience sampling*

As the name suggests this is the most convenient technique of sampling where we happen to take samples as those who come across by chance. In a study about college, students in one's own college would be considered by the researcher rather than reaching out to other institutions. This was a convenient selection where there is high non-probability. The sample is taken by chance and hence is also known as accidental sampling.

- Selecting samples which come across by chance

This method can be used when we have an infinite population or where we do have a clearly defined population. In order to get an idea about the population, this method can be used. This method does not require a frame, expertise or expense. This is a highly biased and least reliable method of sampling.

C. *Quota sampling*

Quota sampling is a non-probability sampling technique used to create a sample that reflects specific characteristics of the population. Instead of randomly selecting individuals, the researcher sets predetermined quotas for different subgroups based on certain characteristics (e.g., age, gender, ethnicity) and then selectively samples individuals within each quota until it is filled. Quota sampling is often used in situations where it is challenging to implement random sampling, but the researcher still wants to ensure representation of different groups in the sample.

- Sampling based on quotas

Here's an explanation of quota sampling with an example:

Suppose a researcher wants to conduct a survey on a college campus to understand students' preferences towards different food options in the cafeteria. The college has a total student population of 5000, with various characteristics such as age and Discipline. The researcher wants to ensure the sample reflects these characteristics in the same proportions as the entire student population.

Step 1: Identify quota categories - The researcher decides to use two quota categories: age and discipline. For age, the researcher wants 60 percent of the sample to be from students aged 18-20 and 40 percent from students aged 21-23. For the discipline, the researcher wants the sample to have the same distribution as the

- Identify quota categories

overall student population (e.g., 20% law, 30% science, 50% arts).

- Selecting the sample

Step 2: Selecting the sample - The researcher starts selecting participants within each quota category. They may approach students on campus and ask questions to determine their age and discipline. Once they find a student who meets the criteria of a specific quota category (e.g., a 20-year-old law student), they include that student in the sample. The researcher continues this process until they have reached the predetermined quotas for each category.

- Adjustments

Step 3: Adjustments - In quota sampling, if a particular quota category is filled before completing the sample, the researcher might move on to the next category or adjust the selection process to include other participants while still maintaining the overall quotas.

- Sampling based on quotas

In this example, the researcher would continue to collect data until the desired number of participants from each age and discipline category is reached. The final sample will mirror the proportions of the entire student population with respect to age and discipline. It is important to note that quota sampling does not involve random selection and, therefore, does not guarantee a fully representative sample. However, it can be a practical and cost-effective approach when conducting surveys or research studies with specific constraints.

D. Snowball sampling

- Generate lead from few initial respondents

This method collects samples in a fashion as to how a ball rolls, so is a fancy name being given to the sampling technique. A few respondents are initially selected and they provide the lead to other respondents, say for e.g. if the researcher wants to study about the students who opt to study abroad after their graduation, one or two can be initially selected and they would provide names of similar students. The process continues like a snowball rolling downhill, growing in size as more participants are added. This method is often used when the target population is difficult to reach or locate. It is particularly useful for studying rare or hidden populations. There is no probability of all elements being included being the major disadvantage of the method.

Criteria for selecting an appropriate sampling technique

- Problem characteristic

i. Nature of the problem- It involves the specific question the researchers want to study. The choice of sampling technique depends on the nature of the problem. For instance, if the problem requires gathering data from a small population were population list if available, a simple random sampling technique may be more suitable. Whereas if the problem requires a representative sample from various subgroups, a stratified sampling technique might be

appropriate.

ii. Goal of researchers- The researchers' goal is the objective they want to achieve through the study. It could be to estimate a population parameter, compare groups, or understand relationships between variables. The sampling technique should align with the researchers' goal and help them obtain the necessary data to answer their research questions.

iii. Geographical area covered by the survey- The sampling technique may vary depending on whether the survey is conducted in a local area, a specific region, or a nationwide or international scale. The size and diversity of the population in the geographical area will influence the choice of sampling method.

iv. Size of the population under study- The number of individuals in the population being studied is an important factor. If the population is small, researchers may choose to survey the entire population (a census). However, if the population is large, a sample of individuals is typically selected to represent the larger population.

v. Extent of fact available about population- Prior knowledge about the population can help determine the appropriate sampling technique. If there is limited information available, researchers may need to conduct a more comprehensive survey or use a random sampling method to ensure a representative sample.

vi. Availability of funds- Conducting research often requires financial resources. The available budget can impact the choice of sampling technique, as some methods may be more expensive than others. Researchers need to consider the costs associated with recruiting participants, collecting data, and analysing the results. The cost of selecting samples through stratified sampling is higher when compared to quota sampling technique.

vii. Available time for study- The time available for conducting the study can influence the sampling technique. Some sampling methods may require more time to implement, such as selecting a random sample from a larger population, while others may be quicker, such as convenience sampling where readily available participants are chosen.

viii. Desired reliability of the result- Researchers may have a specific level of confidence they want to achieve in the accuracy and generalisability of their findings. Different sampling techniques have different levels of reliability, and researchers need to choose a method that provides the desired level of confidence in the results. The reliability offered by random sampling techniques are more when compared to non-random sampling techniques.

- Research objective
- Scope of the study
- Magnitude of population
- Prior knowledge about population
- Cost considerations
- Time constraints
- Scope for generalisability

Summarised Overview

Population and sample are fundamental concepts in sampling theory. The population refers to the complete group or set of individuals, objects, or events that a researcher wants to study and make inferences about. However, studying the entire population is often impractical or impossible, so a sample is selected as a representative subset of the population.

Sampling techniques can be categorised into random and non-random methods. Random sampling involves selecting individuals from the population in a way that ensures each member has an equal chance of being chosen. This helps to minimise bias and increase the generalisability of the findings. Common random sampling techniques include simple random sampling, stratified random sampling, and cluster sampling. Non-random techniques include convenience sampling, quota sampling, and purposive sampling, which involve selecting individuals based on convenience, specific characteristics, or predetermined criteria. Understanding these concepts and techniques is crucial for obtaining reliable and valid data in research and statistical analysis.

Assignments

1. Imagine you want to know what people think about a new restaurant that just opened in your neighbourhood. How would you select a group of people to ask for their opinions? Would you choose them randomly or based on convenience? Explain your reasoning.
2. You are conducting a study on the reading habits of high school students in your city. How would you select a sample of students to participate in your study? Would you randomly select students from different schools, or would you choose a specific school and sample all its students? Explain your choice.
3. Suppose you are organising a school event and you want to estimate the number of attendees. How would you determine the total number of students in your school? Would you count every single student or select a smaller group to represent the whole school? Explain your approach.
4. Imagine you are a product manager for a new smartphone. How would you estimate the demand for your product in the market? Would you survey a sample of potential customers or interview every single person? Discuss the advantages and disadvantages of each approach.

5. Imagine you want to study the opinions of students about the quality of education at your university. How would you select a sample of students to participate in your study? Would you randomly select students from different departments or use a non-random technique such as quota sampling? Justify your approach.

Self- Assessment Questions

1. What do you mean by population?
2. What is sampling?
3. What are the two methods of collecting data from respondents?
4. What is random sampling?
5. Explain non-random sampling.
6. Explain the differences between Stratified sampling technique and Cluster sampling technique.
7. How does snowball sampling work?

References

1. Tandon, B.C; (1979). *Research Methodology in Social Sciences*. Chaitanya Publishing House.
2. Chawla, D; and Sondhi, N., (2016). *Research Methodology: Concepts and Cases*. Vikas Publishing House Pvt. Ltd.
3. Kevin, S., (2021). *Research Methodology for Social Sciences*. Ane Books Pvt. Ltd., New Delhi.
4. Kothari, C. R., (2004). *Research Methodology: Methods and Techniques*. New Age International (P) Limited.
5. Krishnaswami, O.R., Ranganathan, M., & Harikumar, P.N. (2016). *Research Methodology*. Himalaya Publishing House.
6. Panneerselvam, R. (2014) *Research Methodology*. PHI Learning.

Suggested Readings

1. Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education (8th ed.)*. Routledge.
2. Jhunjhunwala, S. (2018). *Research Methodology: Techniques and Trends*. I.K. International Publishing House.
3. Gupta,S.K. & Praneet Rangi. (2018). *Business Research Methodology*. Kalyani Publishers
4. Sharma R, N & Sharma R.K. (2019). *Research Methods in Social Science.* Atlantic Publishers.
5. Singh A.K. (2017). *Tests, Measurements and Research Methods in Behavioural Sciences*. Bharti Bhawan.

Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

Unit 2

Sample Size

Learning Outcomes

The following outcomes are expected from the learner after going through the unit:

- learn about the concept of sample size and various factors influencing it.
- know the concept of optimum sample size.
- understand various methods for calculating sample size.
- gain insights on sampling errors and biases.

Background

Most of the researches are based on sample data as it is economical and operationally feasible. The research result to be valid and accurate, it is essential that the sample is representative of the population characteristics. For instance, a study is conducted to find out how many people in a state want to pursue Ph.D. as part of their higher education. It is not practical to ask every single person, so you pick a smaller group (called a sample), such as post graduate students from various colleges, to represent the whole state. But how will you decide the number of individuals to be included in that sample? That's where sample size comes in. Understanding sample size considerations and potential errors associated with sampling is vital for conducting valid and trustworthy research. By addressing these issues adequately, research findings better reflect the target population and enhance the overall quality of research outcomes. Hence in research, sampling should be done in more organised and scientific way. This unit aims to provide an insight on the determination of an optimum sample size.

Keywords

Sample size, Optimum sample size, Sampling error, Non-sampling error, Sampling bias

Discussion

2.2.1 Sample Size

There are many myths about the sample size determination like if we take larger samples, we may get accurate results but the fact is larger sample size would help to increase the precision of results not exactly accuracy. There is no fixed sample size but we have references, formulae and concepts to determine the sample size. The number of items to be selected from the universe is known as the sample size. An optimum sample size would be representative of the population. Large samples are considered as 30 or more and less than 30 are known as small sizes. The statistic obtained from a large sample can effectively estimate population parameters.

- Number of items to be selected

2.2.2 Factors Influencing the Sample Size

The following are the factors which influence sample size.

a. Confidence level: It indicates the probability, with which the estimation of a statistical parameter (e.g., an arithmetic mean) in a sample survey is also true for the population. It is the degree of confidence with which we can estimate a population parameter with a sample statistic. It is usually taken as 90 percent or 95 percent.

- Degree of confidence

b. Margin of error: A margin of error shows the percentage that the results will differ from the real population value. The margin of error represents the maximum amount of error you can tolerate in your results. It is usually expressed as a percentage and determines the precision of your estimates. A smaller margin of error requires a larger sample size. For example, a 95 percent confidence interval with a 3 percent margin of error means that your statistic will be within (+/- 3) percentage points of the real population value 95 percent of the time.

- Precision

c. Population variability: The variability or dispersion within the population under study influences the sample size. Higher variability requires a larger sample size to accurately represent the population.

- Dispersion

d. Population size: The population may be known and finite or unknown and infinite. Different approaches are adopted in each case. Larger population size requires a larger sample size to ensure representativeness. The reason is that when the population is large, there is a higher chance of variation and diversity within it. Therefore, a larger sample is needed to capture that variability

- Finite and infinite population

and provide a more accurate representation of the population.

- Level of detailing

e. Complexity of tabulation: The complexity of tabulation refers to the level of detail and complexity involved in organising and summarising the collected data. If the study requires detailed analysis with numerous variables and subgroups, a larger sample size may be needed to ensure an adequate representation of all the categories in the analysis. Larger sample size would lead to complex tabulation when compared to a smaller sample size.

- Challenges with large samples

f. Problem related with collection of data: The collection of data becomes tedious when a large sample size is being fixed, though when done properly an adequate representative of the population can be attained.

- Nature of sampling technique

g. Type of sampling: Random sampling techniques like simple random sampling and cluster sampling etc. requires large samples while restricted random sampling requires smaller ones.

- Population, time, money

h. Basic information and resources: The available knowledge about the population, time and money to conduct the study also plays a role in determining the sample size.

- Expected accuracy

i. Degree of accuracy required for the study: The level of accuracy or precision desired in the study findings can influence the sample size. A higher degree of accuracy typically requires a larger sample size to reduce the margin of error and increase the confidence in the results.

- Statistical tools

j. Nature of analysis: The kind of statistical tools a researcher plans influences the sample size determination. For example, if the analysis involves complex statistical techniques or subgroup comparisons, a larger sample size may be needed to ensure sufficient statistical power and reliable results.

2.2.3 Optimum Sample Size

- Most favourable sample size

The term 'Optimum' means best, most favourable level etc. It is clear from discussions so far that the sample taken should be truly representative of the population. The size should be appropriate enough so that proper analysis is possible. The optimum sample size must be obtained by scientific method. Different formulae available to determine sample size can be made use of. It should be such that it can avoid unnecessary expenses and time consumption. It should be large enough to represent the population and reduce sampling errors. Optimum sample size is required for appropriate analysis, to get the required level of accuracy and to get valid test results.

Optimum Sample size must be-

- ***Efficient***: The sample size must be such that it is efficient

enough to bring out the traits of the population.

- ***Representative***: The sample size must be truly representative of the population.
- ***Reliable***: The sample size must be reliable so that proper analysis is possible.
- ***Flexibility***: The sample size must be flexible so that slight changes could be accommodated without compromising on the results.

- Essentials of optimum sample size

2.2.4 Calculation of Sample Size

- Mathematical estimation

The mathematical estimation of the number of units is known as sample size determination. There are different formulae which are practically used by researchers in finding out the desired sample size. The popular ones are as follows:

i. Krejcie and Morgan's Formula

It is one of the popular methods adopted by researchers. Krejcie and Morgan's formula takes into account three key factors; the size of the population being studied, the desired level of confidence, and the acceptable margin of error.

Krejice and Morgan's sample size determination table can also be used. The table is shown in figure 2.2.1.

Table 3.1

Table for Determining Sample Size of a Known Population

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	346
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	354
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	191	1200	291	6000	361
45	40	170	118	400	196	1300	297	7000	364
50	44	180	123	420	201	1400	302	8000	367
55	48	190	127	440	205	1500	306	9000	368
60	52	200	132	460	210	1600	310	10000	370
65	56	210	136	480	214	1700	313	15000	375
70	59	220	140	500	217	1800	317	20000	377
75	63	230	144	550	226	1900	320	30000	379
80	66	240	148	600	234	2000	322	40000	380
85	70	250	152	650	242	2200	327	50000	381
90	73	260	155	700	248	2400	331	75000	382
95	76	270	159	750	254	2600	335	1000000	384

Note: N is Population Size; S is Sample Size *Source: Krejcie & Morgan, 1970*

Figure 2.2.1 Krejcie and Morgan table for sample size determination

a. ***Sample size for a known or finite population***

The formula for calculation is-

$$n = \frac{\chi^2 NP(1-P)}{e^2(N-1) + \chi^2 P(1-P)}$$

where,

χ^2 = the table value of chi-square on a degree

of freedom at a given confidence level. This is derived from table value.

e = Margin of error

P = Population proportion (it is 50% usually 0.5)

N = Population Size

n = Sample size

Illustration 2.2.1: Calculate sample size if population size (N) is 30000.

Solution:

The confidence level is taken as 95 percent with degree of freedom 1, then the (χ^2) Chi-Square value will be 3.841(taken from table value).

Margin of Error (e) at 95percent confidence level is 0.05

Population Proportion (P) is 50 percent = 0.5

When we substitute the values in the equation,

$$n = \frac{\chi^2 NP\,(1-P)}{e^2\,(N-1) + \chi^2\,P\,(1-P)}$$

$$n = \frac{3.841 * 30000 * 0.5 * 0.5}{[(0.05)^2 * (30000-1)] + 93.841 * 0.5 * 0.5)}$$

$$n = \frac{28{,}807.5}{74.9975 + 0.96025}$$

$$n = \frac{28{,}807.5}{75.95775}$$

Therefore,

n = 379.25 that means 379 samples have to be taken to represent a population of 30000.

b. ***Sample size determination for infinite population***

A pilot study has to be conducted and the values have to be used. To determine the sample size of an infinite population, standard deviation has to be calculated for the main variables and the highest one has to be taken to substitute in the formula (Aday and Cornelius, 2006).

$$n = \frac{Z^2 * p * (1-p)}{e^2}$$

Where,

n = Size of Sample

z = z score associated with level of confidence

p = sample proportion

e = margin of error

ii. Cochran's formula

Cochran's formula is a powerful tool used in statistical research to determine the appropriate sample size for a given study or experiment. Developed by William G. Cochran, a prominent statistician, the formula takes into account factors such as the desired level of confidence, margin of error, and the population size to provide an optimal sample size estimation.

a. Cochran's formula for calculating sample size when the population is infinite

Cochran (1977) developed a formula to calculate a representative sample for proportions as:

$$n_0 = \frac{z^2 pq}{e^2}$$

where,

n_0 = sample size

z = selected critical value of desired confidence level

p = estimated proportion of the population

q = 1-p

e = desired level of precision

For example, in a city, a study has to be undertaken to determine the proportion of people who support a particular political candidate during election. Determine the sample size needed for a 95 percent confidence level with a margin of error of 5 percent. Based on past data, the proportion of people supporting the candidate is assumed to be around 0.5.

The calculation for required sample size will be as follows:

$$n_0 = \frac{z^2 pq}{e^2}$$

z = 1.96 (corresponding to a 95% confidence level)

p = 0.5

q= 1-0.5= 0.5

e = 0.05

$$n_0 = \frac{1.96^2 * 0.5 * 0.5}{0.05^2}$$

$$n_0 = \frac{3.8416 * 0.5 * 0.5}{0.0025}$$

$$n_0 = \frac{0.9604}{0.0025}$$

$$n_0 = 384.16$$

Thus, the result shows that a sample size of approximately 384 individuals to estimate the proportion of people supporting the political candidate in the city.

At 99 percent confidence level with ±5 percent precision, the calculation for required sample size will be as follows-

z = 2.58 (corresponding to a 99% confidence level)

p = 0.5

q = 1-0.5= 0.5

e = 0.05

$$n_0 = \frac{2.58^2 * 0.5 * 0.5}{0.05^2}$$

$$n_0 = \frac{6.6564 * 0.5 * 0.5}{0.0025}$$

$$n_0 = \frac{1.6641}{0.0025}$$

$$n_{0} = 665.64 = 666$$

b. Cochran's formula for calculating sample size when population size is finite

The formula to determine the sample size for finite population is as follows:

$$n = \frac{n_0}{1+\frac{(n_0-1)}{N}}$$

where,

n_0 = Cochran's sample size recommendation

N = Population size

Suppose we want to calculate the sample size for the population of our study where, population size is N =13191.

According to the formula (2.1), the sample size will be 666 at 99 percent confidence level with margin of error equal to (0.05). If $\frac{n0}{N}$ is negligible then n_0 is a satisfactory approximation to the sample size. In this case, the sample size (666) exceeds 5 percent of the population size (13191). So, we need to use the correction formula to calculate the final sample size.

N = 13191

$n_0 = 666$

$$n = \frac{666}{1+\frac{(666-1)}{13191}}$$

n= 634.03= 634

But, if the sample size is calculated at 95 percent confidence level with margin of error equal to (0.05), the sample size become 384 which does not need correction formula. So, in this case the representative sample size for our study is 384.

2.2.5 Errors in Sampling

Research results are always subject to some typical error. Such errors can arise from various sources and have significant implications for the validity and reliability of study findings. Researchers need to consider two main factors that can lead to incorrect inferences: systematic bias and sampling error.

2.2.5.1 Systematic Bias

Systematic bias arises from flaws in the sampling procedures and cannot be reduced or eliminated by increasing the sample size alone. However, by identifying and addressing the causes of these errors, researchers can take steps to detect and correct them, thereby improving the accuracy and reliability of their findings.

- Errors in sampling procedure

Causes of systematic bias

- When the frame from which the samples are collected is incorrect or unsuitable for the purpose, it results in systematic bias.
  - Unsuitable sample frame or source list
- The measuring scale used to measure the variables must be appropriate otherwise will lead to faulty results.
  - Faulty measuring device
- Many respondents hesitate to share information due to various reasons like unwilling to share personal or confidential information, lack of time or laziness to fill in the information. This non response has great implications on the results as it truly affects the analysis.
  - Non response from respondents
- It is not always possible to measure exact inferences about a population which is called indeterminacy principle.
  - Indeterminacy principle
- When the researcher reports the findings making slight changes in the results according to his/ her bias, it results in bias.
  - Usual bias in reporting data

2.2.5.2 Sampling Errors

Sampling errors are random variations in the sample estimate around the true population parameters. Sampling error decreases with the increase in the size of the sample, and it happens to be of a smaller magnitude in case of homogeneous population.

The measurement of sampling error is usually called the 'precision of the sampling plan'. Increasing the sample size can improve precision, but this approach has limitations such as increased data collection costs and potential enhancement of systematic bias. Selecting a sampling design with a smaller sampling error for a given sample size and cost is often a more effective way to enhance precision. Therefore, it is crucial for researchers to carefully consider a sampling procedure that minimises sampling error and effectively manages systematic bias.

- Precision of the sampling plan

Summarised Overview

Sample size refers to the number of individuals or observations included in a study or experiment. The determination of an appropriate sample size is crucial for obtaining accurate and reliable results. Several factors influence the selection of the sample size, including the desired level of precision, the variability of the population, the research design, the available resources, and the statistical methods to be used.

The optimum sample size is the one that gives us the right balance between accuracy and practicality which is determined using statistical formulas or power calculations that take into account factors such as the desired level of significance, effect size, and statistical power. Errors in sampling can happen when the sample doesn't represent the whole group, when there's natural variation, or when some people refuse to participate. Determining an appropriate sample size is crucial for obtaining reliable results. Careful consideration of these factors is necessary to ensure the validity and generalisability of the study outcomes.

Assignments

1. Calculate sample size based on Cochran's formula: N=20000, p=0.5, level of precision is 5 percent, at 95 percent level of confidence.
2. You are conducting a study to investigate the opinions of residents in a city regarding a proposed development project. The population size of the city is 30000. You want to determine the sample size needed for your study with a 95 percent confidence level and a margin of error of 0.05. The population proportion is estimated to be 50 percent. Calculate the sample size required.
3. A study is conducted to analyse the voting preferences of registered voters in a district. The population size of registered voters is 50000. The level of confidence is 99 percent and margin of error is 0.03. The population proportion is estimated to be 0.4. Calculate the sample size required.
4. Differentiate sampling errors and non-sampling errors.
5. Explain how an optimum sample size can be estimated and its relevance.
6. What factors influence the sample size and how?
7. Does the variability of the data affect the sample size? If yes, explain how it affects the sample size.

Self- Assessment Questions

1. What do you mean by sampling error?
2. What is sample size?
3. What are the formulas for computing sample size for a finite and infinite population?
4. What is sampling bias?
5. Explain non-sampling bias.
6. Explain the differences between sampling errors and non-sampling errors?
7. What is optimum sample size?

References

1. Tandon, B.C; (1979). *Research Methodology in Social Sciences*. Chaitanya Publishing House.
2. Chawla, D; and Sondhi, N., (2016). *Research Methodology: Concepts and Cases*. Vikas Publishing House Pvt. Ltd.
3. Kevin, S., (2021). *Research Methodology for Social Sciences*. Ane Books Pvt. Ltd., New Delhi.
4. Kothari, C. R., (2004). *Research Methodology: Methods and Techniques*. New Age International (P) Limited.
5. Krishnaswami, O.R., Ranganathan, M., & Harikumar, P.N. (2016). *Research Methodology*. Himalaya Publishing House.
6. Panneerselvam, R. (2014) *Research Methodology*. PHI Learning.

Suggested Readings

1. Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education (8th ed.)*. Routledge.
2. Jhunjhunwala, S. (2018). *Research Methodology: Techniques and Trends*. I.K. International Publishing House.
3. Gupta,S.K. & Praneet Rangi. (2018). *Business Research Methodology*. Kalyani Publishers
4. Sharma R, N & Sharma R.K. (2019). *Research Methods in Social Science.* Atlantic Publishers.
5. Singh A.K. (2017). *Tests, Measurements and Research Methods in Behavioural Sciences*. Bharti Bhawan.

Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

03 BLOCK

MEASUREMENT AND SCALING

Block Content

Unit 1

Measurement

Learning Outcomes

At the conclusion of this unit, the learner will be able to:

- develop a comprehensive understanding of measurement variables and their importance in research.
- acquire the ability to identify and define attributes accurately for effective measurement.
- gain knowledge and skills in designing and implementing the measurement process.
- develop the ability to recognise and minimise errors in measurement for improved data quality.
- distinguish between qualitative and quantitative, discrete and continuous, and independent and dependent variables.

Background

The life span of different people is different. The grades of the students in the same subjects taught by the same teacher to all of them have not been the same. The temperature at different times of the day has been different. All these examples show that variation in a characteristic is found per unit that possesses it. Therefore, we can say that as a person, an object, or a situation changes, so does the value or proportion of the properties associated with it. Characteristics/objects that can change per unit are called variables. These variables must be measured to obtain different types of information.

In our daily lives, many things are continually measured in different ways for different purposes. We can measure height, weight, length, width, income etc. (quantitative measure) and at the same time we can measure attitude, personality, perception, intelligence, preference (qualitative measure) etc.. In order to draw reliable inference from a study, proper measurement of variables and attributes must be performed by reducing the errors in measurement.

Keywords

Attributes, Qualitative variable, Quantitative variable, Continuous variable, Dependent variable, Independent variable, Measurement

Discussion

3.1.1 Variables

- Something that varies

The term variable comes from the Latin word 'variabilis' which means 'changeable' or 'liable to vary'. In social science research, a study is framed using several variables. A variable is a symbol to which numbers or values are assigned. It must vary, that is, it must take on different values, levels, intensities or states. It can be weight, height, anxiety levels, income, body temperature, etc. Variable is an entity that can take on different values across individuals and over time. They are the characteristics or conditions that can be observed, manipulated or controlled by the researcher. The variable that actually varies provides detailed information to the research situation. In order to convert concepts into variables it should be measurable through scales of measurement. It is important to have an understanding of variables in order to use them correctly and discover relevant and meaningful results from them. It is also useful for understanding and evaluating its application in other studies.

- Quantitative and qualitative

In research, a variable refers to the measurable characteristics, qualities, traits or attributes of a particular individual object or situation being studied. In other words, variables are properties or characteristics of people or things that vary in quality or from person to person or from object to object (Miller & Nicholson, 1976). For example, income can be considered as a variable because income can take different values for different people or for the same person at different times. Variables play an important role in increasing the clarity of the research problem. The variable helps to avoid subjectivity and to generate a real image of the events, phenomena or behaviours that social science researchers are faced with. The study of business research always involves the study of the characteristics of the individual / item / unit. These characteristics are represented by variables. As the name suggests the variable changes values for different people / items at the same time or for the same person / item at different times (individual income, company sales)

3.1.1.1 Classification of Variables

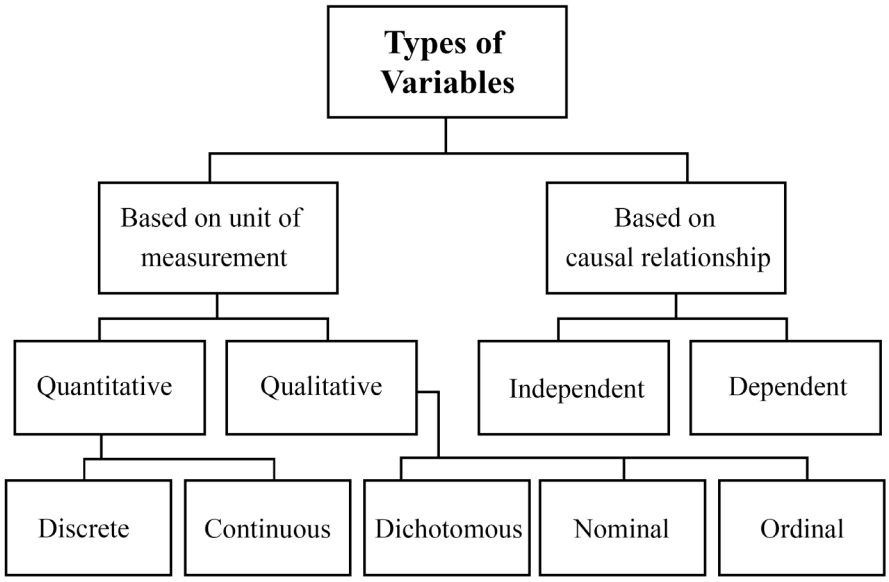


Figure 3.1.1 Types of variables

A. Based on unit of measurement

From the viewpoint of unit of measurement there are two ways of categorising variables, they are:

1. Quantitative Variables

Quantitative variables are those variables that are measured on a numeric or quantitative scale. A quantitative variable represents thus a measure and is numerical. These variables are made up of categories that can be ordered in magnitude, that is, they can exist in greater or lesser quantities. In short quantitative variables are those variables in which the measurements vary in magnitude from trial to trial i.e. some order or ranking can be applied to the levels. Example: income, age, height, weight, population of a country, speed of a car etc.

- Measured on numeric scale

Quantitative variables can again be classified into continuous variables and discrete variables.

a. Discrete Variables

A discrete variable is one that involves a countable number of items. The number of children in a family, the number of women in a particular State, and the number of inhabitants in each town are some of the examples of discrete variables. So the discrete variable consists of whole numbers only. In short, discrete variables are the variables, the values of which are countable and have a finite number of possibilities. In other words, discrete variables can only take a certain individual value.

- Counts or whole numbers

Example: Number of students in a class, Size of shoes (that is it may be 5 but not between 5 and 6) etc.

b. Continuous Variable

- Value within a range

Continuous variables are variables for which data can take on any value in a certain range or interval. The characteristic of a continuous variable is that, its values can vary within the limits and any value is possible. There is no gap in the scales of a continuous variable. They can take any value on the scale on which they are measured.

Example: height, weight.

II. Qualitative Variables/ Categorical Variable

- Represent characteristics

A qualitative variable is a variable that is not numerical and it classifies the data into different categories. It allows the classification of individuals or objects based on some attributes or characteristics. Qualitative variables are those variables which cannot be quantified but their presence or absence will be noticed. Qualitative variables refer to those that cannot be manipulated once the investigation has begun and that consist of categories that cannot be ordered in magnitude. They are ready to use and descriptive in nature. Variables such as colour, gender, religion, marital status etc. are examples.

Qualitative variables can again be classified into Dichotomous, Nominal and Ordinal Variables.

a. Dichotomous Variables

- Two categories

Dichotomous variables are those that have only two possible categories with an assigned value. Although these variables can technically be considered nominal, they are often considered as a special case because their binary nature is an attribute that other measures do not have. Some of the variables used in behavioural research are true dichotomies, that is, they are characterised by the presence or absence of a property: alive/dead, employed/ unemployed. Other examples of two-valued variables are: teacher/ non-teacher, viewers/non-viewers of television, etc..

Example

Athlete	Average point	Position	Won championship
A	15.6	2	Yes
B	12.3	3	No
C	15.8	1	Yes

In the above example, winning the championship is a dichotomous variable, as they have only two answers. While analysing the data, we assign 0 for No and 1 for Yes.

b. Nominal Variable

Variables which can be organised in more than two categories which do not follow a particular order are called nominal variables. Nominal variables are typically measured using labels or codes.

- No order

Example: Blood type, eye colour

c. Ordinal Variable

Variables that can be organised in more than two categories that follow a particular order are known as ordinal variables.

- Follows an order

Example:

Levels of satisfaction- Highly satisfied, Satisfied, Neutral, Dissatisfied, Highly Dissatisfied

B. Based on causal relationship

On the basis of causal relationships, variables can be classified as:

I. Dependent Variable

If one variable depends upon or is a consequence of the other variable, it is termed as a dependent variable. Dependent variables are those variables which change as a result of the introduction or alteration of another variable called the independent variable. Dependent variable is the outcome variable, which is caused, in total or in part, by the input antecedent variable. These variables are expected to change as a result of an experimental manipulation of the independent variable. Other names for dependent variables are measure, response, effect, and outcome variable.

- Depends on another variable

Example: In an examination, score depends upon how much time is effectively spent by the student in his studies. If a student spends more time studying, he will get high scores on the test paper. Here time is the independent variable and score is the dependent variable.

II. Independent Variable

The variable which affects the dependent variable is called the independent variable. An independent variable is the input variable, which causes, in part in total, a particular outcome. Independent variables are those which are introduced, manipulated, measured, observed or controlled by experimenters to study its effect on dependent variables. In other words, a variable which does not depend upon any other variable is known as an independent variable. These variables are stable and unaffected by other

variables we are trying to measure. An independent variable is the presumed cause of the dependent variable, the presumed effect. The independent variable is the antecedent and the dependent variable is the consequent. The independent variable is also called the experimental, manipulated, treatment, cause, and input variable. A variable that is independent in one study may be dependent in another. Take the case of the relationship between farmer's income and water availability. If we take income as the dependent variable and water availability (for irrigation) as the independent variable, the relationship between the two can be shown as: the higher the availability of water, the higher the income and vice versa. But, if we want to show the relationship between income (independent variable) and quality of life (dependent variable), we can say: the higher the income, the higher the quality of life (or standard of living). In the first study, income is the result and in the second study income is the cause.

- Presumed cause of dependent variable

C. Based on cause-and-effect relationship

The variables can be classified as follows based on cause and effect relationship:

I. Mediating Variable/ Intervening Variable

- Intervenes between dependent and independent

Mediating variable explains the relationship between dependent and independent variables. The intervening variable intervenes or mediates between the dependent and independent variable and explains the process by which two variables are related.

Example:

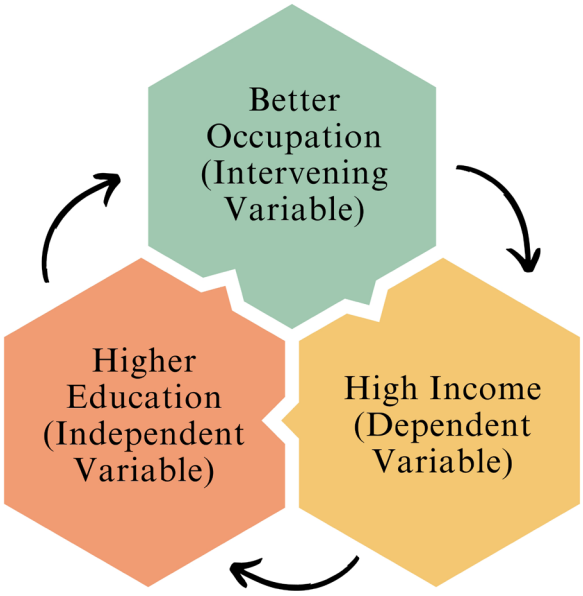


Figure 3.1.2 Mediating Variable

In the above example higher education is the independent variable and high income is the dependent variable. Here better occupation is the intervening variable between the two because it is causally affected by education and it itself affects the income.

II. Moderating Variables

Moderating variables moderate the relationship and affect the strength and direction between independent and dependent variables. It is the degree to which association between the independent variable and dependent variable changes as a function of the third variable moderating variable. The dependent variable may change under different conditions. That condition is called the Moderator variable.

- Affect relationship between variables

Example:

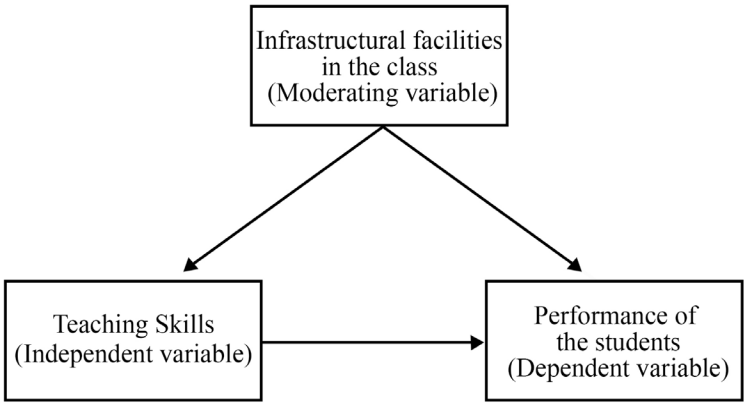


Figure 3.1.3 Moderating Variable

In the above example teaching skill is the independent variable and performance of the students is the dependent variable. Improvement in the teaching skill increases the performance of the students. The relationship between teaching skills and performance of the students is strengthened by the moderating variable infrastructural facility in the class. The relationship will be weaker with low infrastructural facility and higher with good infrastructural facility.

III. Extraneous Variable

In addition to the independent variable, several other factors operating in real-life situations can affect changes in the dependent variable. These factors, not measured in the study, can increase or

- External but influence dependent variable

decrease the magnitude or strength of the relationship between the dependent and independent variables. Extraneous variables are those variables that are not related to the purpose of the study but that may affect the dependent variable. Extraneous variables are factors that affect the dependent variable but that the researcher did not originally consider in the initial stage of research. These unwanted variables can unintentionally change a study's results or how a researcher interprets those results.

Example:

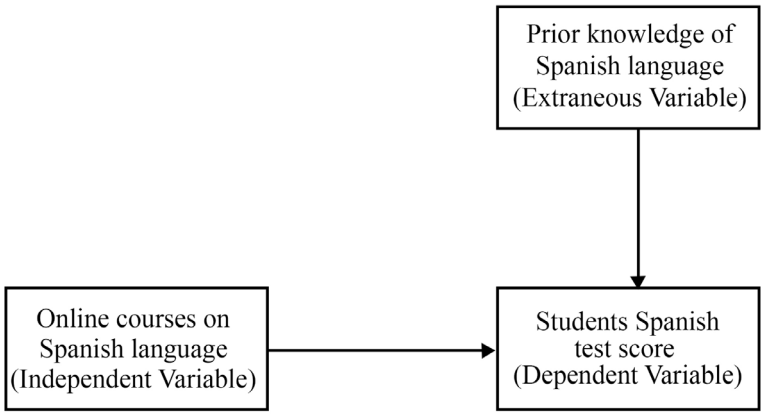


Figure 3.1.4 Extraneous Variable

In the above example Online course is the independent variable and students score is the dependent variable. Here prior knowledge of Spanish language is the extraneous variable that will influence the outcome which was not noticed at the beginning of the study. Extraneous variables affect the strength of the relationship between variables.

IV. Confounding / Lurking Variable

- Affects both variables and invalidate results

Confounding variables are those variables which the researcher did not consider at the time of study. A confounding variable influences both the dependent and independent variable causing an invalid result. Confounding variables can invalidate the research study by making them biased or suggesting a relationship between variables exists when it does not. For example:

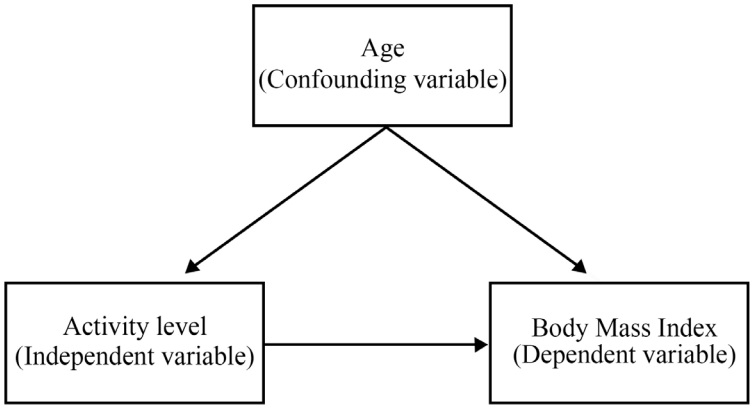


Figure 3.1.5 Confounding Variable

In the above example Activity level is the independent variable and body mass index is the dependent variable. Age is an important variable which will affect the activity level and body mass index. If we are not considering the age's effect on these factors, it becomes a confounding variable that changes the results.

The variable in social science research can be defined in different ways. It is also different from concept and construction, and measurability is the main difference. Variables play an important role in research, without variables it becomes difficult to find relationships and predictions.

3.1.2 Attributes

Attributes are a form of variable that shows the characteristic of an object. Variables are logical grouping of attributes. Attributes represent some quality. An attribute can be the presence or absence of a particular characteristic. Some data are qualitative data with a quality characteristic or attribute that are described in terms of measurements. This category of data is called attribute data. A variety of techniques, including surveys, questionnaires, interviews, and observation, can be used to measure attributes. Demographic data like age, gender, educational attainment, income, and ethnicity as well as psychological or behavioural factors like personality traits, attitudes, beliefs, and habits are a few examples of attributes that may be used in research.

- Characteristics of an object

Similar to that of variables, attributes can also be classified into two based on categories as follows:

- Two categories

- Dichotomous attribute- Those attributes that possess two categories are called dichotomous attributes. For example, when you classify respondents based on their literacy, it can

have two categories- 'Literate' and 'illiterate'.

- More than two categories

- Manifold attribute- Those attributes that possess more than two categories are called manifold attributes. It is also called nominal attributes which does not possess any order. For example, when you classify respondents based on their Age, it can have many categories- 'Young', 'Middle aged', and 'Old'.

Variables and Attributes can be clearly understood from the following information:

Attributes	**Variables**
Characteristics/ qualities that describes some object or person	Logical grouping of attributes
Male/Female	Gender
Teacher, Driver	Occupation
Upper, Middle, Lower	Social class

3.1.3 Measurement

- Assigning numerals or symbols

Measurement involves the process of attributing symbols, letters, or numbers to empirical properties of variables following specific rules. The purpose of measurement is to represent the characteristics of an object using numerical or symbolic values. While certain properties such as weight and height can be directly measured using standard units, other attributes like motivation to succeed or ability to handle stress pose more significant challenges in quantification. When numbers are used, the researcher must have a rule for assigning a number to an observation in a way that provides an accurate description. We do not measure the object but some characteristics or variables of it. Therefore, in research, people/items are not measured, what is measured is only their perception, attitude or any other relevant characteristic. There are two reasons why numbers are usually assigned. One reason is that the numbers allow the statistical analysis of the resulting data. And the other reason is that they facilitate the communication of measurement results.

3.1.4 Process of Measurement

The following is the process involved in measurement:

a. The first and most important step in measurement is learning everything there is to know about the studied subject. A thorough understanding of a subject can be attained by observations, a thorough examination of the literature, and talking to specialists which helps in identifying the concept for the study.

- Concept identification

b. The researcher should learn the key ideas behind their investigation. In theoretical studies as opposed to more practical research, where core notions are frequently already established, this stage of concept formation is more obvious.

- Conceptualisation

c. After gaining a thorough understanding on the concept and its key ideas, the researcher has to specify dimensions of that concept. For example, when a study is conducted to determine the job satisfaction of employees working in a company, various dimensions such as job security, remuneration, opportunities for career growth etc. could be considered.

- Specify dimensions

d. The researcher must create indicators to gauge each concept's component once its dimensions have been determined. When knowledge, opinion, expectations, etc. are measured, indicators are specific questions, scales, or other tools. Since there is rarely a perfect way to quantify a notion, the researcher must take a variety of options into account. The scores are more stable and their validity is increased when more than one indicator is used.

These indicators should then be combined into a single index. By providing scale values for responses and then adding the related scores, it is easy to create an overall index. Due to the fact that a single indication only has a probabilistic association with what we truly want to know, a general index would serve as a better assessment instrument. The broad index of the many concepts relevant to the research investigation should be obtained in this way.

- Formation of index

3.2.5 Errors in Measurements

Despite employing accurate measurement scales when assessing objects or features, errors can still find their way into the process. Implementing a well-designed research methodology allows us to reduce these errors, but complete elimination remains unattainable. Research studies frequently adhere to the GIGO principle, which stands for Garbage In Garbage Out, implying that if inaccurate or flawed data is provided as input, the resulting outputs will be inappropriate or misleading. The errors can be classified as systematic error and random error. Systematic errors

- Systematic error and random error

usually occur due to the bias involved in studies at various levels, namely a) Investigator b) Participants/Subjects/Correspondence c) Implementer/Measurer/Interviewer d) Tool/Instrument. Random error has no pattern or source and are difficult to control.

3.2.5.1 Sources of Errors

The main sources of systematic errors at various levels are as follows:

a. Researcher

Quantitative research is often reliant on the researcher's comprehension of the subject matter because, unlike qualitative research, it offers fewer opportunities to interact with participants and adapt the research design accordingly. As a result, data collection in quantitative research may be prone to investigator bias. The following are some of the typical inquiries that may affect the research study:

- Different perception

A researcher may request particular information for a research study, but the information thought is different. For example, if a research study on credit card earnings that requires collecting data on dependent family members and income earners separately, the researcher may consider consolidated data on all family members. This will introduce errors into the study.

- Improper selection of scales

Error can also be introduced due to improper selection of scales. For example, if a study requests purely numerical data and the researcher uses ordinal data, an error will occur.

- Inappropriate definition of population

Error can also be introduced by an inappropriate definition of the population by the researcher. This is a common problem researcher's face when defining the population. For example, definitions like literate, rural, etc. are difficult to define as definitions may vary from one researcher to another.

b. Participants/ Subjects/ Correspondents

- Respondent's inability to respond

This type of error arises for academic, social, economic, cultural and regional reasons of the respondents, since these factors affect the responses on various topics. The respondent may be reluctant to express strong negative feelings or may have very little knowledge but will not admit their ignorance. All this reluctance is likely to result in a 'guess' interview. Transitory factors such as fatigue, boredom, anxiety, etc. may limit the respondent's ability to respond accurately and completely. The sampling design must allow minimising the impact of such a situation.

c. Implementer/ Measurer/ Interviewer

Errors may arise during interviews due to various factors. For instance, the interviewer may unintentionally alter the question order, change question wording to make it simpler for participants

to comprehend, or modify the form of the questions. Moreover, the interviewer's non-verbal cues, like nodding or smiling while waiting for an answer, can influence respondents and lead to errors in their responses. The interviewer's approach and appearance can also impact how participants answer, either encouraging or discouraging certain types of responses. Additionally, careless handling and processing of data can further distort the overall research findings.

- Interviewer's verbal and non-verbal cues

d. Tool/instrument

Defects in the instrument itself can cause errors. Flaws can be in the form of inappropriate words or language used in questions, wrong order of questions, improperly designed questionnaires, not giving enough choices to respondents, also called omission of response options, which could influence answers and will make measurement difficult. Defective instrument may lead to measurement errors. Another type of instrument deficiency is poor sampling of the universe of items of interest.

- Defective instrument

e. Situation

In addition to the above four levels, there is another source of error, namely "circumstantial". There could be errors due to circumstances such as the presence of someone while answering the questions that could influence the answers. Another circumstantial error is the error that could arise if a participant is not trusted, then he or she might cautiously give responses by suppressing actual responses.

- Circumstantial error

Researchers should be aware that correct measurement depends on successfully solving all of the problems listed above. Researcher should, to the extent possible, try to eliminate, neutralize or otherwise deal with all possible sources of error so that the final results are not affected.

Summarised Overview

This unit dealt with the concept of variables, attributes, process of measurement and on the errors of measurement. In research, a variable is a symbol to which numbers or values are assigned. Variables can be classified into various types based on the unit of measurement, and based on cause and effect relationship. Attributes are a form of variable that shows the characteristic of an object. It can be the presence or absence of a particular characteristic. In order to convert concepts into variables it should be measurable through scales of measurement. Measurement is a procedure for assigning symbols, letters, or numbers to empirical properties of variables according to rules. Measurement is a relatively complex and demanding task, especially when it comes to qualitative or abstract phenomena. Gaining insights on the concept of measurement is essential for the researcher to collect accurate and reliable data and draw inference from them.

Assignments

1. Identify 10 variables to conduct a study on the perception of customers towards the various brands of mobile phones in your district.
2. Find out the attributes for the following variables:

    a. Gender

    b. Income

    c. Education level

3. Imagine you are conducting a survey on people's preferences for different types of food. Create a list of variables (characteristics) that you want to collect from the participants.
4. A study is conducted to identify the factors that influence people's decision to purchase a particular product. Identify two variables: the decision to purchase (yes or no) and the factors that influence the decision. Find out the different factors that might play a role, such as price, brand reputation, or product reviews, and how they might affect the decision to purchase.
5. Develop attributes for the variable 'Age'.

Self- Assessment Questions

1. Explain variables.
2. What is an attribute?
3. What do you mean by measurement?
4. Explain the classification of variables.
5. What are dichotomous variables?
6. What is a categorical variable?
7. Explain the process of measurement.
8. What are the various sources of errors in measurement?

References

1. Tandon, B.C; (1979). *Research Methodology in Social Sciences*. Chaitanya Publishing House.
2. Chawla, D; and Sondhi, N., (2016). *Research Methodology: Concepts and Cases*. Vikas Publishing House Pvt. Ltd.
3. Kevin, S., (2021). *Research Methodology for Social Sciences*. Ane Books Pvt. Ltd., New Delhi.
4. Kothari, C. R., (2004). *Research Methodology: Methods and Techniques*. New Age International (P) Limited.
5. Krishnaswami, O.R., Ranganathan, M., & Harikumar, P.N. (2016). *Research Methodology*. Himalaya Publishing House.
6. Panneerselvam, R. (2014) *Research Methodology*. PHI Learning.

Suggested Readings

1. Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education (8th ed.)*. Routledge.
2. Jhunjhunwala, S. (2018). *Research Methodology: Techniques and Trends*. I.K. International Publishing House.
3. Gupta,S.K. & Praneet Rangi. (2018). *Business Research Methodology*. Kalyani Publishers
4. Sharma R, N & Sharma R.K. (2019). *Research Methods in Social Science.* Atlantic Publishers.
5. Singh A.K. (2017). *Tests, Measurements and Research Methods in Behavioural Sciences*. Bharti Bhawan.

Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

Unit 2

Scaling Techniques

Learning Outcomes

The following are the expected outcomes to the learners from the present unit:

- learn the meaning and techniques of scaling.
- differentiate between Comparative and Non-comparative scales.
- familiarise with the concept of reliability and validity in research.

Background

Measurement is followed by scaling procedure in a research activity. We all are using different types of devices for measurement. For instance, a weighing machine for gauging weight, a stadiometer for quantifying heights, thermometer to measure temperature etc. Similarly in research what we want to measure is not always objects, often we need to quantify qualitative phenomenon like perception,attitudes,preferences etc.Researchers always face the problem of how to measure or quantify abstract concepts and how to relate one individual's response to that with another response. Hence, the problem is two-fold. First is, how to quantify a response in absolute terms, and the second is, how to relate it with other responses. This problem is resolved by scaling process. . It is vital to ensure that the scales used in the instrument are reliable and valid. Understanding of the different types of scales is essential to ensure quality and credibility of your research.

Keywords

Scaling, Comparative scale, Non-comparative scale, Reliability, Validity

Discussion

3.2.1 Scaling

- Group variables in a continuum

A common feature of survey based research is to convert respondent's feelings, attitudes, opinions, etc. into measurable terms. Scaling describes the procedures of assigning numbers to various degrees of opinion, attitude and other concepts. Scaling originated in the social sciences in an attempt to measure or to classify attributes by quantitative methods. Scaling provides a mechanism for measuring abstract concepts. Scales of measurement in statistics are different ways in which variables are grouped to different categories. It describes the nature of the values assigned to the data set variables. A scale is a continuum, consisting of the highest point (in terms of some characteristic e.g., preference, favourableness, etc.) and the lowest point along with several intermediate points between these two extreme points. These scale-point positions are so related to each other that when the first point happens to be the highest point, the second point indicates a higher degree in terms of a given characteristic as compared to the third point and the third point indicates a higher degree as compared to the fourth and so on.

3.2.2 Types of Scales

- Based on order, distance and origin

The scaling technique is a method of placing respondents following a gradual change in pre-assigned values, symbols, or numbers based on the characteristics of a particular object based on defined rules. All scaling techniques are based on four pillars, that is, order, description, distance and origin.

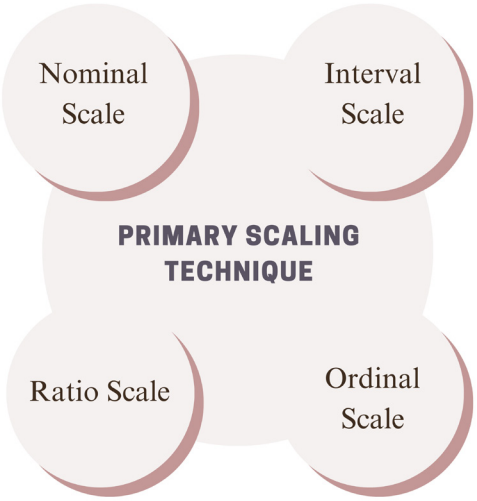


Figure 3.2.1 Primary scaling techniques

Nominal scale

The nominal scale is the simplest form of measurement. It is simply a system of assigning numerical symbols to events to label them. It is the grouping of objects or people without any specific quantitative relationship between the categories. Nominal scales are adopted for the labelling of non-quantitative variables (containing no numerical implications) that are unique and different from each other. Nominal scales classify members of a population into 2 or more categories. The categories must be mutually exclusive and exhaustive, that is, each and every one of the members of the population must be capable of being classified in one and only one category. Nominal scales have no arithmetical properties. No category is greater or less than any other category. Category values are simply names (hence the term nominal). The only mathematical statements that can be made about nominal data consist of relative comparisons between the numbers of members of the population in each category, called proportions.

- Description

In nutshell nominal scale has the following properties:

- The system of empirical relations consists only of different classes. There is no notion of ordering between the classes.
- Any other numbering or symbolic representation of classes is an acceptable measure, but there is no notion of magnitude associated with numbers or symbols.
- It simply labels the objects. Numbers only serve as labels or tags to identify and classify objects (not up, down, better, or worse).
- When used for identification, there is a strict one-to-one match between numbers and objects.
- Figures do not reflect the amount of property an object has.
- Counting is the only possible operation on numbers on a nominal scale.
- Only a limited number of statistical analysis based on frequency numbers are allowed.

- No order, distance, and origin

Example: In which diet do you belong to? The possible answers are:

- Vegetarian.
- Non-vegetarian.

In nominal scale we may label Vegetarian as '1', and Non-vegetarian as '2'. It does not in any way mean any of the diet plans is better than the other. They are just used as an identity for

easy data analysis.

Ordinal scale

The ordinal scale works on the concept of the relative position of objects or labels according to the choice or preference of the individual. It 'orders' the members of a population in ranks, from highest to lowest or lowest to highest. Although each value is ranked, there is no information that specifies what differentiates the categories from each other. Range values do not possess the arithmetic property of equal intervals or true zero points. This means that, with ordinal data, we only know that one member of a population has more or less quality than another member, but we do not know how much more or less. Ordinal scaling maintains descriptive qualities along with an intrinsic order, but it does not have a scaling origin and therefore the distance between variables cannot be calculated. The descriptive qualities indicate labelling properties similar to the nominal scale, in addition to which, the ordinal scale also has a relative position of variables.

- Description and order

In nutshell ordinal scale has the following properties:

- A rating scale in which numbers are assigned to objects to indicate how well objects possess certain characteristics.
- Can determine if an object has more or less of a characteristic than another object, but not how much more or less (1^{st}, 2^{nd}….).
- No distance and origin
- Any series of numbers can be assigned preserving ordered relationships between objects.
- In addition to the counting operation allowed for nominal scale data, ordinal scales allow the use of statistics based on percentiles, for example, percentile, quartile, median (such as top ten percentiles or the 1^{st} decile).

For example: A software company may need to ask its users:

How would you rate our application?

- Excellent
- Very Good
- Good
- Bad
- Very bad

Interval scale

Interval scales incorporate all the properties of nominal and ordinal scales and also indicate the distance or interval between

categories. Interval scales are numerical scales where we know not only the order, but also the exact differences between the values. Each interval on an interval scale is equal to every other interval on the scale. Therefore, addition and subtraction are valid arithmetic operations on interval data but scale cannot be multiplied or divided due to absence of true zero. Some interval scales, like the Celsius temperature scale, do have zero points, but they are arbitrary zero points. Arbitrary zero points do not mean the absence of quality. For example, 0° centigrade does not mean there is no heat, and furthermore 8° is not twice as warm as 4°.

- Description, order and distance

In nutshell interval scale has the following properties:

- Numerically equal distances on the scale represent equal distance in the measured property.
- It allows comparing the differences between objects.
- The position of the zero point is not fixed. Both the zero point and the units of measurement are arbitrary.
- It does not make sense to compare ratios of scale values.

- No origin

Ratio scale

A ratio scale is a type of measurement scale that not only establishes the order of variables but also incorporates information about the true zero value. It is distinct from the concept of a ratio, although ratios can be calculated using data from a ratio scale. The key feature of ratio scales is that they possess all the arithmetic properties of interval scales, with the addition of a true zero point. The presence of a true zero on a ratio scale allows us to treat ratio data as real numbers, enabling basic arithmetic operations like addition, subtraction, multiplication, and division. This property makes ratio scales highly advantageous for a wide range of descriptive and inferential statistics applications. Ratio scales offer several benefits in measurement because they provide information about the order of values, the exact magnitude of differences between units, and they have an absolute zero point, which holds significant meaning. For instance, a height measurement of zero on a ratio scale would indicate the absence of existence.

The ratio scale represents the true number of variables. Measures of physical dimensions, such as weight, height, distance, are examples. In general, all statistical methods are useful with ratio scales, and all manipulations that can be performed with real numbers can also be performed with ratio scale values.

- Description, order, distance, and origin

In nutshell ratio scale has the following properties:

- It has all the properties of nominal, ordinal, and interval scales.
- It has an absolute zero point.
- It is useful for calculating the ratio of scale value.
- All statistical techniques can be applied to ratio data.

- Most accurate scale

Properties of the four types of scales are as follows:

Table 3.2.1

Characteristics	Nominal Scale	Ordinal Scale	Interval Scale	Ratio Scale
Category/ Distinctive Classification	Yes	Yes	Yes	Yes
Order	No	Yes	Yes	Yes
Distance	Not fixed	Not fixed	Fixed	Fixed
Origin	Not fixed	Not fixed	Not fixed	Fixed

Thus, when starting from a nominal scale (least accurate) to a scale of ratios (most accurate), relevant information is obtained in a better way. If the nature of the variables allows, the researcher should use the scale that gives the most accurate description.

3.2.2.1 Comparative and Non-comparative Techniques

Other important scaling techniques are comparative and non-comparative scaling techniques. The comparative scaling technique is used to determine the scale values of multiple items by making comparisons between items. Comparative scales provide a direct comparison of different objects under study. In a non-comparative technique, the scale value of one element is determined without comparing it to another element. Non-comparative scaling techniques involve scaling each object independently of other objects.

Comparative scaling techniques

- Direct comparison between objects

Under comparative scaling technique comparison of stimulus objects are made. These data can be interpreted in relative terms only and thus it has only ordinal and rank order properties. Under this technique, relative judgements are made against other similar

objects. The respondents under this method directly compare two or more objects and make choices among them.

Comparative scaling techniques can be classified as follows:

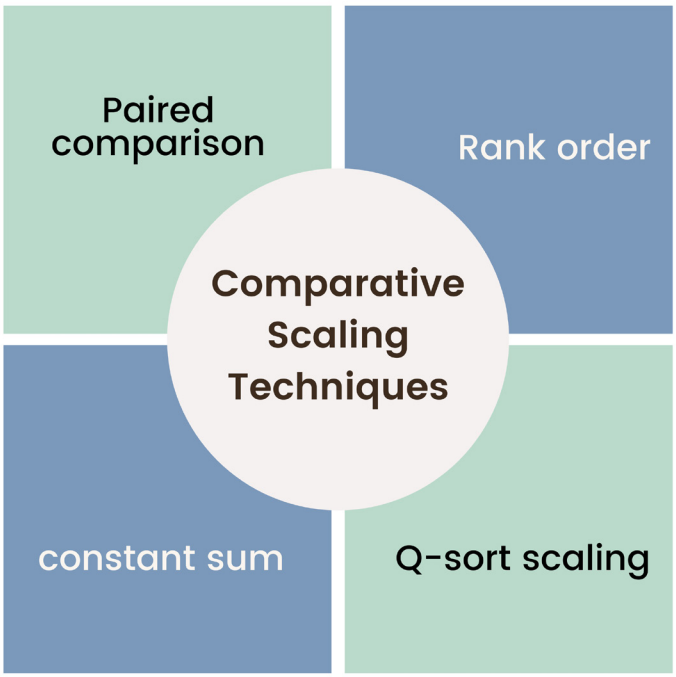


Figure 3.2.2 Comparative scaling techniques

i. Paired comparison method

A paired comparison method consists of two variables from which the respondent needs to select one. Paired comparison scaling is a comparative scaling technique in which the respondent is given two objects at the same time and is asked to select one according to the defined criteria. Paired comparison method is useful when choices are between two objects, and also it is not possible to measure the distance between each item. Paired comparison applies to the ordinal scale and not any numerical scale. Under the paired comparison method, the data can be converted to a rank order.

- Selecting one from two

Example:

In a study of consumer preferences about two brands of health drinks Horlicks and Boost, consumers were asked to fill any one of the two brands given.

Which health drink would you prefer based on taste?

Horlicks ( ) Boost ( )

Which health drink would you prefer based on price?

Horlicks ( ) Boost ( )

When there are more than two stimuli to judge, the number of judgements required in a paired comparison is given by the formula:

$$N = \frac{n(n-1)}{2}$$

Where,

N = number of judgements

n = number of stimuli or objects to be judged

ii. Rank order scale/Forced comparison method

- Ranking objects

Rank order scaling is also known as a forced comparison method, in which respondents are presented with numerous objects at once and are required to sort or rank them according to a specific criterion. Under rank order method, the respondent must rank or arrange the given objects according to their preferences. Under ranking scale also ordinal scale is applied.

Example:

Rank the various brands of toothpaste in order of preference. Begin by picking out the one brand that you like most and assign it a number 1. Then find the second most preferred brand and assign it a number 2 and the like up to 5.

Table 3.2.2

Brand	Rank
Colgate	
Close-Up	
Pepsodent	
Dabur	
Neem	

iii. Constant-sum scale

- Assigning a fixed number

A constant-sum scale is a type of scaling technique in which respondents are required to divide a specific number of points or percentages as part of a total sum. In other words, a scaling technique that involves assigning a fixed number of units to each attribute of the object, reflecting the importance a respondent attaches to it, is called constant-sum scaling. One of the advantages of the constant-sum scaling technique is that it allows proper discrimination between stimulus objects without consuming too much time.

However, it suffers from the following limitations:

- The respondent may allocate more or fewer units than specified.
- There may be a rounding error if too few units are allocated. On the other hand, if a large number of units are used, it could be burdensome for the respondents and adversely affect the result.
- This technique cannot be applied among children and uneducated people.
- If any attribute is not important, the respondent may assign zero point to the same.
- If an attribute is of equal importance to any other attribute, that attribute receives twice as many points.

Example:

In selecting a shampoo, indicate the importance you attach to each of the following four aspects by allotting points for each to total 100.

- Colour
- Fragrance
- Brand
- Conditioning effect

An example for the response to this question can be-

- Colour-0
- Fragrance-15
- Brand-30
- Conditioning effect-55

iv. Q-sort scaling

Q-sort scaling uses a rank order procedure to sort objects based on similarity with respect to some criterion. The important characteristic of this methodology is that it is more important to make comparisons among different responses of a respondent than the responses between different respondents. In this method the respondent is given a statement in a large number for describing the characteristics of a product or a large number of brands of a product. It is suitable in the case where the number of objects is not less than 60 and more than 140, the most appropriate of all ranging between 60 to 90.

- Comparisons among different responses of a respondent

For example, a study is conducted to identify the job satisfaction of an employee in an organisation. Here, the respondents are asked to classify 20 statements based on job satisfaction such as statements relating to job security, remuneration, opportunities for career growth and so forth into five piles from 'Highly satisfied' to 'Highly dissatisfied'. Generally, the most agreed statement is placed on the top while the least agreed statement at the bottom.

3.2.2.2 Non-Comparative Scaling Techniques

- Independent scaling

Under non-comparative scaling techniques each item is scaled independently of each others. A non-comparative scale analyses the performance of an individual product or object on different parameters. It takes into account only one item at a time.

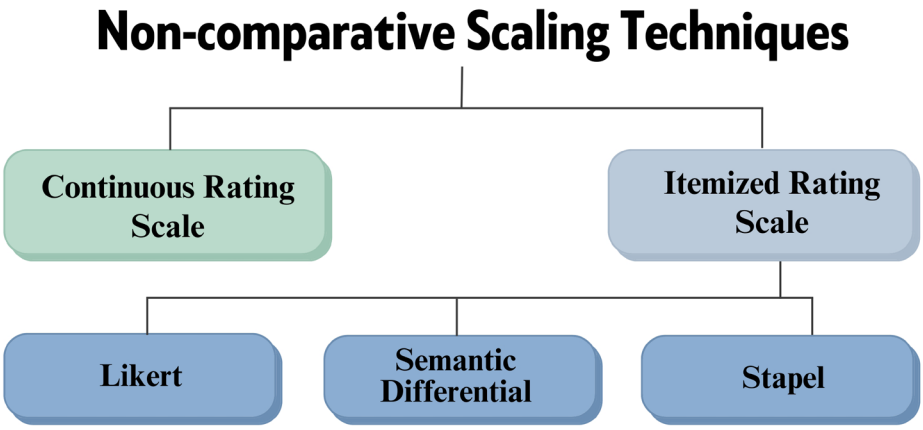


Fig 3.2.3 Non-comparative scaling techniques

Various types of non-comparative scaling techniques are as follows:

i. Continuous rating scale

- Marking a point

Continuous rating scale is also known as graphic rating scale. In this scale, respondents indicate their rating by making appropriate distance on a continuous scale. In this method respondents are free to place the object in a situation of their choice. It is done by selecting and marking a point on the straight or horizontal line between two real criteria. Scale-points with brief descriptions may be indicated along the line, their function being to assist the researcher in performing his job. The researcher, after obtaining the ratings, must divide the lines into different categories and assign scores based on the categories. The scale possesses the features of order, distance, and description. It is easy to construct but scoring is difficult.

ii. Itemized rating scale

It is a scale having numbers or brief descriptions associated with each category. The categories are ordered in terms of scale position and the respondents are required to select one of the limited numbers of categories that best describes the product, brand, company, or attribute being rated. It presents a series of statements from which a respondent selects one as best reflecting his evaluation. These statements are ordered progressively in terms of more or less of some property. It is also called numerical scale.

- Series of statements

Itemized rating scale can be again classified into:

a. Likert scale / Summated scale

Likert scale is developed by Rennis Likert. The Likert scale requires the respondents to indicate a degree of agreement or disagreement with each of a series of statements about the stimulus objects. The scale is extremely popular for measuring attitudes, because the method is simple to administer. The respondents indicate their own attitudes by checking how strongly they agree or disagree with carefully worded statements that range from very positive to negative towards the attitudinal objects. It includes a number of items or statements. Each respondent is asked to circle his opinion on a score against each statement. The final score for the respondent on the scale is the sum of their rating for all the items. The very purpose of Likert scale is to ensure that the final items evoke a wide response and discriminate among those with positive and negative attitudes. Respondents generally choose from five alternatives (Strongly agree, Agree, Neither agree nor disagree, Disagree, Strongly disagree). The disadvantage is that it is difficult to know what a single summated score means. It is easy to construct, administer and understand but is more time consuming.

- Five alternatives

b. Semantic differential scale

Semantic differential scale is a seven-point rating scale with endpoints associated with bipolar labels (such as good and bad, complex and simple) that have semantic meaning. It can be used to find whether a respondent has a positive or negative attitude towards an object. It has been widely used in comparing brands, products, and company images. In the semantic differential scale, only extremes have names. The extreme points represent the bipolar adjectives with the central category representing the neutral position. In this, the phrases used to describe the object form a basis for attitude formation in the form of positive and negative phrases. The negative phrases are sometimes put on the left side of the scale and sometimes on the right side. This is done to prevent a respondent with a negative attitude checking on the

- Seven point rating scale

right side without reading the description of the words. It is a versatile scale but difficult to apply.

c. Staple scale

- Direction and intensity

The staple scale was originally developed to measure the direction and intensity of an attitude simultaneously. Modern versions of this place a single adjective as a substitute for semantic differential when it is difficult to create pairs of bipolar adjectives. This scale measures how close to or how distant from the adjectives a given stimulus is perceived to be. It is a unipolar ten-point scale (For example, -5 to +5) without a neutral point (zero). It is easy to construct but is confusing and difficult to apply.

3.2.3 Goodness of Measurement Scales

A measurement scale must have certain desirable characteristics or criteria to judge its goodness, so that one must have faith or confidence that the scale will measure what it is intended to measure and will measure it consistently and accurately in an inexpensive way.

They are

- Reliability
- Validity
- Practicality

These characteristics are described below:

a. Reliability

- Accuracy and precision

Reliability deals with the accuracy and precision of a measurement procedure. The accuracy of a measurement scale implies that it must give a real value. In popular language it means that if a person's height is 180 cm, the measurement scale should indicate 180cm on the scale. The precision, however, signifies the power to discriminate or distinguish and indicates the degree of precision that can be achieved with the scale of measurement. The Fahrenheit scale for measuring temperature is more accurate than the Celsius scale. Ratings out of, say, 100 provide greater precision and accuracy than simply rating students A+, A, B+, B and C.

Reliability indicates the confidence one can be in the measurement obtained from the scale. It is the consistency with which a measurement instrument measures a given characteristic or concept, that is, if the same object, characteristics or attitude are measured over and over again, approximately the same conclusion would be reached. However, it can be emphasised that reliability does not necessarily imply that the measuring instrument is also

accurate. All it means is consistency in drawing conclusions. For example, the weight of a person with actual weight of 65 kg shown in a weighing machine was 70 kg when he weighed for the first time. If the reading on the machine consistently shows 70 kg when the weight of the same person is weighed several times at that time itself, then we can say that the weighing machine is reliable.

- Stability and consistency

Stability and non-variability are the key components of reliability. Stability deals with stable results in repeated measurements conducted on the same object. Non-variability deals with consistency in the results obtained from different investigators and samples.

b. Validity

The validity of a measurement instrument indicates the extent to which the instrument or scale tests or measures what it is supposed to measure. Validity needs to be checked for abstract concepts such as attitude, satisfaction, motivation etc. rather than physical properties like weight, length, width, height etc.. For example, if a reward system to measure the performance of a salesman is based solely on sales figures regardless of territory, the reward system may not be valid if territories do impact sales.

- Utility of instrument

There are four types of validity that are:

- Face validity
- Content validity
- Criterion validity
- Construct validity

Face validity

In face validity, the researcher focuses only on the outer surface of the tool, may it be an interview schedule or a questionnaire. The main contents are not focused just like a person focusing only on the style, colour, and physical appearance while buying a car rather than on its engine and performance. Therefore, it becomes a subjective assessment.

- Focus on outer surface

Content validity

It indicates the extent to which coverage of the topics being studied is provided. In content validity the researcher evaluates the main content of the tool for its appropriateness, accuracy and completeness. If the instrument contains a representative sample of the universe, the content validity is good. Its determination is primarily judgemental and intuitive. It can also be determined by using a panel of persons who shall judge how well the measuring instrument meets the standards, but there is no numerical way to express it. All aspects of the research tool are considered to check for content validity.

- Coverage of topic

Criterion validity

- Comparison with external criteria

Criterion validity measures the tool of research with an external criterion. The measurement result from the research tool is compared with the measurement result of external criteria to find out if there exists any relationship between both or not. For example, a researcher is studying the effectiveness of classes taken by a Professor in a college. The researcher compares this score of effectiveness with the external criteria which can be the number of research publications published by the Professor to find out if there is any relationship between the two. Higher the correlation, higher is the criterion validity of the research tool. The researcher should ensure that the concerned criterion is relevant, available, reliable, and free from bias.

- Predictive and concurrent validity

It includes predictive validity and concurrent validity. Predictive validity indicates the success of the measurement instruments used to predict. It refers to the usefulness of a test in predicting some future performance. Concurrent validity is used to estimate the current state. It refers to the usefulness of a test in closely relating to other measures of known validity.

Construct validity

- Measure theoretical construct

Construct validity measures the overall validity of the research tool. A measure is said to possess construct validity to the degree that it confirms to predicted correlations with other theoretical propositions. For determining construct validity, we associate a set of other propositions with the results received from using our measurement instrument. If measurements on our devised scale correlate in a predicted way with these other propositions, we can conclude that there is some construct validity. It is used to check the quality of research tools. The researcher has to carefully develop the constructs or indicators while framing the research tool i.e., it should be in such a way that the tool should actually measure what the study intends to measure. For example, a researcher studies the pain suffered by heart patients. If the researcher measures the pain of anxiety instead of measuring the pain caused as a result of surgery, it will affect the quality of research.

c. Practicality

- Economical, convenient and interpretable

From a theoretical point of view a measure should be reliable and valid. However, from a practical point of view the measures must be economical, convenient and interpretable. The measuring instrument should be designed accordingly. Economic consideration suggests that some trade-off is quality of the study and the time and cost required to complete it. Convenience implies the ease with which an instrument such as a questionnaire could easily be administered to the subjects, respondents, or participants.

The interpretability of an instrument like questionnaire is the ease with which the researcher is able to interpret the response from the subjects or respondents or participants.

Summarised Overview

Scaling techniques provide a structured way to compare and measure different options or attributes. Scaling describes the procedure for assigning numbers to various degrees of opinion, attitude, and other concepts. The scaling technique facilitates the measurement of human behaviour and attitude which is based on four pillars- distance, order, description, and origin. Comparative scaling techniques and non-comparative scaling techniques can be used for scaling objects. Comparative scales provide a direct comparison of different objects under study. In a non-comparative technique, the scale value of one element is determined without comparing it to another element.

The researcher should ensure that the instrument is designed in such a way that it offers reliability, validity and practicality. Reliability is the consistency with which a measurement instrument measures a given characteristic or concept. The validity of a measurement instrument indicates the extent to which the instrument or scale tests or measures what it is supposed to measure. Practicality highlights that the measures must be economical, convenient and interpretable. In order to provide valid results the scales used in the instrument should have reliability, validity and practicality.

Assignments

1. Identify the scale (nominal, ordinal, interval, ratio) to be used in the following cases:
    - To scale gender as male, female, others.
    - To rank students based on marks secured by them for exam.
    - To measure the average weight of students in a class.
2. You want to measure the level of stress experienced by individuals in a high pressure work environment. Which scaling technique would be most appropriate in this context? Justify your choice.
3. Develop a question using rank order scale for a study to identify the favourite subject of your respondent.
4. Imagine you are evaluating customer satisfaction for a product on a scale from 1 to 5, with 1 being “Very unsatisfied” and 5 being “Very satisfied.” Which scale type (nominal, ordinal, interval, or ratio) would this fall under? Justify your answer.
5. A study of consumer preferences about two brands of cars- Toyota and BMW is conducted. Develop a question using paired comparison scale on various factors influencing customer preferences.

Self- Assessment Questions

1. What is scaling?
2. Explain nominal scale.
3. Explain the scaling technique that provides a direct comparison of different objects under study?
4. What is a non-comparative scale? What are its various types?
5. Elucidate paired comparison method.
6. What are the features of a good measurement scale?
7. Compare and comment on the various types of scale.
8. Briefly explain the different types of Validity.
9. What is reliability?

References

1. Tandon, B.C; (1979). *Research Methodology in Social Sciences*. Chaitanya Publishing House.
2. Chawla, D; and Sondhi, N., (2016). *Research Methodology: Concepts and Cases*. Vikas Publishing House Pvt. Ltd.
3. Kevin, S., (2021). *Research Methodology for Social Sciences*. Ane Books Pvt. Ltd., New Delhi.
4. Kothari, C. R., (2004). *Research Methodology: Methods and Techniques*. New Age International (P) Limited.
5. Krishnaswami, O.R., Ranganathan, M., & Harikumar, P.N. (2016). *Research Methodology*. Himalaya Publishing House.
6. Panneerselvam, R. (2014) *Research Methodology*. PHI Learning.

Suggested Readings

1. Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education (8th ed.)*. Routledge.
2. Jhunjhunwala, S. (2018). *Research Methodology: Techniques and Trends*. I.K. International Publishing House.
3. Gupta,S.K. & Praneet Rangi. (2018). *Business Research Methodology*. Kalyani Publishers
4. Sharma R, N & Sharma R.K. (2019). *Research Methods in Social Science.* Atlantic Publishers.
5. Singh A.K. (2017). *Tests, Measurements and Research Methods in Behavioural Sciences*. Bharti Bhawan.

Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

Unit 3

Data Collection

Learning Outcomes

The following are expected outcomes to the learners from the present unit:

- know the various sources of data
- learn the different data collection methods
- design effective questionnaires
- utilise secondary sources of data
- list out the ways and tools to collect data

Background

Once the researcher has validated his research instrument, the next job is data collection. The more reliable and valid the source of data, the more authentic will be the findings and conclusion of research. Data can be collected from two sources- primary and secondary. When you collect the data for the first time by observing the world around you, talking to people the data becomes primary. Alternatively, you can tap into the vast wealth of information already collected by others, such as books and journals. Then the data is called secondary data. Let us examine various sources of data and different tools used for collecting data.

Keywords

Data, Primary data, Secondary data, Questionnaire, Interview schedule

Discussion

3.3.1 Data

- Raw facts and figures

In research, data refers to the information or facts that are collected, observed, or measured to support the investigation or analysis of a particular topic or research question. Data can take various forms, such as numerical values, measurements, observations, survey responses, experimental results, textual information, or images. It serves as the foundation for conducting statistical analysis, drawing conclusions, and making informed decisions based on empirical evidence. The collection and analysis of data are fundamental components of the research process, allowing researchers to gain insights, validate hypotheses, and contribute to the advancement of knowledge in their respective fields.

3.3.2 Types of Data

Two types of data are popularly used in research. They are:

a. Secondary data.

b. Primary data.

3.3.2.1 Secondary Data

- Already available data

Secondary data are those which have been collected by some other researcher or organisation, which is published or unpublished. The data is not collected as first-hand information by the researcher rather they use the already available data. Census reports, annual statements published by organisations etc. are examples. Secondary data can be used for references or as a sole source of information available with relation to a particular concept. It can also be used as a benchmark to which research findings can be adhered to.

- Economical

Secondary data can be made available quickly and with less cost. Large areas and time periods can also be covered with the help of secondary data. It also helps to verify the results derived from the analysis. However, secondary data should be used with great care after properly analysing its authenticity, suitability to the present study, reliability and adequacy of the data to fulfil the requirements of the study.

There are two sources of secondary data:

- **Internal source**

These are data sources that are generated and stored within an organisation or entity conducting the research. The information that exists within the company or unit is studied. Here data is generated from the activities within a firm such as sales record, budget etc..

- Generated within an organisation

- **External source**

Data is collected by a source external to the unit. It consists of both private and public documents. Publications of government agencies, RBI bulletins, project reports, conference proceedings etc. are some of the sources. In social science research, researchers generally rely on published sources such as published record, statistics, historical documents, journals and magazines as the external data source.

- Private and public documents

3.3.2.2 Primary Data

The data collected from the respondents directly are called primary data. It is the first-hand information collected by the researcher. The primary data are those which are collected afresh and for the first time, and thus happen to be original in character. The sources of primary data are the respondents of the study.

- First-hand information

3.3.3 Methods of Collecting Primary Data

There are various methods by which one can collect primary data from the sample respondents as explained below:

i. Observation

According to the definition given by the Oxford Dictionary it is an "accurate watching and noting of phenomena as they occur in nature with regard to cause and effect or mutual relations." It is also defined as "the systematic viewing of specific phenomenon in its proper setting for the specific purpose of gathering data for a particular study". Under the observation method, the information is sought by way of investigator's own direct observation without asking from the respondent. This method is particularly suitable in studies which deal with subjects (i.e., respondents) who are not capable of giving verbal reports of their feelings for one reason or the other. It is both a mental and physical activity wherein a researcher fixes a range of things to be observed and noted. Hence, it is selective and purposive.

- Systematic viewing and recording

Types of observations

There are various types of Observation.

- Simple and systematic: An exploratory observation is a simple observation while a properly organised observation with proper procedures is a part of systematic observation.

- Subjective and objective: If the researcher notes only one's own experiences, then the observation is subjective rather if he observes everything it is objective.
- Casual and scientific: If the observations are made as and when the researcher notices events casually, it is not scientific as proper observation checklists are adopted in scientific method.
- Factual and inferential: The observations may just provide description of factual information or it may lead to inferences in an advanced way.
- Direct and indirect: where the researcher directly observes by being present in the scene, it is direct observation. It is an indirect observation, if the researcher makes use of another person to record the observation.
- Participant and non-participant: Sometimes the researcher says in case of tribal community studies, stays along with the residents and observes their culture, habits etc.. This is a participant observation. If a researcher visits a company to study its working capital management he/she is just seeking the information needed and makes observations relating to the scope. Here the researcher is a non-participant.
- Structured and unstructured: When the observation process is well structured it is known as structured like with a check list and when the observations are not done in a pre-planned manner, it is unstructured.
- Controlled and non-controlled: In controlled observations, the observations are done according to a well-defined plan in a particular environment. For example, if ten customers are selected and asked to shop in a supermarket to study the consumer behaviour and observations are made with the help of recording on a hidden camera, it is a controlled observation. On the other hand if the researcher visits a market place and observes the behaviour, then it is a non-controlled observation.

Advantages

- It is an effective method when data cannot be gained through a questionnaire.
- It can bring out the actions and habits of an individual or a group.
- Observation eliminates subjective bias, if it is performed accurately.

- It relates to what is currently happening and is not affected by either the past behaviour or future intentions or attitudes.
- It is relatively less demanding of active cooperation on the part of respondents when compared to interview or the questionnaire method.

Disadvantages

- The researcher needs to possess high observation skills as the researcher's findings are limited to those observed.
- It is time taking and costly.
- The information provided by this method is very limited.
- Sometimes unforeseen factors may interfere with the observational task.

Component of process of observation

- Sensation- implies the attentiveness gained by the researcher through sense organs like seeing an advertisement.
- Attention- is the ability to concentrate on the element observed like how keenly have you watched the advertisement?
- Perception- means to interpret the meaning of what has been observed like you now have a perception about the product after watching the advertisement.

ii. Interview

Interview is one of the popularly used tools for the collection of primary data. This technique involves collecting data related to a social problem verbally. There is face to face communication in the interview method. The person who takes the interview is called interviewer and the one who gives the interview is called interviewee.

- Face to face communication

Process of interview

Interview involves the following process:

- Preparation: Proper planning is necessary for conducting a fruitful interview. The interviewer must be clear as to what he is going to ask? To whom shall he ask? The list of respondents and the schedule must be kept ready. The interviewer must take all measures to take down or record the interview.
- Introduction: The interviewer must properly introduce himself/ herself to the respondents so that they get to know who is going to conduct and what is the purpose of the interview? This can be done by approaching a superior

official and getting introduced through him.

- Developing relationship: A proper rapport must be established so that the interview can be conducted smoothly.
- Carrying the interview: The questions in the schedule must be asked and the interviewer must properly add on and control according to the situation.
- Recording the interview: The responses must be properly recorded and noted.
- Closing the interview: The interview must be closed on a positive note and well acknowledging the involvement of the respondent.

Types of Interviews

The popular types of interviews are discussed below:

a. Structured directive interview

This is a formal interview where the interviewer asks questions in a prepared schedule in the same way and in the same order to all the respondents. This makes the recording, measuring and analysis more accurate.

- Formal and orderly

Easy comparability of one interview with the other, easy coding decoding, and less time consuming are some of the merits of structured interviews. Structured interview cuts down the scope of natural conversation and exploration which are the greatest demerits of the method.

b. Unstructured interviews

Unstructured interviews are characterised by a flexibility of approach to questioning. Unstructured interviews do not follow a predetermined set of questions or standardised techniques for recording information. They allow the interviewer greater freedom to ask supplementary questions, omit certain questions, or change the sequence of questions based on the situation. The flexibility of unstructured interviews, however, results in a lack of comparability between interviews and makes the analysis of responses more difficult and time consuming compared to structured interviews. Unstructured interviews require deep knowledge and greater skill on the part of the interviewer. They are commonly used in exploratory or formulative research studies where the goal is to gather in-depth information and insights. On the other hand, structured interviews are often preferred in descriptive studies due to their economy, ability to provide a basis for generalization, and requiring less skill from the interviewer.

- Non-standardised and flexible

c. Focused interview

This type of interview is semi-structured and is done with respondents who are or were part of a particular programme, phenomenon, incident or the like. The main task of the interviewer in case of a focused interview is to confine the respondent to a discussion of issues with which he seeks conversance. Say for example if we have an interview with the survivors of Bhopal gas tragedy which is a group which has witnessed the incident i.e., the primary witness is called focused interview.

- Semi-structured

d. Clinical interview

This is a kind of focused interview which is concerned with feelings, emotions, motivations or life experiences of individuals. These are highly used in social case work, psychiatric clinics etc.

- Concerned with feelings and motivations

e. Depth interview

This is a long process of interview which aims to bring out the inner expression and feelings of a respondent by probing consciously into the matter. The interviewer must take great care as he/she would have to prevent respondents from hiding affective feelings while expressing.

- Inner feelings

f. Telephone interviews

This is a non-personal method of interview done to collect data, it can be used while the respondents are located in widely scattered areas, when we have less time and the data required is very simple and less in numbers. It is a less costly method but the personal contact is lost and the environment of the respondent cannot be observed. It has to be done within a limited time hence it not suitable in situations where large numbers of data are required.

- Non-personal interview

iii. Panel method

This method involves collection of data from the same sample at regular intervals, say two months, five months or so depending on the nature of the study. The data about the same items are collected from the same persons at successive intervals over a period of time. For example, consumer behaviour surveys. In a survey done by O R Krishnaswami entitled " the factors affecting the economic conditions of agricultural labourers in Coimbatore district" in 1971-1972, the sample farmers were contacted every 10 days all throughout the period to collect data on their farm operations, labourers employed wages paid etc.

- Regular interval

iv. Mail survey

A kind of survey which can be used among educated respondents where the questionnaires are sent through post with a request to fill it and sent it back. For example, study among bank employees, teachers etc. can be done through this method. The researcher

- Questionnaire through post

must take care of printing quality of the questionnaire so that it is readable by the respondent. Self-addressed envelope, stamps etc. are part of mail surveys. Proper covering letter stating the purpose promising the confidentiality of responses and the like should be enclosed. Follow-ups at regular intervals have to be done and also the researcher must circulate survey questionnaire to more respondents. (say 800 if 650 are required) so that the researchers can ensure that they get at least the required number back. Less response rate is the major disadvantage of this method.

v. Projective techniques

- Inference on inner characteristics

Some characteristics or reactions or responses remain unrevealed in the usual forms of data collection method like personal interview, mail survey etc. as the respondents may be reluctant to discuss controversial, personal issues. Hence the indirect method was developed in 1950 as part of motivation research. Projective technique provides stimuli to the respondents which they have to interpret. While doing this their inner characteristics can be revealed as they would predict or interpret the stimuli according to their character.

Some of the popular techniques are:

- First word that comes to mind

(i) Word association tests: Participants are asked to respond with the first word that comes to mind when presented with a stimulus word. This technique helps uncover subconscious thoughts, attitudes, or associations individuals have with specific words.

- Complete incomplete sentences

(ii) Sentence completion tests: Participants are given incomplete sentences and asked to complete them. This technique provides insight into attitudes, beliefs, or motivations by analysing the participants' responses and the patterns that emerge.

- Provide continuity to story

(iii) Story completion tests: Participants are presented with a story or scenario and asked to provide an ending or continuation. By analysing the participants' responses, researchers can gain insights into their thoughts, values, or perceptions.

- Interpretive analysis

(iv) Verbal projection tests: Participants are asked to explain or provide insights into the behaviours, motivations, or thoughts of other individuals or groups. This technique allows researchers to uncover the participants' own beliefs, attitudes, or perspectives through their interpretations of others' actions.

(v) Pictorial techniques: It includes:

- Picture interpretation

(a) Thematic Apperception Test (T.A.T.): Participants are shown ambiguous pictures and asked to create a story or describe what they think is happening in the picture. This technique aims to reveal participants' underlying motivations, desires, or conflicts through their interpretations.

(b) Rosenzweig test: Participants are presented with cartoons and asked to provide their own captions or words for the speech balloons. This technique helps explore participants' attitudes or perceptions based on their responses to the cartoons.

- Provide caption to cartoons

(c) Rorschach test: Participants are shown inkblot images and asked to describe what they see in the images. The responses are then analysed based on predetermined psychological frameworks to gain insights into participants' personality traits, emotions, or thought processes.

- Inkblot perception

(d) Holtzman Inkblot Test (HIT): Similar to the Rorschach test, participants are shown inkblot images, but in this case, they provide only one response per image. The responses are interpreted based on different aspects, such as accuracy, emotional needs, or dynamic aspects of the participant's life.

- Single-response inkblot test

(e) Tomkins-Horn picture arrangement test: Participants are presented with plates containing multiple sketches and asked to arrange them in a sequence that makes sense to them. The responses are interpreted to understand norms, attitudes, or beliefs held by the participants.

- Sequential picture arrangement test

vi. Sociometry

According to Bronfenbrenner Urie, sociometry is "a method for discovering describing and evaluating social status, structure and development through measuring the extent of acceptance or rejection between individuals in groups". It is done with the help of a sociometry test where each member of a group has to choose from all other, whom he/she prefers to work with in a specific situation. This is popularly used by sociologists, psychiatrists and psychologists. A group of individuals is selected as the research sample. Participants in the study are asked to make choices or express preferences regarding their social relationships within the group. Sociograms are used to analyse the patterns of social relationships within the group. Different types of relationships can be examined, such as friendships, advice-seeking, collaboration, or influence. Quantitative measures, such as centrality, density, or reciprocity, can be calculated to understand the social structure and dynamics. The data collected through sociometry can provide insights into various aspects of social interactions and relationships within the group. Researchers can identify key individuals, subgroups, cliques, or patterns of influence.

- Acceptance or rejection

vii. Content analysis

It is a technique which tries to infer findings from content of documents like archival records, newspapers, diaries, manuscripts, minutes of meetings etc.. The analysis of content is a central activity whenever one is concerned with the study of the nature

- Inference on inner characteristics

of the verbal materials. A review of research in any area, for instance, involves the analysis of the contents of research articles that have been published. Researchers choose a set of texts, documents, images, videos, audio recordings, or any other form of communication that is relevant to the research objectives. It allows researchers to analyse large volumes of data efficiently and systematically. It provides insights into the content and messages conveyed through various forms of communication. Content analysis can be used to explore cultural or social representations, media effects, organisational communication strategies, public opinion, or any other topic where the analysis of textual, visual, or auditory content is relevant.

viii. Experimental method

- Causal relationship

Experimental method studies causal relationship between the variable where the effect of independent variable on a dependent variable is focused. While focusing on one variable, the other independent variable is kept constant using some type of control. It is the least used method for collecting primary data. This method is commonly used by marketers in test marketing. There are two types of experiments like laboratory experiments where investigation is conducted in a purposefully created situation and field experiments which are conducted in real life situations with control group and experimental group in order to test a hypothesis. When compared with other methods this method is more powerful to determine the causal relationship between variables and can produce exact measurement. However, sometimes establishing the control and experimental groups may be a difficult task.

ix. Simulation

- Realistic enactment of roles

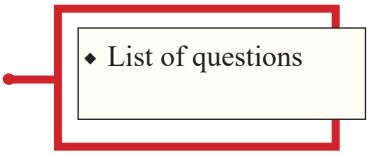
Simulation is a recent research technique. It is a realistic enactment of roles in an imagined situation. It is often done to assess and understand a situation and make decisions pertaining to it. There are three types of Simulation- Computer Simulation, Man Simulation and Man Computer Simulation. In Computer simulation real life processes and situations are imitated using computer graphics like the day to day functioning or role of each desk in a bank can be well explained to the trainees by using this method. People are given different roles to play to understand the situation in Man simulation. The above mentioned methods together make up the Man Computer simulation method.

3.3.4 Tools for Data Collection

Questionnaire and Interview schedule are the two widely used tools for collecting data from respondents.

3.3.4.1 Questionnaire

Questionnaire is a document containing a list of questions designed to solicit information from respondents appropriate for analysis. The questionnaire is used in mail surveys were it is mailed to respondents who are expected to read and understand the questions and write down the reply in the space meant for the purpose in the questionnaire itself. The respondents have to answer the questions on their own.



A questionnaire is designed to fulfil the following objectives:

- Translate the information needed into a set of specific questions.
- Motivate and encourage the respondent to become involved in the interview, to cooperate, and to complete the interview.
- Minimize response error.

Advantages

- There is low cost even when the universe is large and is widely spread geographically.
- It is free from the bias of the interviewer since the answers are in respondents' own words.
- Respondents have adequate time to give well thought out answers.
- Respondents, who are not easily approachable, can also be reached conveniently.
- Large samples can be made use of and thus the results can be made more dependable and reliable.

Disadvantages

- It can be used only when respondents are educated and cooperating.
- The control over questionnaire may be lost once it is sent.
- There is inbuilt inflexibility because of the difficulty of amending the approach once questionnaires have been despatched.
- There is also the possibility of ambiguous replies or omission of replies altogether to certain questions making the interpretation difficult.
- It is difficult to know whether willing respondents are truly representative.

Guidelines for the preparation of questionnaire

There are no strict rules to follow when developing questionnaires. Several crucial decisions need to be made regarding what should be included, how it should be presented, the sequence of questions, and the layout of the questionnaire.

In terms of determining the content of the questionnaire, researchers should consider a few important factors. Firstly, they should assess whether each question is necessary and relevant. Secondly, they need to ensure that the questions have appropriate scope and coverage for the research objectives. Additionally, researchers should consider if the participants will be able to answer the questions adequately as presented and if they will be willing to answer them in the given format. Pre-testing and revising the questionnaire can further enhance its effectiveness.

- Relevance, scope and coverage of questions

The content of a questionnaire typically consists of two types of information: factual and attitude-based. Factual information aims to gather objective data from respondents about their background, environment, habits, and similar aspects. Personal information is often collected at the beginning of the questionnaire. On the other hand, attitude-based questions emphasises into a person's inclinations, prejudices, ideas, fears, and convictions regarding specific topics. Examples of attitude-based questions include measuring agreement, satisfaction, and opinions, which serve as verbal expressions of attitudes. By incorporating both factual and attitude-based questions, researchers can gather comprehensive information from respondents.

- Factual and attitude-based questions

Type of questions

The various types of questions are listed as follows:

a. Open-ended questions

Open-ended questions are those questions which are designed to permit a free response from the respondent rather than one limited to certain stated alternatives. These questions enable individuals to express their thoughts, opinions, or experiences in their own words. However, before open-ended responses can be analysed using computer-based methods, they must be coded. This coding process facilitates systematic analysis and comparison of the open-ended data, enabling researchers to derive meaningful insights from the collected information. Open-ended questions are more difficult to handle, raising problem of interpretation, comparability and interviewer bias. For example-

- Permit free response

In your opinion, what are some key factors that contribute to the success of an E-commerce business?

b. Closed ended questions

Closed-ended questions, also known as structured questions, are a type of questioning technique commonly used in surveys or questionnaires. With closed-ended questions, respondents are provided with a predetermined list of answer choices and are asked to select the option that best represents their views or experiences. These questions offer a structured format and limit respondents to choose from the provided set of responses.

To ensure the effectiveness of closed-ended questions, the response categories should be exhaustive, covering all possible options, and mutually exclusive, meaning each choice should be distinct and not overlapping with others. This allows for accurate data collection and analysis. Closed-ended questions can take various forms, such as Multiple-Choice Questions, where respondents choose one option from a list of possible answers, dichotomous questions that offer two opposing choices or scaled questions that measure intensity or agreement on a specific topic using a rating scale.

- Choosing one from a set of responses

- **Multiple - Choice Questions (MCQs)**

The researcher provides a choice of answers and respondents are asked to select one or more of the alternatives given. In MCQs, the respondents choose one option from a list of possible answers. For example-

Do you intend to visit an industry within the next six months?

- Definitely will not go
- Probably will not go
- Undecided
- Probably will go
- Definitely will go
- Other (please specify)

- Selection from predetermined alternatives

Advantages of Multiple-Choice Questions:

- Easy handling: They are straightforward to administer and record responses.
- Simple to answer: Respondents only need to select an option from the provided choices.
- Quick: Questions can be completed efficiently, saving time for both respondents and researchers.
- Inexpensive to analyse: Data analysis is relatively straightforward and can be done using statistical techniques.

- Statistical analysis: Such questions lend themselves well to quantitative analysis, enabling researchers to draw statistical conclusions.
- Clarity of question: Providing alternative replies can help clarify the intended meaning of the question, reducing ambiguity.

Disadvantages of Multiple-Choice Questions:

- Limits true response: Fixed alternative questions may limit respondents' true opinions or force them to select an option even if they do not hold that particular viewpoint.
- Not suitable for complex issues: Questions may not capture the nuances or complexities of multifaceted topics adequately.
- Limitations in exploring processes: When the researcher's interest lies in exploring a process or gaining detailed insights, such questions may not provide sufficient depth of information.

Dichotomous questions

Dichotomous questions are a type of closed-ended question that presents respondents with only two response alternatives. The options typically include contrasting choices such as "yes" or "no", "agree" or "disagree", or similar binary options. These questions are designed to elicit a straightforward response, requiring respondents to select one of the two provided options. To provide additional flexibility, dichotomous questions often include a neutral alternative. This neutral option allows respondents to indicate that they have no opinion, lack knowledge on the subject matter, choose both alternatives, or select none of the given options. Common examples of neutral alternatives include "no opinion", "don't know", "both", or "none". For example-

- Selection from two response alternatives

"Do you intend to visit an industry within the next six months?" The respondents can choose between "yes" or "no" to indicate their intention to visit an industry. Additionally, the option "don't know" is available for individuals who are uncertain about their plans or lack enough information to provide a definitive answer.

Scales

- Selection from a scale

The options of agreement are given on a five or seven point scale. Weights are given to each level 5 to 1 or 7 to 1 and are analysed. For example-

Do you intend to visit an industry within the next six months?

Definitely will not go	Probably will not go	Undecided	Probably will go	Definitely will go
1	2	3	4	5

c. Contingency question

A survey question is intended for only some respondents which are determined by their responses to some other questions. For example-

- Based on another question

Have you invested in Mutual Funds?

Yes No

If yes, how many have you taken?

Points to remember in questionnaire wording

a. Define the issue: One must clearly define the issue like Who, What, When, Where, Why, and Which (The Six W's). Who, What, When, and Where are particularly important.

- Which brand of soap do you use? (Incorrect)
- Which brand or brands of soap have you personally used at home during the last month? In case of more than one brand, please list all the brands that apply. (Correct)

b. Use simple ordinary words: Respondents may not be highly educated and may not know some of the technical jargon that you are used to.

- "Do you think the distribution of soft drinks is adequate?" (Incorrect)
- "Do you think soft drinks are readily available when you want to buy them?" (Correct)

c. Use unambiguous words: Ambiguous question contains more than one meaning and that can be interpreted differently by different respondents.

- 'Are you satisfied with your canteen?'

  Yes No

This question can be interpreted differently by each respondent

in their own way.

d. Avoid leading or biasing questions: This gives the respondent a clue as to what the answer is desired, or leads the respondents to answer in a certain way.

- Do you think that patriotic Indians should buy imported automobiles when that would put Indian labour out of work?

  Yes No Don't know (Incorrect)

- Do you think that Indians should buy imported automobiles?

  Yes No Don't know (Correct)

e. Avoid double-barrelled questions: It includes two or more questions in one. Therefore, it will be difficult to know which particular question a respondent has answered.

- Do you think Mirinda is a tasty and refreshing soft drink?

  Yes No (Incorrect)

- "Do you think Mirinda is a tasty soft drink?" and
- "Do you think Mirinda is a refreshing soft drink?" (Correct)

f. Avoid implicit alternatives: An alternative that is not explicitly expressed in the options is an implicit alternative. Researchers must not assume that the respondent would think of the same alternative as was intended even if it has not been stated.

Do you like to fly when traveling short distances? (Incorrect)

Do you like to fly when traveling short distances, or would you rather drive? (Correct)

g. Avoid questions that are based on presumptions: In such questions the researcher assumes that respondents fit into a particular category and seeks information based upon that assumption.

- How many cigarettes do you smoke in a day? (Incorrect)

This question is based on a presumption that the respondent is a smoker.

- Do you smoke cigarettes?

  Yes No

If yes, how many cigarettes do you smoke in a day? (Correct)

h. Avoid generalisations and estimates: The estimates are to be calculated by the researchers and are not asked directly. For

example-

- What is the annual per capita expenditure on groceries in your household? (Incorrect)
- What is the monthly (or weekly) expenditure on groceries in your household?

How many members are there in your household? (Correct)

i. Avoid burdensome questions: Questions which have to be answered from memory and quite burdensome will remain unanswered. Hence care should be taken not to include questions like-

- Thinking about the first Saturday of this month, note each quarter-hour time period during which, so far as you can recall, you personally watched television.

j. Avoid long questions.

k. Avoid very general questions like-

- How satisfied are you with your job?

l. Avoid questions that include negatives as-

- Would you rather not use a non-medicated shampoo?

The above discussed points have to be taken care of while drafting the questionnaire wordings because the data collected will determine the accuracy of the research findings.

- Questionnaire guidelines

Determining the order of questions

This relates to the HOW…? in the major decisions of designing a questionnaire i.e., how the questions are to be arranged.

- Start with easy and interesting questions.
- General to specific questions (funnel sequence).
- Use filter questions (and prompters).
- Ask sensitive or potentially embarrassing questions at the end of the questionnaire.
- Use alternative phrasings of the same question to yield a more accurate total response.

- Arrangement of questions

Form and layout

The questionnaire has to follow a proper layout so that respondents can have the connectivity of responses.

- Divide a questionnaire into several parts.
- The questions in each part should be numbered.

- Structure of questions

- The questionnaires should preferably be pre-coded.
- The questionnaires themselves should be numbered serially.

3.3.4.2 Interview Schedule

- Tool for interview

Interview schedule is a tool for collecting primary data similar to that of a questionnaire. The difference between an interview schedule and a questionnaire is related to the party marking responses to the questions. Similar to a questionnaire, interview schedules also encompass a certain number of questions but the responses to it are marked by the enumerator himself/herself and not by the respondents.

- Needs a skilled enumerator

In certain situations, schedules may be handed over to respondents and enumerators may help them in recording their answers to various questions in the said schedules. Enumerators explain the aims and objects of the investigation and also remove the difficulties which any respondent may feel in understanding the implications of a particular question or the definition or concept of difficult terms. This method requires the selection of enumerators for filling up schedules or assisting respondents to fill up schedules and as such enumerators should be very carefully selected. The enumerators should be trained to perform their job well and the nature and scope of the investigation should be explained to them thoroughly so that they may well understand the implications of different questions put in the schedule. Enumerators should be intelligent and must possess the capacity of cross examination in order to find out the truth. Above all, they should be honest, sincere, hardworking and should have patience and perseverance.

Difference between Questionnaire and Interview schedule

The key differences between a questionnaire and an interview schedule are depicted in the following table.

Table 3.3.1 Difference between Questionnaire and Interview Schedule

Questionnaire	Interview Schedule
Filled by the respondents	Filled by research worker or enumerator
Relatively cheap and economical since it can be sent through mail to the informants	Relatively more expensive due to enumerators and training
High non-response bias	Low non-response, but there is risk of interviewer bias and cheating
Identity of respondent not always clear	Identity of respondent is known
Slow due to delayed returns	Information collected well in time by enumerators
No personal contact	Direct personal contact with respondents
Requires literate and cooperative respondents	Can gather information from illiterate respondents
Wider and more representative distribution possible	Difficulty in sending enumerators to wider areas
Risk of incomplete and wrong information	Information collected is generally complete and accurate
Success depends on quality of questionnaire	Success depends on honesty and competence of enumerators
Attractive physical appearance of questionnaire	Filled in by enumerators, appearance less relevant
Observation method not possible with questionnaires	Observation method can be used with schedules

3.3.5 Pre-testing

Testing of the tool used for data collection such as a questionnaire or interview schedule, on a small sample of respondents is essential to identify and eliminate potential problems. A data collection instrument should not be used in the field survey without adequate pre-testing. To ensure the effectiveness of the instrument, it is important to conduct thorough testing before implementing it in the actual survey. The respondents selected for the pre-test should be drawn from the same population as those who will participate in the main survey. Pre-tests are ideally

- Testing of instrument with few samples

conducted through personal interviews, as they allow for direct interaction and immediate feedback. Once the initial pre-test is completed, necessary changes and improvements can be made to the data collection instrument based on the feedback received. In the case of questionnaire, another round of pre-testing can then be conducted using alternative methods such as mail, telephone, or electronic means if those modes will be used in the actual survey. This helps assess the questionnaire's effectiveness across different channels.

- Tested on few samples

It is recommended to involve a variety of interviewers in the pre-tests to ensure a diverse range of perspectives and to identify any potential biases or issues related to interviewer characteristics. The sample size for the pre-test typically ranges from 15 to 30 respondents for each wave, providing a sufficient pool of feedback for analysis. The responses obtained from the pre-test should be carefully coded and analysed. This analysis allows researchers to evaluate the instrument's ability to elicit the required responses from the sample population. If the pre-test is conducted properly, researchers can have confidence that the instrument is well-designed and will yield reliable data that can be generalised to the larger target population.

3.3.6 Pilot Study

- Survey on a smaller scale

A survey on a smaller scale conducted before a large scale field study is termed as pilot survey. It is the replica of the original study done on a smaller sample usually taken as 10 percent of the intended sample size. Pilot study reveals the weaknesses, if any, of the data collection instrument.

Uses of pilot study

- To pre-test the suitability of questions
- To generate fixed choice answers
- To avoid unforeseen problems during the large survey
- To provide experience and confidence to the interviewer

Summarised Overview

Data collection methods can be categorised into primary data collection and secondary data collection. Secondary data collection involves using existing data sources such as books, articles, reports, and databases. Secondary data can be obtained from internal or external sources and can provide valuable context and background information.

Primary data collection involves first-hand gathering of information, and it includes observation, interviews, simulation, content analysis, projective techniques, mail surveys and so forth. When using questionnaires, it is crucial to properly prepare and pre-test the questionnaire to ensure its effectiveness. This involves conducting a pilot survey to refine the questionnaire and test its feasibility. Interviews can be conducted using interview schedules. A combination of primary and secondary data collection methods can provide comprehensive and robust data for research and analysis purposes.

Assignments

1. Develop a questionnaire to conduct a study on the perception of customers towards the various brands of mobile phones in your district.
2. Create a simple questionnaire with three questions to gather opinion on a popular movie or TV show. Ask your friends or family members to complete the questionnaire and summarise their responses.
3. Prepare five interview questions to learn about people's experiences with a recent vacation or travel destination. Conduct interviews with friends or family members and summarise their responses.
4. Choose a topic of interest (e.g., climate change, sports) and find three reliable sources of information (books, articles, websites) on that topic. Summarise the key points from each source and present a brief overview.
5. Design a questionnaire to understand people's preferences for a specific food item (e.g., pizza toppings, ice cream flavors). Ask at least five people to fill out the questionnaire and analyse the results.

Self- Assessment Questions

1. What do you mean by data?
2. Explain primary data.
3. What is secondary data? Explain the sources from which secondary data can be extracted.
4. What is a pilot study?
5. What is pretesting?
6. What are the various methods of collecting primary data?
7. Differentiate between a questionnaire and an interview schedule.
8. Explain briefly the various types of data.

References

1. Tandon, B.C; (1979). *Research Methodology in Social Sciences*. Chaitanya Publishing House.
2. Chawla, D; and Sondhi, N., (2016). *Research Methodology: Concepts and Cases*. Vikas Publishing House Pvt. Ltd.
3. Kevin, S., (2021). *Research Methodology for Social Sciences*. Ane Books Pvt. Ltd., New Delhi.
4. Kothari, C. R., (2004). *Research Methodology: Methods and Techniques*. New Age International (P) Limited.
5. Krishnaswami, O.R., Ranganathan, M., & Harikumar, P.N. (2016). *Research Methodology*. Himalaya Publishing House.
6. Panneerselvam, R. (2014) *Research Methodology*. PHI Learning.

Suggested Readings

1. Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education (8th ed.)*. Routledge.
2. Jhunjhunwala, S. (2018). *Research Methodology: Techniques and Trends*. I.K. International Publishing House.
3. Sashi K Gupta & Praneet Rangi. (2018). *Business Research Methodology*. Kalyani Publishers
4. Sharma R, N & Sharma R.K. (2019). *Research Methods in Social Science.* Atlantic Publishers.
5. Singh A.K. (2017). *Tests, Measurements and Research Methods in Behavioural Sciences*. Bharti Bhawan

Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

04 BLOCK

DATA PROCESSING AND PRESENTATION

Block Content

Unit 1

Data Processing

Learning Outcomes

Upon completion of this unit, the leaners will be able to:

- gain insights on how data can be processed into meaningful information.
- familiarise with the various methods of data processing.
- be aware of the methods of data processing.
- assess the generally accepted principles of tabulation.

Background

The collected data cannot be used as such for data analysis. Before analysis, data requires to be processed. The mass data collected need to be processed for removing errors and to make the data fit for statistical analysis. The refined data can be assigned with codes such as 1,2, 3 for easy data entry. Creating tables and entering the values in table would help in developing a clear understanding. These initial steps of data processing, make the data fit for further analysis.

Keywords

Editing, Coding, Classification, Tabulation, Summarisation

Discussion

4.1.1 Data Processing

After collecting data, raw data is converted into meaningful statements through the data processing, data analysis and data interpretation and presentation. Data reduction or processing mainly involves various manipulations necessary for preparing the data for analysis. The process (of manipulation) could be manual or electronic. It involves editing, categorising the open-ended questions, coding, computerisation and preparation of tables and diagrams. Data processing is concerned with editing, coding, classifying, tabulating and diagramming research data. The essence of data processing in research is data reduction which is explained in detail in this unit.

- Data reduction

Data processing implies editing, coding, classification and tabulation of collected data so that they are amenable to analysis. Data processing occurs when data is collected and translated into usable information. Usually performed by data scientists, it is important for data processing to be done correctly so as not to negatively affect the end product or data output. Data processing starts with data in its raw form and converts it into a more readable format (graphs, documents, etc.) giving it the form and context necessary to be interpreted by computers and utilised by employees throughout an organization.

- Data into information

4.1.1.1 Six Stages of Data Processing

a. Data collection

Collecting data is the first step in data processing. Data is pulled from available sources, including data lakes and data warehouses. It is important that the data sources available are trustworthy and well-built so the data collected (and later used as information) is of the highest possible quality.

- Acquisition of data

b. Data preparation

Once the data is collected, it then enters the data preparation stage. Data preparation, often referred to as "pre-processing" is the stage at which raw data is cleaned up and organised for the following stage of data processing. During preparation, raw data is diligently checked for any errors. The purpose of this step is to eliminate mistakes in data (redundant, incomplete, or incorrect data) and begin to create high quality data for the best business intelligence

- Pre-processing stage

- Data entry

c. Data input

The clean data is then entered into its destination and translated into a language that it can understand. Data input is the first stage in which raw data begins to take the form of usable information.

iv. Processing

- Data transformation

In this step, the computer takes the information it received earlier and starts to work on it. It uses special programs called machine learning algorithms to make sense of the data. The way this is done might be a bit different depending on where the data came from (like data lakes, social networks, or connected devices) and what we want to do with it (like studying advertising trends, diagnosing medical issues from connected devices, or understanding what customers need).

v. Data output/interpretation

- Generation of usable results

The output/interpretation stage is the stage at which data is finally usable to non-data scientists. It is translated, readable and often in the form of graphs, video, images, plain text, etc.). Members of the company or institution can now begin to self-serve the data for their own data analytics projects.

vi. Data storage and report writing

- Data warehousing

The final stage of data processing is storage. After the data is processed, it is then stored for later on. While some information may be put to use immediately, much of it will serve a purpose later on. When data is properly stored, it can be quickly and easily accessed by members of the organisation when needed.

4.1.2 Methods of Data Processing

- Transforms irrelevant data to relevant

Data processing is like organising and sorting information in a research project. First, data is collected and then edited, put into categories, and shown in tables or charts. The main goal is to make the data more manageable and easier to understand. During this process, irrelevant information is removed so that only the important stuff remains.

4.1.2.1 Editing of Data

- Examination of collected data

Editing is the first step of data processing. Editing is the process of examining the data collected through questionnaires or any other method. It starts after all data has been collected to check the collected data or reform into useful data. Editing is done to assure that the data are accurate, consistent with other facts gathered, uniformly entered, is complete as far as possibleand have been well arranged to facilitate coding and tabulation.

When doing their work, editors must be familiar with both

the editing instructions provided to them for the purpose, as well as the directions given to the interviewers and coders. When erasing an initial entry for any reason, they should only draw a single line over it so that it can still be read. They must fill out the form (if necessary) with entries in a standardised format and in a distinguishing colour. They should initial any responses they modify or supply the editor's initials, and they should note the date of editing on each filled-out form or schedule.

Editing involves:

a. Raw data is checked for mistakes made by either the interviewer or the respondent.

b. By reviewing completed interviews from primary research, the researcher can check several areas of concern.

- Editing instructions

c. Asking the proper questions.

d. Accurate recording of answers.

e. Correct screening of respondents.

f. Complete and accurate recording of open-ended questions.

Types of editing

There are different types of editing:

a. Editing for quality: Involves asking the following questions;

- are the data forms complete?
- are the data free from bias?
- are the recordings free from errors?
- are the inconsistencies in responses within limits?
- are there evidences to show dishonesty of enumerators or interviewers?
- are there any manipulations of data?

b. Editing for tabulation: Involves certain accepted modification to data or even rejecting certain pieces of data in order to facilitate tabulation. Extremely high or low value data items may be ignored or bracketed with suitable class intervals.

- Modification and reduction

c. Field editing: It is done by the enumerators. The schedule filled up by the enumerator or the respondent might have some abbreviated writings, illegible writings and the like. These are rectified by the enumerator. This should be done soon after the enumeration or interview before the loss of memory. The field editing should not extend to giving some guess data to fill up omissions.

- Enumerator field review

- Detecting errors and omissions

d. Central editing: It is done by the researcher after getting all schedules or questionnaires or forms from the enumerators or respondents. Obvious errors can be corrected. For missed data or information, the editor may substitute data or information by reviewing information provided by likely placed other respondents. A definite inappropriate answer is removed and "no answer" is entered when reasonable attempts to get the appropriate answer fail to produce results.

4.1.2.2 Coding of Data

- Assigning symbols

Coding is the process of categorising data according to research subject or topic and the design of research. In the coding process researchers set a code for a particular thing like male-(1), female-(2) that indicates the gender in the questionnaire without writing full spelling, just as researchers can use colours to highlight something or numbers like 1+, 1-. This type of coding makes it easy to calculate or evaluate results in tabulation. Codes are numerical. Coding can be tedious if certain issues are not addressed prior to collecting the data.

Four steps involved in coding:

i. Generate a list of as many potential responses as possible

ii. Consolidate responses

iii. Assign a numerical value as a code

iv. Assign a coded value to each response

4.1.2.3 Classification of Data

- Logical grouping of data

Classification or categorisation is the process of grouping the statistical data into various understandable homogeneous groups for the purpose of convenient interpretation. Uniformity of attributes is the basic criterion for classification and the grouping of data according to similarity. Classification becomes necessary when there is diversity in the data collected for meaningful presentation and analysis. However, it is meaningless in respect of homogeneous data. A good classification should have the characteristics of clarity, homogeneity, equality of scale, purposefulness and accuracy. Classification can be one of the following two types- Classification according to attributes and Classification according to class-intervals. In the case of classification according to attributes, data having descriptive characteristics such as literacy, sex, honesty, etc. are considered. The classification according to class-intervals deals with numerical data such as data relating to income, production, age, weight, etc. Such data are known as statistics of variables and are classified on the basis of class intervals.

The following are the objectives of classification:

a. The complex scattered data is organised into concise, logical and intelligible form.

b. It is possible to make the characteristics of similarities and dissimilarities clear.

c. Comparative studies are possible.

d. Understanding of the significance is made easier and thereby good deal of human energy is saved.

e. Underlying unity amongst different items is made clear and expressed.

f. Data is so arranged that analysis and generalisation becomes possible.

- Data categorisation

4.1.2.4 Tabulation of Data

Tabulation is the process of summarising raw data and displaying it in compact form for further analysis. Therefore, preparing tables is a very important step. Researchers can tabulate the data by hand or in digital mode. The choice is made largely on the basis of the size and type of study, alternative costs, time pressures, and the availability of computers and computer programs. If the number of questionnaires is small, and the length is short, hand tabulation is quite satisfactory.

- Arrangement in columns and rows

Based on the number of observations (cases), tabulation is classified into certain categories as follows:

- One way tabulation: Categorisation of single variables existing in a study.
- Cross –tabulation: Simultaneously treating two or more variables in the study. Categorising the number of respondents who have answered two or more questions consecutively.

- Tabulation categories

Generally accepted principles of tabulation

As a general rule, the following principles are to be considered in the preparation of table:

a. Title of the table: The table should be first given a brief, simple and clear title which may express the basis of classification.

b. Table number: Every table should be given a distinct number to facilitate easy reference

c. Columns and rows: Each table should be prepared in just adequate number of columns and rows

d. Caption and stubs: Caption refer to column headings and stub refers to row headings. The columns and rows should be giv-

en simple and clear captions and stubs.

e. Ruling: Columns and rows should be divided by means of thin or thick rulings.

f. Arrangement of items: Comparable figures should be arranged side by side. The arrangement of the categories in a table may be chronological, geographical, alphabetical or according to magnitude to facilitate comparison. Above all, the table must suit the needs and requirements of an investigation.

g. Special emphasis: This can be done by writing important data in bold or special letters. In order to emphasise the relative significance of certain categories, different kinds of type, spacing and indentations may be used.

h. Unit of measurement: The unit of measurement under each head and sub-head should be noted below the lines.

i. Approximation: This should be noted below the title.

j. Foot-notes: Explanatory footnotes, if any, concerning the table should be placed directly beneath the table, along with the reference symbols used in the table,

k. Sources: Source or sources from where the data in the table have been obtained must be indicated just below the table.

l. Totals: Total of rows should normally be placed in the extreme right column and that of columns should be placed at the bottom.

Thus, these methods of data processing which includes editing, coding, classification, and tabulation of data is required to transforms raw data into meaningful information, enabling researchers to gain insights, validate hypotheses, and make informed decisions based on evidence.

Summarised Overview

Data, which is in the form of raw facts and figures, need to be processed for converting it into information in order to be used by the interested parties. Data processing is a series of actions or steps performed on data to verify, organise, transform, integrate, and extract data in an appropriate output form for subsequent use.

Data processing involves methods such as editing, coding, classification, tabulation, and analysis of data. Editing is the process of examining the data collected through questionnaires or any other method. Coding is the process of categorising data

according to research subject or topic and the design of research. Classification or categorization is the process of grouping the statistical data into various understandable homogeneous groups for the purpose of convenient interpretation. Tabulation is the process of summarizing raw data and displaying it in compact form for further analysis. A knowledge on the various process involved is essential as it acts as a pre-requisite for data analysis.

Assignments

1. Develop a questionnaire to study the opinion on a popular restaurant near your locality. Collect data from 20 respondents which may comprise of your friends or family members perform the following:
   - Identify and correct any errors or inconsistencies in that questionnaire.
   - Develop a coding scheme to classify respondents based on their Age and Gender in above.
   - Classify the opinion obtained from the 20 respondents into three groups- Positives, Negatives, Neutral.
   - Create a frequency table to show the distribution of participants across different Age groups and Gender groups.
   - Develop a cross-tabulation table to find relationship between the Gender and Age of the respondents.
2. What is coding? What is the relevance of coding in data analysis?
3. Prepare a questionnaire to collect data from employees working in the textile industry and use the same questions in a schedule to collect data from the same respondents after one week. Check whether the data received from the respondents are the same. If yes, validate your reasons.

Self- Assessment Questions

1. Explain data processing.
2. Elucidate data reduction.
3. What do you mean by editing of data?
4. What is coding?

5. What is tabulation?
6. Write down the different stages of data processing.
7. What are the objectives of classification of data?

References

1. Tandon, B.C; (1979). *Research Methodology in Social Sciences*. Chaitanya Publishing House.
2. Chawla, D; and Sondhi, N., (2016). *Research Methodology: Concepts and Cases*. Vikas Publishing House Pvt. Ltd.
3. Kevin, S., (2021). *Research Methodology for Social Sciences*. Ane Books Pvt. Ltd., New Delhi.
4. Kothari, C. R., (2004). *Research Methodology: Methods and Techniques*. New Age International (P) Limited.
5. Krishnaswami, O.R., Ranganathan, M., & Harikumar, P.N. (2016). *Research Methodology*. Himalaya Publishing House.
6. Panneerselvam, R. (2014) *Research Methodology*. PHI Learning.

Suggested Readings

1. Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education (8th ed.)*. Routledge.
2. Jhunjhunwala, S. (2018). *Research Methodology: Techniques and Trends*. I.K. International Publishing House.
3. Gupta,S.K. & Praneet Rangi. (2018). *Business Research Methodology*. Kalyani Publishers
4. Sharma R, N & Sharma R.K. (2019). *Research Methods in Social Science*. Atlantic Publishers.
5. Singh A.K. (2017). *Tests, Measurements and Research Methods in Behavioural Sciences*. Bharti Bhawan.

Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

Unit 2

Analysis of Data

Learning Outcomes

After completing this unit, the learner will be able to:

- learn the skills of analysing qualitative and quantitative data
- identify various types of descriptive statistics.
- gain insight on how to interpret the data.
- differentiate parametric and non-parametric tests.

Background

Processed data as such will not convey any useful information. Researcher need to determine the relationship between the variables and develop patterns in order to draw meaningful inference from the study.Data analysis serves as the backbone of research, enabling researchers to transform raw data into meaningful insights called information and contribute to new knowledge.

Keywords

Descriptive statistics, Inferential statistics, Inference, Parametric test, Non-parametric test

Discussion

4.2.1 Analysis of Data

- Data reduction and interpretation

According to LeCompte and Schensul, research data analysis is a process used by researchers for reducing data to a story and interpreting it to derive insights. The data analysis process helps in reducing a large chunk of data into smaller fragments, which makes sense.

The systematic application of statistical and logical techniques to describe the data scope, modularise the data structure, condense the data representation, illustrate via images, tables and graphs and evaluate statistical inclinations, and probability data, to derive meaningful conclusions, is known as data analysis.

During the data analysis process, three essential things happen. The first is data organisation, where information is structured in a systematic way. The second method for data reduction involves summarisation and categorisation, helping to identify patterns and themes for easier understanding. Lastly, the third step is interpretation, which researchers do in both top-down and bottom-up approaches.

- Data organising, Summarisation, Categorisation, and Interpretation

Data is everywhere around us, in spreadsheets, on various social media platforms, in survey forms and more. The process of cleaning, transforming, interpreting, analysing and visualising this data to extract useful information and gain valuable insights to make more effective business decisions is called data analysis.

Purpose of statistical analysis of data

- Identify relationship

Analysis is a careful review of the gathered and categorised data in order to analyse the characteristics of the research topic and identify patterns of relationships among the relevant variables. The use of diverse statistical methods is part of quantitative analysis in social science research. The following are the primary goals of data analysis:

- Make it easier to identify the causal factors underlying complex phenomena.
- Convert enormous amounts of data into understandable summaries.
- Provide precise descriptions of the data.
- Drawing inference
- Draw valid conclusions from observational data.
- Evaluate the significance of specific sample results under a

presumptive population.

4.2.2 Types of Data Analysis

Statistical analysis of data is classified into the following two broad areas:

- Descriptive statistics
- Inferential statistics

4.2.2.1 Descriptive Statistics

- Describes characteristics

Descriptive statistics is used to describe, show or summarise data points. It describes the nature of an object or phenomenon under study and provides us with profiles of organisations, work groups, persons, and other subjects. It describes the pattern and trends of data. It gives you a conclusion of the distribution of data and also enables to identify similarities among variables.

Descriptive statistics can be categorised into three types which are measures of central tendency, measures of dispersion, and measures of shapes.

- Average

i. Measures of central tendency: In descriptive statistics, it is important to find out the Central (or average) Tendency or response. Central tendency is measured with the use of three averages- mean, median, and mode. Out of this, mean is arithmetical average. Median and mode are positional averages.

- Variability of the data

ii. Measures of dispersion: It provides information about the spread or variability of the data. Sometimes it is important to know how data is divided across a range. It includes range, inter-quartile range, variance and standard deviation.

- Normal or skewed

iii. **Measures of shape**: It provides information regarding the shape of the data- whether the data is normal or skewed. It includes skewness, kurtosis, and scatter plot.

4.2.2.2 Inferential Statistics

- Facilitate interpretation

Inferential statistics is concerned with drawing inferences and conclusion from the findings of a research study. Inferential statistics focuses on the testing hypotheses to ascertain the degree of validity with which evidence can be used to support a conclusion or series of conclusions. The estimation of population values is another issue it addresses. The task of making inferences and conclusions is carried out primarily on the basis of inferential statistics. Inferential statistics are also known as sampling statistics.

Inferential statistics includes:

i. The estimation of population parameters from the results of

sample data analysis. The researcher must ensure that the samples chosen for the study are representative and adequate in number in order to arrive at accurate estimates of parameters. The estimation can be done using two methods- Interval estimation and Point estimation.

- Estimation of population parameters

ii. Test of hypotheses: Inferential statistics focuses on the numerous significance tests for testing hypotheses to ascertain the degree of validity with which evidence can be used to support a conclusion or series of conclusions. Testing of hypotheses for inferential statistics can be done using the following two types of tests:

- ***Parametric tests*** - Parametric tests assume that the data follows a specific distribution, usually the normal distribution. These tests make assumptions about the population parameters, such as mean and variance. Parametric tests are powerful when these assumptions are met, but they may not be accurate when the assumptions are violated. The most common parametric test includes t-test, z-test, ANOVA, MANOVA, regression etc..

- Assumptions about population

- ***Non-parametric tests***- Non-parametric test are those tests which can be used for ordinal and nominal data. It does not make assumptions about population such as normality in distribution and randomness like parametric tests. They are used when the data doesn't meet the assumptions of parametric tests, such as when the data is not normally distributed or when it includes outliers. The most common non-parametric tests are Mann-Whitney U test, Kruskal-Wallis H test, Friedman test, Wilcoxon signed-rank test etc..

- No assumptions about population

iii. Based on the number of variables considered for analysis, data analysis can be classified as:

a. Univariate analysis- This sort of analysis describes the data on one variable. 'Uni' means one and 'variate' means variable, so in univariate analysis, there is only one dependable variable. The objective of univariate analysis is to derive the data, define, summarise it, and analyse the pattern present in it. In a data set, it explores each variable separately. It is possible for two kinds of variables- categorical and numerical.

- One variable

b. Bivariate analysis- This sort of analysis describes the data on two variables. 'Bi' means two and 'variate' means variable, so here there are two variables. The analysis is related to cause-and-effect relationship between the two variables.

- Two variables

c. Multivariate analysis- Multivariate analysis is required

- More than two variables

when more than two variables have to be analysed simultaneously. It is a tremendously hard task for the human brain to visualise a relationship among 4 variables in a graph and thus multivariate analysis is used to study more complex sets of data.

4.2.3 Interpretation

- Drawing inferences

Interpretation is the process of making sense of information and drawing conclusions based on the facts gathered from analytical or experimental studies. Developing explanatory concepts and tying the findings of one study to the findings of others to establish research continuity are its two key components. Incorporating results from other studies, theories, and hypotheses is part of interpretation, which extends beyond analysing the data that has been gathered. Its goals are to deepen our comprehension of the elements that seem to explain what the researcher saw throughout the study and to present a theoretical framework for future research. In simple terms, interpretation is the process by which researchers make sense of and explain their discoveries through the analysis of data, connections to related fields of study, and the development of hypotheses that can direct additional research.

Need for interpretation

Interpretation is regarded as a fundamental part of the research process for the following reasons:

- Enhanced communication via interpretation

- Researchers can more successfully convey the genuine value of their research to others by understanding the motivations underlying their findings through interpretation.

- Research continuation

- Research continuity is aided by interpretation, which makes it easier for researchers to connect their findings to other studies, link them to abstract principles that underlie them, and make predictions about the future.

- Transitioning from exploratory to experimental research

- By developing hypotheses based on the results of exploratory investigations, interpretation plays a critical role in the switch from exploratory research to experimental research.

Techniques of interpretation

The following are the techniques of interpretation:

- Sound justifications

a. Explanation- Researchers should offer reasonable justifications for the links they have found and interpret those relationships by looking into the underlying mechanisms at play in order to ensure relevant and trustworthy research findings. Thus, they are able to recognise typical patterns and create concepts that facilitate efficient generalisation. Researchers should also carefully

take into account any additional data that was acquired along with the core data during the interpretation stage. These supplemental details frequently include crucial insights into comprehending the issue under investigation.

b. Consultation with experts- Before settling on an interpretation, it is strongly advised to seek the advice and knowledge of an authority in the field. The correctness of interpretations can be substantially improved by consulting with individuals who have deep insights, are regarded for their honesty, and are prepared to point out any errors in logical thinking. Their insightful comments and helpful criticism can help to sharpen the interpretation and ultimately increase the usefulness of the study report.

- Engaging expert input

c. Avoid false generalisations- Researchers should also proceed with caution and diligence by considering all pertinent elements that might have an impact on the issue before beginning the interpretive process. In this stage, haste can result in inaccurate judgements and erroneous generalisations. Initial impressions might be deceiving; thus, it is imperative to carefully assess the facts and conclusions. Researchers can provide more robust and credible interpretations that contribute to the development of knowledge in their field by taking into account all pertinent elements and undertaking a thorough study.

- Prudent interpretation

Summarised Overview

Statistics involves data collection, interpretation and validation. Statistical analysis is the technique of performing several statistical operations to quantify the data and apply statistical analysis. This unit dealt with the two types of statistical analysis namely, Descriptive statistics and Inferential statistics. Descriptive statistics helps to describe, show or summarise data points in a constructive way making you ready for conducting further statistical analyses. Inferential statistics draws conclusions from the findings of the study. Based on the analysis conducted, interpretations are generated. Then the researcher has to present the study's findings in the form of a report.

Assignments

1. Choose a research study from your field of interest. Refer the analysis part of that study and interpret the key findings and implications of the study.
2. Take the attendance list of students in your class and collect data on marks obtained by them for particular subject. Compare the relationship between their attendance and marks obtained. Determine the type of analysis suitable for this study.
3. Differentiate between parametric and non-parametric tests, and also state where each is applied for inferences.
4. How is data analysis helpful for interpreting the results? Elucidate.

Self- Assessment Questions

1. What is descriptive statistics?
2. What is interpretation?
3. Elucidate inferential statistics.
4. What are the different types of descriptive statistics?
5. Differentiate univariate, bivariate and multivariate analysis.
6. What are the various techniques of interpretation?
7. What is non-parametric test?

References

1. Tandon, B.C; (1979). *Research Methodology in Social Sciences*. Chaitanya Publishing House.
2. Chawla, D; and Sondhi, N., (2016). *Research Methodology: Concepts and Cases*. Vikas Publishing House Pvt. Ltd.

3. Kevin, S., (2021). *Research Methodology for Social Sciences*. Ane Books Pvt. Ltd., New Delhi.
4. Kothari, C. R., (2004). *Research Methodology: Methods and Techniques*. New Age International (P) Limited.
5. Krishnaswami, O.R., Ranganathan, M., & Harikumar, P.N. (2016). *Research Methodology*. Himalaya Publishing House.
6. Panneerselvam, R. (2014) *Research Methodology*. PHI Learning.

Suggested Readings

1. Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education (8th ed.)*. Routledge.
2. Jhunjhunwala, S. (2018). *Research Methodology: Techniques and Trends*. I.K. International Publishing House.
3. Gupta,S.K. & Praneet Rangi. (2018). *Business Research Methodology*. Kalyani Publishers
4. Sharma R, N & Sharma R.K. (2019). *Research Methods in Social Science.* Atlantic Publishers.
5. Singh A.K. (2017). *Tests, Measurements and Research Methods in Behavioural Sciences*. Bharti Bhawan.

Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

Unit 3

Report Writing

Learning Outcomes

After completing this unit, the learner will be able to:

- familiarise with the style and format of writing the research report logically and objectively
- attain skills in the preparation of a research report
- gain insight on different types of reference style

Background

The final stage of the research work involves preparing a research report. This report communicates the researcher's findings and conclusions to the intended audience. It serves as the primary means of sharing key elements of the research and acts as evidence of the researcher's efforts.

To make the report understandable to a wider audience, it should follow a proper layout. Adherence to guidelines for citation, referencing, and other elements is essential. This unit provides information on the format of preparing reports and the necessary contents to include.

Keywords

Research report, Citation, Referencing, APA

Discussion

4.3.1 Research Report

- Detailed account of research experience

A research report is a thorough and detailed explanation of the research process. The researcher must provide a formal and comprehensive account of their experiences and thoughts throughout the research, guiding the reader from identifying and defining the problem to stating specific research objectives, forming research questions or hypotheses, gathering evidence through data collection, analysing and interpreting the data, and finally testing hypotheses and drawing conclusions.

4.3.1.1 Steps Involved in a Research Report

The usual steps involved in writing report are:

- Inception phase

a. The first step is largely focused with the creation of a subject and involves logical analysis of the issue. A subject can be developed in one of two ways: logically or chronologically. The development of the material from the simplest possible to the most complex structures is a common component of logical treatment. The foundation of chronological development is the relationship or order of events over time.

- Framework formation

b. The process of creating a final outline, which acts as a framework for organising the information and highlighting important points in the report, follows logical analysis.

- Preparation of rough draft

c. The researcher then prepares a preliminary report that details the data collection process, challenges encountered, analytical strategies employed, overall results, and recommendations about the issue under investigation.

- Revision of rough draft

d. After that, the rough draft is revised and polished while being examined for logical progression, presentation consistency, and grammatical accuracy.

- Preparing bibliography

e. All pertinent books, pamphlets, journals, and newspaper articles consulted during the study are listed in a final bibliography that is created.

- Final report preparation

f. The researcher then writes the report's final draft in a clear, objective style while retaining the reader's interest.

4.3.2 Types of Report

- Based on target audience

The research report is classified into two based on target audience. A research report can be said to be technical or popular based on the target audience. If you are dealing with a general audience, you need to present a popular research report, and if

you are dealing with a specialised audience, you would submit a technical report.

a. Technical research report- The researcher must include comprehensive and explicit information on the research procedure in a technical research report. Usually formal in nature, the report is written with the academic community in mind. The study's methodologies, the assumptions made, and a thorough explanation of the conclusions, including any caveats and supporting evidence should be considered in a technical report.

- Detailed and lengthy report

A general outline of a technical report can be as follows:

i. Summary of result: A brief review of the main findings just in two or three pages.

ii. Nature of the study: Description of the general objectives of study, formulation of the problem in operational terms, the working hypotheses, the type of analysis and data required etc..

iii. Methods employed: Specific methods used in the study and their limitations. For instance, in sampling studies we should give details of sample design, namely sample size, sample selection etc..

iv. Data: Discussion of data collected, their sources, characteristics and limitations. If secondary data are used, their suitability to the problem at hand is fully assessed. In case of a survey, the manner in which data were collected should be fully described.

v. Analysis of data and presentation of findings: The analysis of data and presentation of findings of the study with supporting data in the form of tables and charts be fully narrated. This in fact happens to be the main body of the report usually extending over several chapters.

vi. Conclusion: A detailed summary of the findings and the policy implications drawn from the results be explained

vii. Bibliography: Bibliography of various sources consulted are to be prepared and attached.

viii. Technical appendices: Appendices are given for all technical matters relating to questionnaire, mathematical derivations, elaboration on particular techniques of analysis and the like.

ix. Index: Index must be prepared and be given invariably in the report at the end. The order presented above only gives a general idea of the nature of a technical report. The order of presentation may not necessarily be the same in all the technical reports.

b. Popular research report: A popular research report is one that is intended for a wide audience, including people who may

not necessarily be experts in the topic of study. Everyone should be able to access information, according to a well-known research paper. It is really clear writing that makes it simple to understand the findings and suggestions.

The following are the general outline of a popular report

i. The findings and their implications: Emphasis in the report is given on the findings of most practical interest and on the implications of these findings.

ii. Recommendations for actions: Recommendations for actions on the basis of the findings of the study are made in this section of the report.

iii. Objective of the study: A general review of how the problem arises is presented along with the specific objective of the project under study.

iv. Methods employed: A brief and non-technical description of the methods and techniques used, including a short review of the data on which the study is based, is given in this part of the report

v. Results: This section constitutes the main body of the report wherein the result of the study are presented in clear and non-technical terms with liberal use of all sorts of illustrations such as charts, diagrams and the like ones

vi. Technical appendices: More detailed information on methods used, forms etc. is presented in the form of appendices. But the appendices are often not detailed if the report is entirely meant for the general public.

4.3.3 Contents of Report

For the purpose of presentation of a research report, some universities, research organisation or journal boards have established their own format to which their theses, dissertations or research papers must conform, but all formats are somewhat similar to the following outline which comprises three main sections

A. The Preliminary section

B. The Body of the report or main content

C. The End matters

A. Preliminary sections

- Cover page

a. Title page: Several pages of preliminary material are presented prior to the body of research report. Generally, it contains the following information:

i. Title of the study

ii. Name of the institution to which the report is being submitted

iii. Name of the candidate (if desired , previous academic degrees may be listed after name)

iv. Date of submission of the report

- Simple report for general audience

b. Preface: The preface usually includes a brief statement of the purpose and scope of the report. A preface must also include acknowledgements for those who gave the researcher substantial guidance or assistance in the conduct of the study. If the researcher has little to say about the contribution of his research work, the preface can easily be omitted. In such a situation, the page should be labelled as 'Acknowledgements' rather than 'Preface'. Acknowledgement should be brief and simple.

- Introductory notes

c. Table of contents: The table of contents includes the major divisions of the report- the introduction, the chapters with their sub-sections, the bibliography and the appendix. Page numbers for each of these divisions and sub-divisions are given. The title of chapters and sub-divisions within chapters should correspond exactly with those included in the body of the report with correct page citation. The preface or acknowledgements, list of tables and list of figures are also entered in the table of contents. The table of contents provides the reader a bird's eye view of the report and enables him to quickly locate each section of it.

- Divisions of the report

B. Body of the report or main text

The main body of the research report usually contains four logical divisions. (a) Introduction (b) Design of the study (c) Analysis and interpretation of the data (d) Summary and conclusions. In a thesis or a dissertation these divisions comprise chapters, while in a research paper they may consist of sections with suitable headings.

- Nature and significance of study

a. Introduction: The introduction of a research report should be lucid, complete and concise. It should introduce the research problem in the proper context and arouse and stimulate the reader's interest. In the introduction the researcher defines, analyses and states the nature of the problem and includes the significance of the problem and the need for conducting the investigation.

b. Design of the study: A reasearcher may present the population, size of the sample, and the rationale for the size of the sample. This should involve the method of sampling, when and what type of date were collected, tools and techniques used for collecting data, along with their reliability and validity. The design and method of conducting the experiment should give full details about the assumptions, classifications and manipulations of variables and the nature of treatment. The type of analysis

- Methodology

made, statistical methods employed, and reasons for selecting such methods should be explained,along with how the date will be organised and presented for analysis and interpretation.

c. Analysis and interpretation of data: This section is the heart of the research report. The data analysis and interpretation may either be presented in separate chapters or may be integrated and presented in one chapter. The data are presented in tables and figures accompanied by textual discussions. The tables and figures should be constructed and listed in such a way that they clarify significant relationships and become self-explanatory. The tables which are complex and lengthy should be placed in appendix, otherwise the continuity of textual discussion gets broken. In the textual discussion of the data, the report should not repeat all the detailed information that is provided in the tables and figures. It should only point out important facts and relationships to give meaning to the data and make certain generalisations about the data. The formulae and statistical procedures which were used in the analysis of data should be clearly specified and explained in detail.

- Inference

d. Summary and conclusions: This section includes a brief re-statement of the problem, a description of the procedures used, and discussion of the findings and conclusion of the study. The conclusions are presented concisely and related directly to the hypotheses that were tested or to the research questions. They announce whether the findings of the study accept or reject the hypotheses. Conclusions are answers to questions raised and suggest modification in the existing theory. The summary and conclusion section are the most widely used part of the research report. Most readers scan this section of the report first to get an overview of the study and to determine its utility to them.

- Comprehensive overview

C. End matter

This section includes bibliography and appendix. The bibliography is a record of those sources and materials that have been used for the study. If the number of sources and materials is large, the researcher may divide the bibliography into various sections, one for books, one for periodicals and journals, and possibly one for reports and special documents.

- Sources and materials used

An appendix follows the bibliography. All the relevant supporting materials that are important but not essential to the understanding of the report are presented in the appendix. These materials include questionnaires, copies of covering letters used, evaluation sheets, checklists, course of study, long quotations, documents, tests, interview forms, and raw-data.

- Supporting materials

A list of cited papers, each with a list of citing articles, arranged in an order is known as a citation index (or indexing). The

referenced article is noted as a reference, while the citing article is noted as the source.

4.3.4 Format of Research Report

The following outline presents the sequence of topics covered in the typical research report prepared according to the American Psychological Association's (APA) Publication Manual 5th ed. (2002)

I. Title Page

A. Title

B. Author's name and institutional affiliation

C. Running head

II. Abstract

III. Introduction (no heading)

A. Statement of the problem

B. Background/review of literature

C. Purpose and rationale /hypotheses

IV. Method

A. Subjects

B. Apparatus or instrumentation (if necessary)

C. Procedure

V. Results

A. Tables and figures, as appropriate (these follow the author note)

B. Statistical Presentation

VI. Discussion

A. Relates the findings to the research objectives or hypotheses

B. Practical and theoretical implications

VII. Conclusion

A. Summarises the main findings and their significance

B. Restates the research question or objectives

C. Offers final thoughts or recommendations

VIII. References

IX. Appendix (if any)

The APA style for typing a manuscript requires double spacing throughout the paper. Leave margins of at least 1 inch at the top, bottom, right and left of every page. Number all pages except the

figures. The title page and the abstract are on separate pages (pages 1 and 2 respectively). Begin a new page for the introduction, for the reference, for each table and figure, and for each appendix.

4.3.5 Documentation Styles

- Citing sources

A documentation style is a recommended method for citing sources that a paper's author has read, summarised, or used in a quote. It specifies how to format headings and margins as well as how to cite sources inside the text and include a list of works referenced at the conclusion of the document. Documentation styles have been established to provide you with a way to give credit for work that you have used in writing your paper. It is important to cite sources not only to give credit where its due, but also to allow the reader of your work to locate the sources you have consulted. In short, the reader of your paper must be able to use the information you provide, both in the text and in appended list(s) to duplicate the research you have done. Most academic writing draws on previous research, writings and materials. While some assignments require you to focus on your own experiences, impressions and responses, more advanced writing projects will require you to gather, evaluate, and use the work of others. And when you do draw upon the work of others, you must give proper credit. Failure to do so constitutes plagiarism. Different academic disciplines use different documentation styles.

The major documentation styles

i. American Political Science Association (APSA)

ii. American Psychological Association (APA)

iii. Chicago/Turabian

iv. Council of Biology Editors (CBE)

v. Modern Language Association (MLA)

vi. Numbered References

4.3.5.1 Citation and Referencing

While writing an article, one must quote or refer to the original source of the information, fact or idea, from which it has been taken. It is not just to support your own points, but also to prevent plagiarism and denote that a variety of sources are used to write the piece.

Citation

Citation refers to identifying and crediting the informational sources used in the main body of a research paper or other academic work. In the citation, the author cites or refers to the source in the

text to represent that the information is derived from an external source and to mention that source, in brief. Basically, it is an abbreviated reference, which you can find in the main body of the article addressing the source of a quote, image, video, paraphrase, chart, table, etc. Due to this very reason, it is also called "in-text citation", which includes a set of parentheses. In the citation, the author cites or refers to the source in the text to represent that the information is derived from an external source and to mention that source, in brief.

- Quoting original source

Referencing

In the reference, the author lists the items which he/she have read and considered in his/her piece of work. While providing references, the author actually tells its readers about what kind of source he/she used in the document. Along with that it also helps the readers to identify the difference between the author's words, theories and ideas and those of other author's. Further, it helps the reader to refer to the source for further information in that area, whenever required. Reference is given at the end of the document or article in alphabetical order, by the first or main author's last name.

- List of sources cited

Basically, reference and citation are provided to give the user or reader, the source of facts, images, statistics, charts, tables and diagrams, which are a part of the article or assignment. It may also be used when you are talking about a theory, method or model, discovered by or linked to a specific person or writer.

4.3.5.2 APA (American Psychological Association)

Following a citation style helps readers to concentrate on the ideas being presented rather than the formatting when there is uniformity and consistency, and they can scan works quickly for essential points, findings, and references. The APA manual was published by the American Psychological Association. It is mostly used in social science and education fields. In APA style, a source citation consists of a brief parenthetical citation in the text and a full reference at the end of the paper. However, citations look slightly different in each style, with different rules for things like title capitalisation, author names, and placement of the date.

- Citation style

Rules used in APA style

i. In-text citations in APA

APA use parenthetical citations to cite sources in the text. APA in-text citation includes the author's last name and the publication year. If you are quoting or paraphrasing a specific passage, you also add a page number. When there are two authors, APA style separates their names with an ampersand (&). For three or more authors, list the first author followed by "et al.".

- Parenthetical citations

Examples:

- For sources having single author

APA- (Taylor, 2018,p.23)

- For sources with 2 authors

APA- (Taylor & Kotler, 2018,p.23)

- For sources with 3+ authors

APA- (Taylor et al.,2018,p.23)

- List of all cited sources

ii. APA reference list

In APA style, you list full details of all cited sources on a separate page at the end of your paper. In APA it is usually called the reference list. The formatting of source entries is different in each style.

- APA norms

iii. APA formatting

The general formatting guidelines for APA style recommend:

- 12pt Times New Roman font
- Double spacing
- 1 – inch margins

- Separate cover page

iv. Title page and header

In APA a separate cover page is required. It lists the title of your paper, your full name, your institution and department, the course of the paper is for, your instructor's name and the due date, all centered and double spaced.

- Page number and running head

v. Running head

An APA header includes a right aligned page number. In manuscripts that will be submitted for publication, you should also include an APA running head with a shortened version of your paper's title (up to 50 characters long), all in capitals and left aligned.

- Long quotations with no quotation marks

vi. Block quotes formatting

Block quotes are long quotations that are set on a new line and indented as a block, with no quotation marks. In APA, any quote of 40 words or longer should be formatted as a block quote. For block quotes, indent the entire block quote 0.5 inches (or 1.27 cm) from the left margin. Maintain double-spacing within the block quote. Use an ellipsis (...) to indicate the omission of any part of the original text within the block quote. Include the author's name,

publication year, and page number in parentheses after the block quote's ending punctuation mark.

4.2.6 Plagiarism

- Unauthorised appropriation

Plagiarism is presenting someone else's work or ideas as your own, with or without their consent, by incorporating it into your work without full acknowledgement. All published and unpublished material, whether in manuscript, printed or electronic form, is covered under this definition. In the educational context, there are differing definitions of plagiarism depending on the institution. Plagiarism is considered a violation of academic integrity and a breach of journalistic ethics. It is subject to sanctions such as penalties, suspension, expulsion from school or work, substantial fines, and even imprisonment.

Plagiarism can be avoided by the following the below guidelines:

i. Paraphrase the content.

ii. Use quotations.

iii. Cite the sources.

iv. Maintain records of the sources you refer to.

v. Use plagiarism checkers.

Summarised Overview

The final stage of a research work is report writing. It is through the research reports that the researcher communicates about his work to the interested parties. Research report is a formal statement which includes a complete and detailed account of detailed research experience. While preparing a report, the researcher has to follow guidelines that highlights with the format in which a report has to be prepared.

The content of the research report generally has three parts- Preliminary section, Body of the report, and End matter. Using documentation styles helps to ensure that all the citation and referencing has been correctly included in the report. The research report should adhere to a particular documentation style while designing the format which includes title of the study, abstract, introduction, method, results, discussion,

references, appendix, and author's note. American Psychological Association is a major documentation style that is mostly used in social science and education fields. Proper citation and referencing help to avoid plagiarism.

Assignments

1. Select an article in your area of interest. Analyse the contents of the report and prepare a report summarising the way the author has developed the introduction, methodology, analysis, and discussion of the study.
2. Perform a small-scale study to examine the effect of social media on academic achievement among students. Develop a report including an introduction, methodology, data analysis, results, discussion, and conclusion. Make use of the right tables, graphs, and charts to support your conclusions.
3. Conduct 10 literature reviews on any topic of your interest and develop a list of references based on APA style.
4. Explain the role of referencing in research work.
5. Discover and explain the differences between APA and MLA citation styles.
6. What are the required contents of a social science research paper according to APA 7th edition?
7. What is the significance of using in-text citations in a research report, and how does it enhance the credibility of the study?
8. Explain the importance of creating a properly formatted reference list and how it helps readers locate the sources used in the research.
9. Compare and contrast the key elements of a research report in APA 7th edition with those in APA 6th edition, highlighting the major changes and updates.

Self- Assessment Questions

1. Explain Research report.
2. Elucidate the term Bibliography.
3. What is Documentation style?
4. What are the modes of reference writing?

5. What do you mean by citation?
6. What is referencing?
7. Identify the referencing styles used in social science research.
8. What is plagiarism?
9. How can plagiarism be avoided from the research work?

References

1. Tandon, B.C; (1979). *Research Methodology in Social Sciences*. India, Chaitanya Publishing House.
2. Chawla, D; and Sondhi, N., (2016). *Research Methodology: Concepts and Cases*. New Delhi: Vikas Publishing House Pvt. Ltd.
3. Kevin, S., (2021). *Research Methodology for Social Sciences*. Ane Books Pvt. Ltd., New Delhi.
4. Kothari, C. R., (2004). *Research Methodology: Methods and Techniques*. India, New Age International (P) Limited.
5. Krishnaswami, O.R., Ranganathan, M., & Harikumar, P.N. (2016). *Research Methodology*. Himalaya Publishing House.
6. Panneerselvam, R. (2014) *Research Methodology*. India, PHI Learning.

Suggested Readings

1. Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education (8th ed.)*. Routledge.
2. Jhunjhunwala, S. (2018). *Research Methodology: Techniques and Trends*. I.K. International Publishing House.
3. Gupta,S.K. & Praneet Rangi. (2018). *Business Research Methodology*. Kalyani Publishers
4. Sharma R, N & Sharma R.K. (2019). *Research Methods in Social Science*. Atlantic Publishers.
5. Singh A.K. (2017). *Tests, Measurements and Research Methods in Behavioural Sciences*. Bharti Bhawan.

Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

സർവ്വകലാശാലാഗീതം

വിദ്യയാൽ സ്വതന്ത്രരാകണം
വിശ്വപൗരരായി മാറണം
ഗ്രഹപ്രസാദമായ് വിളങ്ങണം
ഗുരുപ്രകാശമേ നയിക്കണേ

കൂരിരുട്ടിൽ നിന്നു ഞങ്ങളെ
സൂര്യവീഥിയിൽ തെളിക്കണം
സ്നേഹദീപ്തിയായ് വിളങ്ങണം
നീതിവൈജയന്തി പാറണം

ശാസ്ത്രവ്യാപ്തിയെന്നുമേകണം
ജാതിഭേദമാകെ മാറണം
ബോധരശ്മിയിൽ തിളങ്ങുവാൻ
ജ്ഞാനകേന്ദ്രമേ ജ്വലിക്കണേ

കുരീപ്പുഴ ശ്രീകുമാർ

SREENARAYANAGURU OPEN UNIVERSITY

Regional Centres

Kozhikode
Govt. Arts and Science College
Meenchantha, Kozhikode,
Kerala, Pin: 673002
Ph: 04952920228
email: rckdirector@sgou.ac.in

Thalassery
Govt. Brennen College
Dharmadam, Thalassery,
Kannur, Pin: 670106
Ph: 04902990494
email: rctdirector@sgou.ac.in

Tripunithura
Govt. College
Tripunithura, Ernakulam,
Kerala, Pin: 682301
Ph: 04842927436
email: rcedirector@sgou.ac.in

Pattambi
Sree Neelakanta Govt. Sanskrit College
Pattambi, Palakkad,
Kerala, Pin: 679303
Ph: 04662912009
email: rcpdirector@sgou.ac.in

Research Methodology

Course Code: M21CM01DC

SREENARAYANAGURU
OPEN UNIVERSITY

ISBN 978-81-966907-6-2

Sreenarayanaguru Open University
Kollam, Kerala Pin- 691601, email: info@sgou.ac.in, www.sgou.ac.in Ph: +91 474 2966841